

RECLAMATION

Managing Water in the West

Finding of No Significant Impact Final Environmental Assessment Middle Entiat River Habitat Improvement Project Chelan County, Washington



U.S. Department of the Interior
Bureau of Reclamation
Pacific Northwest Region
Boise, Idaho

February 2018

U.S. DEPARTMENT OF THE INTERIOR

The Department of the Interior protects and manages the Nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its trust responsibilities or special commitments to American Indians, Alaska Natives, and affiliated island communities.

MISSION OF THE BUREAU OF RECLAMATION

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

FINDING OF NO SIGNIFICANT IMPACT

Middle Entiat River Habitat Improvement Project Chelan County, Washington

U.S. Department of the Interior
Bureau of Reclamation
Pacific Northwest Region
Columbia-Snake Salmon Recovery Office

PN FONSI 18-2

INTRODUCTION

The U.S. Department of the Interior, Bureau of Reclamation (Reclamation) has prepared this Finding of No Significant Impact (FONSI) and Decision to comply with the National Environmental Policy Act (NEPA). This FONSI is prepared for the *Middle Entiat River Habitat Improvement Project Environmental Assessment (EA)*. Reclamation is the lead agency for the purposes of compliance with the NEPA for this Proposed Action. This document briefly describes the Middle Entiat River Habitat Improvement Project's (Project) background, public involvement, alternatives considered, Proposed Action, summary of environmental effects, permits and approvals associated with the Project, decision, and FONSI. The Final *Middle Entiat River Habitat Improvement Project Environmental Assessment (EA)* documents the analysis.

BACKGROUND

Reclamation proposes to fund implementation of habitat improvement actions for Endangered Species Act (ESA)-listed species on portions of the Entiat River in Chelan County, Washington. This will involve Reclamation providing financial assistance to three local project sponsors, Cascadia Conservation District (CCD), Cascade Columbia Fisheries Enhancement Group (CCFEG), and Chelan County Natural Resource Department (CCNRD). The Reclamation Departmental Manual, Section 255 DM 1, delegates the authority for the activities contained within Reclamation's Columbia-Snake Salmon Recovery Office Habitat Program. Reclamation has developed a design for the proposed Project that is comprised of four separate project areas, each of which will be implemented by one of the three project sponsors.

The Project will improve natural riverine processes and thereby enhance fish habitat along the Entiat River between river mile (RM) 16.2 and RM 20.1 (Entiat River Mile Post [MP] 15.2 to MP 18.4) through the construction of large woody material (LWM) structures, re-establishment of side channels, and removal of a levee. The Project is intended to increase the amount of suitable habitat for fish and wildlife species that utilize the Entiat River with specific focus on the needs of Upper Columbia River (UCR) steelhead (*Oncorhynchus mykiss*) and UCR spring-run Chinook (*O. tshawytscha*) which are respectively listed as threatened and endangered, under the ESA (16 U.S.C. 1531 et seq.). These efforts will complement other habitat improvement activities already occurring throughout the Columbia River Basin that are funded through Reclamation's Habitat Program and will help mitigate for the operation of the Federal Columbia River Power System (FCRPS).

Bonneville Power Administration (BPA), U.S. Army Corps of Engineers (USACE), and Reclamation (collectively referred to as the Action Agencies) consulted with the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NOAA Fisheries) on effects of the FCRPS on salmon and steelhead listed under the ESA. The 2014 Supplemental FCRPS Biological Opinion (FCRPS BiOp) includes hydrosystem, harvest, hatchery, predator control, and tributary and estuary habitat actions to avoid jeopardy and aid recovery of these species. Each action agency fills different roles for meeting FCRPS BiOp commitments. Reclamation works primarily, but not exclusively with BPA to meet tributary habitat commitments for the FCRPS BiOp by designing habitat complexity and floodplain connectivity projects that are constructed on tributaries of the Upper Columbia, like the Entiat River. Specific to the FCRPS, Reclamation operates and maintains water storage facilities in the Upper Columbia River system at the Grand Coulee and Hungry Horse dams.

Reclamation and BPA contribute to the implementation of salmonid tributary habitat improvement actions in the Columbia River Basin to help meet commitments from the 2008 FCRPS BiOp, as amended by Supplemental FCRPS BiOps in 2010 and 2014 (NOAA Fisheries 2008; 2010; 2014). The FCRPS BiOp includes a reasonable and prudent alternative (RPA), to protect ESA-listed salmon and steelhead across the freshwater components of their life cycles. Habitat improvement actions in various Columbia River tributaries are one aspect of this effort and can be found in RPA Actions 35. The EA referenced research (Roni et al. 2014) and the 2014 Annual Report to the Washington State Salmon Recovery Board (Tetra Tech 2014) that concluded habitat improvement projects designed to improve natural river processes have provided fisheries benefits in the Upper Columbia Basin.

Purpose and Need

The purpose of the Project is to restore hydraulic connectivity between the Middle Entiat River and its floodplain and improve connectivity of flows with adjacent floodplain wetlands. To fulfill this purpose, the Project seeks to re-establish connection of historic

side channels and alcoves along the river and through the strategic placement of LWM along the Middle Entiat River's bends and bars to direct flow into the restored side channels and alcoves and onto the floodplain. Reclamation needs to meet its obligations under the ESA (16 U.S.C. 1531 et seq.) and fulfill actions associated with RPA Action 35 of the FCRPS BiOp, as follows, "The Action Agencies will identify additional habitat projects for implementation based on the population specific overall habitat quality improvements still remaining in Table 5." The Entiat River is identified in Table 5 of RPA Action 35 as part of both the UCR spring Chinook and UCR steelhead Ecologically Significant Units (ESU) (NOAA Fisheries 2008; 2010; 2014). RPA Action 35 also states that, "Habitat quality improvements associated with projects will be estimated in advance of project selection by expert panelist." An expert panel evaluated and provided input on habitat projects in the Columbia River Basin, including the Entiat River under the Regional Recovery Board and Regional Technical Teams (NOAA Fisheries 2008; 2010; 2014).

PUBLIC AND TRIBAL INVOLVEMENT

Reclamation and its partners engaged with the public in discussions about the Project in 2014 and 2015. This effort included public meetings in Entiat, Washington, and at one of the project sites near the Stormy Preserve along the Entiat River. These outreach meetings were publicized in the local free newsletter distributed by the Entiat Valley Chamber of Commerce and via post cards mailed to residents of the Entiat Valley. Reclamation initiated NEPA public scoping on February 2, 2016, when it sent a letter to the public potentially interested in the Project. Reclamation also provided Project information to the Confederated Tribes of the Colville Reservation (CCT) and the Confederated Tribes and Bands of the Yakama Nation (YN). Eighteen entities provided Reclamation with public scoping comments, which Reclamation summarized in the public Draft EA.

Reclamation posted the Draft EA on Reclamation's website for public review on August 27, 2017. Reclamation provided a 30-day public comment period on the Draft EA. Reclamation received six comment letters from the public and one from the CCT. The Final EA included a summary of the letters and Reclamation's response to substantive comments as required by the NEPA process (Appendix A of the EA); revisions are reflected in the Final EA. The primary issues identified in the comment letters are summarized in the "Summary of Environmental Effects" section of this FONSI.

ALTERNATIVES CONSIDERED

One action alternative was considered and evaluated in the EA. The No Action alternative was also evaluated as required by NEPA.

No Action

Under the No Action alternative, Reclamation will not provide funding to sponsors for construction of the Project and will not support implementation of the Project to help satisfy its ESA obligations identified in the FCRPS BiOp (RPA Action 35). Project sponsors could pursue habitat improvement actions with non-federal funding, but the extent of those activities will be dependent on the ability to find additional funding or funding partners.

Proposed Action – Middle Entiat River Habitat Improvement Project

Reclamation will fund the Project, which includes installing constructed LWM structures to enhance fish habitat, reconnecting abandoned side channels to enhance floodplain connection, and removal of a levee to help satisfy Reclamation's ESA obligations identified in the FCRPS BiOp (RPA Action 35). Habitat improvement actions will occur at four project areas along the Entiat River as described below. Once constructed, Reclamation and CCNRD will inspect and adaptively manage the LWM structures in accordance with the signed *Cooperative Agreement between Reclamation and Chelan County Natural Resource Department for Middle Entiat Adaptive Management Plan and the Adaptive Management Program Agreement between Chelan-Douglas Land Trust and Chelan County Natural Resources Department for Entiat Restoration Projects*.

- The proposed Project is detailed in the 80 percent habitat restoration engineering design plans prepared by a collaborative design process (Section 2.2 of the EA) in August 2016. Reclamation considered public feedback through scoping, outreach, and site visits (see Section 3.10 of the EA) and incorporated that feedback in the design process
- The design process followed methods for design and review as established in BPA's Habitat Improvement Program III (HIP III) BiOps (NOAA Fisheries 2013; USFWS 2013). Completion of the projects improvement designs will also incorporate General Conservation Measures per the 2017 restoration programmatic agreement between the Seattle USACE District and NOAA Fisheries (NOAA Fisheries 2017) (Section 2.3 of the EA).
- To address risk and public health and safety, the design also followed Reclamation's Large Woody Material Risk Based Design Guidelines (RBDG) (Reclamation 2014). (Section 2.2 and 2.3 of the EA).
- The proposed Project will be implemented at four proximate project areas (B, C, E, and F) between RM 16.2 and RM 20.1 (the equivalent of Entiat River Road MP 15 to 18.6). The most downstream location (Area F) will be located approximately

16.2 river miles from the town of Entiat, Washington and the Columbia River (see Section 2.2 of the EA). Table 1 summarizes habitat improvement actions and actions that are necessary to facilitate construction. Projects are scheduled to be constructed in 2019 (Areas B and E) and 2020 (Areas C and F) based on Reclamation’s current known funding structure.

- Construction elements will include staging areas, helicopter flights, access routes, river crossings, vibratory pile driving, side channel excavation, construction observation, and post-construction inspection.
- The Proposed Action includes construction observation and post-construction inspection as actions to support the intended habitat benefits of the Project.

Table 1. Middle Entiat Habitat Improvement Project features.

	Quantities				
Project Activity	Area B (RM 20.0-19.4)	Area C (RM 18.6-18.2)	Area E (RM 17.4-16.9)	Area F (RM 16.7-16.2)	Total (3.8 miles)
LWM Structures	24	15	8	39	86
Side Channel & Alcove Logs	NA	10	18	9	18
Side Channel Enhancement	600 linear feet	NA	335 linear feet	4,245 linear feet	5,180 linear feet
New Channel Construction	NA	300 linear feet	NA	NA	300 linear feet
Levee Removal	1,000 linear feet	NA	NA	NA	1,000 linear feet
Fill & Floodplain Bench Removal	NA	NA	NA	6,260 cubic yards	6,260 cubic yards
Temporary Bridge	1	1	NA	2	4
Wet Crossings	1	2	NA	1	4
Riparian Plantings	13,931 plants	4,083 plants	431 plants	13,848 plants	32,293 plants
Temporary Access & Staging	4.8 acres	0.9 acres	0.5 acres	2.3 acres	8.5 acres
River Miles	0.6	0.4	0.5	0.8	2.3
Sponsor	Chelan Co.	CCFEG	Cascadia	Cascadia	

SUMMARY OF ENVIRONMENTAL EFFECTS

Reclamation issued a Draft EA for public review and comment on August 27, 2017 for the Middle Entiat Habitat Improvement Project. The EA provided a thorough analysis that described the affected environment and environmental consequences of both alternatives for the natural and human environment. A summary of this analysis can be found in Table 2-8 of the EA.

The release of the Draft EA provided an opportunity for any interested members of the public, government agencies, organizations, and tribes to review the EA and submit their comments on the Project as analyzed in the EA.

Reclamation has reviewed the letters received from the public and tribes on the Draft EA issued on August 27, 2017. The primary issues brought forth in these comment letters are specifically addressed below and include:

- Water resource risks from flooding associated with the Project's changes to the floodplain
- Public health and human safety risk from LWM structure that may break apart, dislodge, and or move en masse downstream
- Public health and human safety risk from racking and channel spanning of LWM structures
- Recreation risk to boaters from encountering constructed LWM structures and how those LWM structures may change the recreational experience on the river.

Other priority elements of the Project addressed in this summary section are the requirements to comply with the ESA for threatened and endangered species, cultural resources related to the National Historic Preservation Act (NHPA), Sacred Sites, Indian Trust Assets (ITAs), and Environmental Justice.

Water Resources

The risk to public health and safety from flooding was analyzed in Section 3.4 of the EA. Under current conditions, in-channel anthropogenic structures do not exist within the Project areas other than the Bremmer Levee. One dwelling (Area F) occurs within the 100-year floodplain shown on the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM).

The EA assessed the overall changes in floodplain inundation resulting from the Project by modeling post-project conditions across a range of flood flow events. The installation of LWM structures will increase local surface water elevation adjacent to the structures, and during floods, flows will result in greater localized floodplain inundation. However, the proposed side channel excavation also increases floodplain capacity. The increased frequency and extent of flooding into side channels and floodplains will be an intended outcome of the Project, replicating natural river processes.

The EA also analyzed the extent of the 100-year floodplain based on the most recently available Chelan County FIRM map, which is the map developed in 1981. Based on current aerial imagery, topography, and updated modeling techniques, more accurate and up to date floodplain maps were produced by Reclamation's Technical Service Center showing where and how water flows over the landscape. The floodplain analysis conducted for the Project using current hydraulic modeling techniques showed the project's effects relative to the 100-year floodplain will result in minor changes to the current extent of the actual 100-year floodplain (i.e., actual floodplain per Reclamation's 2D hydraulic model). Two occupied dwellings shown to be within the updated 100-year floodplain (existing conditions) are in the most downstream project area, Project Area F. While the proposed Project will slightly increase the extent and frequency of flooding in some areas, there are no additional dwellings under the Proposed Action that will be affected by the 100-year flood event, compared to the existing conditions.

The EA addressed the measures to be taken to ensure the Project is constructed as designed to further minimize the risk to public health and safety from LWM structures and flooding. The Project's Proposed Action includes construction observation to be performed by an engineer to confirm the Project is constructed as intended. The EA also summarized the Post-construction Inspection Plan that will be implemented to document the built conditions of the LWM structures, side channels, and levee removal area; and repeated inspections in following years to identify whether adaptive management actions are required based on the conditions of the LWM structures. As directed by the inspection plan, land surveys of the structures, side channels, and levee will be required, along with site photographs, to document post-construction conditions at low flow and high flow. Based on results of monitoring, corrective measures will be taken, as explained below, for public health and safety, or to improve natural riverine processes and habitat conditions.

Although public comments on the Draft EA did not identify wetlands as a priority issue, wetlands are a resource regulated by the USACE under the Clean Water Act. The EA stated in Section 3.3 that there are 116.2 acres of wetlands present in the Project area. The Project will permanently affect less than 1 percent of those wetlands (a cumulative 1.03 acres across the entire Project area) and will offset those impacts by creating 2.00 acres of wetland and rehabilitating 14.93 acres of wetland. The wetlands will provide habitat for plants and wildlife that use wetland habitat for all or part of their life stages. The 23 acres

of upland vegetation that will be temporarily disturbed by construction will be replanted with native species.

Public Health and Safety

Section 3.11 of the EA, along with a detailed description of the risk analysis in Section 3.10, analyzed the risk to public health and safety from LWM structure construction and placement. The EA showed the Project follows numerous methods for design and review to achieve habitat improvement goals and to ensure the design and construction result in predictable and minimal short-term environmental effects as they pertain to public health and safety.

Section 3.10.2 in the EA showed the Project utilized Reclamation's RBDG to address stability of the LWM structures. The Project design team included licensed professional engineers that used the RBDG for design and placement of wood to address public health and safety concerns. LWM structures will primarily be stabilized through driven piles. The only structural connections used to secure logs used in LWM structures will be threaded bolts that "pin" logs to one another. For helicopter constructed LWM structures, short lengths of chain will be used to create "rock collars" used to create ballast intended to secure logs. As the wood deteriorates over the expected 25-year lifespan, individual logs could break from the larger structure. Since these logs are not cabled together, it is not expected that multiple logs will move together downstream. River users will be notified of the LWM structures through the posting of signs at public access points along the middle Entiat that are owned and managed by the CDLT. Signs will not be placed in-river at the individual structure sites.

To further address safety, Section 3.11.2 of the EA explains the LWM structures were designed to allow the racking and shedding of woody material that is transported through the river reach. The structures themselves are not intended to create channel spanning conditions. Rather, structures have been positioned to not extend more than 30 percent across the width of the channel, which allows the largest observed logs (~100 feet) to pass without creating a channel spanning condition. The structures have also been designed to be overtopped at flood flows to allow buoyant debris to be shed to avoid racking and resulting debris jams. These design considerations are intended to minimize the likelihood and effect of debris jams, and given the smaller size of woody material likely transported to the Project site at any given event, it is unlikely that material will accumulate in quantities to create a channel spanning debris jam. The EA stated that although the minimum stability design flow criteria in the RBDG criteria is the 25-year flow, the designs were evaluated using the 100-year design flow to meet Washington State code for the design of LWM structures (Registered Code of Washington [RCW] 77.85.050). The same RCW requires habitat improvement projects to be led by professional engineers or licensed geologists. The Project's design was consistent with this requirement.

The EA addressed long-term management of the Project (Section 2.2.3) to further address public safety in the post-construction conditions by summarizing the post-construction Adaptive Management Program. The Adaptive Management Program will be administered by CCNRD and Reclamation. In the event a LWM structure should need inspection or modification, CCNRD will be responsible for all adaptive management of structures on/adjacent to CDLT property (Project Areas B, C, and F), per Adaptive Management Program Agreement between CDLT and CCNRD for Entiat Restoration Projects, and CCD will be responsible for the same in Area E unless agreements are made with CCNRD to assume responsibility. The CDLT and CCNRD agreement include the following provisions to address the post-construction condition of the LWM structures:

- CCNRD will implement an Adaptive Management Program occurring in 5-year increments up to 25 years;
- CCNRD will monitor, maintain, and modify (if needed) LWM structures and side channels constructed as part of the restoration project;
- CCNRD will take action to protect public health and safety and/or natural river function to immediately address any health or safety emergencies, and non-emergency actions after consulting with an adaptive management team;
- CDLT/CCNRD will cooperate to ensure the restoration Project meets requirements of RCW 77.85.050, which in part, requires the Project to be designed by a licensed professional engineer or geologist.

Finally, the EA listed best management practices (BMPs) that will be enacted during construction of the Project to avoid, reduce, and minimize impacts to the natural and human environment.

Recreation

Section 3.10 of the EA discussed recreation on the Entiat River. There is currently no commercial rafting or recreational boating outfitters that utilize the Project area. The Project area has a relatively low-gradient and thus, slow moving water and no whitewater rapids. The Middle Entiat has limited public access and meandering flows, making this section desirable to local visitors that are more familiar with the area and that may not have the technical experience required for the upper section. Recreational use on the Middle Entiat was found to occur mostly in the summer and fall, with limited use as early as late spring. River flows during the period range from 200 to 500 cubic feet per second (cfs) (USGS 2017). Respondents to a recreational survey (CCD 2014) showed the frequency of use in the Project reach of the Middle Entiat is low compared to the more popular rivers in the Upper Columbia such as the Wenatchee and Methow Rivers. Additionally, the survey results indicated 23 percent of local users reported floating in the Stormy and Gray Reaches

(Middle Entiat stretch) while the other (77 percent) reported floating in other reaches in the Entiat River basin on U.S. Forest Service property and below the Project area between Ardenvoir and the Columbia River.

Section 3.10.2 of the EA stated that minimizing risk to the recreating public was a primary design criterion for all of the structures that will be built. Designs for the proposed Project were developed following Reclamation's Large Woody Material - RBDG (Reclamation 2014). The RBDG were used to assess and evaluate watershed-level, reach-level, and site-level characteristics as part of the design approach. In addition, by following the guidelines, the design team was able to document the decision-making process and follow a consistent evaluation methodology for identifying the potential risks from each LWM structure. RBDG risk minimization to recreational boaters is as follows:

- Safety concerns generated from public outreach associated with LWM structures location were reduced by eliminating five planned LWM structures and modifying the type or location of eight LWM structures in the design
- All structures were designed to give users a minimum sight distance of 150 feet
- All structures were designed to give users a minimum reaction time 40 to 60 seconds
- Only ~20 percent of the LWM primary and secondary structures in the mainstem will require active avoidance by boaters.
- Final RBDG evaluation concluded that the public safety risk rating for all of the structure groups is low.

Many of the structures that will be installed were designed to interact with the river at higher flows (>500 cfs). This is because high flows provide the energy necessary to achieve the desired hydrological response. At low flows, many structures will likely be in shallow water or not in the water at all. This will reduce the risk for recreational users by removing the structure from the water and through reduced depths and velocities adjacent to the structure. Substantial changes to the quality of recreation experience of boaters and other river users are not anticipated (Section 3.10.2).

Endangered Species Act – Threatened and Endangered Species

Section 3.5 of the EA analyzed the effects of the Project on federally-listed threatened and endangered species. The USACE have been in consultation with the U.S. Fish and Wildlife Service (USFWS) and NOAA Fisheries for ESA compliance for this Project as part of the Clean Water Act Section 404 application per two restoration programmatic BiOps (NOAA Fisheries and USFWS 2008; NOAA Fisheries 2017; see Section 4.3.1). On January 11, 2018, USFWS agreed that the Project is consistent with the Programmatic, and effects to bull trout and bull trout critical habitat are covered therein. The Programmatic BiOp is set to expire before Project completion. Consultation on effects to bull trout and its designated critical habitat will need to be reinitiated if the Project is not consistent with any future Programmatic and Incidental Take Statement issued prior to Project completion. USFWS also concurred with the determination of "may affect, not likely to adversely affect" for the northern spotted owl. On January 11, 2018, NOAA Fisheries concurred that the Project is consistent with the Programmatic BiOp and approved the minor requested modification of in-water work windows and staging areas in the programmatic, as described in the EA. Tables 2 and 3 show the federally-listed species evaluated in the EA and the federal agencies responsible for managing the species. The Project was designed to improve habitat for fish species but could also result in beneficial effects to wildlife.

Table 2. Federally-listed fish species evaluated in the EA.

Species ^a	Federal/ State Status ^b	Comments	Effects Determination
Federally-protected Anadromous Fish (NOAA Fisheries)			
Chinook salmon (<i>Oncorhynchus tshawytscha</i>) Upper Columbia River Spring-Run ESU ^c	E/C	Spawning occurs August – September. Fry emerge from the redds February – mid-May Juvenile rearing occurs February – September	LAA; covered under the NOAA Fisheries 2017 programmatic BiOp
Steelhead (<i>O. mykiss</i>) Upper Columbia River DPS ^c	T	Spawning occurs late-February – early-June Fry emerge from the redds June – August Juvenile rearing occurs June – October	LAA; covered under the NOAA Fisheries 2017 programmatic BiOp
Federally-protected Resident Fish (USFWS)			
Bull Trout (<i>Salvelinus confluentus</i>) Columbia River DPS ^c	T	Spawning occurs August – mid-November Fry emerge from the redds March – June Juvenile rearing occurs year-round. Bull trout migrating upstream within the Entiat River to spawning areas located upstream of the project area tend to migrate through the project action area starting in late-May/early-June and are upstream of the project action area by mid-July (Nelson 2014). Bull trout migrating post-spawning tend to migrate downstream in October, but individuals have been recorded migrating downstream as early as August and as late as December (Nelson 2014).	NLAA; covered under the NOAA Fisheries and USFWS 2008 programmatic BiOp
<p>Notes:</p> <p>^a Species Presence based on USFWS 2017b</p> <p>^b Federal Status – E=Endangered, T=Threatened, N/A=Not Applicable State Status – E=Endangered, T=Threatened, C= Candidate, N/A=Not Applicable</p> <p>^c ESU=Evolutionarily Significant Unit. DPS=Distinct Population Segment. LAA = Likely to Adversely Affect; NLAA =Not Likely to Adversely Affect</p>			

Table 3. Federally-listed wildlife evaluated in the EA.

Species ^a	Federal/State Status ^a	Comments	Effects Determination
Federally-protected Wildlife Species (USFWS)			
Marbled Murrelet (<i>Crachyramphus marmoratus</i>)	T/T	May occur in Chelan County, but not expected in Entiat River subbasin. No nesting habitat is present in the project area.	NE
Northern Spotted Owl (<i>Strix occidentalis caurina</i>)	T/E	Resident within the Entiat River subbasin.	NLAA
Yellow-billed Cuckoo (<i>Coccyzus americanus</i>)	T/C	Rare in Washington with individual sightings, including Chelan County. Breeding no longer occurs in Washington. Only 8 siting's in eastern Washington between 2000 and 2012. No nesting habitat is present in the project area.	NE
Gray wolf (<i>Canis lupus</i>)	E/E	There have been unconfirmed sightings in the past several years.	NE
Grizzly bear (<i>Ursus arctos</i>)	T/E	Habitat exists and occurrence is suspected but not confirmed within the Entiat River subbasin. They are an extremely wide-ranging animal with individuals requiring several square miles of habitat.	NE
Canada Lynx (<i>Lynx Canadensis</i>)	T/T	Sightings have been documented in the Entiat River subbasin, but occurrence is rare.	NE
North American Wolverine (<i>Gulo luscus</i>)	PT/C	Approximately three dozen estimated to occur in Washington's northern Cascades with 10 wolverines captured in the state between 2006 and 2012. No sightings documented in the analysis area although wolverines have been reported in the Entiat Valley upstream of the analysis area.	NE
<p>Notes:</p> <p>^a Federal Status: E=Endangered; T=Threatened; PT=Proposed Threatened; SC=Species of Concern State Status: E=Endangered; T=Threatened; C=Candidate; S=Sensitive NLAA = Not Likely to Adversely Affect; NE = No Effect</p>			

The EA referenced studies that show habitat improvement projects designed to improve natural river processes, have provided benefits to fish habitat in the Upper Columbia Basin. Roni et al. 2014, documented that most studies of LWM structures and biological benefit report positive biological responses for adult and juvenile salmonids. This 2014 study examined 200 published studies on wood placement that reported positive, negative, or no change in physical habitat, juvenile and adult salmonids, non-salmonids, and invertebrates. A total of 69 percent and 80 percent of the studies reported positive responses for juvenile and adult salmonids, respectively. The 2014 Annual Report on Project Effectiveness Monitoring Program for the Upper Columbia River (Tetra Tech 2014), also found that wood structures in streams have been consistently effective at improving aquatic habitat. In addition, the study found that wood structures have largely remained in place and functional over a 5-year monitoring period.

The Project incorporated design elements in the HIP III process, and will be required to follow the General Conservation Measures (BPA 2016) that are conditions of the USACE's restoration programmatic agreement with NOAA Fisheries for compliance with the ESA. Impacts on fish habitat will be avoided, reduced, and minimized by implementation of these measures (Section 2.3 and Appendix B).

Reclamation must comply with these measures and all the BMPs listed in the EA (Table 2-6). The Project will benefit ESA-listed fish species by improving habitat through the installation of 86 LWM structures and 5,240 linear feet of side channel improvements. The structures will provide resting and refuge habitat within the main channel, wood structures will enhance natural channel habitat forming processes such as channel scour and formation/maintenance of pool/riffle habitats, and side channels will provide refuge for juveniles. The EA described how this type of habitat is limited along the Entiat River (Section 1.4.2), and that the Project will improve aquatic habitat by constructing these habitat features.

Cultural Resources

As stated in Section 3.7 of the EA, Cultural Resource Consultants, Inc. conducted cultural resource field investigations and a records search for any historical or prehistorical artifacts recorded in and near the project area. Cultural Resource Consultants, Inc. prepared a report describing the methods and results of the investigations (Berger and Hartmann 2015). Reclamation adopted the findings of these cultural studies that had been prepared for BPA. Reclamation's archaeologist also conducted field investigations in a 1-acre area south of Project Area C that had inadvertently been excluded from the original Cultural Resource Consultants, Inc. field studies. Based on the results of the field investigations and records search, the EA concluded there were no pre-contact archaeological sites or isolates identified in the Project's Area of Potential Effect. No Traditional Cultural Properties (TCP) were identified in the project area based on the results of field investigations and tribal consultation. Therefore, there are no anticipated project-related impacts on TCPs.

On October 6, 2015 Washington State Department of Archaeology and Historic Preservation (WDAHP) issued a letter that concurred with BPA's finding of "No Historic Properties Affected." Reclamation sought concurrence on adoption of BPAs findings for Section 106 of the National Historic Preservation Act from the WDAHP, CCT, and the YN. The WDAHP concurred with the adoption on October 30, 2017. On November 29, 2017 the CCT concurred with a finding of "no adverse effect." The YN did not respond to a request for concurrence. Reclamation has an Inadvertent Discovery Plan in the event of a post-review discovery or inadvertent discovery during construction.

Sacred Sites

Section 3.8 of the EA reported that the Project resides on non-federal land and no Sacred Sites will be affected by the Project.

Indian Trust Assets

Reclamation is responsible for determining if the Project has a potential to affect ITAs. Section 3.9 of the EA reported that while the majority of ITAs are located on reservations, ITAs can also occur outside reservation boundaries. In consultation with the CCT and the YN, no ITAs were identified in the Project area.

Environmental Justice

Construction activities will create temporary, localized disturbances to the public (Section 3.10 – Land Use and Recreation; Section 3.11 – Noise and Air Quality, Public Health and Safety; Section 3.12 – Transportation). However, based on guidelines provided by the Council of Environmental Quality, the Project will have no adverse or disproportionate effects on minority or low-income populations in the Project area or Chelan County (Section 4.12).

Other Resources

In addition to those addressed above, the EA addressed and analyzed other human and natural environmental resources; these are summarized in Table 2-8 of the EA.

Cumulative Effects

The Final EA evaluated the Proposed Action in the context of past actions and present and reasonably foreseeable future actions and concluded there are no significant cumulative effects on the human and natural environment (Section 3.14). Two additional similar projects are reasonably certain to occur in the Middle Entiat Watershed. Previous projects have been constructed in the Entiat River both upstream and downstream of the proposed

Project. This proposed Project will add to the cumulative benefits of the other past and future habitat improvement projects on the Entiat River.

PERMITS AND APPROVALS

Permits and approvals required for the Project are identified in Chapter 4 of the EA. Permit applications have been made to the appropriate local, state, or federal agency. The Project will not commence until all applicable permits, authorizations, reviews, and exemptions have been received by the local sponsors and/or Reclamation.

DECISION

It is my decision to approve the Proposed Action, which will fund implementation of the Middle Entiat Habitat Improvement Project.

FINDING OF NO SIGNIFICANT IMPACT

Based upon a review of the EA and supporting documents, I have determined that implementing the Proposed Action will not significantly affect the quality of the human and natural environment, individually or cumulatively with other actions in the area. No environmental effects meet the definition of significance in context or intensity as defined at 40 CFR 1508.27. Therefore, an environmental impact statement is not required for this Proposed Action. This finding is based on consideration of the context and intensity as summarized below from the EA.

Context

Affected Region

The Proposed Action is a site-specific action involving four selected projects along an approximately 4-mile section of the Middle Entiat River, all within Chelan County, Washington. Similar project actions have occurred throughout the local area and across the greater Columbia River Basin. Some of these projects were constructed as part of the FCRPS BiOp that requires planning of projects in the Entiat subbasin as well as on other tributaries in key subbasins in Washington, Oregon, and Idaho. The Entiat River's headwaters begin in the Okanogan-Wenatchee National Forest and continue through National Forest System lands into private lands approximately halfway along its course, eventually discharging into the Columbia River near the town of Entiat, Washington. The Entiat River is not considered a wild and scenic river and the Project occurs on non-federal land. The Project is not located in or near any local or state managed parks or designated wilderness areas.

The Columbia River is 1,243 miles long and the entire Columbia River watershed is approximately 258,000 square miles, or roughly the size of Idaho, Oregon, and Washington. Numerous tributaries, like the Entiat River, occur in the Upper Columbia subbasin and contribute to the Columbia River's flow. These key subbasins represent over 1,000 miles of primary tributaries and almost 33,000 square miles of watershed area in the Upper Columbia River. The Entiat River is 57 miles long with a 466 square mile watershed area and is one of the primary tributaries to the Columbia River. Annual high flow in the Entiat River is approximately 3,000 cfs at the Project site compared to approximately 180,000 cfs for the Columbia River near the confluence with the Entiat River.

The Project area is 3.9 miles long and involves the placement of 86 LWM structures within this stretch of the Entiat River. LWM structures on the main channel of the Entiat River total about 18 percent of the total linear feet of the Project.

Affected Interest and Locality

The Middle Entiat River is of local importance to residents and visitors in the area, and the Proposed Action is expected to affect a small number of Chelan County residents. The local population for Census Tract 9601 (2014) in Chelan County, which overlaps the Project area, was 1,225 people (U.S. Census Bureau 2016). This is approximately 2-percent of the overall population in the County (see Section 3.13.1), and the Census Tract data do not indicate there are Environmental Justice Communities present. Residents along the Middle Entiat access their dwellings or the river itself via the Entiat River Road which runs 37 miles upstream from the Columbia River.

Local residents are known to use and recreate on the Middle Entiat River and within the Project area, but survey data indicates this use within the Project area is lower than areas that are outside of or beyond it. The implementation of the proposed Project will result in changes to the river that will affect how recreational boaters see and interact with the Entiat River. The Middle Entiat does not have the regional draw of the Wenatchee or the Methow rivers; therefore, the number of local users affected will be relatively low in comparison (see *Recreation* above and Section 3.10.2 of the EA).

Intensity

The following discussion is organized around the significance criteria described in 40 CFR 1508.27, repeated in bold text below, and is based on analysis of those factors, in their local context, for implementation of the Proposed Action.

(1) Impacts that may be both beneficial and adverse. A significant effect may exist even if the Federal agency believes that on balance the effect will be beneficial.

None of the effects on the quality of the human environment, beneficial or adverse, discussed in the EA are significant. Short-term, localized adverse impacts will occur during 2 years of construction during the summer and fall work windows. Long-term beneficial impacts to fish habitat are expected over the 25-year life of the LWM structures. Impacts to resources are summarized in Table 2-8 of the EA. Environmental design features, BMPs, and conservation measures were incorporated into the design to minimize adverse impacts (Table 2-6 of the EA). Beneficial impacts on fish are identified in Section 3.5.2 of the EA, which are related to the post-construction conditions of the Project that will support natural river processes and provide benefits to salmonid fish species. Although the Project will be beneficial to salmonid species at the Project site, it is not considered significant in the context of recovery of the species in the region or greater Columbia River Basin (see Intensity Factor 9). Beneficial impacts on wetlands are noted in Section 3.3.2 of the EA as wetland habitat will be created or rehabilitated to offset impacts on wetlands from the Project.

(2) The degree to which the Proposed Action affects public health or safety.

Implementing the Proposed Action will have no significant impacts on public health or safety. This FONSI (above under Summary of Environmental Effects) and the EA describe the potential effects of the Proposed Action relative to public health and safety.

The Project design followed Reclamation's RBDG which requires an engineer to be part of the design process. The engineer ensured the design incorporates various measures to reduce risk to public health and safety. The engineer for the Project designed LWM structures using: 1) the 100-year design flow to meet Washington State code for the design of LWM structures (RCW 77.85.050); 2) used driven piles, appropriate anchoring systems, and threaded bolt fasteners to pin and stabilize structures; 3) utilized a 25-year life span of LWM structures; and 4) designed structures to span no more than 30 percent of the channel width. While the proposed Project will increase the extent and frequency of flooding in some areas, there are no additional structures that will be affected by increases to the 100-year flood event compared to the existing condition (Section 3.4.2). To further minimize risk, there is a post-construction inspection plan and an adaptive management program to assess structures to determine if there is a need for repair or removal. Funding is secured for the first 5 years, although agreements with Reclamation can be renewed on 5-year cycles up to 25 years.

Risk to the recreating public was a primary consideration in the Project design. After four design iterations that considered public input, the final RBDG evaluation concluded that the

public safety risk rating for all of the LWM structure groups is low (Section 3.10.2). To further reduce risk on public health and safety, signage about the Project will be placed at public use/access points along the river.

(3) Unique characteristics of the geographic area such as proximity to historic or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas.

There are no prime farmlands, wild and scenic rivers, wilderness areas, National Landscape Conservation Areas, National Monuments, National Parks, or eligible NHPA historic resources in the Project area, and therefore, none will be affected by implementing the Proposed Action.

The Entiat River is identified in Table 5 of RPA Action 35 as habitat for both the UCR spring Chinook and UCR steelhead ESUs (NOAA Fisheries 2008; 2010; 2014). As described in the EA, restoring hydraulic connectivity between the Middle Entiat River and its floodplain, improving connectivity of flows with adjacent floodplain wetlands, and re-establishing connection of historic side channels and alcoves along the river are Project purposes that will enhance habitat for these ESUs.

The Project area contains 116 acres of wetland. The proposed habitat improvement actions will result in a total of 1.03 acres of impacts (permanent) across all four project areas, but once completed the Project will rehabilitate or create 16.93 acres of wetlands. Refer also to the above discussion of wetlands in the “Summary of Environmental Effects” section under Water Resources.

Reclamation, as the lead federal agency, has completed Section 106 consultation and the finding was Finding of No Historic Properties Affected. This was concurred by the CCT and the WDAHP (see Intensity Factor 8).

(4) The degree to which the effects on the quality of the human environment are likely to be highly controversial.

The effects of the proposal on the quality of the human environment are not highly controversial based on comments received from the public and CCT. Reclamation contacted representatives of other federal agencies, state and local governments, Indian tribes, public and private organizations, and individuals regarding the proposal and its effects on resources. Reclamation received six comment letters from local public and one from the CCT on the Draft EA. This low number of comments is likely a result of public outreach efforts to inform the public about the project.

Although Reclamation recognizes that not all of the public may be fully satisfied with the Project, Reclamation did incorporate input from the public during the design process and has designed the Project to address concerns of public health and safety. Reclamation

responded to comments made in the seven letters and addressed them in the Final EA. The Project included tribal coordination as the YN attended and participated in design team meetings for the project. The YN, as described in Section 3.14.2, is currently pursuing habitat improvement actions immediately upstream of Project Area B.

(5) The degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks.

This FONSI and the Final EA have described risk minimization strategies associated with the Project design, specifically: HIP III, RBDG, Reach Assessment, and the Programmatic Conservation Measures, etc. The Project is a consistent land use action with Chelan County's Comprehensive Plan and the Shoreline Master Program. Based on this documentation and analysis, risks have been quantified and addressed and Reclamation has not been made aware of any unique or unknown risks associated with the Project.

As noted in the response to Intensity Factor 2 above, the Project has limited uncertainty by utilizing engineers in the design, using Reclamation's RBDG, designing to the 100-year flood, and will implement a post-construction inspection plan and adaptive management program. LWM structures have been a part of river restoration projects for over 40 years in the Pacific Northwest. For this Project Reclamation utilized the RBDG to design LWM structures using the latest design and engineering techniques to meet current regulatory standards. There are no predicted effects on the human and natural environment that are considered highly uncertain or that involve unique or unknown risks.

Force majeure events are not predictable, but design criteria (as described in Intensity Factor 2 above) represent a reasonable and robust attempt to engineer for unforeseen events.

(6) The degree to which the action may establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration.

The Project is not precedent setting – the design process and installation of the same type of habitat features (e.g., LWM structures, side channels, levee removals) has been used in other locations in the Columbia River Basin and therefore does not set a precedent. Over the past 5 years very similar projects have been constructed on the Entiat River, upstream and downstream of the Project site. Therefore, this is not a decision in principle about a future consideration.

(7) Whether the action is related to other actions with individually insignificant but cumulatively significant impacts. Significance exists if it is reasonable to anticipate a cumulatively significant impact on the environment. Significance cannot be avoided by terming an action temporary or by breaking it down into small component parts.

No significant impacts or cumulative impacts were identified in the EA (Section 3.14). This Project combines four distinct Project areas (B, C, E, and F) into one project. Two additional similar projects are reasonably certain to occur in the Middle Entiat Watershed (Section 3.14.2). Past habitat improvement projects have been constructed in the Entiat River both upstream and downstream of the proposed project. The Final EA evaluated cumulative impacts for all natural and human environmental resources.

(8) The degree to which the action may adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or may cause loss or destruction of significant scientific, cultural, or historical resources.

Reclamation adopted cultural resource studies and evaluations conducted by BPA for the Project, and conducted their own evaluation on a 1-acre site not included in BPA's studies. Reclamation, as the lead federal agency, has completed Section 106 consultation and the finding was Finding of No Historic Properties Affected. This was concurred by the CCT and the WDAH.

(9) The degree to which the action may adversely affect an endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act of 1973.

The Project is being undertaken for Reclamation to meet its obligations under the ESA. The Project will fulfill actions associated with RPA Action 35 of the FCRPS BiOp issued by NOAA Fisheries. The USACE have been in consultation with the USFWS and NOAA Fisheries for ESA compliance for this project as part of the Clean Water Act Section 404 application per Restoration Programmatic for the State of Washington issued to the USACE by NOAA Fisheries and USFWS (2008) and USACE programmatic consultation process with NOAA Fisheries (2017).

The Project May Affect, but is Not Likely to Adversely Affect Bull Trout and northern spotted owls (species managed by USFWS). The Project May Affect, and is Likely to Adversely Affect UCR spring-run Chinook and UCR steelhead (species managed by NOAA Fisheries). Although project construction will result in some short-term, negative effects to ESA-listed salmon and steelhead and their habitat, overall the Project will provide considerable long-term benefit to aquatic organisms and their habitat. The negative effects will be localized to the immediate area of construction and a short distance downstream,

will be limited to a relatively small number of individual Chinook and steelhead, and will be minimized by implementation of BMPs and conservation measures.

USFWS agreed that this Project is consistent with the programmatic BiOp (NOAA Fisheries and USFWS 2008), and effects to Bull Trout and Bull Trout critical habitat are covered therein. USFWS have concurred with the determination of “May Effect Not Likely to Adversely Affect” for the northern spotted owl. NOAA Fisheries has concurred that the Project is consistent with the programmatic BiOp for the UCR Chinook salmon and UCR steelhead (NOAA Fisheries 2017; Section 4.3.1).

(10) Whether the action threatens a violation of Federal, State, or local law or requirements imposed for the protection of the environment.

The Project does not threaten a violation of federal, state, or local law or requirements imposed for the protection of the environment. As previously stated in the FONSI, local, state, and federal permits and approvals will be required before the Project will occur. In addition, this Project is consistent with applicable policies and programs and the Chelan County Comprehensive and Shoreline Master Plans. State, local, and tribal interests were given the opportunity to participate in the environmental analysis process. Furthermore, letters were sent to the YN and the CCT asking whether they wished to consult on the project. The CCT have concurred with the Project as an undertaking, the area of potential effect, the level of effort, and the results of those findings as *No Adverse Effect*. The YN have not responded to requests for concurrence at this time.

Recommended:



Columbia-Snake Salmon Recovery Office Program Manager
Pacific Northwest Region, Boise, Idaho

2/1/18

Date

Approved:



Environmental Compliance Officer
Pacific Northwest Region, Boise, Idaho

2/1/18

Date

References

Parenthetical Reference	Bibliographic Citation
Berger and Hartmann 2015	Berger and Hartmann. 2015. <i>Cultural Resources Assessment of the Middle Entiat Restoration Project, Chelan County, Washington</i> . Prepared for Bonneville Power Administration. August 28, 2015, Revised September 9, 2015. CRC Project #1504J
BPA 2016	Bonneville Power Administration. 2016. HIP III Handbook, Version 3.0. Downloaded: July 5, 2016. https://www.bpa.gov/efw/Analysis/NEPADocuments/esa/2016HIPIIIHandbookVer3.0.pdf
CCD 2014	Cascadia Conservation District. 2014. <i>Middle Entiat Recreational Use Report</i> . Wenatchee, Washington.
NOAA Fisheries 2008	National Oceanic and Atmospheric Administration's National Marine Fisheries Service. 2008. <i>Endangered Species Act Section 7(a)(2) Consultation Biological Opinion And Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation</i> . Northwest Region. May 5, 2008.
NOAA Fisheries 2010	National Oceanic and Atmospheric Administration's National Marine Fisheries Service. 2010. <i>Endangered Species Act Section 7 (a)(2) Supplemental Biological Opinion. Supplemental Consultation on Remand for Operation of the Federal Columbia River Power System, 11 Bureau of Reclamation Projects in the Columbia Basin and ESA Section 10(a)(1)(A) Permit for Juvenile Fish Transportation Program</i> .
NOAA Fisheries 2013	National Oceanic and Atmospheric Administration's National Marine Fisheries Service. 2013. <i>Endangered Species Act Section 7 Formal Programmatic Biological and Conference Opinion, Letter of Concurrence, and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for Bonneville Power Administration's Habitat Improvement Program III (HIP III) KEC-4</i>
NOAA Fisheries 2014	National Oceanic and Atmospheric Administration's National Marine Fisheries Service. 2014. <i>Endangered Species Act Section 7 (a)(2) Supplemental Biological Opinion</i> . Consultation on Remand for Operation of the Federal Columbia River Power System NOAA Fisheries Log Number NWR-2013-9562

Parenthetical Reference	Bibliographic Citation
NOAA Fisheries 2017	National Oceanic and Atmospheric Administration's National Marine Fisheries Service. 2017. <i>Endangered Species Act Section 7(a)(2) Programmatic Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for the Fish Passage and Restoration Actions in Washington State (FPRP III)</i> . Action Agency: U.S. Department of the Army, Corps of Engineers. Issued June 21, 2017
NOAA Fisheries and USFWS 2008	National Oceanic and Atmospheric Administration's National Marine Fisheries Service and U.S. Fish and Wildlife Service. 2008. <i>Endangered Species Act Section 7 Formal Consultation and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for the Washington State Fish Passage and Habitat Enhancement Restoration Programmatic Biological Opinion</i> . Lead agency U.S. Army Corps of Engineers. Consultation conducted by National Marine Fisheries Service and U.S. Fish and Wildlife Service. Issued July 8, 2008.
Reclamation 2014	Bureau of Reclamation. 2014. <i>Large Woody Material – Risk Based Design Guidelines</i> . Boise, Idaho. U.S. Bureau of Reclamation. Pacific Northwest Region. U.S. Department of the Interior. Boise, Idaho.
Roni et al. 2014	R Roni, P., G.R. Pess, T.J. Beechie, and K.M. Hanson. 2014. Fish-habitat relationships and the effectiveness of habitat restoration. U.S. Department Commerce. NOAA Tech. Memo. NMFS-NWFSC-127.
Tetra Tech 2014	Tetra Tech. 2014. 2014 Annual Report Project Effectiveness Monitoring Program. Prepared for Washington State Recreation and Conservation Office Salmon Recovery Funding Board.
U.S. Census Bureau 2016	U.S. Census Bureau. 2016. State and County QuickFacts. Available online at https://www.census.gov/quickfacts/table/PST045216/53007.00
USFWS 2013	U.S. Fish and Wildlife Service. 2013. <i>Formal Section 7 Programmatic Consultation on BPA's Columbia River Basin Habitat Improvement Program – Biological Opinion</i> . Oregon Fish and Wildlife Office. Portland, Oregon. TAILS no. 01EOFW00-2013-F-0199.
USGS 2017	U.S. Geological Survey. 2017. USGS 12452990 Entiat River Near Entiat, Washington. https://waterdata.usgs.gov/nwis/uv?site_no=12452990

This page intentionally left blank.

RECLAMATION

Managing Water in the West

Final Environmental Assessment Middle Entiat River Habitat Improvement Project Chelan County, Washington



U.S. Department of the Interior
Bureau of Reclamation
Pacific Northwest Region
Boise, Idaho

February 2018

U.S. DEPARTMENT OF THE INTERIOR

The Department of the Interior protects and manages the Nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its trust responsibilities or special commitments to American Indians, Alaska Natives, and affiliated island communities.

MISSION OF THE BUREAU OF RECLAMATION

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

Acronyms and Abbreviations

Action Agencies	Reclamation, Bonneville Power Administration, and the U.S. Army Corps of Engineers
B&GEPA	Bald & Golden Eagle Protection Act
BiOp	2008 FCRPS Biological Opinion
BMP	best management practice
BPA	Bonneville Power Administration
CCC	Civilian Conservation Corps
CCCD	Chelan County Conservation District
CCD	Cascadia Conservation District
CCFEG	Cascade Columbia Fisheries Enhancement Group
CCNRD	Chelan County Natural Resources Department
CCT	Confederated Tribes of the Colville Reservation
CDC	Center of Disease Control
CDLT	Chelan-Douglas Land Trust
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
cfs	cubic feet per second
CSRO	Columbia/Snake Salmon Recovery Office
dBA	A-weighted decibels
dbh	diameter at breast height
DPS	distinct population segment
EA	Environmental Assessment
EIS	Environmental Impact Statement
ENFH	Entiat National Fish Hatchery
EPA	Environmental Protection Agency
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
FCRPS	Federal Columbia River Power System

FCRPS BiOp	2014 Supplemental FCRPS Biological Opinion
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FONSI	Finding of No Significant Impact
FWCA	Fish and Wildlife Coordination Act
HIP III	Habitat Improvement Program III
ITAs	Indian Trust Asset(s)
JARPA	Joint Aquatic Resources Permit Application
LWM	large woody material
MBTA	Migratory Bird Treaty Act
MP	mile post
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NOAA Fisheries	National Oceanic and Atmospheric Administration Marine Fisheries Service
NPCC	Northwest Power and Conservation Council
NRHP	National Register of Historic Places
NTU	nephelometric turbidity units
NWP	nationwide permit process
OHWM	ordinary high water mark
OWNF	Okanogan-Wenatchee National Forest
PHS	Priority Habitat and Species
Project	Middle Entiat Habitat Improvement Project
RBDG	Risk Based Design Guidelines
RCW	Revised Code of Washington
Reclamation	U.S. Bureau of Reclamation
RHS	Relative Habitat Suitability
RM	river mile
RPA	reasonable and prudent alternative
RTT	Regional Technical Team
SMP	Shoreline Master Program
TCP	Traditional Cultural Properties
UCR	Upper Columbia River

USACE	U.S. Army Corps of Engineers
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VS	valley segments
WDAHP	Washington State Department of Archaeology and Historic Preservation
WDFW	Washington Department of Fish and Wildlife
WDNR	Washington Department of Natural Resources
WDOE	Washington Department of Ecology
WQI	Water Quality Index
YN	Confederated Tribes and Bands of the Yakama Nation

Page intentionally left blank.

TABLE OF CONTENTS

Acronyms and Abbreviations

Chapter 1	Purpose and Need.....	1
1.1	Introduction.....	1
1.2	Background.....	4
1.3	Purpose and Need.....	5
1.4	Supporting Technical Studies.....	6
1.4.1	Entiat Tributary Assessment.....	6
1.4.2	Gray and Stormy Reach Assessments.....	7
1.4.3	Project Map Book.....	7
1.5	Roles of Other Entities.....	8
1.5.1	Cascadia Conservation District.....	8
1.5.2	Cascade Columbia Fisheries Enhancement Group.....	8
1.5.3	Chelan County Natural Resource Department.....	8
1.5.4	Chelan Douglas Land Trust.....	8
1.5.5	Bonneville Power Administration.....	9
1.6	Public Involvement and Issue Summary.....	9
1.6.1	Public Scoping for NEPA Document Preparation.....	9
1.6.2	Public Comments on Draft EA.....	12
Chapter 2	Proposed Action and Alternatives.....	15
2.1	Introduction.....	15
2.2	Proposed Action Alternative.....	15
2.2.1	Project Areas.....	18
2.2.2	Habitat Improvement Actions.....	28
2.2.3	Construction Elements.....	40
2.3	Environmental Design Features and Best Management Practices.....	46
2.4	No Action Alternative.....	49
2.5	Comparison of Alternatives.....	50
Chapter 3	Affected Environment and Environmental Consequences.....	57
3.1	Introduction.....	57
3.2	Soils and Geology.....	57
3.2.1	Affected Environment.....	58
3.2.2	Environmental Consequences – Proposed Action.....	59
3.2.3	Environmental Consequences – No Action.....	61
3.3	Vegetation and Wetlands.....	61

TABLE OF CONTENTS (continued)

3.3.1	Affected Environment	61
3.3.2	Environmental Consequences – Proposed Action.....	63
3.3.3	Environmental Consequences – No Action.....	67
3.4	Water Resources.....	67
3.4.1	Affected Environment	67
3.4.2	Environmental Consequences – Proposed Action.....	71
3.4.3	Environmental Consequences – No Action.....	75
3.5	Fish and Wildlife.....	75
3.5.1	Affected Environment	75
3.5.2	Environmental Consequences – Proposed Action.....	90
3.5.3	Environmental Consequences – No Action.....	99
3.6	Visual Resources.....	99
3.6.1	Affected Environment	99
3.6.2	Environmental Consequences – Proposed Action.....	100
3.6.3	Environmental Consequences – No Action.....	102
3.7	Cultural Resources	102
3.7.1	Affected Environment	102
3.7.2	Environmental Consequences – Proposed Action.....	105
3.7.3	Environmental Consequences – No Action.....	106
3.8	Sacred Sites	107
3.8.1	Affected Environment	107
3.8.2	Environmental Consequences – Proposed Action.....	107
3.8.3	Environmental Consequences – No Action.....	107
3.9	Indian Trust Assets.....	107
3.9.1	Affected Environment	107
3.9.2	Environmental Consequences – Proposed Action.....	108
3.9.3	Environmental Consequences – No Action.....	109
3.10	Land Use and Recreation	109
3.10.1	Affected Environment	109
3.10.2	Environmental Consequences – Proposed Action.....	114
3.10.3	Environmental Consequences – No Action.....	118
3.11	Noise, Air Quality, and Public Health and Safety	118
3.11.1	Affected Environment	119
3.11.2	Environmental Consequences – Proposed Action.....	121
3.11.3	Environmental Consequences – No Action.....	127
3.12	Transportation	128

TABLE OF CONTENTS (continued)

3.12.1	Affected Environment	128
3.12.2	Environmental Consequences – Proposed Action.....	128
3.12.3	Environmental Consequences – No Action.....	129
3.13	Socioeconomics.....	129
3.13.1	Affected Environment	129
3.13.2	Environmental Consequences – Proposed Action.....	131
3.13.3	Environmental Consequences – No Action.....	132
3.14	Cumulative Effects Analysis.....	132
3.14.1	Past Actions	133
3.14.2	Present and Reasonably Foreseeable Future Actions.....	134
3.14.3	Soils and Geology.....	135
3.14.4	Vegetation and Wetlands.....	135
3.14.5	Water Resources	136
3.14.6	Fish and Wildlife Habitat	136
3.14.7	Visual Resources	137
3.14.8	Cultural Resources, Sacred Sites, and Indian Trust Assets	137
3.14.9	Land Use and Recreation.....	137
3.14.10	Noise, Air Quality, and Public Health and Safety.....	138
3.14.11	Transportation.....	138
3.14.12	Socioeconomics	139
Chapter 4	Environmental Consultation, Review, and Permit Requirements	141
4.1.	National Environmental Policy Act	141
4.2.	Wetlands, Floodplains, and Water Resources.....	141
4.2.1	Clean Water Act Section 401	142
4.2.2	Clean Water Act Section 402	142
4.2.3	Clean Water Act Section 404	142
4.3.	Fish and Wildlife.....	143
4.3.1	Endangered Species Act	143
4.3.2	Fish and Wildlife Conservation Act and Fish and Wildlife Coordination Act	144
4.3.3	Migratory Bird Treaty Act and Federal Memorandum of Understanding.....	144
4.3.4	Bald Eagle and Golden Eagle Protection Act.....	145
4.4.	Land Use Plan Consistency.....	145
4.5.	Cultural and Historic Resources.....	146

TABLE OF CONTENTS (continued)

4.6.	Sacred Sites	147
4.7.	Indian Trust Assets.....	147
4.8.	Air Quality	148
4.9.	Noise	148
4.10.	Spill Prevention and Control.....	148
	4.10.1 The Spill Prevention, Control, and Countermeasures Rule.....	148
4.11.	Environmental Justice	149
Chapter 5	Consultation and Coordination.....	151
5.1	Introduction.....	151
5.2	Federal Agencies.....	151
5.3	State Agencies.....	151
5.4	Tribes.....	151
5.5	Local Governments	152
5.6	Others	152
5.7	Preparers.....	152
Chapter 6	References	153

Appendices

- Appendix A Comments and Reclamation’s Responses to 2017 Draft EA
- Appendix B USACE Programmatic General Conservation Measures

List of Figures

Figure 1-1.	Middle Entiat River Habitat Restoration Project area.....	3
Figure 2-1.	Proposed Project area.....	17
Figure 2-2.	Project Area B.....	19
Figure 2-3.	Project Area C.....	22
Figure 2-4.	Project Area E.....	24
Figure 2-5.	Project Area F.....	27
Figure 2-6.	Primary LWM structures mid channel.....	30
Figure 2-7.	Primary LWM structures along river bank.....	31
Figure 2-8.	Secondary LWM structures along river bank.....	32
Figure 2-9.	Secondary LWM structures side channel.....	32
Figure 2-10.	Helicopter-constructed LWM structures.....	33
Figure 2-11.	Helicopter-constructed natural jam LWM supplement.....	34
Figure 2-12.	Proportion of LWM structures in the Project area.....	35

TABLE OF CONTENTS (continued)

Figure 2-13.	Typical side channel cross section.	36
Figure 2-14.	Bremmer Levee.	40
Figure 2-15.	An example of a temporary bridge using an old railcar.	42
Figure 2-16.	Vibratory pile driver.	44
Figure 2-17.	Typical side channel excavation by a small tracked excavator.	45
Figure 3-1.	Photo simulations of primary LWM structure in Project Area E.	101
Figure 3-2.	Project area is on private land with more than 85 percent of the land owned by the CDLT.	110

List of Tables

Table 2-1.	Project Area B summary of activities.	20
Table 2-2.	Project Area C summary of activities.	23
Table 2-3.	Project Area E summary of activities.	25
Table 2-4.	Project Area F summary of activities.	28
Table 2-5.	Revegetation quantities of materials by project area.	39
Table 2-6.	Environmental design features and BMPs.	47
Table 2-7.	Comparison of the Proposed Action and No Action alternative by project purposes.	50
Table 2-8.	Summary of potential environmental effects of actions.	50
Table 3-1.	Delineated wetland area by Project area.	62
Table 3-2.	Temporary vegetation effects by Project area (ICF International 2015).	64
Table 3-3.	Evaluation of potential construction impacts to wetlands (Stratten 2017).	65
Table 3-4.	Post-construction impacts to wetlands (Stratten 2017).	66
Table 3-5.	Evaluation of anticipated benefits to wetlands (Stratten 2017).	66
Table 3-6.	Entiat River hydrology at key locations.	68
Table 3-7.	Fish species present in the analysis area.	77
Table 3-8.	Wildlife occurrence in the Entiat River subbasin.	84
Table 3-9.	Number of LWM structures of type C – F in each Project area.	114
Table 3-10.	Common activities and associated noise levels.	119
Table 3-11.	Construction equipment noise levels (FHA 2016).	122
Table 3-12.	Total population of Chelan County in 2014 (U.S. Census Bureau 2016).	130

TABLE OF CONTENTS (continued)

This page intentionally left blank.

Chapter 1 PURPOSE AND NEED

1.1 Introduction

The U.S. Department of Interior, Bureau of Reclamation (Reclamation) proposes to fund¹ implementation of habitat improvement actions for Endangered Species Act (ESA)-listed species on portions of the Entiat River in Chelan County, Washington. This would be carried out by providing financial assistance to three local project sponsors, Cascadia Conservation District (CCD), Cascade Columbia Fisheries Enhancement Group (CCFEG), and Chelan County Natural Resource Department (CCNRD). Reclamation has developed a design for the proposed Middle Entiat Habitat Improvement Project (Project) that is comprised of four separate project areas, each of which would be implemented by one of the three project sponsors.

The project areas are located in the Entiat subbasin within the Columbia River Basin, between Entiat River Road mile post [MP] 15.0 and 18.7. The Middle Entiat River begins at the headwaters on Wenatchee-Okanogan National Forest Service Lands, travels through the national forest and private lands, and ends at the mouth of the Columbia River near the town of Entiat for a total of 57 river miles. The town of Entiat and the unincorporated community of Ardenvoir are the closest communities to the project areas (Figure 1-1).

The Project would enhance fish habitat along the Entiat River between river mile (RM) 16.2 and RM 20.1 through the construction of large woody material (LWM) structures and re-establishment of side channels. The Project is intended to increase the amount of suitable habitat for fish and wildlife species that utilize the Entiat River with specific focus on the needs of Upper Columbia River (UCR) steelhead and UCR spring-run Chinook (UCR Spring Chinook salmon) (*O. tshawytscha*) which are listed as threatened and endangered, under the ESA (16 U.S.C. 1531 et seq.). These efforts would complement other habitat improvement activities already occurring throughout the Columbia River Basin that are funded through Reclamation's Columbia-Snake Salmon Recovery Office Habitat Program and would help mitigate for the operation of the Federal Columbia River Power System (FCRPS).

¹ Reclamation funding is authorized under the authority of Section 225 of the Reclamation Department Manual, subsection 1 1.B

Reclamation prepared a Draft Environmental Assessment (EA) to comply with the National Environmental Policy Act (NEPA) (42 U.S. Code [U.S.C.] 4321 et seq.), which requires federal agencies to assess the effects their actions may have on the natural and human environment. This Final EA was prepared based on public comments Reclamation received on the Draft EA. Based on this analysis, impacts were not identified that would trigger the threshold of significance in terms of context and intensity (40 Code of Federal Regulations [CFR] 1508.27). If the decision maker supports this assertion of non-significance, a Finding of No Significant Impact (FONSI) will be issued. If not, then a decision will be made to either select the No Action alternative or issue a notice of intent to prepare an Environmental Impact Statement (EIS).

This chapter provides the following information regarding the Project:

- Background information on the Project.
- Purpose and need of the Proposed Action.
- Supporting technical studies.
- Role of entities associated with the Project.
- Summary of the public involvement process and comments received during the scoping process and on the Draft EA.

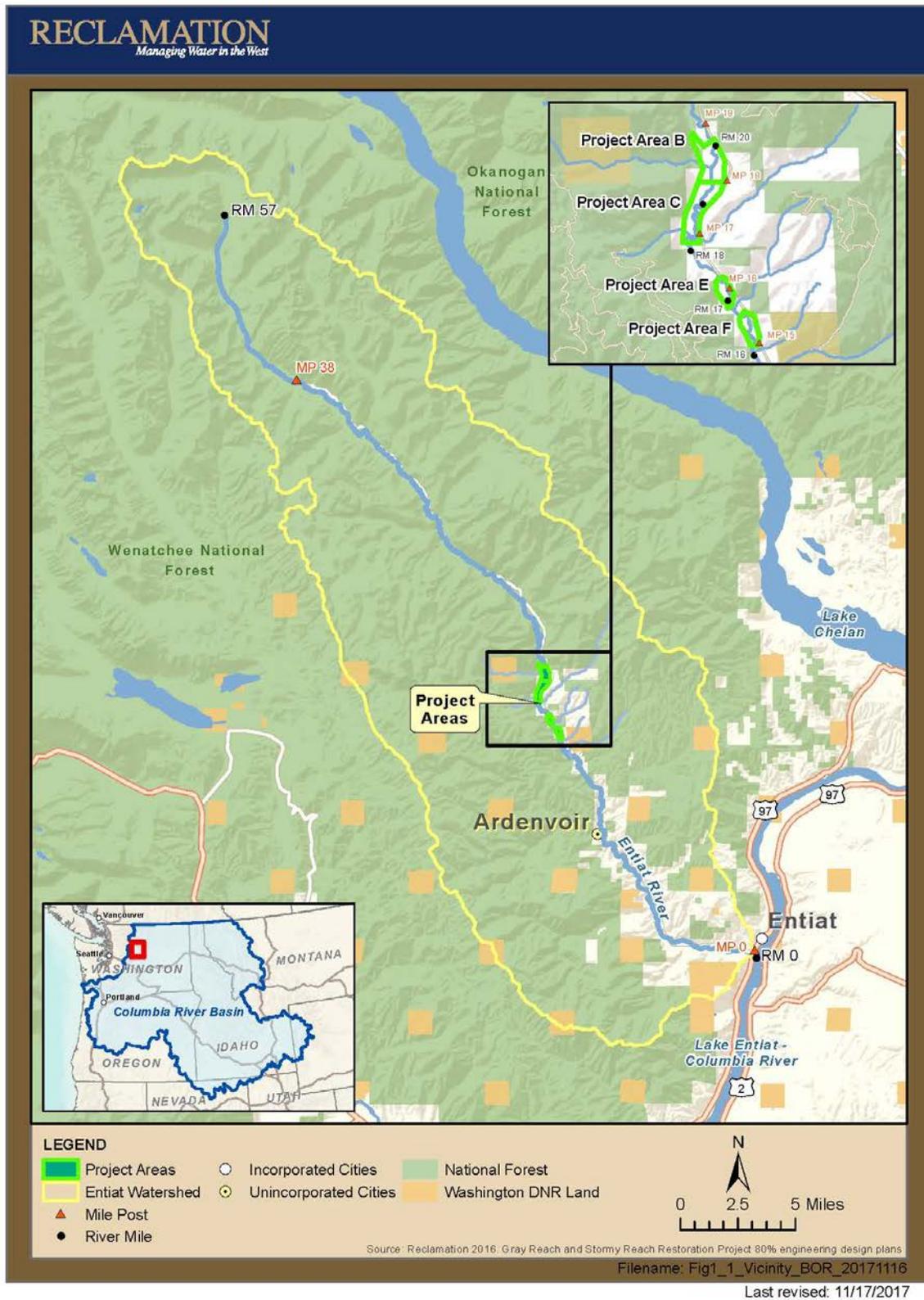


Figure 1-1. Middle Entiat River Habitat Restoration Project area.

1.2 Background

Bonneville Power Administration (BPA), U.S. Army Corps of Engineers (USACE), and Reclamation (collectively referred to as the Action Agencies) consulted with the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NOAA Fisheries) on effects of the FCRPS on salmon and steelhead listed under the ESA.² The 2014 Supplemental FCRPS Biological Opinion (FCRPS BiOp) includes hydrosystem, harvest, hatchery, predator control, and tributary and estuary habitat actions to avoid jeopardy and aid recovery of these species. Each action agency fills different roles for meeting FCRPS BiOp commitments. Reclamation works primarily, but not exclusively with BPA to meet tributary habitat commitments for the FCRPS BiOp by designing habitat complexity and floodplain connectivity projects that are constructed on tributaries of the Upper Columbia, like the Entiat River. Specific to the FCRPS, Reclamation operates and maintains water storage facilities in the Upper Columbia River system at the Grand Coulee and Hungry Horse dams.

Reclamation and BPA contribute to the implementation of salmonid tributary habitat improvement actions in the Columbia River Basin to help meet commitments from the 2008 FCRPS BiOp, as amended by Supplemental FCRPS BiOps in 2010 and 2014 (NOAA Fisheries 2008; 2010; 2014).³ The FCRPS BiOp includes a reasonable and prudent alternative (RPA), or a suite of actions, to protect ESA-listed salmon and steelhead across their life cycle. Habitat improvement actions in various Columbia River tributaries are one aspect of this and can be found in RPA Action 35.

Habitat improvement projects designed to improve natural river processes, and thus provide benefits to fisheries habitat, have been recently documented in the Upper Columbia Basin. In over 200 published studies (Roni et al. 2014), it was documented that LWM structures resulted in positive responses for juvenile and adult salmonids (see Section 3.5.2).

Reclamation provides technical assistance to states, tribes, federal agencies, and other local partners for identifying, designing, permitting, coordinating, and providing other technical services for stream habitat improvement actions. These primarily address streamflow, habitat access, entrainment, and channel complexity limiting factors. The Department of Interior, Departmental Manual, Section 255 DM 1 delegates the authority for the activities contained within Reclamation's Columbia-Snake Salmon Recovery Office (CSRO) Habitat Program.⁴

² The full title for the 2008 FCRPS BiOp is Consultation on Remand for Operation of the Federal Columbia River Power System, 11 Bureau of Reclamation Projects in the Columbia Basin and ESA Section 10(a)(1)(A) Permit for Juvenile Fish Transportation Program (Revised and Reissued Pursuant to Court Order, NWF V. NMFS, CIV. NO CV01-640-RE (D. OREGON)).

³ These biological opinions are available at

http://www.westcoast.fisheries.noaa.gov/fish_passage/ferps_opinion/federal_columbia_river_power_system.html

⁴ See <http://www.usbr.gov/recman/delegations/Delegations.pdf>

Reclamation generally does not provide construction funding but works with project sponsors to implement habitat improvement actions. Reclamation's goal for the CSRO Tributary Habitat Program supports meeting the Action Agency's commitments in the FCRPS BiOp with special attention to RPA Action 35.⁵ Reclamation works with project sponsors and watershed partners through the local scientifically-based planning, prioritizing, and implementing processes for each subbasin.

1.3 Purpose and Need

The purpose of the Project is to restore hydraulic connectivity between the Middle Entiat River and its floodplain and improve connectivity of flows with adjacent floodplain wetlands. To fulfill this purpose, the Project seeks to re-establish connection of historic side channels and alcoves along the river and through the strategic placement of LWM along the Middle Entiat bends and bars to direct flow into the restored side channels and alcoves and onto the floodplain. Reclamation needs to meet its obligations under the ESA (16 U.S.C. 1531 et seq.) and fulfill actions associated with RPA Action 35 of the FCRPS BiOp, as follows, "The Action Agencies will identify additional habitat projects for implementation based on the population specific overall habitat quality improvements still remaining in Table 5." The Entiat River is identified in Table 5 of RPA Action 35 as part of both the UCR spring Chinook and UCR steelhead Ecologically Significant Units (ESUs) (NOAA Fisheries 2008; 2010; 2014). RPA Action 35 also states that, "Habitat quality improvements associated with projects will be estimated in advance of project selection by expert panelist." An expert panel evaluated and provided input on habitat projects in the Columbia River Basin, including the Entiat River under the Regional Recovery Board and Regional Technical Teams (NOAA Fisheries 2008; 2010; 2014).

Relative to the Entiat River, the decline in salmonid habitat is associated with anthropogenic changes that are generally localized and have included floodplain fill, levee construction, residential development, agriculture (e.g., orchards), and timber harvesting (Andonaegui 1999; Reclamation 2009, Reclamation 2013a; 2013b). The importance of floodplain habitat for juvenile salmonids (Martens and Connolly 2014; Bellmore et al. 2012; Opperman et al. 2010) and off channel spawning habitats for adults (Roni et al. 2014) on the Entiat and other systems is important biologically for salmonid species (UCR spring Chinook salmon, UCR steelhead, and Bull Trout) as well as other native fish and floodplain-associated wildlife in the Entiat River basin. Re-establishment of natural riverine processes and a properly functioning and self-sustaining riverine floodplain ecosystem would aim to provide critical spawning, rearing,

⁵ See <http://www.usbr.gov/pn/fcrps/habitat/panels/reference/1A-RPA35Table5.pdf>

and off-channel refuge habitat for these fish species, thereby partially fulfilling RPAs associated with RPA Action 35.

1.4 Supporting Technical Studies

Previous technical studies were conducted to analyze the condition and characteristics of the Middle Entiat River and are summarized in this section. These studies were conducted as part of Reclamation's process to identify restoration opportunities throughout the Upper Columbia River Basin where habitat for UCR steelhead and UCR spring Chinook salmon could be improved. The studies identify existing physical and biological conditions of the Entiat River that limit habitat conditions supporting UCR spring Chinook salmon and UCR steelhead, and recommend conceptual restoration actions to improve habitat. The proposed Project furthers these conceptual ideas into the 80 percent habitat restoration engineering design plans and specifications as described in Chapter 2 (Reclamation 2016a).

1.4.1 Entiat Tributary Assessment

Reclamation established its Tributary Habitat Program under authorities contained in the ESA, Fish and Wildlife Coordination Act (FWCA), and Fish and Wildlife Act as delegated from the Secretary of the Interior in Departmental Manual Section 255 DM 1. Reclamation's objective for the Tributary Habitat Program is to identify projects that will improve the survival of UCR salmon and steelhead listed under the ESA, which is required as part of the tributary habitat improvement commitments under RPA Action 35 in the FCRPS BiOp. Through this program, Reclamation evaluates fish screens to make sure they meet current criteria, identifies artificial fish passage barriers that need to be replaced or removed to allow fish access to spawning and rearing areas, and looks for opportunities where instream flows can be increased and spawning and rearing habitat can be improved in selected Columbia River tributaries. Reclamation works closely with local organizations and willing private landowners and provides engineering and related technical assistance where needed to meet the Tributary Habitat Program objectives.

This Entiat Tributary Assessment (Reclamation 2009) is intended to be a summary document containing the pertinent scientific information necessary for habitat improvement planning and decision making. Reclamation's assessment focused on the lower 26 river miles of the Entiat subbasin (the upper part of the basin, managed by the Okanogan-Wenatchee National Forest was not included) with the intention of both providing the context for developing habitat improvement projects by describing the historical natural and human-induced disturbances in the basin and identifying the locations where protection and/or habitat improvement should be implemented to address the limiting factors of ESA-listed UCR steelhead and spring Chinook salmon throughout the Entiat River subbasin.

1.4.2 Gray and Stormy Reach Assessments

Following the completion of the Entiat Tributary Assessment, Reclamation conducted a reach-scale refinement of the information contained in that document that was intended to provide a summary of pertinent larger-scale background information and to expand upon that information at the reach scale. The Gray and Stormy Reach Assessments evaluated the two reaches of the Entiat River that comprise the proposed Project area. These assessments documented the current condition of the river and how conditions have changed over time. This was then used to identify suitable habitat improvement actions necessary to address the limiting factors for UCR spring Chinook salmon and UCR steelhead within the reach. This reach level analysis was then used to guide the early concepts for restoration activities in the Middle Entiat River. Several existing reports have documented the limiting factors for these two species and they were summarized in the order of most limiting factor to least limiting factor based on interpreted findings from those reports as they pertain to the assessment area:

1. Lack of overwintering juvenile rearing habitat attributed to losses in floodplain connection and depleted riparian zone conditions (Andonaegui 1999; CCCD 2004; Reclamation 2009).
2. Lack of instream structure, especially poor size and distribution of LWM (CCCD 2004; Andonaegui 1999; Reclamation 2009).
3. Loss of well-established riparian vegetation/buffer and lack of cover (Andonaegui 1999; Reclamation 2009).
4. Excess fine sediment has been identified as a minor limiting factor within the Entiat River as a whole (Andonaegui 1999; CCCD 2004; Reclamation 2009). This report shows that fine sediment levels fluctuate in accordance with natural conditions and do not represent a consistent or long-term concern.

1.4.3 Project Map Book

Following the development of the Entiat Tributary Assessment and the Gray and Stormy Reach Assessments that included the documentation of historical, existing, and target conditions, and potential habitat improvement actions, Reclamation led the development of Project Map Books that took the next step towards identifying appropriate habitat actions for the Project area based on the cumulative information developed in the previous studies.

A small group of habitat project designers (physical scientists and engineers) familiar with the Entiat subbasin were selected to participate in the development of the Project Map Books. The early concepts illustrated in the Project Map Books were identified based primarily on geomorphic appropriateness, engineering feasibility, and risk as assessed at a reach scale. Biological benefit and priority were evaluated by a subcommittee of the Upper Columbia

Regional Technical Team (RTT) also at a reach scale. In the Project Map Books, the Gray and Stormy reaches were broken into six specific project areas. Maps of each Project area were used to display the locations of potential restoration actions that would be necessary to achieve the objectives identified in the Gray and Stormy Reach Assessments. The early concepts shown in the Project Map Books were the starting place for the current designs for the Project.

1.5 Roles of Other Entities

Multiple entities have been associated with the Project. Local sponsors that participated in the design process and would implement the projects include the CCD, CCFEG, and the CCNRD. Representatives from these entities are part of the project team that worked with Reclamation to develop the Project's restoration plans. Although not a local sponsor, the Chelan-Douglas Land Trust (CDLT) is part of the project team as a primary land owner where the Project would be constructed.

1.5.1 Cascadia Conservation District

The CCD is a non-regulatory political subdivision of the State of Washington that serves all of Chelan County. CCD works cooperatively with local landowners and communities to provide technical and financial assistance for soil, water, forest, fish, and wildlife conservation efforts.

1.5.2 Cascade Columbia Fisheries Enhancement Group

In 1990, the Washington State Legislature created fourteen Regional Fisheries Enhancement Group Programs intended to involve local communities, citizen volunteers, and landowners in the state's salmon recovery efforts. The CCFEG works within Chelan, Douglas, Okanogan, and Ferry counties to cooperatively facilitate fisheries enhancement projects.

1.5.3 Chelan County Natural Resource Department

The CCNRD works to address federal, state, and local natural resource mandates and issues. Areas of focus include water resources and timber, fish, wildlife, and agricultural activities within Chelan County and North Central Washington. The Department responds to the general policy direction of the Board of County Commissioners.

1.5.4 Chelan Douglas Land Trust

The CDLT works with local organizations, businesses, and individuals to protect natural areas, a strong economy, clean air and water, abundant wildlife, and the ability for the public to enjoy it all. CDLT has acquired properties along the Entiat River and is a primary landowner where

many of the proposed actions for the Project would be constructed, therefore, CDLT has been an interested and active participant during the Project's design process. CDLT's management of the properties for conservation purposes, and support of the Project's goal to improve natural river processes, is consistent with CDLT's mission. As a landowner, CDLT has developed an agreement with the CCNRD on the roles and responsibilities to oversee the Project actions after construction.

1.5.5 Bonneville Power Administration

As an Action Agency in the 2008 BiOp (as supplemented by the 2010 and 2014 BiOps), BPA participated in the development of the Middle Entiat Project as a project team member through the 80 percent design process. That participation included issuance of a scoping letter for this Project on February 2, 2016, in which BPA assumed Lead Agency status for federal environmental compliance. BPA contributed to the development of the Project Map Books (see Section 1.4.3), and engaged with Reclamation and local sponsors during planning and development of the Project, including funding a portion of the engineering design, until the fall of 2016. At that point, BPA made the decision to reallocate their funding to other projects in the Upper Columbia Region. This reallocation of funding necessitated BPA's change in status from Lead Agency to no longer a participant in the Project.

Due to the BiOp commitments for the Entiat River for UCR spring Chinook salmon and UCR steelhead, Reclamation decided to allocate funding to complete the planning and design for the Project. Further, under the authority of Section 225 of the Reclamation Department Manual, subsection 1 1.B, Reclamation is providing financial assistance to the three local project sponsors to construct the Project. Reclamation became the Lead Agency for environmental compliance upon the assumption of primary responsibility for funding. This includes compliance with the NEPA, ESA, National Historic Preservation Act (NHPA), and other pertinent regulations.

1.6 Public Involvement and Issue Summary

1.6.1 Public Scoping for NEPA Document Preparation

The purpose of public involvement is to provide an opportunity for the public to learn about the Project and invite them to comment on the Project or ask questions. Input from the public is used by Reclamation to identify potential issues that would be addressed during the NEPA process. This section summarizes the public involvement process and the issues that have been identified through the process.

The project team began public involvement for the proposed Project with two Entiat Watershed Outreach meetings in Entiat, Washington that were hosted by the CCD. The first outreach meeting was held on November 20, 2014, and the second was August 26, 2015. The team also hosted a landowner meeting and barbeque at the Stormy Preserve on June 20, 2015, where residents with property adjacent to the Project area were invited to learn about the proposed Project and were given a presentation by Reclamation on the Project background and desired outcomes. At each of these meetings, information was made available to the public regarding the Project restoration actions being planned. The Entiat Watershed Outreach meetings were advertised in the Entiat Valley Lookout, a free newsletter distributed by the Entiat Valley Chamber of Commerce and via post cards mailed to residents of the Entiat Valley. Four landowners attended the November 2014 meeting, and 30 landowners attended the August 2015 meeting. Additionally, several meetings with individual landowners took place in the field or at CCD offices to discuss the Project.

Several people who attended the Watershed Outreach Meetings commented on the potential for the Project to affect boating in the project area. As a result, in October 2015 Reclamation led a field trip to look at the Project area and evaluate potential recreation risks. Six landowners attended the field trip and provided input on structure locations.

The NEPA public scoping outreach for the Project was initiated on February 2, 2016, when a letter was sent to the public potentially interested in or affected by the Project, including adjacent landowners, public interest groups, local governments, tribes, and state and federal agencies. The letter explained the proposal, the environmental process, and how to participate. Additionally, ads were placed announcing the public scoping period in the Wenatchee World, the Lake Chelan Mirror, and in the Entiat Valley Lookout newspapers.

Two tribes were identified that have a potential interest in the Project on their historic or current use of the land in the Project area: Confederated Tribes of the Colville Reservation and the Confederated Tribes (CCT) and Bands of the Yakama Nation (YN). Project information was provided to the two tribes and requested information from the consulting tribes, including information on potential cultural resources in the Project area.

Eighteen entities, which included individual landowners, CCT, and Icicle Valley Trout, responded with comments during the scoping comment period. Reclamation considered the comments in preparing this EA.

The comments are summarized below.

Project Description

There was public confusion regarding the Project area map that was sent with the public scoping letters about where Project implementation would occur. Project area figures are depicted in Section 2.2.

Alternatives

Comments were made regarding the number, size, and location of structures, the efficacy of structures to create fish habitat, and the need for restoration in the Project area. There were also concerns regarding potential risks from man-made structures in the river, particularly to downstream property. This topic is addressed in Sections 2.2, 3.5, and 3.10.

Water Resources

Several comments requested evaluation of the effects from the LWM structures on bank erosion, flooding, and water temperature. There were comments expressing concern around the recent fires in the upper Entiat watershed and the potential for sediment to be transported and deposited in the Project area. This topic is addressed in Section 3.4.

Land Use and Recreation

There were several comments requesting evaluation of potential effects to recreational boaters posed by the LWM structures. In particular, the potential of additional logs being caught on the manmade log jams and blocking the entire river. This topic is addressed in Section 3.11.

A comment was received during public scoping asking that the Project comply with Chelan County's Shoreline Master Plan that regulates development within the 100-year floodplain (Chelan County Code, Chapter 3.20 Flood Hazard Development). This topic is addressed in Section 3.4 and 3.10.

Public Safety

Comments were also received expressing concern for the potential of the LWM structures installed as part of the Proposed Action becoming loose and causing damage to people and property.

Several people commented about the potential for the side channels installed as part of the Project increasing mosquito habitat. This topic is addressed in Section 3.11.2.

Wildlife

One comment expressed concern that the excavation necessary for the side channels would affect habitat for other species. This topic is addressed in Section 3.5.2.

Fishing Rights

One comment expressed concerns about the differences in fishing rights in the Entiat River and a request to consider impacts to tribal fishing rights. This topic is addressed in Section 3.9.

Cultural Resources

The CCT requested consultation on the cultural resource process under the NHPA and expressed its concern over Project impacts to cultural resources. Reclamation has adopted the Section 106 NHPA consultation process completed by BPA; consultation is addressed in Section 3.7 and 4.5.

1.6.2 Public Comments on Draft EA

Reclamation prepared the Final EA, which addresses issues relative to the Project, including those issues raised during public scoping (See Section 1.6.1). The Draft EA was distributed to the public on August 27, 2017 and was posted on Reclamation's web site for public review through September 27, 2017. Reclamation received six comment letters from individuals in response to the Draft EA. Common issues raised in those comment letters are summarized below. Appendix A includes a summary table of the six comment letters received, Reclamation's response to comments for those letters, and whether a change was made in the EA based on the comment, with reference to which section in the EA the change occurred.

Summary of common issues:

- **Public Safety** – Comments on public safety were made relative to the downstream effects of logs being dislodged from wood structures and moved downstream by river flows. There is a concern that the logs could create safety issues for land owners, river users, and structures. Commenters noted that the inherent risk of the Project with the numerous wood structures and flooding has not fully been considered in the EA. These comments were addressed in Sections 2.2.3, 3.10.2, and 3.11.2 in the Final EA.
- **Flooding and Changing Course of River** – There is concern on how the Project could increase the risk of flooding on properties and whether the Project is designed to withstand 100-year floods. Examples of past flood events on the Entiat, or other rivers, were cited and how similarly-sized flood events would affect landowners' property and safety. Changing the course of the river was another related concern and how the river's flows could affect landowners. These comments were addressed in Sections 3.4 in the Final EA.
- **Large Wood Structures** – Construction of large wood structures was a concern in many of the letters. Concerns included the design life of the structures; engineering design and consideration of risk; effectiveness of structures with regard to providing the intended physical and biological functions; monitoring effectiveness in preventing unforeseen structure breakup; structures increasing chance of floods; downstream risk of dislodged wood on property, structures, and life; and structures collecting river debris

that can create debris jams or ice jams. These comments were addressed in Sections 3.10.2 and 3.11.2 in the Final EA.

- **Recreation** – Some commenters requested that recreational use on the river be clarified in the EA, including an account of the number of recreationists. This would include a better description of how the river is used by different recreationists along different reaches of the river. These comments were addressed in Reclamation’s response to comments in Appendix A and Section 3.10.1 in the Final EA.
- **Wildlife** – Two commenters requested that additional information on wildlife in the Project area and whether the Project will have a beneficial effect on wildlife habitat be described in the EA. These comments were addressed in Sections 3.5.1 and 3.5.2 in the Final EA.
- **Purpose and Need and Project Description** – There were comments that noted the size, scale, and cost of the Project and whether the proposed Project is the best use of public funds. These comments were addressed in Reclamation’s response to comments (Appendix A).
- **Need for an EIS**– Some commenters noted that an EIS should be prepared given the potential environmental consequences and effects to the human environment associated with the Project. These comments were addressed in Reclamation’s response to comments (Appendix A) and in Section 1.1.
- **Alternatives** – Several commenters noted they preferred the No Action alternative. These comments were addressed in Reclamation’s response to comments (Appendix A).

This page intentionally left blank.

Chapter 2 PROPOSED ACTION AND ALTERNATIVES

2.1 Introduction

This chapter describes the Proposed Action and the No Action alternative. This chapter also compares the Proposed Action and the No Action alternative by the project purposes and potential environmental effects.

2.2 Proposed Action Alternative

Under the Proposed Action, Reclamation would fund the Project, which includes installing constructed LWM structures to enhance fish habitat, reconnecting abandoned side channels to enhance floodplain connection, and removal of a levee. Reclamation's funding of the Project would be consistent with RPA Action 35 that states Action Agencies (such as Reclamation) provide funding to implement specific habitat projects in the Upper Columbia Basin, including the Entiat River (NOAA Fisheries 2008). Once constructed, Reclamation and CCNRD would inspect and adaptively manage the LWM structures in accordance with a cooperative agreement signed by both agencies.

The proposed Project is detailed in the 80 percent habitat restoration engineering design plans prepared in August 2016. The 80 percent plans were prepared through a collaborative design process that included the project team and a design team. The design team consisted of representatives from each of the project sponsors, the CDLT, Reclamation technical staff, BPA technical staff, Upper Columbia Salmon Recovery Board, U.S. Forest Service (USFS), YN, U.S. Fish and Wildlife Service (USFWS), NOAA Fisheries, Washington Department of Fish and Wildlife (WDFW), and Washington Department of Natural Resources (WDNR). BPA has withdrawn from the Project (as noted in Chapter 1) and USFS and YN are pursuing design of a habitat improvement project separate from this Project, and are no longer part of the design team. The design team provided review and comment throughout the project team's design process.

The design process followed methods for design and review as established in BPA's Habitat Improvement Program III (HIP III) BiOps (NOAA Fisheries 2013; USFWS 2013). This requires the critical review of designs at the conceptual, 15 percent, 30 percent, and 80

percent design junctures. This also requires the application of General Aquatic Conservation Measures (BPA 2016) to ensure that design and construction result in predictable and minimal short-term effects. Completion of the projects' restoration designs would also incorporate general conservation measures per the 2017 restoration programmatic agreement between the Seattle USACE District and NOAA Fisheries (NOAA Fisheries 2017). The design also followed Reclamation's Large Woody Material Risk Based Design Guidelines (RBDG) (Reclamation 2014). This methodology is used to evaluate watershed-level, reach-level, and site-level characteristics in a risk-based design approach for the placement and design of LWM. Risk was evaluated for public safety and property damage and the resulting level of risk and risk tolerance then informed the stringency of the planning and design. The design team utilized the HIP III and RBDGs in the design process to develop a post-project condition that improves access to spawning and rearing habitat and improve habitat quantity and quality for the UCR spring Chinook salmon and UCR steelhead. These post-project benefits are considered an element of the Proposed Action and would be accomplished through the construction of the habitat improvement elements described in this Chapter. The Proposed Action includes construction observation and post-construction inspection (Section 2.2.3) as measures to support the intended habitat benefits of the Project. Staging for the project areas is scheduled for 2018 (Areas B and E) and 2019 (Areas C and F). Projects are scheduled to be constructed in 2019 (Areas B and E) and 2020 (Areas C and F) based on Reclamation's current known funding structure.

The proposed Project would be implemented at four proximate project areas (B, C, E, and F) between RM 16.2 (Entiat River Road MP 15.0) and RM 20.1 (MP 18.6) (Figure 2-1). The most downstream location would occur approximately 16.2 river miles from the town of Entiat, Washington and the Columbia River (equivalent to approximately MP 15.0); see Figure 2-1. In Reclamation's Reach Assessments this stretch of the Entiat River was divided into two reaches: the Stormy Reach and the Gray Reach. In the Project Map Books, each reach was divided into three project areas: Project Areas A, B, and C in the Stormy Reach and Project Areas D, E, and F in the Gray Reach. During project planning, Project Areas A and D were dropped from inclusion in this Project, resulting in only four current project areas (B, C, E, F). Project Area A is being pursued by a separate entity (YN) using a separate design process, schedule, separate environmental compliance process and lead agency, and would utilize construction funding from a different source. Project Area D encountered landowner issues, and has been halted for the foreseeable future. If and when the landowner issues are resolved, Project Area D may become active again. Any future construction of Project Area D would occur after completion of the current Project. Each of the project areas and the actions that would occur there are described in Section 2.2.1.

The proposed Project is comprised of both habitat improvement actions and actions that are necessary to facilitate construction. Habitat improvement actions would include installation of LWM structures and side channel logs, enhancement of side channels, and levee removal, as described in Section 2.2.2. Construction elements would include staging areas, helicopter

flights, access routes, river crossings, vibratory pile driving, side channel excavation, construction observation, and post-construction inspection, as described in Section 2.2.3. Construction on the Project cannot begin until all local, state, and federal permits required for the Project have been received (see Chapter 4 for permit requirements).

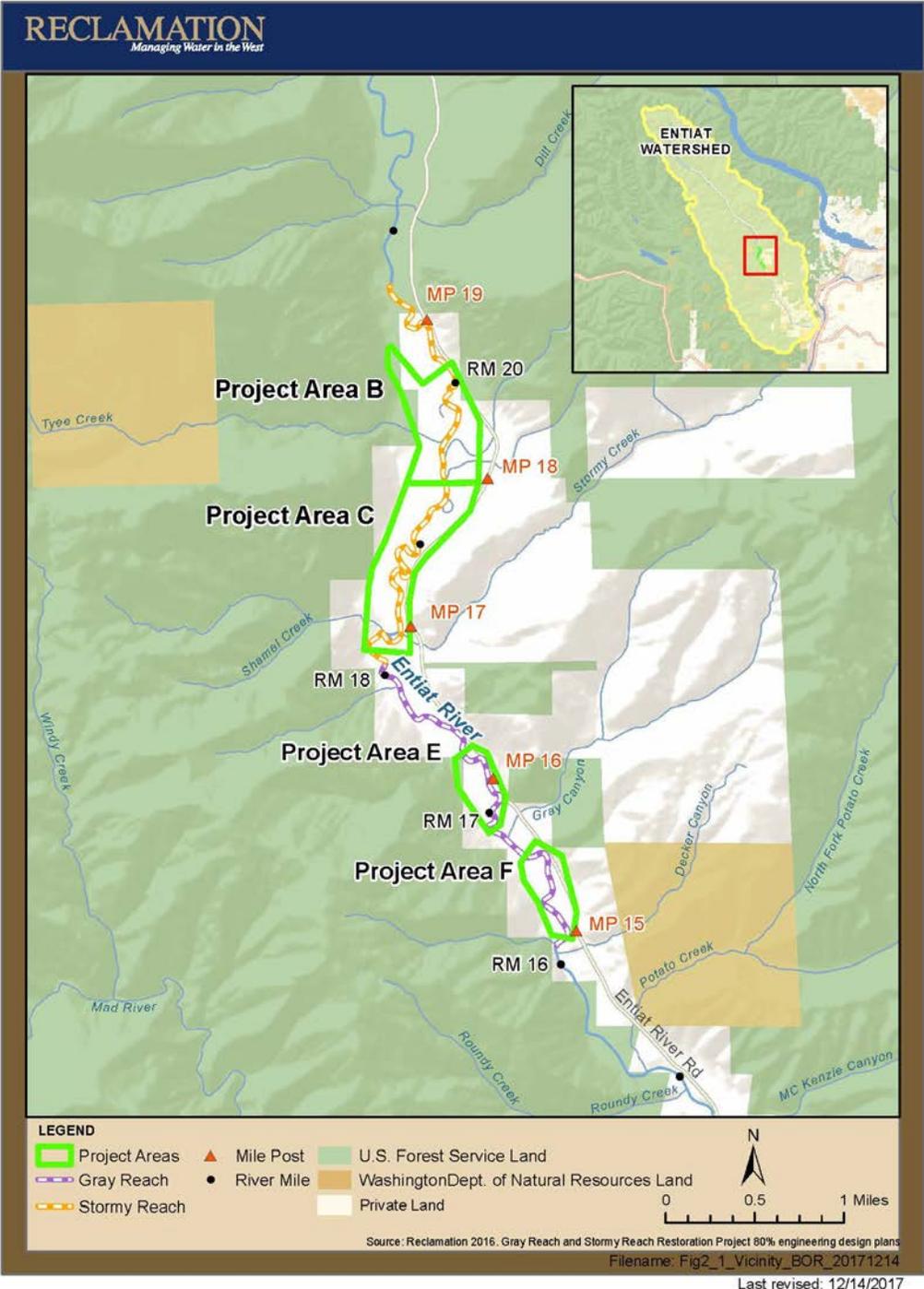


Figure 2-1. Proposed Project area.

2.2.1 Project Areas

Project Area B

Project Area B is located between RM 20.0 (MP 18.7) and RM 19.4 (MP 18.0). The Chelan County Department of Natural Resources would implement this Project on land owned by the CDLT. Project features proposed for Area B are summarized in Table 2-1 and shown on Figure 2-2. The main focus of work in this project area is the removal of a levee at RM 19.8, known locally as the Bremmer Levee. The levee was constructed from onsite material in the early 1970s by the local landowner to protect the adjacent hay field from river erosion. The growing of hay has been abandoned and the levee is no longer maintained.

Twenty-four LWM structures would be constructed to provide habitat complexity and encourage channel migration and erosion of the area currently occupied by the levee within the project reach. The open field in Project Area B would be used as a large wood staging area. Logs would be transported to the staging area using trucks and then would be lifted and delivered to the individual LWM structure construction sites using a helicopter. (Helicopters would be used to deliver all logs to the LWM structure sites, however, once delivered to the construction site, the LWM structures would either be constructed by ground-based equipment, or by the helicopter, as described in Sections 2.2.2 and 2.2.3.)

Side channel enhancement on river right would include 71 linear feet of excavation of an inlet and outlet to introduce seasonal flows into an existing side channel. This action would improve low-flow winter connectivity and would allow for the migration of the main channel through this area in response to the removal of the levee from river left. Dump trucks would haul the excavated material to legal disposal or placement at offsite locations. The number of dump truck trips would depend on the size and type of equipment the contractor decides to use to complete the Project (see Section 3.12 for analysis of expected number of truck trips).

Nineteen of the 24 LWM structures are considered primary and secondary structures and would be constructed by ground-based equipment. Five structures would be constructed using helicopters to reduce impacts associated with ground equipment. One wet crossing would be needed at the upstream end of the project area to allow two pieces of equipment to cross the river and install a LWM structure on river right. One temporary bridge would be installed to allow four to six pieces of construction equipment to cross the river to install two LWM structures and excavate the side channel enhancement inlet/outlet. Temporary access routes would be used to allow machines and equipment to access the river. Revegetation would occur within the temporary access and staging areas, and within the greater floodplain area that had been cleared by humans for the relict hay field.



Figure 2-2. Project Area B.

Table 2-1. Project Area B summary of activities.

Activities*	River Mile/River Bank (Entiat River Road MP)	Quantities
Levee removal/spoil transportation	RM 19.8-19.65/left (18.4 – 18.2)	1,000 linear feet of levee removal; 9,530 cubic yards of off-haul.
Side channel enhancement	RM 19.7 – 19.6/right (18.3 – 18.2)	71 linear feet of excavation; 110 cubic yards of off-haul; 600 linear feet of side channel development;
Primary LWM structures (apex, deflector, and meander)	RM 19.9 – 19.45/right and left (18.5 – 18.05)	10
Secondary LWM structures (bank enhancement and side channel structures)	RM 19.9 – 19.8/left (18.5 – 18.4)	9
Natural jam LWM supplement (constructed by helicopters)	RM 20.0 and RM 19.9/right and left (18.6 – 18.5)	2
Helicopter-constructed structures	RM 20.0/left (18.6)	3
River crossing/temporary bridge	RM 19.7/NA (18.3)	1
River crossing/wet crossing	RM 19.9/NA (18.5)	1
Riparian plantings	Throughout	13,931 individual plants
Temporary access and staging	Throughout	4.8 acres
*See Sections 2.2.2 and 2.2.3 for a description of habitat improvement actions and construction elements.		

Project Area C

Project Area C is located between RM 18.75 (MP 17.3) and RM 18.3 (MP 16.9) (Figure 2-3). The CCFEG would implement the work in Project Area C on land owned by the CCLT known as the Stormy Preserve. Project features proposed for Area C are summarized in Table 2-2 and shown on Figure 2-3. In Project Area C, 15 LWM structures would be constructed by ground-based equipment to enhance habitat complexity and encourage geomorphic response, and an additional 10 individual logs would be placed by helicopter in an existing alcove and at the confluence of Stormy Creek to provide cover for aquatic and terrestrial species. An alcove is a natural off-channel aquatic habitat that can be seasonally or permanently connected by water to the Entiat River. Alcoves are “dead end” channels that do not have an outlet and therefore are not considered channels with water that flows through and inlet and outlet from the river.

A new channel would be excavated to encourage the Entiat River to flow away from the Entiat River Road and towards river right. The channel would be excavated across an exposed gravel bar and would be approximately 300 feet long and 30- to 60-feet wide. The excavated gravel would be placed on the adjacent gravel bar and incorporated into two proposed LWM structures.

Three river crossings would be needed to allow equipment to cross the river and install LWM structures. One temporary bridge would be installed to allow construction equipment to cross to the gravel bar where the new channel would be excavated. Two wet crossings would occur to facilitate construction of LWM structures on river right. Two staging areas for construction equipment would be sited within Area C. One staging area would be at a pullout along Entiat River Road and a second staging area would be located at the Stormy Preserve. Temporary access routes would be used to allow machines and equipment to access the river. The staging area within Project Area B would be used to stage large wood and helicopters to deliver the wood directly to structure sites in Area C. Revegetation would occur within the temporary access and staging areas, and within the greater Stormy Preserve floodplain area that had been cleared by humans for the relict hay field following construction.



Figure 2-3. Project Area C.

Table 2-2. Project Area C summary of activities.

Activities	River Mile/River Bank (Entiat River Road MP)	Quantities
New channel construction	RM 18.55/left (17.1)	300 linear feet of excavation; 225 cubic yards spoiled onsite.
Primary LWM structures (apex, deflector, and meander)	RM 18.65 – 18.35/right and left (17.25 – 16.95)	8
Secondary LWM structures (bank enhancement and side channel structures)	RM 18.75 – 18.35/right and left (17.3 – 16.95)	7
Alcove logs (placed by helicopters)	RM 18.3/right (16.9)	10
River crossing/temporary bridge	RM 18.55/NA (17.15)	1
River crossing/wet crossing	RM 18.50 and 18.35/NA (17.1 – 16.95)	2
Riparian plantings	Throughout	4,083 individual plantings
Temporary access and staging	Throughout	0.9 acres
*See Sections 2.2.2 and 2.2.3 for a description of habitat improvement actions and construction elements.		

Project Area E

Project Area E is located between RM 17.4 (MP 16.1) and RM 16.9 (MP 15.75) (Figure 2-4). The CCD would implement the work at Project Area E on privately-owned land. Project features proposed for Area C are summarized in Table 2-3 and shown on Figure 2-4. Eight LWM structures would be installed to encourage geomorphic response and enhance habitat complexity. The majority of these structures would be constructed using ground-based equipment, with one constructed using a helicopter to reduce impacts associated with ground equipment. An additional 18 individual logs would be placed by helicopter in an existing alcove to provide cover for aquatic and terrestrial species. An existing bermed access road that enters the site from the Entiat River Road would be excavated to create a vehicle ford. This action would remove soil that acts as a barrier to flows and fish within an existing side channel while allowing continued vehicle access to the private property.

A staging area would be located in a non-vegetated area between the river and Entiat River Road, and a temporary access route would be used to allow machines and equipment to access the river. Wood staging for helicopter delivery would occur offsite. Revegetation would occur within the temporary access and staging areas.

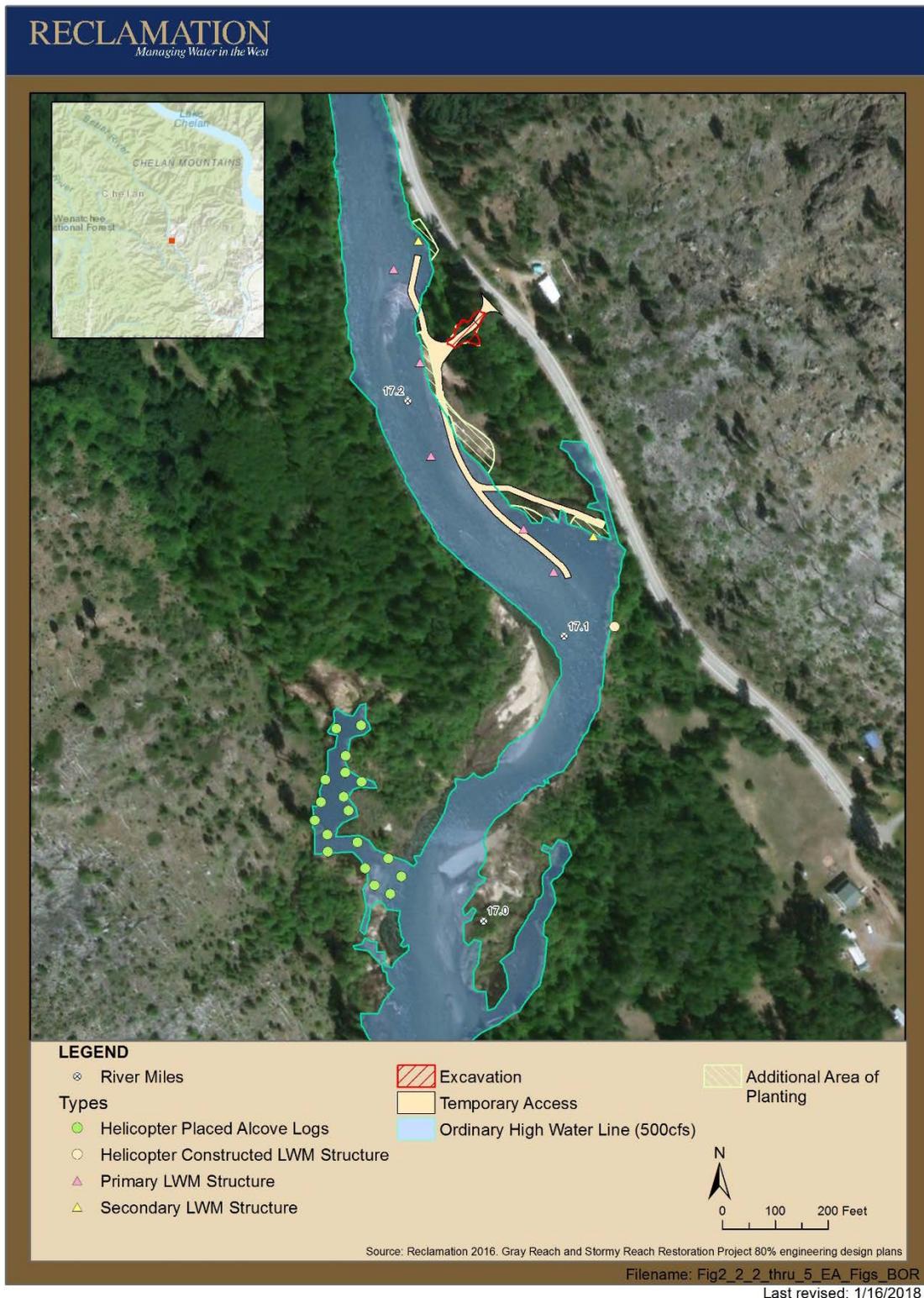


Figure 2-4. Project Area E.

Table 2-3. Project Area E summary of activities.

Activities	River Mile/River Bank (Entiat River Road MP)	Quantities
Side channel enhancement/ford installation	RM 17.2/left (16.0)	76 linear feet of excavation; 96 cubic yards of material spoiled offsite; 335 linear feet of side channel development;
Primary LWM structures (apex, deflector, and meander)	RM17.25 – 17.1/left (16.05 – 15.9)	5
Secondary LWM structures (bank enhancement and side channel structures)	RM17.25 – 17.1/left (16.05 – 15.9)	2
Alcove logs (placed by helicopters)	RM 17.0/right (15.9)	18
Helicopter-constructed structures	RM 17.1/left (15.9)	1
Riparian plantings	Throughout	431 individual plantings
Temporary access and staging	Throughout	0.5 acres
*See Sections 2.2.2 and 2.2.3 for a description of habitat improvement actions and construction elements.		

Project Area F

Project Area F is located between RM 16.7 (MP 15.5) and RM 16.15 (MP 15.0) (Figure 2-5). The CCD would implement the work at Project Area F on both privately-owned land and land owned by CDLT. Project features proposed for Area F are summarized in Table 2-4 and shown on Figure 2-5. Nine primary and 10 secondary LWM structures would be installed within the main channel throughout the reach to enhance habitat complexity. An additional 20 secondary LWM structures and 9 side channel logs would be installed within the proposed side channel elements. At the upstream end of the Project area, two inlets would be excavated on river right to improve floodplain connectivity to an existing complex of side channels, to provide high-flow refuge habitat for juvenile salmon and steelhead. An existing outlet would be excavated to allow surface water that has entered in the upstream inlets to return to the river. The excavated material at one inlet area and the downstream outlet would remain on site and placed on a nearby upland area. Material from the second inlet area would be transported off site.

Farther downstream, also on river right, a side channel excavation would establish a perennial side channel, which is a side channel that would have water flowing through it year-round. At the downstream end of Project Area F on river left, a parcel of land recently purchased by CDLT would be converted, through removal of fill, from a property that was once a private residence with maintained lawn, into an excavated network of side channels, floodplain benches, and alcoves that would provide approximately five acres of low-velocity, year-round, temperature-regulated rearing habitat for juvenile salmon and steelhead. Habitat logs would be placed to enhance juvenile-rearing habitat and habitat for terrestrial species.

One wet crossing would be needed to allow equipment to cross the river and excavate the most upstream inlet. Two temporary bridges would be installed. One temporary bridge would allow equipment to access river right to excavate the second inlet and the outlet and allow haul trucks to carry material back to river left and off site. A second temporary bridge would allow equipment to access river right to construct the year-round side channel and allow haul trucks to carry material back to river left and off site. One staging area would be located at the recently purchased CDLT property. Wood staging would occur offsite. Temporary access routes would be used to allow machines and equipment to access the river. Revegetation would occur within the temporary access and staging areas and would occur throughout the side channel enhancement, floodplain bench, and fill removal areas. Revegetation would also occur within the greater floodplain areas that were cleared by humans in the past, directly adjacent to the side channel enhancement and floodplain bench areas.

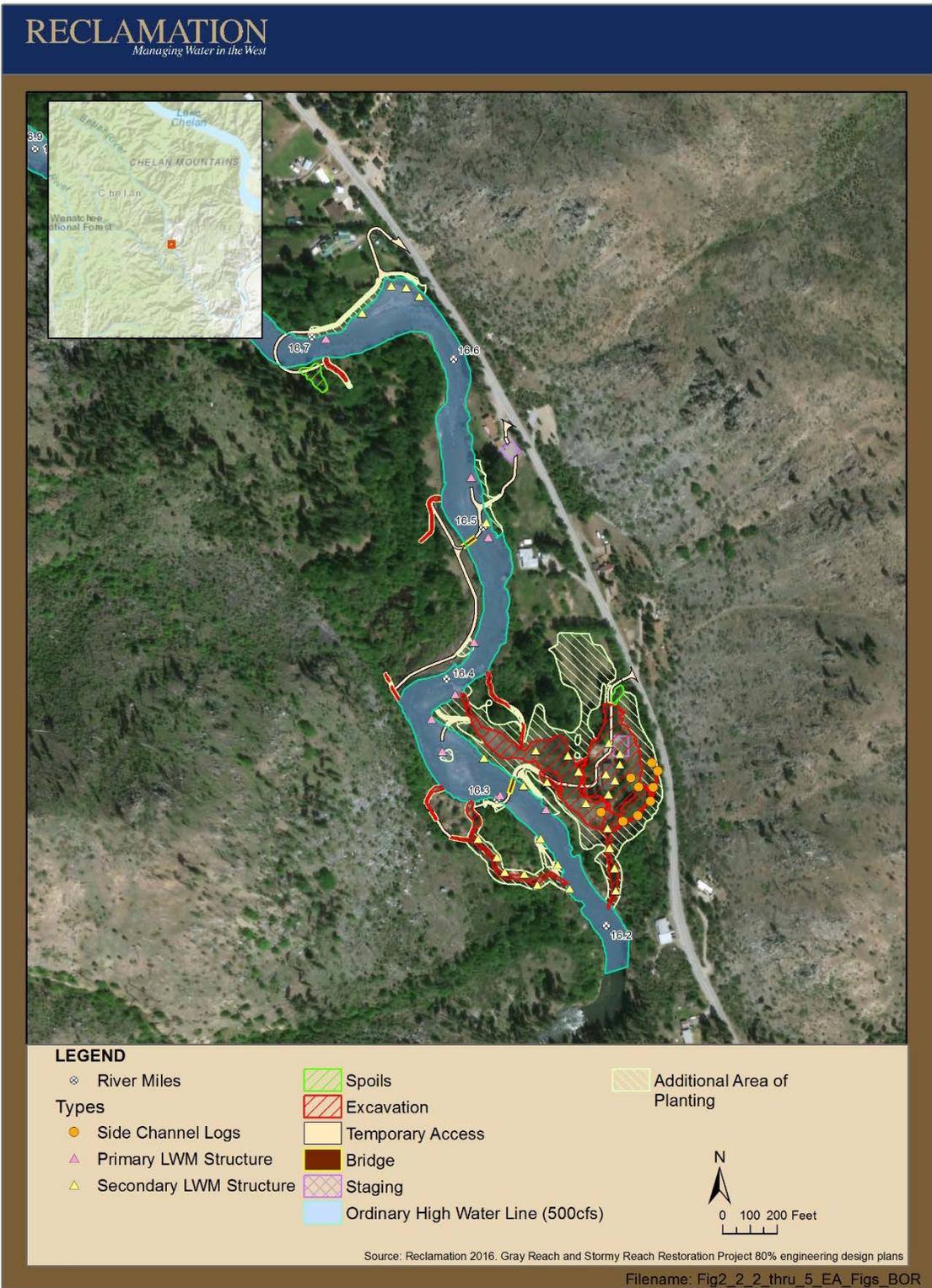


Figure 2-5. Project Area F.

Table 2-4. Project Area F summary of activities.

Activities	River Mile/River Bank (Entiat River Road MP)	Quantities
Side channel enhancement	RM 16.7 – 16.2/left and right (15.5 – 15.0)	4,245 linear feet of side channel development, 4,541 cubic yards of material spoiled offsite; 100 cubic yards spoiled onsite.
Fill and floodplain bench removal	RM 16.2/left (15.0)	6,260 cubic yards of material spoiled offsite.
Primary LWM structures (apex, deflector, and meander)	RM 16.7-16.25/left and right (15.5 – 15.05)	9
Secondary LWM structures (bank enhancement and side channel structures)	RM 16.6 – 16.25/left and right (15.4 – 15.05)	30
Side channel logs	RM 16.3 – 16.2 (15.1 – 15.0)	9
River crossing/temporary bridge	RM 16.5 and RM 16.3/NA (15.3 – 15.1)	2
River crossing/wet crossing	RM 16.7 (15.5)	1
Riparian plantings	Throughout.	13,848 individual plantings
Temporary access and staging	Throughout	2.3 acres.
*See Sections 2.2.2 and 2.2.3 for a description of habitat improvement actions and construction elements.		

2.2.2 Habitat Improvement Actions

LWM Structure Types

A total of 86 LWM structures would be installed to provide biological benefits to native fish either by directly creating suitable habitat or through the geomorphic processes that would result from the Entiat River and the LWM structures interaction. The LWM structures consist of multiple logs placed together. Different types of structures would be installed in each Project area, each with specific hydraulic and biological objectives depending on the structure type and location. Structures are designed to be “low-profile” to reduce visual impact and would be overtopped by flood waters during large flood events. All of the LWM structures would be wetted during seasonally high flows to direct flows into side channels, split flows,

and encourage lateral channel migration (see text below for description of the different type of structures). As flows recede during summer and into fall months, portions of the structures would be above water line. In some cases, during lowest flows, entire structures may become unwetted, similar to natural conditions.

The project design engineers followed Reclamation's Large Woody Material RBDGs (Reclamation 2014) to establish the design standards for wood structures. Based on this analysis, minimum stability design flow criteria for the LWM structures is the 25-year flow, however the design engineers applied the 100-year design flow in order to meet Washington State code for the design of LWM structures (Registered Code of Washington [RCW] 77.85.050). The design life of the proposed LWM structures would be 25 years. The design life is based on the materials used, delivery methods, construction methods, climate conditions, and hydrologic conditions (Reclamation 2014). Reclamation also used a two-dimensional fixed-bed hydraulics model (SRH-2D) as recommended in the RBDG. The model, developed by Reclamation, allowed engineers to design structures that include a factor of safety while considering the various forces generated by multiple river flows, including the 100-year flood event.

The only structural connections used to secure logs used in LWM structures would be threaded bolts that "pin" logs to one another. For helicopter-constructed LWM structures, short lengths of chain would be used to create "rock collars" used to create ballast intended to secure logs. In addition to the LWM structures, a total of 37 individual logs would be placed within side channel areas to enhance cover for aquatic and terrestrial species. No anchoring or pinning of these logs would occur. Logs for the wood structures would be commercially procured prior to construction by contractors hired by the project sponsors and would follow the necessary permits and approvals for this activity.

Primary LWM structures (Figure 2-6 and Figure 2-7) are the largest type of LWM structures and have different purposes based on where they are located. When installed mid-channel they would split river flows to either side of the structure and increase scour on the river bottom adjacent to and immediately upstream of the structure. The size of the structure would create areas of slow moving water, or eddies, behind it that would allow for the deposition of material just downstream. When primary LWM structures are placed nearby or opposite of side channel enhancements (see text below for a description of side channel enhancement), they would force river flows into those areas and out onto the adjacent floodplain during floods. Primary LWM structures placed on the edge of the river would create natural resistance to erosion intended to narrow the river channel, induce scour, and encourage lateral channel migration.

The design of the LWM structures is intended to allow the racking and shedding of woody material that is transported through the reach. The structures themselves are not intended to create channel spanning conditions. Structures would be positioned to block no more than 30

percent of the channel and to allow the largest observed logs (~100 feet) to pass without creating a channel spanning condition. They have also been designed to be overtopped at flood flows to allow buoyant debris to be mobilized away from the structures during high flows in order to minimize the potential of creating larger debris jams.

There are three types of primary LWM structures: apex, deflector, and meander, all which would provide instream habitat complexity and habitat for fish. Apex structures are located in the middle of the river and intended to develop pools and bars in the river; deflector structures are located generally along banks to deflect flow away from the bank and create habitat pools or direct streamflow into side channels; and meander structures are placed to direct flow in lateral directions to create increased channel meanders. Primary LWM structure dimensions would be between 45- to 55-feet long by 50- to 75-feet wide. They would be constructed with approximately 12 piles driven into the river bed and then interlaced with 15 to 30 logs. Piles are 25-foot long logs that are driven into the ground using an excavator-mounted vibratory pile driver. When feasible, a scour pool may be excavated in front of a structure to encourage pool formation. The excavated materials would be incorporated into the downstream side of the structure. Other smaller logs and branches, called slash, would be incorporated in front of the structure by hand or with track equipment depending on size and volume of material.

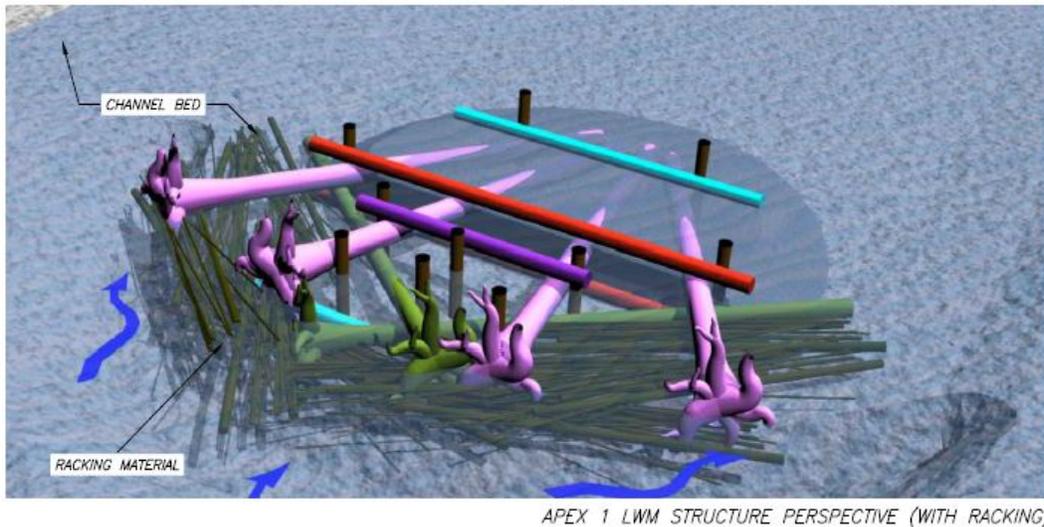


Figure 2-6. Primary LWM structures mid channel.

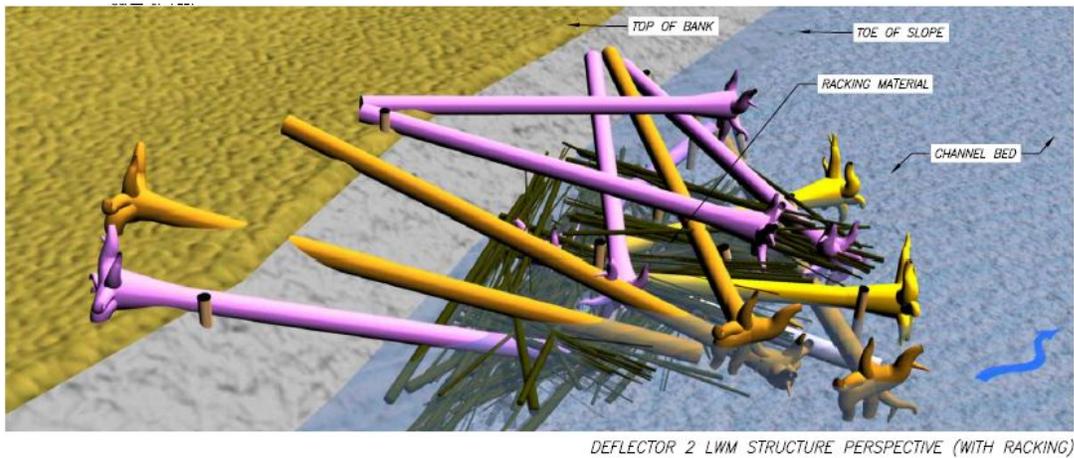


Figure 2-7. Primary LWM structures along river bank.

Secondary LWM structures (Figure 2-8 and Figure 2-9) would be installed along the river's edge at the outside of bends and pool edges to provide cover and complexity for juvenile fish. The secondary LWM structures would also be placed in off-channel areas to slow floodwaters across the floodplain, provide stability, and cover in side channel habitats.

There are several types of secondary LWM structure including bank enhancement, and side channel LWM. The secondary LWM structures would range from 20-feet to 50-feet long and between 10- and 55-feet wide. The bank enhancement structures would be constructed around four to six driven piles using a vibratory pile driver. As with the primary LWM structures, logs would be laced in between the piles and secured with threaded bolts. Slash would be added on top of the structure. The side channel structures would be driven into the bank or woven within existing standing vegetation.

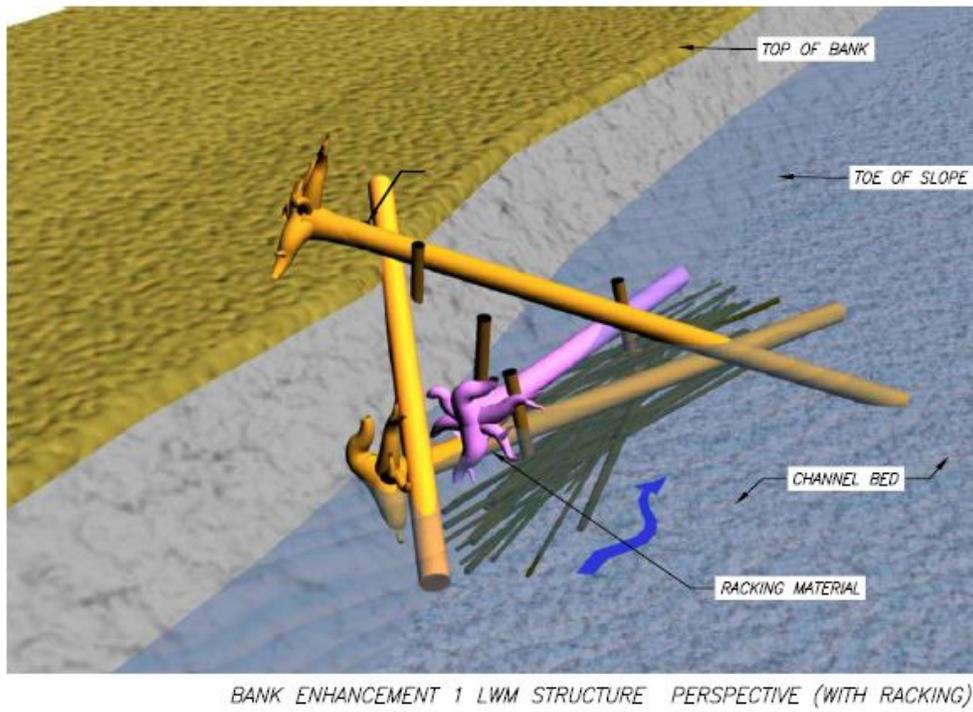


Figure 2-8. Secondary LWM structures along river bank.

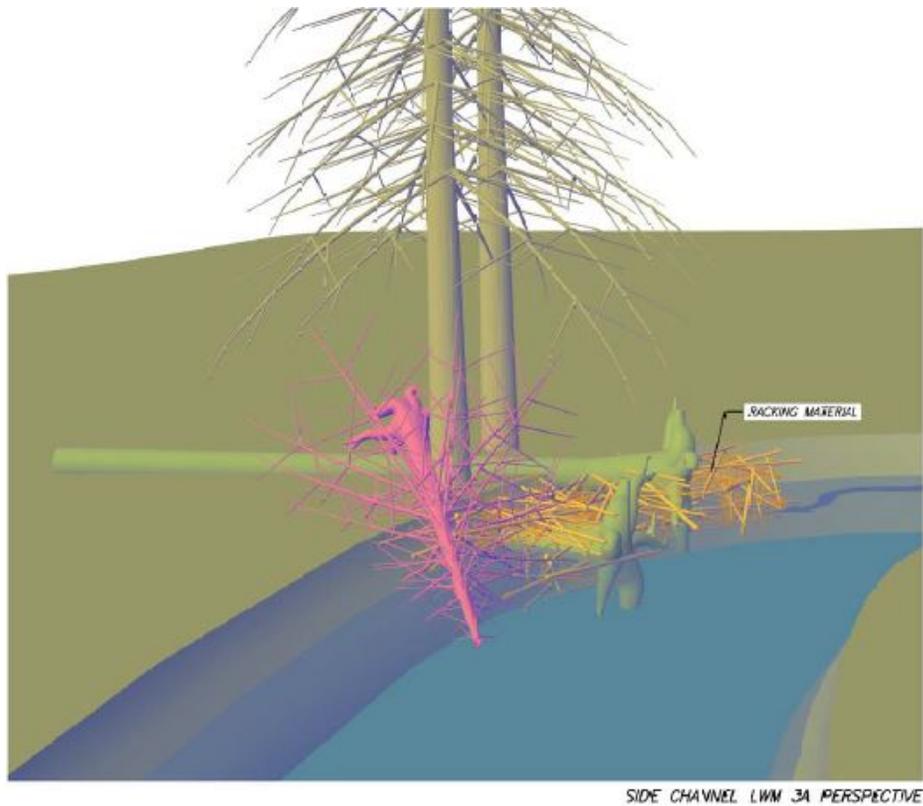


Figure 2-9. Secondary LWM structures side channel.

Helicopter-constructed LWM structures (Figure 2-10) would be installed to create habitat complexity in areas where the river is uniform and lacks structure. They are intended to produce scour needed to create pools and initiate channel migration. Some helicopter structures would also be placed along channel and pool edges to provide refuge and cover for juvenile fish similar to the secondary LWM Structures. Unlike the primary and secondary LWM structures, which would be installed using a vibratory pile driver, a helicopter would be used to place the wood, and a ground-based crew would then install pinning with rebar stakes to ensure structural stability. Rock collars would be used to anchor helicopter structures. A rock collar consists of two boulders connected by chain that are placed by the helicopter to hold the logs in place. Two rock collars would be placed on each log. Structures would consist of eight logs and be approximately 45 feet long by 30 feet wide. Additional smaller logs and branches would be layered on top to provide cover habitat. A total of four helicopter-constructed LWM structures would be constructed; three in Project Area B and one in Project Area E.

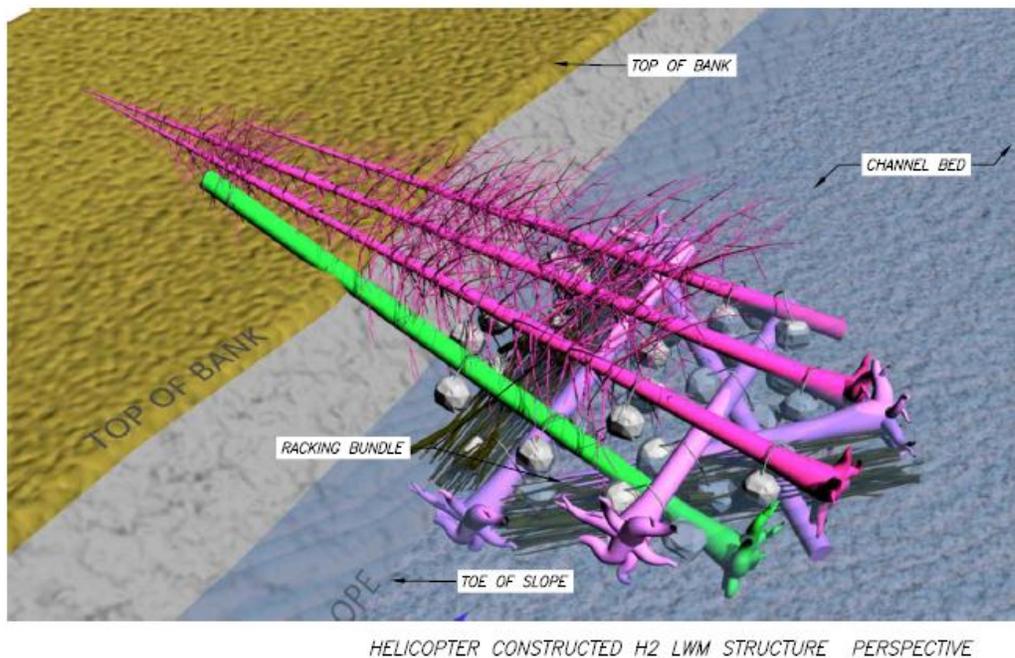


Figure 2-10. Helicopter-constructed LWM structures.

Natural jam LWM supplement (Figure 2-11) would use helicopters to supplement existing/natural large wood or boulder elements (jams) by adding large wood to increase habitat and hydraulic effectiveness. Wood and rock collar elements would be added by helicopter to avoid impacts associated with ground based equipment. Structures would vary in size and the quantity of materials based on the individual site conditions. Two natural jam LWM supplement sites would be constructed by helicopter in Project Area B.

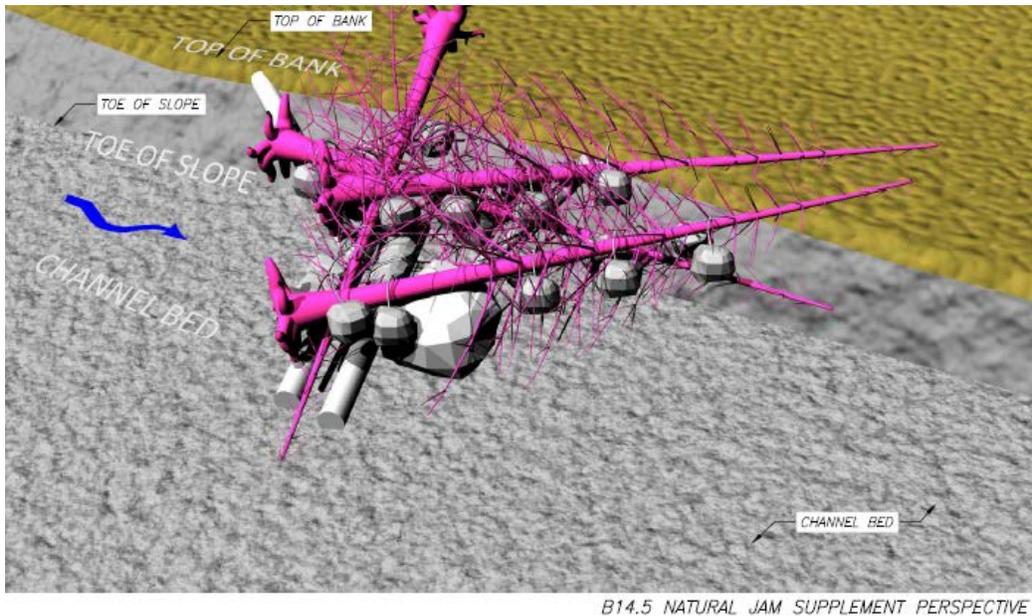


Figure 2-11. Helicopter-constructed natural jam LWM supplement.

The total length of the Project, including all four project areas is 3.9 miles. Figure 2-12 indicates that the sum total length of LWM structures that would be placed in the main channel (as if each structure were placed end to end) is 0.73 miles. This represents 18 percent of the total Project length.

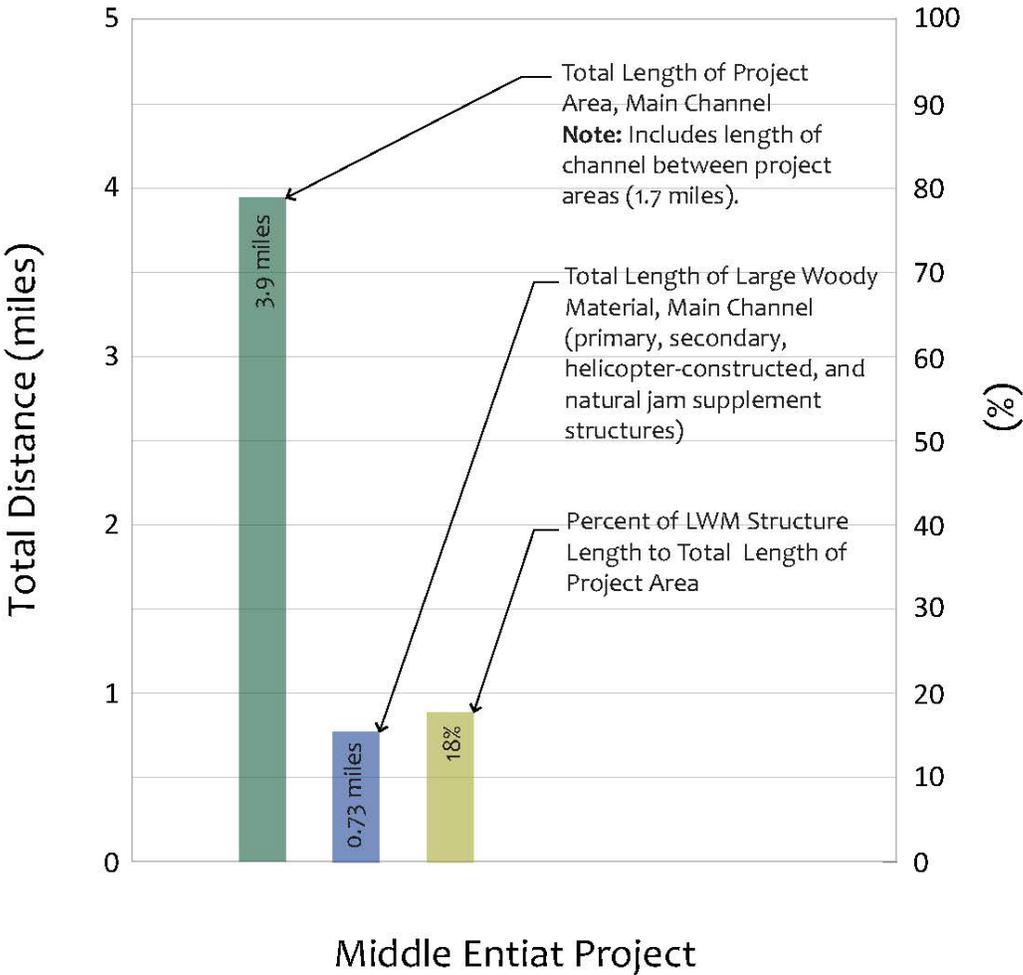


Figure 2-12. Proportion of LWM structures in the Project area.

Side Channel and Alcove Logs

The proposed Project would include the placement of 37 individual logs in existing alcoves and constructed side channel habitats. The placement of the logs within existing alcoves would be achieved using helicopters. The placement of single logs within constructed side channels would be achieved by using both helicopters and ground-based equipment based on access. The logs themselves would range in length from 30 to 50 feet and would include branches to improve the effectiveness of providing cover to aquatic and terrestrial species. Existing vegetation would be used to hold the logs in place; no anchoring or pinning would occur. Side channel and alcove logs would be placed in Project Areas C, E, and F.

Side Channel Enhancements

The proposed Project would include the construction of a variety of side channel features that would increase flow interactions between the main stem river and adjacent floodplain, and increase the quality and quantity of juvenile salmon and steelhead-rearing habitat. See Table 2-1, 2-3, and 2-4 for description of side channels enhancement actions. Side channel enhancements include excavation of native floodplain material to increase flow connectivity, fish access, wetland and floodplain hydraulic function, and water quality function. Side channel enhancements would include excavation of inlets or outlets to existing side channels on the floodplain, to reconnect the channel to the river (e.g., Area B and Area F on river right). Side channel excavation also includes excavation of entirely new side channels to increase floodplain reconnection and side channel habitat (e.g., Area F, river left). A total of 5,240 linear feet of newly inundated side channels would result from the Project. This includes 4,634 linear feet of newly constructed side channels and an additional 606 linear feet of existing side channel that would be reconnected to flows from the Entiat River through project construction.

Side channel enhancement areas include helicopter-placed and ground-based installation of individual habitat logs and secondary LWM structures to provide habitat complexity and cover for juvenile fish. Some of the structures would be placed to increase habitat availability for other reptile and amphibian species. Figure 2-13 shows a typical side channel cross section.

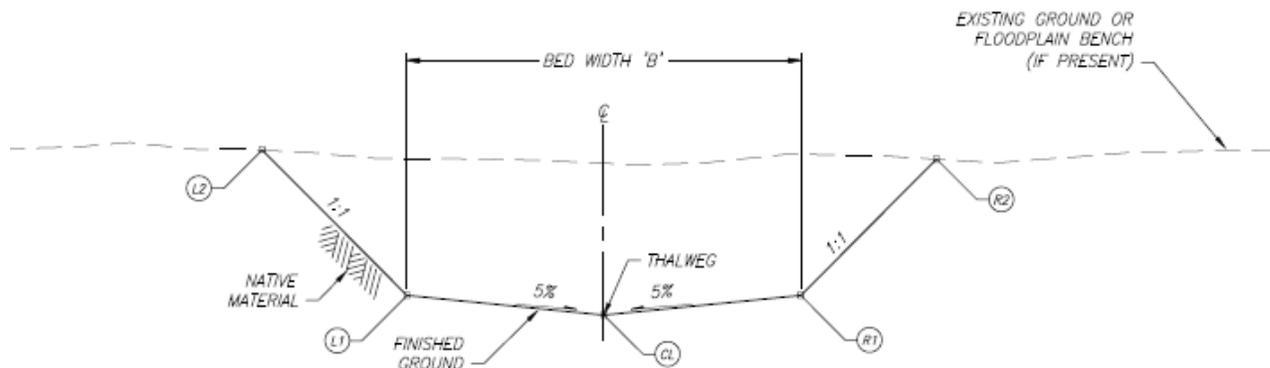


Figure 2-13. Typical side channel cross section.

At Project Area B, side channel enhancements would be used to establish floodplain connections to remnant side channels that would activate during high flows and provide off-channel-rearing habitat for juvenile salmon and steelhead. A total of 71 linear feet of excavation (110 cubic yards) would establish a flow-through connection to an existing alcove when flows in the Entiat River exceed 600 cubic feet per second (cfs). The 600 cfs is a design

feature intended to wet this side channel to provide high-flow refuge habitat for juvenile salmonids. The excavated material would be hauled offsite across the temporary bridge.

At Project Area E, an existing access road that currently blocks a side channel would be removed and a ford would be installed to allow continued vehicle access while removing the impediment to side channel flows. This action would require the excavation of 76 linear feet of road bed (96 cubic yards). Materials would be spoiled offsite. The construction would allow flows through the existing 335-foot long side channel.

At Project Area F, side channel enhancements similar to Project Area B would occur as well as the creation of a perennial side channel (a side channel that receives flowing water all year long) and a network of new side channels would be constructed in a former residential property. In all, 4,245 linear feet of side channel construction would occur in five separate locations. This would require a total of 4,641 cubic yards of excavation. Only 100 cubic yards of material would be spoiled onsite, with the remaining 4,541 cubic yards off hauled. Excavated and spoiled material would consist of native floodplain soils.

Features excavated as part of the side channel floodplain enhancement are as follows:

- To establish a high-water connection to a remnant side channel would require excavation in three areas: two inlets would be excavated, 110 feet in one area; and 220 feet and 91 feet of excavation at the downstream end. Water from the Entiat River would be able to enter this area when flows exceed 1,400 cfs. The 100 cubic yards of material excavated at the most upstream inlet and downstream outlet would be the entirety of the material left onsite in Project Area F, and the 100 cubic yards of material excavated at the second inlet would be part of the material hauled offsite, and would be removed across a temporary bridge.
- A new perennial side channel on river right would require 780 feet of excavation. This side channel would have water from the Entiat River year-round, though would be cut off if river flows dropped below 120 cfs. Material from the excavation (1,665 cubic yards) of the perennial side channel would be part of the off-haul excavation, and would be removed via a temporary bridge.

At Project Area F on river left, on the former residential property with a grass lawn, a network of side channel and alcoves would be constructed. In 2016, the CDLT removed the structures from this property. In total, 3,045 linear feet of side channels and open water alcoves would be excavated accounting for 2,676 cubic yards of the off-hauled material. Excavated material is primarily a sandy loam floodplain soil. Water would come into the side channel network via two excavations. Both inlets would be seasonal with one activated at 500 cfs and one activated at less than 120 cfs. Other channels and deep pools would be excavated to a depth that would intercept groundwater that would create a cold water refuge for juvenile fish during periods of high water temperatures in the Entiat River. An outflow channel would be

excavated to connect with an existing alcove area at the downstream end of the property. This alcove would be excavated and enhanced with wood cover to improve and increase the habitat refuge for juvenile salmon and steelhead along with terrestrial animals.

Fill and Floodplain Bench Excavation

In Project Area F, fill material at the location of the former residence on river left would be removed to restore the area to floodplain elevations. Areas adjacent to the constructed side channel network on river left would be excavated to establish floodplain benches to increase flow interactions between the side channels and adjacent wetlands, and increase the quality and quantity of juvenile salmon and steelhead-rearing habitat. Following construction of the fill removal and floodplain bench areas, these areas would be scarified to increase soil porosity, and planted with native forested wetland vegetation. The fill removal excavation includes 2,360 cubic yards and floodplain bench construction encompasses 3,900 cubic yards, for a total of 6,260 cubic yards of material removed from the floodplain and hauled off in the construction of these features.

New Channel Construction

In Project Area C, a new channel would be excavated (225 cubic yards) into an existing gravel bar as a way to encourage a new channel alignment directed away from the Entiat River Road. Currently, the main channel abuts the Entiat River Road which does not allow for the development of floodplain vegetation or water storage on river left. The new channel would be approximately 300 feet in length and 30- to 60-feet in width to redirect flows away from the road prism. This would allow the abandoned main channel to function as perennial off-channel habitat. The gravel material excavated to create the channel would be spoiled on the adjacent gravel bar and incorporated into the proposed large wood structures.

Revegetation

Revegetation includes the restoration of access and staging areas temporarily disturbed during construction to restore construction areas to their pre-project condition and minimize the potential for erosion to occur in the first few years following construction. Revegetation also includes, seeding, mulch, and plantings associated with habitat elements (e.g., side channels, and LWM structures), and within floodplain areas that were previously cleared for hay fields (Project Areas B and C) and human residence (Project Area F). These plantings would improve soil stability following construction and would enhance long-term regrowth of riparian vegetation communities adjacent to the Entiat River.

Seeding would include a mix of native grasses, rushes and flowering plants such as bentgrass (*Agrostis scabra*), slender rush (*Juncus tenuis*), lupine (*Lupinus sericeus*), bluebunch

wheatgrass (*Agropyron spicatum*), and a mix of sterile grasses to increase soil stability such as sterile triticale (*Triticium aestivum*). All seeding would be followed by the application of certified weed-free straw mulch to improve seed germination.

Plantings would include native, locally collected or grown shrub, tree, and herbaceous species. Plantings would be sorted into ecological communities to match the environments that they would be planted within. This would result in species that can grow in frequently flooded conditions, such as willows (*Salix* sp.), being planted along stream banks, and species better adapted to dry soils such as Ponderosa pine (*Pinus ponderosa*) being planted in dry floodplain areas. Typical shrub and tree species that would be planted include coyote willow (*Salix exigua*), Sitka willow (*Salix sitchensis*), speckled alder (*Alnus incana*), water birch (*Betula occidentalis*), black cottonwood (*Populus balsamifera*), Douglas spiraea (*Spiraea douglasii*), chokecherry (*Prunus virginiana*), Nootka rose (*Rosa nutkana*), and serviceberry (*Amelanchiar alnifolia*). Plant materials would consist of container-grown, long-rooted stock and live cuttings. Live cuttings would be harvested onsite and planted immediately. Wood chip mulch would be added in a ring around each of the container plantings to improve soil moisture and planting survival. In addition to the planting of wood species, sprouted sedge and rush plugs would be planted by hand in wet areas. These species include Kellog's sedge (*Carex lenticularis*), lateral sedge (*Carex unilateralis*), and paniced bulrush (*Scirpis microcarpus*). Table 2-5 summarizes the quantity of revegetation materials required for each area.

Table 2-5. Revegetation quantities of materials by project area.

Project Area	Seed (acre)	Straw (ton)	Wood Chip Mulch (cubic yard)	Live Stake (each)	Container Plant (each)	Live Plug (each)
B	10.5	21	504	1,223	9,107	3,601
C	5.7	11.4	161	319	3,190	574
E	0.4	0.8	0	24	232	175
F	7.5	15	233	3,520	6,807	3,521
Total	24.1	48.2	898	5,086	19,336	7,871

Levee Removal

The proposed Project would include the removal of the Bremmer Levee, located on land owned by CDLT at RM 19.8 (MP 18.4) (Figure 2-14 and Figure 2-14; Project Area B). The levee is being removed to reintroduce flood flows to the adjacent floodplain and to induce future channel migration processes. Levee removal would include the removal of all the rock used to create the levee. The levee is 950-feet long, 70-feet wide, and 9-feet deep.

Construction equipment would work along the top of the levee to remove material to the low-flow water level. Some additional large pieces of non-native riprap would be removed from below the surface of the water if they can be removed without disturbing the native material. Approximately 900 cubic yards of riprap and 8,600 cubic yards of native soil and gravel/cobble material that was originally used to create the levee would be removed. The material would be transported off site, requiring approximately 600 dump trucks (16 cubic yards per load).



Figure 2-14. Bremmer Levee.

2.2.3 Construction Elements

Staging Area

Temporary staging areas have been located where the disturbance to existing vegetation would be avoided or minimized. Areas would be cleared of woody vegetation as necessary for construction materials storage, office and equipment trailer(s), contractor parking, portable toilets, refuse and recycling, and equipment fueling and maintenance. Stored materials might include erosion and sediment control materials, piles, root wads, tree stems, live cuttings, and plant stock. Fueling and hazardous materials storage would occur within applicable spill containment measures. Staging areas would be protected with a stabilized construction entrance and the access drive would be secured with a temporary gate, as selected by the contractor, as a security measure. Each of the project areas would have equipment staging areas, and there would also be three wood storage staging areas where logs would be sorted, and stacked. A total of 6 temporary staging areas would be constructed covering 4 acres. Staging areas would be restored by ripping the soil to decompact the soil, then seeded and revegetated after they are no longer in use.

Helicopter Flights

Helicopters would be used to transport logs from the wood storage areas to the locations of the majority of the primary and secondary LWM structures. LWM structures that are located immediately adjacent to a log staging area and that have direct access between the staging area and the construction site may have logs transported by ground equipment. It is anticipated that helicopters would require 2 to 3 days of flight time per project area to complete the wood placement. The flights would deliver the specific logs for each structure. Helicopters would also be used to construct four helicopter-constructed LWM structures, two natural jam LWM supplements, and to place 28 individual logs in alcove areas in Areas C and E (as opposed to on ground track equipment used to construct the remaining 86 LWM structures and 9 side channel logs).

Access Routes

A total of approximately 9,600 linear feet of temporary access routes would be constructed to allow equipment to access the locations where LWM structures and side channels would be constructed. Access routes would be approximately 12 to 15-feet wide and have been selected to minimize impacts to existing vegetation and sensitive aquatic resources (i.e., wetlands). Due to the staging of wood by helicopters, access routes would require minimal use by ground-based equipment to construct LWM structures. Access routes would also be used to haul excavated materials associated with side channel construction and levee removal. Wood chips or mats would be required where access routes cross wetlands to minimize impacts to soils. These routes would be temporary and at project completion, all temporary access routes would be obliterated, and the soil would be stabilized and revegetated. Route obliteration involves decompacting the surface, leveling the soil surface, reshaping to match the original contour, and revegetating with native grass/forb seed mix and planting native shrubs and trees if any are removed or damaged.

River Crossings

Both temporary bridge crossings and wet crossings would be used to construct project elements on the river bank opposite from the Entiat River Road. Temporary bridge crossing locations would be in Project Areas B (1), C (1), and F (2). Temporary bridges would be constructed using a commercial structure, old railcar, or similar that would be placed on a temporary footing and span the river (Figure 2-15). Approach ramps would be clean angular 3- to 6-inch rock. The lowest portion of the bridge would be a minimum of 1-foot above the water at time of installation and would be required to remove bridge in the event of a rise in water that would hit or cover the bridge. Exact locations, elevation and configuration of approach ramps would be determined in the field with the aid of the local sponsor's contracting officer associated with the project.

A wet crossing refers to construction equipment crossing through the river during the allowed period when work can occur in water. Wet crossings would occur where a maximum of two machines would be able to complete the work by making an average across the project area of six or less crossings of the river.



Figure 2-15. An example of a temporary bridge using an old railcar.

Work Windows, Work Area Isolation, and Dewatering

In-water work windows are established by WDFW, NOAA Fisheries, and USFWS and would be part of the permit conditions for construction. Typical in-water work is allowed on the Entiat River between July 15 and July 31 each year. No work would be allowed from August 1 through mid-September unless authorized by USFWS, NOAA Fisheries, and WDFW through the ESA consultation process. Each year there is the potential that the window can be extended to August 10, to be determined by WDFW and based on the presence/absence of adult UCR spring Chinook salmon in the project area. The extension applies to this project; in-water work windows developed for the project with the USFWS and NOAA Fisheries are as follows:

- July 15 – August 10: In-water work, river crossings, and installation of cofferdams may occur during this timeframe. All in-water work executed from the right bank and any in-water work performed without cofferdam isolation (bank enhancement structures) must be performed during this time period. Water quality monitoring must be performed, as outlined in conditions A through D below.

August 11 – October 15 (estimated): Isolated in-water work is allowed during this time period provided it meets the following conditions:

- A. Work is executed from the left bank (all right bank work to be completed between July 15 and August 10); and
 - B. In-water work is isolated behind cofferdams (cofferdams to be installed between July 15 and August 10); and
 - C. No spring-run Chinook salmon redds are present within 100 feet upstream or 300 feet downstream of the in-water work area (to be surveyed by the contracting agency or their representative); and
 - D. Water quality standards are maintained, as described here. Water quality monitoring will be conducted up to 300 feet downstream of in-water work to ensure turbidity does not increase more than 5 nephelometric turbidity units (NTUs) above background (background turbidity to be measured at least 100 feet upstream of all in-water work). If turbidity increases more than 5 NTUs above background, in-water work must stop and best management practices (BMPs) should be adjusted to control turbidity. Work shall not resume until turbidity measures are below 5 NTUs above background.
- October 16 (estimated) – November 1: All in-water work shall continue in isolation behind cofferdams, however work may resume in isolation in areas near salmon redds, and turbidity monitoring will continue in accordance with condition D above. WDFW will determine the date of spring-run chinook salmon egg eye-up (approximately October 16. Once egg eye-up occurs, as determined by WDFW, cofferdam removal can occur where other in-water work is completed. All in-water work, including cofferdam removal, shall be complete by November 1.

The primary LWM structures and excavation that would occur within the channel associated with side channel enhancement would require isolation from flowing waters to prevent sediment-laden water from entering the river and to prevent fish from entering the work area. In-water work would be isolated by constructing cofferdams with bulk bags and/or floating turbidity curtains. Biologists would remove fish from the isolation area and approve the area prior to construction. A record of all salvaged fish would be kept and reported to the interested agencies. The secondary, helicopter-constructed, and natural jam LWM supplement structures would not require machinery to enter the wetted channel, and, therefore, not require site isolation.

Construction of the side channels and LWM structures would not require excavation of the channel bed below water and therefore are not expected to require dewatering of the work area.

Vibratory Pile-Driving

Piles used to construct the primary and secondary LWM structures would be installed with a vibratory pile driver attached to the arm of a tracked excavator. The pile-driving machine is lifted and positioned over the pile by means of an excavator or crane, and is then fastened to the pile by a clamp and/or bolts. Figure 2-16 shows a vibratory driver attached to the arm of an excavator. Helicopter-constructed structures would not use vibratory drivers.



Figure 2-16. Vibratory pile driver.

Side Channel and Floodplain Excavation

The creation, enhancement, and reconnection to floodplain habitats for juvenile salmonids would be accomplished by the excavation of material from floodplain areas. In Project Areas B, C, E, and F, an excavator would excavate small areas to a depth that would increase river flows onto the adjacent floodplain and in existing and newly-created side channel areas. Figure 2-17 shows a typical side channel excavation by a small excavator.



Figure 2-17. Typical side channel excavation by a small tracked excavator.

Construction Observation

The Proposed Action includes Reclamation providing construction observation services. Reclamation would require engineers from the project team to be on site during construction. Engineers would observe work done by construction contractors hired by the local sponsors and report to Reclamation and the sponsors whether the work is being constructed to meet the intent of the design. Daily observation reports would be prepared and submitted to local sponsors and Reclamation describing work that was completed and report any changes to the design plans that were agreed to by the contractor, local sponsor, and Reclamation.

Post-construction Inspection

The Proposed Action includes a post-construction inspection plan (Reclamation 2016b). This plan would evaluate the performance of habitat improvement actions implemented on the Project. Restoration actions refer to the different habitat features designed for the project such as LWM structures, side channels, Bremmer Levee removal (Area B), and a side channel ford at Area E (Section 2.2.2). The inspection plan provides metrics for determining success of the individual project restoration actions, outlines methods to measure the metrics of that success, identifies factors to review relative to structural stability of the restoration actions, and describes an adaptive management program. This plan focuses on the physical structures proposed to be built as presented in the 80 percent plans, and also includes qualitative assessment of biological benefits as measured by presence or absence of salmon species.

Inspection is intended to provide sufficient data to determine how the restoration actions are functioning in the river system. Field inspection would determine if the river's response is meeting the intended result of the restoration action. Field inspection would occur twice a year, once during low flows for land surveys of the cross sections and longitudinal sections at large wood structures, the Bremmer levee site, and river at the location of the structure. The second survey would occur during the spring's high flows typically associated with snow-melt season to inspect conditions at each structure to qualitatively assess the site. If emergency modifications are required during high flows to protect human life or property, and if those modifications can be conducted safely, then the response would be initiated. An adaptive management plan is intended to be part of the inspection program if the field inspection has identified a potential situation where the restoration action is trending outside its expected range of function or structural stability. The adaptive management plan would identify a "chain of command" to alert Reclamation and local sponsors of the site conditions, and ultimately whether an action should be taken to address the site condition. The adaptive management program allows local sponsors and Reclamation to take actions to enable the project to maintain features that provide post project habitat benefits and ensure safety for recreational users and property owners.

The adaptive management plan would be implemented through an agreement signed between CDLT and CCNRD, which identifies CCNRD as the responsible party for implementation. The agreement specifies actions CCNRD would take to monitor, maintain, and repair LWM structures to address public health and safety, and allowance for natural river functions to occur. The agreement is signed for a 5-year period, with option for incremental renewal of the agreement every 5 years up to 25 years. Funding for implementing the plan would be based on an agreement signed between Reclamation and CCNRD. Please see Chapter 3.11.2 for additional details of the plan.

2.3 Environmental Design Features and Best Management Practices

Environmental design features and BMP measures are incorporated into the Project to help avoid and minimize construction effects (see Table 2-6). The BMPs are prescribed through the General Aquatic Conservation Measures within the HIP III process, expected permit conditions, through Reclamation's RBDGs, and the 2017 General Conservation Measures included in the restoration programmatic agreement between the Seattle USACE District and NOAA Fisheries (NOAA Fisheries 2017). Table 2-6 lists the environmental design features and BMP measures that apply directly to the resource elements described in Chapter 3. The Project incorporates the General Conservation Measures from the USACEs' programmatic agreement as it is being used for the Project's compliance with the ESA. General Conservation Measures from the Seattle USACE's programmatic agreement are shown in

Appendix B. Additional BMPs may be applied to the project through permit conditions and consultations with state and federal permit agencies that are not listed here.

Table 2-6. Environmental design features and BMPs.

Resource	Environmental Design Feature/BMP Measure
Soils and Geology	<ul style="list-style-type: none"> • Use sediment barriers such as fences, silt curtains, weed-free straw matting/bales, or fiber wattles, as necessary, in all work areas to minimize soil loss. • Use water trucks to apply water where needed daily to the construction area to minimize air-borne soil loss. • Cover stockpiled excess excavated materials to minimize loss of soil from stockpiles. • Reseed and plant disturbed areas with appropriate native species, and control weeds, following construction. • Minimize the size of the disturbance area, to the extent practicable. • Temporary access roads and paths would not be built on slopes where grade, soil, or other features suggest a likelihood of excessive erosion or failure. • Seven percent (355 cubic yards) of the total 5,102 cubic yards of material excavated for side channels would be placed on site in upland areas, reducing and minimizing the potential of soil erosion or turbidity caused by storage of excess soil materials. • Temporary sediment erosion control and sediment plan would be prepared.
Vegetation and Wetlands	<ul style="list-style-type: none"> • Minimize the removal of riparian vegetation during construction of temporary access roads • Mark wetland habitats as avoidance areas on construction drawings and flag as no-work areas in the field prior to construction. • Reseed disturbed banks with native herbaceous grasses to prevent the spread of noxious weeds. • Wash all construction equipment prior to leaving the site to prevent the spread of noxious weeds. • Inspect all watercraft, waders, boots, and any other gear to be used in or near water for aquatic invasive species. • Wading boots with felt soles are not to be used due to their propensity for aiding in the transfer of invasive species.
Water Resources	<ul style="list-style-type: none"> • Use sediment barriers such as fences, silt curtains, weed-free straw matting/bales, or fiber wattles, as necessary, in all work areas to minimize soil loss. • Locate staging areas whenever possible, (used for construction equipment storage, vehicle storage, fueling, servicing, and hazardous

Resource	Environmental Design Feature/BMP Measure
	<p>material storage) 150 feet or more from any natural water body or wetland, or on an adjacent, established road area in a location and manner that would preclude erosion into or contamination of the stream or floodplain.</p> <ul style="list-style-type: none"> • Operate machinery, to the extent feasible, from the top of the bank along adjacent uplands and previously cleared areas. • Operate refueling areas using BMPs and equip these areas with appropriate spill containment systems. • Biodegradable lubricants and fluids shall be used on equipment operating in and adjacent to the stream channel and live water. • Inspect machinery daily for fuel or lubricant leaks. • Cover and stockpile excess excavated materials away from water bodies and flank with sediment fencing to minimize opportunity for fine sediment to be transported into water bodies. • Dewatering would occur if work isolation is too wet and work cannot be done. Pumped water would be discharged and detained or filtered to allow removal of fine sediments prior to the waters re-entering the river. A fish screen would also be used on the pump intake to prevent harm to any fish that may remain within the isolated area being pumped dry. • Construction contractor must adhere to all spill prevention, containment/ and counter measures described in the construction plans • Construction contractor must monitor water quality as required by any permits issued by local, state, or federal agencies and stop work if water quality standards as identified in the Section 401 water quality certification. If at any time during turbidity monitoring, inspections or observation, water sampling shows that turbidity controls are not effective, work crews would immediately be mobilized to repair, replace, or reinforce water quality control measures as needed.
Fish and Wildlife	<ul style="list-style-type: none"> • No construction activities would occur during nighttime hours and prior to 30 minutes after dawn or continue any later than 30 minutes before dusk. • Conduct work according to in-water work windows established by WDFW, NOAA Fisheries, and USFWS as detailed in Section 2.2.3 (Work Windows, Work Area Isolation, and Dewatering) • Use biodegradable lubricants and fluids on equipment operating in and adjacent to the stream channel and live water. • Require any work area where machines would be operating within the wetted channel be isolated from the Entiat River. • Construction contractor must isolate any work site along the Entiat River from river flows to keep fish from entering the active construction area. Contractor must contact contracting officer for local sponsor to remove any fish in the work isolation area.

Resource	Environmental Design Feature/BMP Measure
Visual Resources	<ul style="list-style-type: none"> • Retain existing vegetation, when possible, to visually screen new disturbances, during construction. • Reseed and plant disturbed areas with appropriate native species, and control weeds, following construction.
Cultural Resources	<ul style="list-style-type: none"> • Implement an Inadvertent Discovery Plan developed by Reclamation if unanticipated archaeological or historical resources are encountered during construction. As required by the plan, halt all ground-disturbing activity in the vicinity of the find and immediately notify Reclamation cultural resource staff.
Land Use and Recreation	<ul style="list-style-type: none"> • Post public notifications as needed to inform the public of the potential effects of construction activities. • Install permanent signs near usual river public access points to facilitate public awareness of the habitat improvement and LWM structure presence. Signs would also contain an educational element to describe the different project locations, the types of structures, and the benefits they provide for fish.
Noise, Air Quality, and Public Health and Safety	<ul style="list-style-type: none"> • Limit construction noise to normal daytime working hours per Chelan County noise ordinance. If construction is necessary during other times, such as at night, limit activities generating noise to those absolutely necessary. • Construction contractor to submit work safety plan to Reclamation before construction activities begin.
Transportation	<ul style="list-style-type: none"> • Keep construction activities and equipment clear of residential driveways, to the greatest extent possible. • Employ traffic control flaggers and post signs along roads warning of construction activity and merging traffic for temporary interruptions of traffic, where needed.
Socioeconomics	<ul style="list-style-type: none"> • Use local labor and materials, to the extent practicable.

2.4 No Action Alternative

Under the No Action alternative, Reclamation would not fund the Project and would not use the project to help satisfy its ESA obligations identified in the FCRPS BiOp (RPA Action 35). Project sponsors could pursue habitat improvement actions with non-federal funding, but the extent of those activities would be dependent on the ability to find additional funding or funding partners.

2.5 Comparison of Alternatives

Table 2-7 compares how well the alternatives meet the project purpose as defined in Section 1.3. Table 2-8 summarizes and compares the potential environmental consequences of the alternatives. See Chapter 3, Affected Environment and Environmental Consequences, for a full discussion of environmental consequences.

Table 2-7. Comparison of the Proposed Action and No Action alternative by project purposes.

Purpose	Proposed Action	No Action Alternative
Restore hydraulic connectivity between the Middle Entiat River and its floodplain and improve connectivity of flows with adjacent floodplain wetlands. Support Reclamation's efforts to meet its obligations under the Endangered Species Act by fulfilling commitments to implement RPA Action 35, which calls for identifying tributary habitat improvement projects in the 2008 FCRPS BiOp, as amended by a Supplemental FCRPS BiOp in 2010 and 2014 (NOAA Fisheries 2008; 2010; 2014).	<p>Would partially implement RPA Action 35 in the 2008 FCRPS BiOp by increasing the quality and quantity of tributary habitat to benefit and improve the survival of ESA-listed salmon and steelhead.</p> <p>Would create additional wood structures, pools, and floodplain side channels to improve floodplain connectivity and rearing and refuge habitat for UCR spring Chinook salmon and UCR steelhead.</p>	Would not contribute to Reclamation's efforts to implement RPA Action 35 or improve habitat complexity or floodplain connectivity on the Middle Entiat River.

Table 2-8. Summary of potential environmental effects of actions.

Resource	Proposed Action	No Action Alternative
Soils and Geology	<p>Approximately 12 acres of soil resources would be temporarily affected by construction of LWM structures (4 acres) and access roads and staging areas (~8 acres). Localized soil and compaction would occur. Upon completion of LWM installation and roads and staging area usage, soil would be replaced and revegetated with native seed mix, and roads would be rehabilitated. No soil erosion is expected to occur after site is revegetated.</p> <p>Approximately 5,102 cubic yards of soil would be removed to excavate side channels. BMPs would contain temporary soil erosion during construction. Post-construction, soil erosion</p>	<p>Construction-related impacts on soils would not occur from the project.</p> <p>Soil resources would be affected by ongoing natural processes (e.g., bank erosion) or activities related to human disturbance to soil (e.g., vehicle use on dirt roads).</p>

Resource	Proposed Action	No Action Alternative
	<p>and deposition would likely occur after channels are constructed and flow enters channels, similar to natural processes. Banks of side channels, and the onsite spoil locations would be revegetated.</p> <p>Removal of 8,600 cubic yards of levee material consisting of native soil and gravel and cobble sized material would occur. An additional 895 cubic yards of imported riprap would be removed.</p> <p>Placement of wood structures is expected to direct flows toward river banks as part of the natural lateral migration associated with rivers in floodplains. This could cause localized soil erosion as banks lose sediment from river flows</p>	
Vegetation and Wetlands	<p>Permanent removal of approximately 5 acres of grasses, trees, or shrubs would result where LWM structures or areas excavated for side channels would occur in vegetated areas.</p> <p>Temporary disturbance of approximately 23 acres of grass and shrubs from access roads, staging areas, spoil piles, and new side channel banks. These areas would be revegetated with native grasses, shrubs, and trees for the site to establish native plant cover after construction.</p> <p>Project construction would permanently impact 0.55 acre of wetland and temporarily impact 1.98 acres of wetland. Post construction impacts would be 0.48 acre where existing wetlands would be converted to open water channels.</p> <p>Wetlands temporarily affected during construction (i.e., access road use) would be recontoured as necessary to pre-project conditions and then revegetated with native grasses, forbs, shrubs, and trees.</p> <p>Once completed the project would rehabilitate 14.93 acres and create 2.0 acres of wetlands. The area of wetland benefit (i.e., rehabilitated or created wetlands) would vary by project area.</p>	<p>There would be no effect to vegetation or wetlands associated with construction.</p> <p>Wetland enhancements from side channel enhancements would not occur.</p> <p>Potential loss of vegetation or wetlands could occur if other development or restoration activities occur in along the project area.</p>
Water Resources	Construction would generate localized turbidity within the site due to new channel excavation, modifications to existing channels, and fill placement. Design features and BMP's such as isolation of work area to construct structures	Construction effects to water resources would not occur.

Resource	Proposed Action	No Action Alternative
	<p>and side channels, in-water construction only during allowed work windows, silt fencing, would minimize and reduce the amount of sediment entering water bodies.</p> <p>Water quality impacts would be reduced and minimized by turbidity monitoring, inspections or observation of water quality samples during construction.</p> <p>LWM structure placement would cause stream channel migration and erosion.</p> <p>LWM structures and new side channels would allow for increase inundation of the floodplain. Flooding of buildings/structures is not expected to occur based on analysis of 100-year flood event.</p> <p>Approximately 5,240 linear feet of reconnected side channels would occur from the project providing a benefit to aquatic habitat and habitat for rearing and refuge of juvenile and adult UCR spring Chinook salmon and UCR steelhead.</p>	
<p>Fish and Wildlife</p>	<p>Construction equipment and activities would create temporary sediment and turbidity that would temporarily degrade aquatic habitat. Limiting construction to NOAA Fisheries and WDFW approved in-water work windows would reduce and minimize impacts.</p> <p>Removal of 5 acres of vegetation and temporary disturbance to 23 acres of vegetation would reduce wildlife habitat for migratory and resident birds and mammals. Revegetation with native species would replace habitat that is temporarily or permanently affected by the Project.</p> <p>Construction impacts on federally-listed terrestrial species (wolverine, grizzly bear, lynx, wolf) are unlikely as these species are not expected to be in the area based on the current level of human activity, and would likely avoid the area during construction.</p> <p>Construction impacts on bald eagle or golden eagle are unlikely as no known nests occur in the project area and construction would occur in July after majority of nesting occurs and fledglings would likely be starting to fly and be mobile.</p>	<p>The Entiat River would continue to lack large wood within the stream channel.</p> <p>There would be no increase in the amount of rearing habitat available to juvenile salmon and steelhead.</p> <p>There would not be construction associated wildlife species.</p>

Resource	Proposed Action	No Action Alternative
	<p>Construction-related impacts on salmonids would be avoided, minimized, or reduced because of the HIP III General Aquatic Conservation Measures incorporated into the design. These measures are also used to facilitate Project's ongoing ESA consultation.</p> <p>An increase in overall UCR spring Chinook and UCR steelhead habitat for spawning, rearing, cover, foraging would increase in post-construction condition. Installation of LWM structures and side channels would increase rearing, cover, and foraging habitat.</p> <p>Helicopter noise could impact northern spotted owls nesting in close proximity to the project area but effects would be low because of the lack of suitable quality habitat and no nests have been recorded in the project area.</p> <p>Project effects on migratory birds would be low because planting of native trees in the disturbed areas would increase and enhance the riparian areas and habitat along the Entiat River.</p> <p>Construction could result in temporary effects on other wildlife due to noise and presence of humans which may disturb feeding/breeding activities of wildlife within the immediate vicinity.</p>	
Visual Resources	<p>Construction vehicles, construction materials, and disturbed areas would be visible during July to October 2019 and 2020.</p> <p>After construction, wood structures would be visible from the floodplain and from the Entiat River Road in Project Area C.</p>	<p>There would not be visual effects during construction or post construction from the Project.</p> <p>Visual resources could change as other activities could occur in the area.</p>
Cultural Resources	<p>No archaeological resources were identified in the project area so no known impacts would occur on cultural resources. Reclamation would implement an Inadvertent Discovery Plan if a cultural resource was encountered during construction. Inadvertent Discovery Plans would be consistent with Washington's RCW's governing human remains, cemeteries, and graves and records.</p>	<p>No new ground disturbance would occur in the project area; therefore, no potential effects to cultural resources would occur.</p>
Sacred Sites	<p>No Sacred Sites occur that would be affected by the project.</p>	<p>No Sacred Sites are present that would be affected by the No Action alternative.</p>

2.5 Comparison of Alternatives

Resource	Proposed Action	No Action Alternative
Indian Trust Assets (ITAs)	No ITAs occur that would be affected by the project.	No ITAs are present that would be affected by the No Action alternative.
Land Use and Recreation	<p>LWM structure placement would alter the river in ways that could affect how recreational boaters experience the river but substantial changes to the quality of recreation experience are not anticipated.</p> <p>Design and placement of wood structures utilized Reclamation’s RBDGs, and input from local recreationists to reduce and minimize risk to recreationists.</p> <p>Project is consistent with Chelan County Comprehensive Plan.</p>	<p>Construction of LWM structures would not occur therefore, recreational user experience and risks to recreationalists would remain the same if no other projects are proposed in the area.</p> <p>Natural recruitment of wood in the stream could create different conditions for river users compared to existing conditions.</p>
Noise, Air Quality, and Public Health and Safety	<p>Noise from construction activities could be discernible from ambient noise from public that are within 2,000 feet of on-ground construction equipment. Duration of construction equipment would primarily occur during construction periods with heavy equipment July to October each year.</p> <p>Noise from helicopter use would be heard from public in the Entiat subbasin. Noise associated with helicopter use would be 2 to 3 days each construction year.</p> <p>Air and dust emissions would be temporary and localized at individual construction sites. Water trucks would be used to reduce dust. Construction at the four sites is scheduled to occur over 2 years to reduce and minimize pollutant and dust emissions. Total vehicle emissions from the proposed Project would be low compared to emissions from other regional, national and worldwide contributors.</p> <p>Impacts on work safety and public would be avoided, reduced, and minimized as construction contractors would be required to follow all local, state, and federal policies (including Reclamation safety work plans on land and in or near water).</p> <p>Reclamation’s RBDGs were used to inform the LWM structure stability, lifespan, and potential for log jams to reduce potential downstream risks. Design of the LWM structures meets RCW pertaining to LWM structures. Post-</p>	<p>Temporary construction-related noise effects would not occur.</p> <p>Construction-related emissions would not occur</p> <p>Public safety would remain the same.</p>

Resource	Proposed Action	No Action Alternative
	<p>construction inspection would occur to monitor the integrity of structures.</p> <p>See "Land Use and Recreation" above in this table for recreational boater safety associated with wood structures.</p>	
Transportation	<p>Increased truck and equipment traffic would occur on the Entiat River Road during years 2019 and 2020 for construction.</p> <p>Based on the proposed construction occurring in 2019 and 2020, the number of round trips would be approximately 5 to 10 trips per day, each construction year.</p>	<p>There would not be a construction-related increase in traffic or traffic delays from the Project.</p> <p>Traffic patterns would reflect local and regional use in the Entiat watershed.</p>
Socioeconomics	<p>Project construction costs are estimated to be \$5.2 million. This cost would include expenditures on purchasing materials, equipment cost or rentals, and income to construction workers during the construction period.</p> <p>Temporary increase in need for lodging and supplies would support local lodging and businesses.</p> <p>Project would be an open bid process and would provide income for selected contractor and workforce. Some earned income would likely be spent Entiat and Wenatchee, Washington (approximately 18 and 35 miles from the Project).</p> <p>No individuals or residents would be removed from their property.</p> <p>Construction of the Project would likely have no adverse or disproportionate effects on minority or low-income populations.</p>	<p>No socioeconomic effects associated with construction would occur.</p> <p>No effects on environmental justice associated with construction would occur.</p>

This page intentionally left blank.

Chapter 3 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

3.1 Introduction

This chapter evaluates the potential effects of the Proposed Action, as well as the No Action alternative, on human and natural resources to determine whether either alternative has the potential to cause significant environmental effects. For each resource, the narrative describes the existing environment that could be affected by the alternatives and the potential environmental consequences of the alternatives. Environmental consequences on the human and natural resources described in this chapter are discussed for both: 1) construction-related impacts, and 2) post-construction impacts. Post-construction impacts can include beneficial impacts that are related to habitat and river conditions after the project has been constructed. Construction impact mechanisms include:

- Construction of LWM structures that require track equipment and trucks,
- Construction of side channels that require track equipment and trucks,
- Placement of spoils material in upland floodplain locations,
- Construction of access roads and staging areas,
- Helicopter use to deliver logs to LWM structures, use of vibrator pile driving to install pilings at selected LWM structures, use of dump trucks to haul material, and
- River crossings that include bridges or limited number of “wet” crossings across the river channel.

Construction impacts include permanent impacts where vegetation or soil is permanently removed to install LWM structures or excavate new side channels, and temporary impacts include actions such as construction of access roads and staging areas.

Discussion of the cumulative effects (incremental effects of the action when added to other past, present, and reasonably foreseeable future actions) is at the end of this chapter.

3.2 Soils and Geology

The analysis area for soils and geology is limited to the areas directly affected by the proposed Project.

3.2.1 Affected Environment

Soils

The Project area is generally characterized as alluvium mixed with volcanic ash and are characterized as very deep, somewhat poorly drained soils in floodplains (Aho and Beielser 2007). Burnscreek stony sandy loam and Billyridge gravelly sandy loam occur along the higher edges of the floodplain. Burnscreek stony sandy loam is formed in alluvium and is characterized as very deep, well drained soils in alluvial fans and terraces (Aho and Beielser 2007). Billyridge gravelly sandy loam formed in alluvium and is characterized as very deep, well-drained soils in alluvial fans (Aho and Beielser 2007).

The soil inventory (Aho and Beielser 2007) indicates that the following soils underlie the majority of the floodplain within the four project areas:

- Aeric fluvaquents, nearly level, under the vast majority of the floodplain in all six project areas. This series is a very deep, somewhat poorly drained floodplain soil that formed in recent alluvium mixed with volcanic ash.
- Billyridge gravelly sandy loam, 0 to 8 percent slope occurs under the secondary floodplain terrace at the northern end of Project Area D.
- Burnscreek stony sandy loam series, nearly level occurs under the higher elevation areas of the floodplain on river left in portions of Project Areas B, D, and F and along river right in Project Areas D, E, and F.

Geology

The geology of the Entiat River valley consists of three distinct valley segments (Reclamation 2009). A valley segment is defined as a section of river that shows similar geomorphic characteristics such as channel gradient, form, and structure. The upper most valley segment upstream of the Project area is considered the headwaters of the Entiat River and has a steep gradient with many water falls, rapids and pools. In the second valley segment between RM 24 to RM 16 (MP 22.4 to 15.0), which is where the proposed Project is located, the river gradient flattens out, likely caused by deep glacial scour during the last glacial period and subsequent infilling of glacial and post-glacial sediment. In the third valley segment the slope increases again downstream of the Project area from RM 16.1 to the river's mouth where it joins the Columbia River.

The dominant geomorphic factors affecting the river within the Project area are the Potato Creek moraine located at the downstream end of Project Area F, tributary alluvial fans, and delivery of sediment and wood from debris flows and sources in the upper watershed and local tributaries. The river channel within the Project area has sections of multi-thread meandering channels separated by short relatively straight reaches with a single-thread channel. The multi-thread sections snake back and forth, have a wide floodplain, and some

side-channels and relict channels. The single-thread sections are located in areas where large amounts of sediment has been deposited in the Entiat River by its smaller tributary creeks. These deposits are called alluvial fans and constrict the river into a narrow channel where it cuts through the sediment deposit at the mouth of the creeks. Alluvial fans affecting the river include: (1) Dill Creek alluvial fan just upstream of the Project area at RM 21.1 (MP 19.5) and alluvial fan of the two unnamed tributaries across from Dill Creek, (2) Tyee Creek alluvial fan in Project Area B, and (3) Stormy Creek and Shamel Creek alluvial fans spanning from RM 18.4 to 18.0 (MP 16.9 to 16.5) at the lower end of Project Area C, Gray Creek alluvial fan between Project Areas E and F, and (4) an unnamed tributary just downstream of Project Area F.

3.2.2 Environmental Consequences – Proposed Action

Soils and Geology

Construction Impacts

During construction, the movement of machines at staging areas and along temporary access routes would result in some soil compaction. Following construction, the access routes would be mechanically ripped as appropriate to reduce compaction and reseeded and replanted to stabilize the soils. The project design has been developed to avoid and minimize effect to soils by finding the most direct routes to construction areas, avoiding routes on steep slopes, and reducing the size of access routes and staging areas to just the area that is needed. Also, the proposed Project has incorporated helicopters to deliver logs to the LWM structures sites and would use helicopters to construct whole LWM structures to avoid the use of ground-based equipment where long access routes would have been necessary.

Construction of the LWM structures would result in some temporary erosion or soil loss, but erosion and sediment control measures would be used during construction to control and manage temporary soil loss and accelerated sediment delivery to the river. Soil erosion during construction would be temporary and mitigated through the BMPs discussed in Chapter 2 (Table 2-6).

In Project Areas B, C, and F, side channel excavations would allow flows to enter existing side channels. For Project Areas B and C, excavated soil would be loaded into a dump truck and disposed of off-site to avoid altering floodplain function. These excavations would affect soils in Project Areas B and C but exposed soils would be replanted and seeded in order reduce the risk channel bank erosion.

In Project Area F, soil excavated for side channel enhancement would be hauled by small machine and would be deposited within 50 feet of the excavation on nearby upland areas so to not alter floodplain function. Soil excavated from the second inlet and at the downstream

outlet would be transported off site via a temporary bridge. Also, new side channels would be created and a remnant side channel would be enhanced for its entire length. Soils from all three of these areas would also be transported off-site. Much of the excavation would occur in river left, which was formerly a residential property. Much of the material that would be removed had been brought to the site to elevate and protect the home so it would be out of the floodplain. On river left, a historical side channel would be excavated to create a side channel with year-round flow. These side channel excavations would result in the removal of 10,000 cubic yards of native soils from the area.

Post-construction Impacts

Primary LWM structures installed throughout the project areas would increase scour of the river bottom to create “holes” which provide habitat for fish. The material that is displaced from these areas would be moved downstream until it reached a depositional area where slower moving water would cause the material to settle back into the river bed so it would not leave the system. In addition, some of primary LWM structures would force flow towards the opposite bank, rather than straight downstream. The energy from this redirected flow would cause erosion of the river bank causing lateral channel migration. Soils would be carried away and moved downstream; materials would be deposited depends on the size of the material and how quickly the water is moving. Soil erosion occurs when a stream channel experiences lateral migration, which is a natural occurrence in rivers and has happened historically in the Entiat River (Julien 2002). Larger rocks and cobbles would drop out and settle on the river bed fairly quickly. Finer materials such as gravels and soils could be carried for miles downstream. The historical channel scars visible in the floodplain are evidence of where the main channel was once located. Because of past human and natural disturbances within the riparian area (i.e., land clearing and fire), there are few large mature trees available for recruitment into the river that could both initiate channel migration and trap mobilized sediments. The addition of LWM structures within the Project reach would not only initiate erosion and mobilization of soils but would create areas of slow water that would settle and trap soils as they move through the river system.

Mobilization of exposed soils would occur during the first flush of water through these newly excavated side channel areas. This would mobilize fine sediments into the Entiat River but would likely occur during the first spring high flow when high water volumes and sediment-laden water would reduce the effect on water quality. Once riparian plantings and seeding is allowed to take hold the annual effect of high flows on soil mobilization would be reduced.

Bremmer Levee in Project Area B prevents lateral channel migration and so the river moves straight down the valley rather than moving from side to side. The material being removed at the Bremmer Levee is anthropogenic (something done by a human that affects nature), and its removal would help restore the natural functions of the river, including allowing greater lateral channel migration and improved connectivity between the flood flows and the adjacent floodplain.

3.2.3 Environmental Consequences – No Action

Under the No Action alternative, Reclamation would not provide funding for the Project and the proposed habitat improvement efforts would not be implemented. The limited amount of lateral channel migration and connection to adjacent floodplains would continue.

3.3 Vegetation and Wetlands

The analysis area for vegetation and wetlands is limited to the Entiat River valley floodplains within the Project area.

3.3.1 Affected Environment

The Entiat River subbasin lies generally within the lower elevation edge of the grand fir (*Abies grandis*) Vegetation Zone of the North Cascades Province. This vegetative complex occupies the midslope foothills of the eastern slope of the Cascade Mountains in Washington. This zone generally transitions to the Douglas-fir (*Pseudotsuga menziesii*) or ponderosa pine (*Pinus ponderosa*) zone at its lower limits (Franklin and Dyrness 1988). The landscape surrounding the project areas is a combination of undeveloped floodplain dominated by young deciduous tree and shrub species, and upland forests, and intermixed with rural residential properties.

Vegetation

The tree species found within the Project area are grand fir, western white pine (*Pinus monticola*), Ponderosa pine, western larch (*Larix occidentalis*), and Douglas-fir (*Pseudotsuga menziesii*), with one species often dominating forest stands. The understory is composed of a mixture of grasses including pinegrass (*Calamagrostis rubencens*), Geyer's sedge (*Carex geyeri*), northwestern sedge (*Carex concinnoides*), heartleaf arnica (*Arnica cordifolia*), tailcup lupine (*Lupinus caudatus* or *laxiflorus*), and white hawkweed (*Hieracium albiflorum*) (Franklin and Dyrness 1988). Shrub species include birch-leaved spirea (*Spiraea betulifera*), various rose and willow species (*Rosa* and *Salix* sp.), and snowberry (*Symphoricarpos albus*) (Franklin and Dyrness 1988). Scouler's willow (*Salix scouleriana*), snowbrush (*Ceanothus velutinus*), serviceberry (*Amelanchier alnifolia*), and both blue and red elderberry (*Sambucus cerulean* and *S. racemosa*) are also common shrub dominated areas in this zone (Franklin and Dyrness 1988).

Riparian and wetland vegetation is a mixture of trees, shrubs, and grasses that include Sitka alder (*Alnus viridis/sinuata*), black cottonwood (*Populus balsamifera* ssp. *trichocarpa*), trembling aspen (*P. tremuloides*), western red cedar (*Thuja plicata*), red-osier dogwood

(*Cornus sericea*), snowberry (*Symphoricarpos albus*), and various species of rose (*Rosa* spp.) and willows (*Salix* spp.), and a variety of sedges (*Carex* spp.).

Wetlands

Reclamation conducted wetland delineation for each Project area to determine where wetlands currently exist in an effort to limit effects to wetlands. It was estimated, based on the delineation that there are 116.2 acres of wetlands within the Project area (ICF International 2015). Table 3-1 presents the area of delineated wetland within each Project area.

Table 3-1. Delineated wetland area by Project area.

Project Area	Acres of Wetland
B	16.9
C	70.9
E	12.7
F	15.7
Total	116.2

These wetland areas were comprised of both riverine and depressional wetlands. Riverine forested/scrub-shrub wetlands are the most common variety of wetland found within the Project area and are characterized by dense trees and shrubs with sparse grassy or emergent vegetation underneath. Depressional wetlands generally support a diverse mixture of native emergent species but also have degraded components dominated by non-native reed canary grass (*Phalaris arundinacea*) and/or have been affected by development in the floodplain.

These riverine and depressional wetlands are generally found within the floodplain of the Entiat River in the Project area as follows:

- Riverine wetlands, strongly influenced by beavers, where beavers have created diverse open water/emergent areas at the mouth of historic or active side channels. These wetlands typically extend back into the floodplain as scrub-shrub/forested wetlands.
- Riverine wetlands, in which beavers have created small open water/emergent areas back in the floodplain within larger scrub-shrub and forested wetlands.
- Riverine forested/scrub-shrub wetlands within the floodplain. These floodplain wetland/upland mosaic areas are the most common variety of wetland, with a dense tree and shrub overstory and a very sparse understory.
- Depressional, predominately emergent wetlands separated from the river by man-made features (e.g., Project Area B behind the Bremmer Levee on river left). These wetlands generally support a diverse mixture of native emergent species.

- Riverine wetlands with depressional, often emergent components. These wetlands typically support a mixture of native species, but also have degraded components dominated by reed canary grass and/or have been affected by floodplain development.
- Riverine wetlands where trembling aspen trees co-dominate with river birch and willow trees. Only one of the wetlands sampled during the field effort met this criterion, Project Area B, on river right. This wetland is considered a Category I wetland due to the 'special characteristic' of having an estimated 20 percent of forested community composed of trembling aspen.

Because there are differences in the type and amount of habitat functions that a wetland provides, they are broken into three category types. To determine the classification for the wetlands found within the Project area, the Washington State Wetland Rating System for Eastern Washington (Hruby 2014) was used. Three wetland categories were identified within the Project area :

- Category I wetlands are those that 1) represent a unique or rare wetland type; or 2) are more sensitive to disturbance than most wetlands; or 3) are relatively undisturbed and contain ecological attributes that are impossible to replace within a human lifetime; or 4) provide a high level of functions. Generally, these wetlands are not common and make up a small percentage of the wetlands in the region. Only two Category I wetlands were found within the entire Project area : The aspen wetland in Project Area B (described above), and a wetland in Project Area C. The wetland in Area C is Category I because of the high scores it received for providing water quality and hydrologic functions and wildlife habitat characteristics.
- Category II wetlands are difficult, though not impossible, to replace, and provide high levels of some functions. These wetlands occur more commonly than Category I wetlands, but still need a relatively high level of protection. Category II wetlands are the predominant wetland type within found throughout the Entiat River floodplain areas within the four project areas.
- Category III wetlands are wetlands with a moderate level of functions, have usually been disturbed in some way, and are often less diverse or more isolated from other natural resources in the landscape than Category II wetlands. Few Category III wetlands were identified within the four project areas, and all of these wetlands were associated with past human disturbance.

3.3.2 Environmental Consequences – Proposed Action

The proposed Project includes construction activities associated with LWM structures and new side channel habitats that would damage or destroy some plants and wetlands during construction, but would create conditions for establishing larger and more robust vegetated riparian areas and wetlands in the long term.

Vegetation

Construction Impacts

To install LWM structures, construction equipment would need to have access to the river bank in areas with existing vegetation. In the short term, these construction activities would result in a temporary loss of approximately 23.6 acres grasses, shrubs, and trees at specific spots in each Project area. The excavation for side channels and the construction of LWM structures would result in a permanent loss of 5 acres of riparian vegetation. Construction access and staging areas were sited in areas to minimize and direct effect to vegetation (refer to Figures 2-2 through 2-5 in Chapter 2). While much of the Entiat River's riparian area is vegetated, due to fire and human activity the majority of vegetation consists of young deciduous trees and shrub vegetation. No mature trees would be removed to facilitate construction access or staging. Table 3-2 presents the acreage of vegetation that would be temporarily disturbed during construction.

Table 3-2. Temporary vegetation effects by Project area (ICF International 2015).

Project Area	Acres of Disturbed Vegetation
B	9.6
C	3.3
E	1.7
F	9.0
Total	23.6

Vegetation cleared for access and staging areas would be cut but the roots would not be grubbed to allow rapid regrowth. Access and staging routes would also be replanted or re-seeded following construction (see Section 2.2.2).

Invasive species such as reed canary grass within Project Area F would decrease as a result of the vegetation clearing during construction. Controlling the introduction and spread of invasive species during construction would be achieved through BMPs described in Chapter 2 (Table 2-6).

Post-construction Impacts

The restoration of flood waters and the increased wetting of the floodplain would increase the growth of native riparian plant species. In addition, floodplain plantings in Project Areas B, C, and F would restore floodplain areas that have been cleared by humans to native woody riparian complexes. The installation of the LWM structures would increase lateral channel migration, local bank erosion, and recruitment of shrubs and trees into the river. These effects are expected to be localized and are a normal process that is intended to be initiated.

Wetlands

Construction Impacts

Project elements and temporary access routes with impacts on wetlands that were avoidable or not balanced by benefits were revised or eliminated in efforts to minimize unavoidable impacts on wetlands and waters. Through the design process, several side channels, alcoves, and LWM structures were eliminated and work within wetlands to restore flow to relic side channels was substantially reduced. The Project also incorporates construction of LWM structures by helicopter into areas too difficult to access without substantial impact on wetlands or waters in order to avoid temporary impacts and minimize the need for additional access routes and staging areas. All access routes and wet crossings of the river were similarly strategically oriented to minimize impacts on wetlands and waters. Placement of excavated material (where necessary to eliminate additional access routes and river crossings) was strategically oriented to occur only in upland areas lacking mature riparian vegetation; no side cast or placement of excavated material would occur in wetlands.

An analysis was done where the proposed habitat improvement actions were mapped along with the areas of existing wetland. Table 3-3 provides the results of this analysis showing the temporary construction impacts (staging areas and access roads), and more permanent construction impacts such as earthwork activities (e.g., cut, fill).

Table 3-3. Evaluation of potential construction impacts to wetlands (Stratten 2017).

Project Area	Temporary and Permanent Construction Impacts (acres)		
	Permanent	Temporary	Wetland Total
B	0.01	0.47	0.48
C	0.00	0.04	0.04
E	0.00	0.07	0.07
F	0.54	1.40	1.94
Total	0.55	1.98	2.53

Post-construction Impacts

While some wetland areas would be affected by excavations needed to reconnect old side channels (direct construction impacts), allowing surface water to flow into these side channels would allow for more frequent inundation of these areas. More frequent inundations through these excavations or through the placement of LWM structures would convert some wetland areas into open water channels (Table 3-4). This would reduce wetland functions related to vegetative structure and were considered a post-construction impact.

Table 3-4. Post-construction impacts to wetlands (Stratten 2017).

Project Area	Impacts (acres)
B	0.14
C	0.14
E	0.03
F	0.17
Total	0.48

In addition to calculating the negative effects to wetlands, the beneficial effects were estimated by combining the proposed changes to the landscape as a result of the Project with river hydrology data to show where new inundation levels would either enhance existing wetlands or create new wetland areas. The wetland benefits accrued across the floodplain are classified into two categories: wetland rehabilitation, and wetland creation. The definition of the benefit categories is consistent with the definitions of mitigation terms from the Environmental Protection Agency (EPA) and USACE regulations governing compensatory mitigation for losses of aquatic resources (Mitigation Rule, 33 CFR Parts 325 and 332, and 40 CFR Part 230) (79 FR 19594). Wetland rehabilitation is defined as manipulation of physical, chemical, or biological characteristics with the goal of repairing the natural or historic functions to a degraded aquatic resource. In this analysis, wetland rehabilitation is represented as the net area of existing floodplain wetlands—not currently, but that would be—flooded by the 2-year flows. In this analysis, upland areas would become wetlands by the removal of fill. Fill to be removed would typically consist of material placed many years ago to create roads or residences (e.g., the house and fill pad in Project Area F) and the Bremmer levee in Project Area B, most likely in areas that were formerly wetland. Table 3-5 summarizes the anticipated area of benefits to wetlands.

Table 3-5. Evaluation of anticipated benefits to wetlands (Stratten 2017).

Project Area	Net Benefits (acres)		
	Wetland Rehabilitation	Wetland Creation	Total
B	3.52	1.02	4.54
C	5.92	0.00	5.92
E	1.26	0.01	1.27
F	4.23	0.97	5.20
Total	14.93	2.00	16.93

The proposed habitat improvement actions would result in 1.03 acres of permanent impacts (i.e., 0.55 acre of construction impacts and 0.48 acre of wetland converted to open water from post-construction impacts) for all four project areas, but once completed the Project would rehabilitate or create 16.93 acres of wetlands. The amount of wetland benefit would

vary by Project area , but in all cases the proposed Project design would improve the frequency of floodplain connectivity between the river’s flow and the floodplain wetlands.

3.3.3 Environmental Consequences – No Action

Under the No Action alternative, Reclamation would not provide funding for the Project. The current extent and condition of wetlands in the Project area would remain the same because the Entiat River would remain disconnected from the floodplain. Riverine wetlands that are located adjacent to downcut or incised streams provide less flood attenuation than those adjacent to a stream with no incision (Hruby 2014). This current condition within the Project area has led to a degradation of hydrologic functions and a decreased ability to store floodwaters to reduce the effects of flooding. The decreased storage of floodwaters also decreases the ability to provide late summer low-flow discharge as more water is held within the incised channel during flood events. While the wetlands that currently exist would continue to provide some ecological value, the increase in wetland area and improved hydraulic function proposed under the Proposed Action would not occur.

3.4 Water Resources

Water resources include hydrologic characteristics within the basin and project areas, water quality, and floodplain functions.

3.4.1 Affected Environment

The Entiat River originates on the eastern slopes of the Cascade Mountains. All runoff generated from the Entiat River drainage basin empties into the Columbia River just south of the city of Entiat, Washington. The Entiat River begins at about elevation 9200 feet and the elevation at the mouth of the Entiat River is approximately 710 feet. The Mad River is the only major tributary of the Entiat River and enters the Entiat 6 miles downstream of the proposed Project area. Within the Project area small seasonal tributaries enter the Entiat River, they include Shamel Creek and Stormy Creek (Project Area C), Gray Creek (between Areas E and F), and several unnamed seasonal tributaries.

Hydrologic Characteristics

The hydrologic regime in the Entiat watershed is predominantly controlled by spring and summer snow melt, with episodic rainfall at low to mid-elevations and rain-on-snow events in the upper watershed contributing to flow during the fall and winter months. Mean annual precipitation ranges from 90 inches in the moist alpine areas of the upper basin to less than 10 inches in the arid shrub steppe portions of the lower basin (Andonaegui 1999). Much of

the precipitation falls as snow, accumulating through the winter as mountain snowpack and melting through the warmer spring and summer months. Snowmelt is the primary source of surface and groundwater in the valley. The permeable sands and gravels that comprise the valley bottom allow for groundwater movement between the stream channel and the surrounding floodplain (Andonaegui 1999). Peak flows are associated with late spring and early summer snow melt, with base flows receding throughout late summer and fall. Snow melt is the dominant control on the magnitude of peak flow events (Reclamation 2009). The flood of record occurred on May 29, 1948, with a discharge of 10,800 cfs (USGS gage #12453000, Entiat River near Entiat), and is approximated as a 500-year flood event (Reclamation 2009). Major flood events also occurred in 1894 (no gage record), 1972 (6,430 cfs, approximately 100-year event), and 1999 (5,600 cfs, approximately 10-year event) (Reclamation 2009).

A comprehensive hydrologic evaluation of the Entiat River subbasin was completed by Reclamation and is described in detail in Appendix B of the Entiat River Tributary Assessment (Reclamation 2009). This report calculated the peak flows for the 2- to 100-year events for each river mile from the mouth at the Columbia River to RM 32 (12 miles upstream from the proposed Project). The 2009 analysis included the hydrologic response to the large fires that occurred between 1957 through 2009. These peak flows are summarized in Table 3-6.

Table 3-6. Entiat River hydrology at key locations.

Location	River Mile	Drainage Area (mi ²)	2-year Peak (cfs)	25-year Peak (cfs)	100-year Peak (cfs)
Project Area B	20	187.736	2,640	5,040	6,220
Project Area C	19	192.02	2,650	5,070	6,250
USGS 12452800	18	203.35	2,680	5,130	6,330
Project Area E	17	204.56	2680	5,130	6,330
Gray Reach Area F	16.2	208.01	2,690	5,150	6,360

In addition to evaluating the stability of LWM structures during the 100-year design flow, lesser high water events were also used to determine how, where, and why habitat improvement elements should be placed on the landscape. The hydrologic analysis in Reclamation's Entiat Tributary Assessment identified several limiting factors in this reach of the river related to its hydrology. By using the peak flows from more regularly occurring high-water events (flows that occur on average every 2 or 5 years), the analysis showed that areas that used to experience flooding (the active floodplain) had been disconnected from the river over time. This is largely due to a lack of mature trees in the riparian area, most of which have been harvested or destroyed during wildfires. Historically large trees would have regularly fallen into the river as the stream channel migrated across the floodplain and

created large logjams that would force the water off onto the floodplain. The river's energy would have then created side channels. Because the Entiat River riparian area lacks large trees those logjams are not being created so the water does not get directed toward the floodplain but instead it stays in the main channel. In the river's current state the energy carried by the water is directed downward toward the river bed. This concentration of flow in the main channel causes "down-cutting" as the river's energy moves material along the river bed and downstream. Down-cutting ultimately deepens the channel and further disconnects the river from the floodplain.

Recent Fire Effects

In 2015, severe wildfires burned portions of the Entiat watershed upstream of the Project area. These fires occurred relative to a long historic record of both fire and flood in the Entiat River Watershed (Reclamation 2016b). Specifically, the 2015 Wolverine fire complex included lands in the Entiat River Watershed above Entiat River Falls located at RM 32 (MP 30.4) approximately 12 miles upstream of the Project area. In a November 25, 2015 letter addressed to YN Fisheries (Whitehall 2015), the USFS expressed concerns that the burned watershed areas above the proposed Project could be at risk to experience increased runoff and debris during a 3-year period following the 2015 fire. The letter described the potential for an increased runoff response, rill and gully erosion, flash floods, debris flows and sediment deposition in the post fire condition for approximately 3 years while the watershed vegetation and soils recover. The Project is scheduled for construction in 2019 and 2020, past the period of concern (2015 through 2018) for increased flooding and debris flow as expressed in the USFS letter.

Water Quality

The Entiat River is classified as a Class A (excellent) stream from the boundary of the Wenatchee National Forest at approximately RM 26 (MP 24.4) to its confluence with the Columbia River and as a Class AA (extraordinary) stream from the National Forest boundary to its headwaters (Cascadia Conservation District 2014). It supports beneficial uses including domestic, industrial and agricultural water supply and primary contact recreation. Overall water quality at the Washington Department of Ecology (WDOE) ambient water quality monitoring station 46A070 (Keystone) met or exceeded expectations in water year 2002, and is of lowest concern according to Washington Department of Ecology's Water Quality Index (WQI).

Water quality in the Entiat River has been affected in the past by practices including flood control, logging and related road building, livestock grazing, and past hayfields practices. Substantial positive changes and reductions have been made in several of these land uses. Logging and grazing in the watershed has declined significantly, and agricultural practices have improved significantly with new technology. Watershed restoration emphasizing road

rehabilitation has become a major focus of federal land managers. Furthermore, the amount and type of flood rehabilitation and control measures used and/or financed by federal agencies earlier in the century would probably not reoccur, due to a better understanding of the environmental sensitivity of the watershed.

No water quality issues have been identified in the Entiat River with respect to fecal coliform, dissolved oxygen, pH, or turbidity. Temperature exceedances in the summer months have been identified throughout the record, beginning in 1960. Occasional temperature exceedances may have occurred naturally prior to settlement of the Entiat Valley; however, it is likely that the number and frequency of exceedances has increased due to a combination of historic manipulation of channel geometry and removal of riparian vegetation.

Floodplains

The Entiat Tributary Assessment (Reclamation 2009) evaluated and estimated the size of the adjacent floodplain. The width of the river's active channel and active floodplain were averaged by reach in order to identify general patterns in channel complexity as well as any deviations in width measurements that might signal altered areas. In general, width-averaged measurements show that wider active channels correspond to wider or unconfined active floodplains. Where a river is wider it normally has more channel complexity because there is a wider range of depths, velocities, and substrate and a greater number or length of side-channels that provide off-channel habitat. Where a river is narrow or has confined floodplains it normally has less channel complexity because in-channel velocities, depths and substrates are more uniform and off-channel habitat is more limited.

Several manmade structures are within the active channel area and floodplain and are currently at risk of erosion or flooding during large magnitude events (Reclamation 2016c). These include Entiat River Road, the Bremmer Levee at RM 19.75 (MP 18.35), the utility line crossing at RM 18.75 (MP 17.3), the private dirt roads in the right bank floodplain at RM 19.0 (MP 17.5) and along the right bank at RM 18.25 (MP 16.8), and a home near RM 16.5 (MP 15.3) within the 100-year floodplain shown on the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) (FEMA 1982). There is an additional occupied dwelling in Area F at RM 16.7 (MP 15.5) that does not show on the FIRM but shows to be within the updated floodplain based on current two-dimensional hydraulic modeling and topographic data. The term 100-year flood indicates that the area has a one-percent chance of flooding in any given year, not that a flood will occur every 100 years .

3.4.2 Environmental Consequences – Proposed Action

Hydrologic Characteristics

Future wildland fires can lead to increased peak flows following storm events and the mobilization of debris through the Project area. The FCRPS BiOp (NOAA Fisheries 2014) experts predicted several physical changes to rivers and streams in the Columbia Basin including altered streamflow volume and more winter flooding. The addition of LWM structures would help dampen the expected increases to peak flows by increasing long-term channel stability through adding stable hard points in the floodplain to collect debris, slow flood flows, and increase flood inundation on adjacent floodplains. The LWM structures would also help to recharge local groundwater during flood events through the increased floodplain inundation which would lead to increased groundwater discharge to the main channel during low flows (Abbe and Montgomery 2003; Pollock et al. 2015). This would help augment low flows with additional cool-water discharge.

Water Quality

Construction Impacts

Impacts to water quality in the Entiat River could occur during construction of the LWM structures, the excavation of side channels, installation of temporary bridges, and potentially from leaks or spills of fuel, or oil from construction machinery.

The majority of LWM structures would be constructed using a pile-based design and so would require little-to-no excavation. A pile driver positioned on the streambank would lift logs and drive them into the riverbed. The additional logs used to create the bulk of the structure would be laid/woven between the piles. Small amounts of sediment would be released in to the water when the piles are driven but the small amount of sediment would likely not be visible. For LWM structures where construction equipment would need to be in the river, the work area would be isolated from the main channel to prevent disturbed sediment from flowing into the river (see Section 2.2.3). Once the vertical piles are driven into the substrate of the river, the horizontal logs would be placed between the vertical piles with very minor, if any disturbance to river sediment. Only temporary effects of sediment on water quality during construction are expected due to the methods used to construct each of the LWM structures and the site isolation methods for in-water work.

Excavation to construct and connect historical side channels would occur when the areas are dry or disconnected from the Entiat River so little to no sediment would be released during side channel excavations. In some areas once the excavation is completed and water from the river is allowed to enter the new channel, a pulse of sediment would be released into the river but the effect on water quality would be temporary and localized.

Several types of large machinery would be used during the construction of Project. Leaks and spills from these machines could occur during construction but the potential effects on water quality would be reduced by construction BMPs described in Chapter 2 (Table 2-6).

Post-construction Impacts

The long-term effects of the Project would result in increased complexity within the river that would allow for more floodplain connection. This increased connection to the floodplain would slow the speed of water during high flows and encourage sediment and fine particles to settle out in depositional areas. The placement of LWM structures would encourage stream channel migration and cause erosion in certain areas but this represents the natural functions of a river system.

Floodplains

Construction Impacts

Construction impacts within the floodplain would be limited to those caused by construction equipment access and staging, and the construction of the LWM structures and side channels. These activities would result in temporary impacts to floodplain vegetation and soil stability which would be reduced in severity through the implementation of the BMPs listed in Chapter 2.

Post-construction Impacts

The changes in floodplain inundation resulting from these project actions were modeled across a range of flood flow events in order to assess the overall project effects to flood flows. The installation of the LWM structures typically results in local increases in surface waters adjacent to the structure and during higher flows (e.g., flood flows) this also results in greater floodplain inundation. The excavation of the side channel elements typically increases local floodplain capacity. The increase in the extent and frequency of flooding to vegetated floodplain areas is part of the intended outcome of the Project. The installation of the LWM structures and increase in floodplain capacity associated with the side channel construction would work to allow flood flows greater access to the vegetated floodplain thereby slowing and storing flood flows and reducing the peak and timing of the flood events downstream of the Project area.

The LWM structures may accumulate additional wood, gravel, and ice debris that is mobilized through natural riverine processes. Through the RBDG (See Section 3.10.2) design process, representative structures were evaluated for stability related to debris jams which represented wood, debris from fire-related runoff, or ice accumulation. The design of LWM structures is supported by flood frequency analysis using the Ardenvoir gage (USGS# 12452800) at RM 18 which located within the Middle Entiat Project and provides the best

hydrologic data for the project area. This gage has a period of record from 1958 to present. This period of record includes the 1972 peak event (approximately a 100-year event) which resulted in the debris torrent at Preston Creek which was generated through the burned area caused by the 1970 fire events upstream of the Project area. These design criteria represent a reasonable and robust attempt at engineering for unforeseen events.

The design process accommodated the volume of flows and debris that can be associated with fires in the watershed. LWM structures have been designed to the 100-year flood event at the Project area. The 100-year flood event is based on long-term recorded stream gauge history of the Entiat (59 years of data), which incorporates a long history of floods and fires in the Entiat River Watershed.

The Wolverine Fire in 2015 was analyzed to determine the behavior of potential debris flows from that fire. The analysis was based on debris flows associated with the Preston Creek fire event in 1972 to estimate how far wood, gravels, and other sediment is transported from the fire event. From this past fire and associated debris flow event, it was determined that debris transported from the Wolverine Fire would primarily consist of smaller woody debris material (1- to 6-foot size), flotsam, and suspended sediments. Design of the LWM structures included this debris accumulation on structure stability.

The engineering analysis determined, even in a scenario of debris accumulating in channel spanning conditions, that the risk-based design guidelines for factors of safety (for sliding and buoyancy) are not exceeded suggesting the designed structures are adequate to withstand debris flow accumulations at current streamflow velocities from the Wolverine Fire. Assuming a worst-case scenario of extreme flow velocities (15 feet/second), channel spanning debris, and with flow constricted to the channel (i.e., no bank erosion occurs and no water is diverted into side channels or the adjacent floodplain), some structural stability may be compromised. This is a very unlikely scenario in the Gray and Stormy reaches given the amount of floodplain and side channels that would relieve hydraulic forces. Based on this analysis, the design of LWM structures are expected to perform as designed and not affect property along the river from debris flows and LWM structure instability.

Additionally, as mentioned in Section 3.4.1, this potential for increased runoff response with debris would occur in a post fire condition for approximately 3 years while the watershed vegetation and soils recover. Since the Project is scheduled for construction in 2019 and 2020, this would be past the period of concern.

As discussed in Section 2.2.2, the LWM structures would be primarily stabilized through driven piles. The only structural connections used to secure logs used in LWM structures would be threaded bolts that “pin” logs to one another. For helicopter-constructed LWM structures, short lengths of chain would be used to create “rock collars” used to create ballast intended to secure logs. As the wood deteriorates over the expected 25-year lifespan (see

Sections 2.2.2 and 3.11.2), individual logs may break from the larger structure. Since these logs are not cabled together we do not expect multiple logs to move together downstream. This reduces the risk of the creation of unintended channel spanning debris jams, and impounded water that could create flooding, downstream of the Project area.

The floodplain analysis of the Project also looked at the extent of the 100-year floodplain based on the current Chelan County FIRM produced by the FEMA that went into effect on February 4, 1981 (FEMA 1982). The 100-year floodplain depicted on the 1981 FIRM was determined with the data and hydraulic modeling available in 1981. Since that time, hydraulic modeling and data from aerial imagery and topography gathered using satellites now allows for a much more accurate assessment of where and how water moves and flows over the landscape during a high flow event. In accordance with Reclamation's risk-based design guidelines, the Project was evaluated to determine if the proposed project would affect the extent of the 100-year floodplain and result in increased risk to property throughout the project area. This analysis showed that the 100-year floodplain shown on the 1981 FIRM map underestimates the extent of the actual 100-year floodplain in some locations (Reclamation 2016c).

The assessment of effects on the 100-year floodplain is based on the assessment using current hydraulic modeling and topographic data and not the FIRM. The floodplain analysis of the project's effects relative to the 100-year floodplain shows that the proposed project would result in minor changes to the current extent of the actual 100-year floodplain. The only homes shown to be within the updated 100-year floodplain are in Project Area F. In the vicinity of these structures, frequent floods (e.g., less than the 100 year) have inundated large portions of the floodplain that extend beyond the 100-year floodplain boundary shown on the FIRM.

The County's Shoreline Master Plan (SMP) regulates development within the 100-year floodplain. On June 3, 2016, project engineers met with staff from Chelan County's Community Development Department to discuss the effects of the project. Additional information on this plan is discussed in Section 3.10 under land use. The project designers showed Reclamation's hydraulic modeling and how it was used to develop the planned habitat improvement actions to create increases in the frequency of inundations to the existing 100-year floodplain while minimizing any effects to its extent, particularly in areas where structures or infrastructure existed.

Throughout the project areas, the proposed LWM structures would reduce future bank erosion in some areas but also increase the water surface that may increase the extent of floodplain inundation. While the proposed project would increase the extent and frequency of flooding in some areas, there are no structures that would be affected by increases to the 100-year flood event.

3.4.3 Environmental Consequences – No Action

Under the No Action alternative, Reclamation would not provide funding for the proposed project and the construction effects to water resources from Reclamation-funded work would not occur. During high flows, the Entiat River would continue to down cut, further disconnecting from the floodplain. This would continue the trend of increasing peak flood flow quantities, and as the depth of the river increases, the velocity of flows would increase; increasing the potential for effects to infrastructure like downstream bridges and the Entiat Valley Road. These trends would continue to reduce the Entiat River's resiliency to the predicted effects of fire on hydrology, channel erosion, and floodplain function.

3.5 Fish and Wildlife

The Project area is located on the Entiat River between RMs 16.2 and 18.7. The analysis area for this EA has been delineated based on the anticipated impacts and benefits to fish and wildlife and their habitats, extending 1,000 feet from the Project area. This analysis area is based on the anticipated noise levels that would be generated during construction of the project. Construction-related impacts to the aquatic environment would extend approximately 1,000 feet from the Project area, based on the use of vibratory pile drivers to install the LWM structures.

3.5.1 Affected Environment

Fish Habitat Conditions

The Entiat Tributary Assessment (Reclamation 2009) subdivided the lower 26 miles of the Entiat River into three valley segments (VS). The analysis area is within VS-2, which extends from the Potato Creek moraine at the downstream end to the Dill Creek alluvial fan at the upstream end. This unconfined valley segment has relatively good floodplain connectivity compared to the higher gradient segments up- and downstream, which is a key factor in targeting reaches within VS-2 for habitat restoration.

Human impacts to the Entiat River watershed date back to the late 19th century, during which time logging and grazing by sheep and cattle acted as the primary anthropogenic disturbances (Andonaegui 1999; Reclamation 2009). Log drives down the river necessitated channel modifications to improve timber transport to mills near the mouth of the Entiat at its confluence with the Columbia River. Timber harvest throughout the watershed greatly reduced the quantity and size of trees available for recruitment to the channel, also reducing water storage capacity and increasing runoff and soil erosion (USFS 1996). As development of the valley increased, agricultural land use began to expand, with apple orchard tracts

appearing in the early 20th century (Andonaegui 1999). Establishment of the Okanogan-Wenatchee National Forest (OWNF) occurred in 1908, initiating federal control over timber harvest and grazing practices in the watershed above RM 25.5 (MP 23.4). These land use practices continued throughout the watershed, however, and salvage timber harvest still occurs in portions of the OOWNF. The upper reaches of the watershed above RM 43 are within the Glacier Peaks Wilderness Area, which was established in 1964. As such, this portion of the watershed has restricted uses, with impacts limited to natural disturbances and trail maintenance (Reclamation 2016b). These elements have all contributed to the existing fish habitat conditions in the Entiat River subbasin, as well as the existing wildlife habitat conditions.

Downstream of the National Forest boundary (RM 25.5 [MP 24.4]), higher road densities and encroachment of the riparian area by hayfields, grazing, and development negatively impact fish habitat through excess fine sediment delivery, compaction of soils leading to flashy runoff, changes in land cover, and reductions in riparian forest (Andonaegui 1999). Such conditions can affect the diversity and density of aquatic invertebrates, as can changes in riparian vegetation. High sediment levels in a given stream reach can create unsuitable habitat conditions for all life cycle stages of salmonids and for the insects (macroinvertebrates) upon which they feed. Excess fine sediment has been identified as a minor limiting factor within the Entiat River as a whole (Andonaegui 1999). Fine sediment levels fluctuate in accordance with natural conditions and do not represent a consistent long-term problem (Reclamation 2013a). Loss of floodplain connectivity and floodplain forests is identified as a limiting factor for fish and fish habitat in the Entiat subbasin (Andonaegui 1999). Twenty two bridge crossings span the Entiat in the reaches below the OOWNF boundary, locally constricting the river (Reclamation 2009). Two such bridge crossings span the Entiat within Gray Reach (Reclamation 2016c). No bridges occur in the Stormy Reach.

Pool frequency in the Entiat has been reduced by 90 percent since the 1930s, which is likely associated with historic removal of beavers and large wood (Andonaegui 1999). Large wood was actively removed from the river by the USACE in 1971 (Reclamation 2009). Current wood loading in the Entiat is below that of undisturbed watersheds of similar size and geomorphic nature (Fox and Bolton 2007). The Gray Reach Assessment (Reclamation 2013a) estimated that historically, there were 5 to 10 logjams per mile (defined as 10 or more interconnected pieces of LWM) and at least 20 additional large wood pieces per mile (defined as greater than 12-inch diameter and 30-feet long). Existing logjams and individual large wood pieces were identified in the field during the May and July 2014 field assessments of the Gray Reach. It was determined that today, there are only 3.3 logjams per mile and 3.3 additional large wood pieces per mile in the Gray Reach. The nearby Chiwawa River has similar watershed and channel characteristics as the Entiat, but differs in that it has more intact forest, larger diameter trees, and higher wood loading. As such, geomorphic conditions in the Chiwawa are considered as somewhat of a reference for target conditions in

the Entiat. The Chiwawa has more than double the amount of large wood accumulations as the Gray Reach with 6.8 jams per mile (Reclamation 2016c).

Fish Species

The Entiat River currently supports both federally-protected and non-protected anadromous and resident fish, as listed in Table 3-7. The following discussion provides a brief overview of these species.

Table 3-7. Fish species present in the analysis area.

Species ^a	Federal/State Status	Comments
Federally-protected Anadromous Fish		
Chinook salmon (<i>Oncorhynchus tshawytscha</i>) Upper Columbia River Spring-Run ESU ^b	E/C	Spawning occurs August – September. Fry emerge from the redds February – mid-May Juvenile rearing occurs February – September
Steelhead (<i>O. mykiss</i>) Upper Columbia River DPS ^b	T	Spawning occurs late-February – early-June Fry emerge from the redds June – August Juvenile rearing occurs June – October
Federally-protected Resident Fish		
Bull Trout (<i>Salvelinus confluentus</i>) Columbia River DPS ^b	T	Spawning occurs August – mid-November Fry emerge from the redds March – June Juvenile rearing occurs year-round
Non-protected Anadromous Fish		
Chinook salmon (<i>O. tshawytscha</i>) Upper Columbia River Summer-Run ESU ^b	N/A	Spawning occurs late-September – early-November Fry emerge from redds January – April Juvenile rearing occurs January – March
Sockeye Salmon (<i>O. nerka</i>)	N/A	Sockeye salmon are not endemic to the Entiat subbasin. Those sockeye salmon that occur in the subbasin are assumed to be strays.
Coho Salmon (<i>O. kisutch</i>)	N/A	Coho Salmon are not endemic to the Entiat subbasin. Those Coho Salmon that occur in the subbasin are assumed to be strays.
Pacific Lamprey (<i>Entosphenus tridentatus</i>)	N/A	Spawning occurs March – July Embryos hatch after approximately 19 days Ammocoetes drift downstream to areas of low velocity and fine substrates where they may remain for 3-7 years.
Non-protected Resident Fish		
Westslope Cutthroat Trout (<i>O. clarki lewisi</i>)	N/A	Spawning occurs March – July Fry emerge from redds May – August Juvenile rearing occurs year-round
Rainbow Trout (<i>O. mykiss</i>)	N/A	Spawning occurs February – June Fry emerge from redds April – July Juvenile rearing occurs year-round

Species ^a	Federal/State Status	Comments
Brook Trout (<i>S. fontinalis</i>)	N/A	Nonnative to the Entiat subbasin.
Speckled Dace (<i>Rhinichthys osculus</i>)	N/A	Spawning occur June --August
Longnose Dace (<i>R. cataractae</i>)	N/A	Spawning occurs May – early-July
Sculpin (<i>Cottus</i> spp.)	N/A	Spawning typically occurs February – June
Largescale Sucker (<i>Catostomus macrocheilus</i>)	N/A	Spawning occurs April – June
Bridgelip Sucker (<i>C. columbianus</i>)	N/A	Spawning occurs April – June
Northern Pikeminnow (<i>Ptychocheilus oregonensis</i>)	N/A	Spawning occurs May – July
Chiselmouth (<i>Acrocheilus alutaceus</i>)	N/A	Spawning occurs May – July
Three-spined Stickleback (<i>Gasterosteus aculeatus</i>)	N/A	Spawning occurs May – July
Notes: ^a Species Presence based on USFWS 2017b Federal Status – E=Endangered, T=Threatened, N/A=Not Applicable; State Status – E=Endangered, T=Threatened, C= Candidate, N/A=Not Applicable ^b ESU=Evolutionarily Significant Unit. DPS=Distinct Population Segment.		

Federally-Protected Anadromous Fish

Spring-run Chinook salmon

The UCR spring-run Chinook salmon ESU was listed as endangered under the ESA on March 24, 1999. Critical Habitat was designated on September 2, 2005. Adult spring Chinook salmon (stream type) enter and ascend the Columbia River between March and June and reach the Entiat River (484 miles upriver) between May and August each year. Adult fish hold in deep pools within the Entiat River or Columbia River from May to August and then move upriver to spawn in the Entiat and Mad Rivers from late August to late September. Within the project analysis area approximately 68 spring-run Chinook salmon redds were identified during surveys by the USFWS in 2011 (Hamstreet 2012). The 2009 Tributary Assessment (Reclamation 2009) provides context and background information regarding the historical abundance and long-term population trend of spring-run Chinook salmon in the Entiat River subbasin. The 1999 listing of the UCR spring-run Chinook salmon was a direct response from the NOAA Fisheries to the diminishing population trend of this species.

Currently, in the Entiat River, spawning generally begins in August near RM 30, then progresses downriver as stream temperatures drop and is typically completed by the third week of September. Adult Chinook salmon die within a short time after spawning and

carcasses can often be observed in close proximity to newly constructed redds. Decomposition of carcasses contributes nutrients back to the stream where their eggs have just been deposited; thereby contributing to the growth of their offspring. Spring Chinook salmon eggs remain in the gravel until hatching in December and fry emergence occurs in January and/or February (LaVoy 1992, as cited in Reclamation 2009). Juveniles spend approximately one year in fresh water before smolting and migrating to the Pacific Ocean between April and June. Adult spring Chinook salmon returning to the Wenatchee River system, had remained in the ocean from 2 to 3 years before they matured and returned to spawn (Mosey and Murphy 2000).

The Entiat National Fish Hatchery (ENFH) raised spring-run Chinook salmon from 1979 to 2008. Beginning in the fall of 2009, the ENFH began raising summer Chinook salmon. The goal of the program is to maintain a segregated harvest program for summer Chinook salmon. Fish from this program are not intended to spawn naturally and are not intended to establish, supplement, or support any summer Chinook salmon populations occurring in the natural environment (USFWS 2017a).

Steelhead

Steelhead of the UCR DPS were listed as threatened under the ESA on August 18, 1997 (re-evaluated on January 1, 2006). Critical habitat was designated on September 2, 2005. Steelhead exhibit one of the most complex suites of life history traits of any salmonid species. Entiat River steelhead enter and ascend the Columbia River in June and July, arriving near their tributary spawning grounds by November. However, some steelhead hold in the mainstem Columbia River until the following February or March before moving into natal streams to spawn (English et al. 2001). Unlike other anadromous salmonids that return from the ocean to spawn and subsequently die, steelhead have the ability to migrate back to the ocean after spawning and to return and spawn again.

The population of steelhead within the Entiat River is not known with certainty due to the inability to distinguish resident Rainbow Trout from steelhead juveniles and due to a short period of record for spawning surveys (2003 to 2008). Spawning survey data from the Mad River and Entiat River indicate that the Entiat/Mad steelhead population has ranged from 150 spawning adults (2007) to 550 spawning adults (2008), assuming 2 fish per redd. UCR steelhead spawning has been documented within the project area. Between 2005 and 2012 approximately 79 steelhead redds were documented in the Project area (Reclamation 2014), an average of approximately 10 redds per year.

Non-protected Anadromous Fish

Summer/Fall-run Chinook salmon

Chinook salmon of the UCR summer/fall-run ESU are currently not listed for protection under the ESA. Summer/fall-run Chinook salmon in the Columbia River are defined as “ocean-type.” Ocean-type Chinook salmon juveniles migrate to the sea as sub-yearlings and return as adults to their natal stream from late summer to fall, and spawn almost immediately. They are also referred to as summer/fall, or ‘late-run’ Chinook salmon. The term summer will be used for discussion purposes in this section. UCR summer Chinook salmon return to the Entiat River primarily in July and August, but may enter the river into early October. Virtually all summer Chinook salmon returning to the Entiat River spawn in 23 miles of the mainstem downstream of the Preston Creek confluence, although they have been observed above Box Canyon and as far upstream as Entiat Falls (USFWS and WNF 1996). No summer Chinook salmon spawn in the tributaries of the Entiat River. Data indicate the primary main stem spawning area is found in the Project area between RM 16.2 to 18.7 (MP 15.0 to 17.3). Spawning begins in late September, peaks in late October, and ends in early November (Peven 1992). Spawning has been recorded in the project reach, with spawning recorded between late-September and early-November (USFWS 2004; Hamstreet 2012). Juveniles emerge from the gravel sometime between January and April and most travel downstream to the ocean in their first year of life.

Within the analysis area and between RMs 16.2 and 28.9, spawning surveys have occurred since 1994. Between 1994 and 1999, the number of redds recorded annually was below 50. Since 2001, the number of redds recorded annually has been at or above 100. In 2015, 212 Spring-run Chinook salmon redds were recorded. The number of redds appear to be relatively stable, but are certainly below historic levels that were observed before the completion of the construction of Grand Coulee Dam in 1941.

Sockeye Salmon

Sockeye salmon were not originally found in the Entiat River (Craig and Suomela 1941). They were stocked only twice, in 1943 and 1944, from Lake Quinault and Lake Whatcom stocks. From that, a small run was observed spawning in the Entiat River from 1945 to 1955. Between 75 and 150 sockeye salmon were noted in the Entiat River during incidental counts over the period 1969 to 1981 (Mullan 1986). Little is known about sockeye salmon life history strategy in the Entiat River. Spawning occurs between mid-September and mid-October. Gravel emergence occurs from March through May, and juveniles are assumed to move downstream immediately afterward to the rear in the lower reach of the Entiat River and the Columbia River reservoirs (Chapman 1995).

Coho Salmon

Although Coho Salmon were once present in the Entiat subbasin, only 475 Coho Salmon were counted at Rock Island Dam, located on the Columbia River downstream of the Entiat River, from 1933 to 1943. From 1942 to 1975, 46 million juveniles were released by hatcheries; however, this effort failed to re-establish populations, and mid- and upper Columbia River Coho Salmon are now considered an extirpated species under the ESA (Andonaegui 1999). In an effort to reintroduce Coho Salmon, the YN recently initiated a juvenile release program in the Wenatchee and Methow subbasins. Although no Coho Salmon were released in the Entiat subbasin, straying of returning adults has been documented. In October 2001, during their spring-run and summer-run Chinook salmon spawning ground surveys, the USFWS identified 12 Coho Salmon redds, three adults, and three carcasses. In 2002, one Coho Salmon carcass was noted near the confluence with the Columbia River (Hamstreet and Carie 2002). In 2011, the USFWS documented 10 Coho Salmon redds, 15 adults and 8 carcasses (Hamstreet 2012). In subsequent years, the USFWS has noted the presence of Coho Salmon redds, adults and carcasses but has not quantified the amount observed.

Pacific Lamprey

Pacific lamprey are known to occur in the Entiat River, but little is known related to their abundance and distribution within the subbasin and their potential occurrence within the project analysis area. A petition to protect the Pacific lamprey under the ESA was received by the USFWS on January 27, 2003. In 2004, the USFWS found that the petition did not provide the required information to indicate that listed the species may be warranted and, therefore, a status review was not initiated. Pacific lamprey do have cultural importance to several Northwest Tribes within the Columbia River Basin. Pacific lamprey have commercial, subsistence and ceremonial significance for several Tribes, including the YN.

Spawning takes place in the spring in low-gradient sections of water with gravel and sandy bottoms, when water temperatures are between 50 and 60°F. Adults die within 3 to 36 days after spawning (Clemens et al. 2013).

The young (ammocoetes larvae) hatch in 2 to 3 weeks and are dispersed by currents to slack-water areas with soft substrates, where they settle in sediments, which are soft and rich in dead plant materials. They quickly burrow into the muddy bottom where they live for a period of 3 to 8 years as filter feeders consuming microscopic plants (mostly diatoms) and animals. Late in the ammocoetes life stage, unknown factors trigger a metamorphosis, from which lamprey juveniles emerge. During high water periods, in late winter or early spring, the juveniles migrate to the ocean where they mature (Moyle 2002).

Federally-Protected Non-Anadromous Fish

Bull Trout

Currently, Bull Trout found in the mainstem Entiat and Mad Rivers are considered to be two distinct local populations. Bull Trout are known to occur in the Entiat and Mad Rivers (located downstream of the analysis area), exhibiting both fluvial (residing in and migrating between rivers and streams) and resident (resides in natal stream) life history strategies. Bull trout spawning surveys conducted by the USFWS (Nelson 2014) between 2007 and 2013 recorded the number of Bull Trout redds between RM 11.18 and 18.7 (MP 9.7 to 17.3). The number of Bull Trout redds fluctuates considerably annually, with a peak of 29 redds recorded in 2007 and a low of 2 redds recorded in 2013 (Nelson 2014). Fluvial Bull Trout that spawn within the analysis area migrate between tributaries of the Columbia River. Bull trout use the habitat within the analysis area for adult migration and spawning, egg incubation, and juvenile rearing and migration. Overall, the Mid-Columbia Recovery Unit is considered vulnerable, but specific actions have been identified that would contribute toward Bull Trout recovery in the Mid-Columbia Recovery Unit, which includes implementing conservation actions (USFWS 2015).

Non-protected Non-anadromous Fish

Other Non-protected Non-anadromous Fishes

Several species of resident salmonids, including; Rainbow, Westslope Cutthroat, Brook, and Interior Redband Trout, as well as Mountain Whitefish utilize the Entiat River and tributary habitats year-round. In 2001, a petition was made to list Westslope Cutthroat Trout. The petition to list Westslope Cutthroat Trout as threatened under the ESA was found to be “not warranted” by the USFWS in April 2000 and again in August 2003. Westslope Cutthroat Trout continue to be a federal species of concern as their status is uncertain in the Entiat River. Other resident fish identified in Table 3-7 likely occur within the analysis area as well, with residence times lasting from weeks to year-round. Fish that may occur in the analysis area for spawning, such as suckers and northern pike minnow, may occur in the analysis area for weeks. Fish such as sculpins, dace and stickleback would be expected to occur within the analysis area year-round.

Wildlife

Habitat Conditions

Terrestrial habitat within the project analysis area has been modified through human development such as hayfields, forest practices, infrastructure and residential development, much of which is located within the floodplain or valley bottom areas. Riparian vegetation is sparse and typically consists of narrow, fragmented patches of trees along either bank.

Overall terrestrial habitat conditions within the valley bottom and floodplain areas have been extensively modified by human activity. Upland areas within the analysis area have similarly been modified through grazing, road building, and logging activities. The analysis area is located at an elevation of approximately 1,500 to 1,600 feet. Current activities such as forest management, wildland fire fighting and military flights that occur within the Entiat River subbasin generate elevated noise levels from the use of heavy equipment (i.e., trucks, helicopters), hand-equipment (i.e., chain saws) and military jets. It is therefore expected that wildlife species that occur within the subbasin are acclimated to elevated noise levels similar to those that would be generated by the proposed project.

Species

Historically, the types and numbers of wildlife present in the Entiat subbasin have varied as much as the habitats on which they depend. Fluctuations in habitat conditions due to atmospheric conditions, wildfires, and other natural events have been a common occurrence in the subbasin. Prior to European settlement, wildfires occurred frequently in the lower elevations, but were of low intensity and allowed for the maintenance of somewhat stable wildlife populations. Human activities such as development, hayfields, logging, roads, and fire suppression have exacerbated natural disturbances and now both natural and manmade changes have effected resulted in fragmented habitat for many species. Some of the more common species known to occur in the Entiat Valley are shown in Table 3-8 (NPCC 2004; WDFW 2017).

Table 3-8. Wildlife occurrence in the Entiat River subbasin.

Species	Federal/State Status	Comments
Federally-protected Wildlife Species		
Marbled Murrelet (<i>Crachyramphus marmoratus</i>)	T/T	May occur in Chelan County, but not expected in Entiat River subbasin.
Northern Spotted Owl (<i>Strix occidentalis caurina</i>)	T/E	Resident within the Entiat River subbasin.
Yellow-billed Cuckoo (<i>Coccyzus americanus</i>)	T/C	Rare in Washington with individual sightings, including Chelan County. Breeding no longer occurs in Washington. Only 8 sightings in eastern Washington between 2000 and 2012.
Gray wolf (<i>Canis lupus</i>)	E/E	There have been unconfirmed sightings in the past several years.
Grizzly bear (<i>Ursus arctos</i>)	T/E	Habitat exists and occurrence is suspected but not confirmed within the Entiat River subbasin. They are an extremely wide-ranging animal with individuals requiring several square miles of habitat.
Canada Lynx (<i>Lynx Canadensis</i>)	T/T	Sightings have been documented in the Entiat River subbasin, but occurrence is rare.
North American Wolverine (<i>Gulo luscus</i>)	PT/C	Approximately 36 wolverines estimated to occur in Washington's northern Cascades with 10 wolverines captured in the state between 2006 and 2012. No sightings documented in the analysis area although wolverines have been reported in the Entiat Valley upstream of the analysis area.
Non-protected Wildlife Species		
Black bear (<i>Ursus americanus</i>)	NA	Common throughout Washington.
Cougar (<i>Puma concolor</i>)	NA	Common throughout Washington.
Coyote (<i>Canis latrans</i>)	NA	Common throughout Washington
Mule deer (<i>Odocoileus hemionus</i>)	NA	Mule deer are the most important big game animal in the Entiat River subbasin. Although populations are currently depressed after the 1994 wildfires. It would take 10 to 15 years for them to recover to post fire levels.
Great blue heron (<i>Ardea Herodias</i>)	NA	Great blue herons are commonly observed in the lower Entiat River subbasin.
Peregrine falcon (<i>Falco peregrinus</i>)	SC/S	Birds have been seen in the Entiat River subbasin.

Species	Federal/State Status	Comments
Osprey (<i>Pandion haliaetus</i>)	NA	Observations of both have been made in the Entiat River subbasin. Ospreys are common residents.
Prairie falcon (<i>Falco mexicanus</i>)	NA	
Northern goshawk (<i>Accipiter gentilis</i>)	SC/C	Both species have been observed in the Entiat River subbasin and are assumed year-round residents.
Swainson's hawk <i>Buteo swainsoni</i>	NA	Swainson's Hawks prefer open grassland habitat. Goshawks prefer forested habitat.
Black-backed woodpecker <i>Picoides arcticus</i>	N/A/C	Nest and forage within the Entiat River subbasin.
Pileated woodpecker <i>Dryocopus pileatus</i>	N/A/C	Nest and forage within the Entiat River subbasin.
Dunn's salamander (<i>Plethodon dunni</i>)	N/A/C	Occurs within the Entiat River subbasin.
Western Toad (<i>Bufo boreas</i>)	N/A/C	Occurs within the Entiat River subbasin.
Columbia spotted frog (<i>Rana luteiventris</i>)	N/A/C	Occurs within the Entiat River subbasin.
Northern leopard frog (<i>Rana pipiens</i>)	N/A/E	Occurs within the Entiat River subbasin.
Sharptail snake (<i>Contia tenuis</i>)	N/A/C	Occurs within the Entiat River subbasin.
Striped whipsnake (<i>Masticophis taeniatus</i>)	N/A/C	Occurs within the Entiat River subbasin.
Birds with Other Regulatory Protection [<i>Migratory Bird Treaty Act (MBTA) and Bald and Golden Eagle Protection Act (B&GEPA)</i>]		
Bald eagle (<i>Haliaeetus leucocephalus</i>)	MBTA and B&GEPA	Bald eagles are residents of the Entiat Subbasin.
Black Swift (<i>Cypseloides niger</i>)	MBTA	Breeding
Brewer's Sparrow (<i>Spizella breweri</i>)	MBTA	Breeding
Calliope Hummingbird (<i>Stellula calliope</i>)	MBTA	Breeding
Cassin's Finch (<i>Carpodacus cassinii</i>)	MBTA	Year-round residents
Eared Grebe (<i>Podiceps nigricollis</i>)	MBTA	Breeding
Flammulated Owl (<i>Otus flammeolus</i>)	MBTA	Breeding
Fox Sparrow (<i>Passerella iliaca</i>)	MBTA	Breeding
Golden Eagle (<i>Aquila chrysaetos</i>)	B&GEPA	Golden eagles are residents of the Entiat Subbasin.

Species	Federal/State Status	Comments
Greater Sage-grouse (<i>Centroceus urophasianus</i>)	MBTA	Year-round residents
Lewis's Woodpecker (<i>Melanerpes lewis</i>)	MBTA	Breeding
Loggerhead Shrike (<i>Lanius ludovicianus</i>)	MBTA	Breeding
Long-billed Curlew (<i>Numenius americanus</i>)	MBTA	Breeding
Peregrine Falcon (<i>Falco peregrinus</i>)	MBTA	Breeding
Rufous Hummingbird (<i>Selasphorus rufus</i>)	MBTA	Breeding
Sage Thrasher (<i>Oreoscoptes montanus</i>)	MBTA	Breeding
Short-eared Owl (<i>Asio flammeus</i>)	MBTA	Year-round residents
Swainson's Hawk (<i>Buteo swainsoni</i>)	MBTA	Breeding
Western Grebe (<i>Aechmophorus occidentalis</i>)	MBTA	Breeding
White Headed Woodpecker (<i>Picoides albolarvatus</i>)	MBTA	Year-round residents
Willow Flycatcher (<i>Empidonax traillii</i>)	MBTA	Breeding
Notes: Federal Status: E=Endangered; T=Threatened; PT=Proposed Threatened; SC=Species of Concern MBTA=Protected under the Migratory Bird Treaty Act B&G EPA=Protected under the Bald & Golden Eagle Protection Act State Status: E=Endangered; T=Threatened; C=Candidate; S=Sensitive NA = Not Applicable		

Federally-protected Wildlife Species

There are three mammals and one bird species listed under the ESA with the potential to be in the Entiat Valley: grey wolf, grizzly bear, Canada lynx, and northern spotted owl.

Grizzly Bear: There have been unconfirmed sightings of the grizzly bear in the Entiat subbasin. Denning occurs at the higher elevations in the alpine, subalpine fir and white bark pine forests. Grizzlies forage primarily on vegetation in wet/dry meadows, marshes, low gradient stream bottoms, riparian areas, berry-producing shrub fields, avalanche chutes, rivers, and streams. They also feed on winter-killed deer, ground squirrels, mice, grubs, and ants. There is the potential for grizzly bear to migrate through the Project area en route to more suitable habitats. However, due to their solitary nature, they more likely would avoid this area.

Gray Wolf: The gray wolf population in the Entiat watershed has decreased significantly from historical figures. They are currently listed as endangered under the ESA, but numbers have grown slightly in this area over the last few years. Although there are no known den sites in the Entiat River subbasin, they usually occur in remote country with sources of ungulates and water nearby. Prey includes deer, elk, mountain goats, bighorn sheep and small mammals. The Wolf Conservation and Management Plan (Wiles et al. 2011) was developed as the first wolves were becoming reestablished in Washington. The Plan was developed to outline the conservation and management objectives for wolf reintroduction. Within the Entiat River subbasin, no Wolf Recovery Regions have been identified and no known Wolf Pack Territories are documented (WDFW 2013a). In 2013, a wolf sighting was documented in the Entiat River subbasin of a female wolf that had been tagged by WDFW. The wolf was from the Teanaway pack and was dispersing north (WDFW 2013b).

Canada Lynx: Lynx are associated with habitat above 4,000 feet elevation and use a mosaic of forest types. Their primary food source, snowshoe hare (*Lepus americanus*), is found in early successional lodgepole pine thickets, and lynx locate their dens in piles of large downed wood in late successional stands of larger conifers. This type of habitat is not present in the analysis area. However, there is the potential for lynx to migrate through the Project area en route to habitats.

North American Wolverine: Approximately 36 wolverines are reported to occur in the northern Cascades in Washington State, and generally occur in alpine and sub-alpine habitats of the cascades (Conservation Northwest 2017; Aubrey et al 2014). Wolverines are not expected to occur in the project analysis area, as they are typically associated with areas with persistent spring snow cover (WDFW 2013a). There is the potential for wolverine to migrate through the Project area en route to more suitable habitats as wolverines have been reported to occur in the Entiat Valley upstream of the analysis area (Aubrey et al. 2014). However, due to their solitary nature, they likely would avoid this area to avoid interactions with humans and human activity.

Northern Spotted Owl: Spotted owls have been known to exist in the Entiat watershed since 1986 when the first inventories were completed. The analysis area has not been surveyed for northern spotted owls; however, Priority Habitats and Species (PHS) data from WDFW (2017) does not indicate the presence of any northern spotted owl nest sites within the analysis area. Logging and fires have destroyed or damaged spotted owl habitat in the watershed. Suitable habitat for spotted owls consists of stands of trees with sufficient structure (large trees, snags, and downed wood) to provide opportunities for owl nesting, roosting, and foraging. Generally, these conditions are associated with conifer-dominated stands, 80 years old or older, multi-storied in structure, have trees greater than or equal to 18 inches mean diameter at breast height (dbh), and the canopy closure generally exceeds 60 percent. Stands are defined at a larger scale (e.g., province) as suitable based just on age or size (i.e., 80 years, >18") alone (USFWS 2013). Designated critical habitat does not occur within the

project analysis area. The nearest designated critical habitat for the northern spotted owl is approximately three miles west of the project analysis area (77 FR 71875).

The USFWS critical habitat data rates areas in terms of Relative Habitat Suitability (RHS) for northern spotted owls. Habitat suitability ranges from 0 to 1. Habitats with RHS values below 0.35 have a low likelihood of occupancy by nesting spotted owls. The habitat that would be flown over by helicopters has an RHS value of 0.26 or less (Halupka 2017); this low RHS may indicate a lower chance that northern spotted owls would nest in the project area.

Marbled Murrelets: The USFWS species list obtained for the project indicates that marbled murrelets may occur in the project area. However, marbled murrelets typically occur within 50 miles of Puget Sound or coast waters, and it is unusual for them to occur on the east side of the Cascade Mountains. Marbled murrelets are not anticipated to occur within the analysis area, due to the distance from Puget Sound and lack of a clear migratory pathway along a river valley between the analysis area and Puget Sound.

Birds with Other Regulatory Protection

Several species of birds are also federally-protected under the Bald and Golden Eagle Protection Act (B&GEPA) and/or the Migratory Bird Protection Act (MBTA). These species are identified in Table 3-8, and discussed briefly below.

Bald Eagle: The USFWS species list obtained for the project indicates that bald eagles may occur in the project area. The WDFW PHS data (WDFW 2017) does not indicate the presence of any bald eagle nest sites or winter roost sites within the project analysis area. Bald eagles may occur within the analysis area year-round.

Golden Eagle: The USFWS species list obtained for the project indicates that golden eagles may occur in the project area. PHS data do indicate the presence of golden eagle breeding activity in the vicinity of the project analysis area (WDFW 2017). Golden eagles may occur within the analysis area during the breeding season, and could occur year-round.

Other birds that may occur in the analysis area year-round, according to the USFWS species list obtained for the project include Cassin's Finch, greater sage-grouse, Short-eared Owl and White-headed Woodpecker. PHS data does not document any occurrences of these species. Cassin's finch is typically associated with montane pine forests, and could occur in the project analysis area. Sage-grouse are found almost exclusively in dry sagebrush plains, and thus would not be expected to occur in the project analysis area. Short-eared owl is typically found in open expanse, coursing low to the ground in search of prey, and could occur within the project analysis area. The white-headed woodpecker is associated with mountain conifers and could occur within the project analysis area.

Birds occurring in the subbasin during the breeding season are identified in Table 3-8. The breeding season, including nesting, rearing, fledging and dispersal, typically occurs in spring and summer. Specific times vary by species. While PHS data does not document the presence of any of these species in the project analysis area, many of these species are relatively common in Washington and are assumed to be present.

Non-protected Wildlife

Several species of wildlife are common in Washington and are expected to occur in the Entiat River subbasin, as identified in Table 3-8. These species include mammals and birds.

Mammals

Mammals such as black bear, cougar, coyote, bobcat, beaver, and mule deer are common throughout the area and could occur within the analysis area during project construction. These mammals are highly mobile and occur in a variety of habitat types as they migrate within their home range and forage and stalk prey. Moose are also known to occur in the Entiat River valley. Given their mobile nature, these species may cross the river, riparian areas, residential areas, and the Entiat River Road to access other habitats. As natural river processes occur and the course of the river changes over time, the species adapt as needed to access the river and floodplains for foraging, resting, and breeding.

Beaver are also common within the Entiat River floodplain as noted in Section 3.3.1. The wetland report prepared in support of the Project notes that riverine wetlands in the project areas B, C, E, and F are influenced by beavers as they have created diverse open water/emergent areas at the mouth of historic or active side channels (ICF International 2015). The emergent areas within the floodplain, often maintained by beavers, are dominated by a similar mixture of common native emergent species including several species of sedge (*Carex* spp.), small-fruited bulrush (*Scirpus microcarpus*), and slender rush (*Juncus tenuis*), often with the beaver influenced areas supporting a willow fringe.

Birds

Birds that are likely to occur in the Entiat River subbasin, as identified in Table 3-8 above, could occur during the construction period.

Amphibians

Amphibians such as salamanders and frogs may occur in the analysis area, and could be present in aquatic habitats during construction. WDFW (2017) PHS data does not indicate any documented observations or detections of the amphibians identified in Table 3-8 within the analysis area.

Reptiles

Reptiles such as rattlesnakes and other species of snakes and lizards may occur in the analysis area, and could be present in terrestrial and aquatic habitats during construction. WDFW (2017) PHS data does not indicate any documented observations or detections of any reptiles identified in Table 3-8 within the analysis area.

3.5.2 Environmental Consequences – Proposed Action

Fish

The proposed Project activities are designed to improve aquatic habitat conditions for anadromous salmonids; post project; however, construction activities could adversely affect anadromous salmonids and other fish and aquatic organisms in the short-term, during construction.

The Project is intended to provide substantial benefits for federally-protected anadromous fish, including UCR Chinook salmon and steelhead, and non-listed species. The Project would improve habitat conditions that support adult holding and successful spawning and egg incubation as well as juvenile rearing. Other native fish, both anadromous and resident fish, would also benefit from the increased habitat complexity created by the Project.

The Project would result in construction and post-construction impacts. Fish and fish habitat would be affected by in-water construction activities that would include; installation of LWM structures, creation of off-channel habitat, heavy equipment crossing and operating within the active channel, installation of cofferdams, and the removal of riparian vegetation. Fish and fish habitat would be affected post-Project by the habitat created, and the functions and processes that would develop post construction, which would be intended to provide increased habitat complexity and habitat forming processes over time.

To avoid and minimize potential adverse impacts, the proposed Project would be implemented following the General Aquatic Conservation Measures required by the Programmatic HIP III BiOp (USFWS 2013), which at the time of design was intended to be the tool to comply with the ESA. Thus the avoidance and minimization measures outlined within the Programmatic HIP III BiOp were included as design features for the proposed project. However, when funding of the project went from the BPA to Reclamation the Programmatic HIP BiOp would no longer be used to comply with the ESA Section 7 consultation requirements. Therefore, compliance with Section 7 of the ESA would occur using NOAA Fisheries' Fish Passage and Restoration Action in Washington State Programmatic BiOp (NOAA Fisheries 2017) and the Washington State Fish Passage and Habitat Enhancement Restoration Programmatic Consultation BiOp (NOAA Fisheries and USFWS 2008). Environmental design features and BMPs are listed in Chapter 2, Table 2-6

for each of the environmental elements for which they apply. Additional General Conservation Measures incorporated into the Project per ESA compliance are in Appendix B.

Construction Impacts

Construction impacts would result from in-water construction activities. The discussion below focuses on the impacts to fish and fish habitat that could result from such construction activities.

Sediment and Turbidity

In-water construction activities, such as driving heavy equipment across the wetted channel, cofferdam installation, off- and side-channel creation and enhancement, installation of LWM structures, levee removal, and gravel removal and replacement on adjacent gravel bar for new channel alignment, could result in an increase in sedimentation and turbidity. Sedimentation and erosion associated with construction of the project could potentially affect fish and fish habitat. Ground-disturbing construction activities could potentially degrade aquatic habitat through erosion and subsequent sediment transport and delivery to streams. Short-term pulses of suspended sediments (i.e., elevated turbidity) have been shown to cause physiological effects (gill trauma in salmonids, changes to blood chemistry and impaired osmoregulatory capability (Bash et al. 2001). Suspended sediment may cause behavioral effects to fish including avoidance, changes in foraging ability, response to predation risk, and reduced territoriality (Meehan 1991). Deposition of excessive fine sediment on the stream substrate could eliminate habitat for aquatic insects; reduce density, biomass, number, and diversity of aquatic insects and vegetation; reduce the permeability of spawning gravel; and block the interchange of surface and subsurface waters. Increases in fine sediments in low-velocity stream reaches could also cover suitable spawning gravel. Other potential effects include channel braiding, increased width/depth ratios, increased incidence and severity of bank erosion, reduced pool volume and frequency, and increased subsurface flow. Such changes could result in a reduction in the quality and quantity of spawning and rearing habitat (Meehan 1991).

The Project would incorporate BMPs to avoid or minimize sediment inputs to the river during construction, as well as minimize potential increases in turbidity associated with in-water activities. Spawning activity by Chinook salmon and steelhead has been documented within the Project analysis area; however, the Project would not introduce any new sources of fine sediments. Ground-disturbing activities would disturb floodplain soils, where much of the sediments are alluvial. Thus, the Project would not be likely to introduce fine sediments at quantities that would be expected to affect spawning areas, reduce the diversity or density of aquatic insects, further increase substrate embeddedness, or degrade existing channel conditions.

In-water construction activities could result in direct impacts to aquatic insects resulting from pile driving, installation of cofferdams and woody material structures, construction access, and other in-water activities. These impacts would be localized and temporary, and recolonization by aquatic insects is anticipated to occur relatively quickly as a result of drift from upstream, undisturbed areas. Aquatic insect drift occurs continuously in stream environments, and thus areas disturbed by construction activities would be expected to recolonize relatively quickly.

Turbidity would increase during construction from in-water construction activities outlined above (see Section 3.4 Water Resources), but would likely not increase to levels that could cause injury to, or affect the physiology of fish that may be present within the analysis area. Turbidity levels may temporarily affect the behavior of fish, causing such behavioral changes as avoidance of project activities, or turbidity levels may temporarily affect juvenile foraging success and response to potential predation.

Adhering to the approved in-water work window would ensure that in-water activities occur when the life history stages of federally-protected fish species that are best able to avoid increased turbidity are present and impacts to incubating eggs or alevins (newly hatched fish) are minimized to the greatest extent practicable. In-water work windows are intended to be protective of all fish life, not just federally-protected fish.

Riparian Vegetation Removal

Riparian vegetation directly influences the quality of salmonid habitat, affecting cover, food, instream habitat complexity, streambank stability, and temperature regulation. LWM recruited from streamside trees provides instream cover and habitat complexity, an essential component of fish habitat. Riparian vegetation also provides shade and an insulating canopy that moderates water temperatures in both summer and winter. Riparian vegetation provides a filter that reduces the transport of fine sediment to the stream, and the roots provide streambank stability and cover for rearing fish (Meehan 1991).

Riparian vegetation influences the food chain of a stream, providing organic detritus and terrestrial insects. Riparian vegetation also controls aquatic productivity dependent on solar radiation (Meehan 1991). Because of the numerous ways riparian vegetation influences the stream ecosystem, the effects of altering riparian vegetation are highly variable, ranging from potential increased sedimentation and stream temperatures to decreased food production and habitat complexity depending on various factors ranging from the size of the stream to the condition and integrity of the riparian corridor.

The project would permanently remove approximately 5 acres of riparian grasses, trees or shrubs where LWM structures would be placed and side channel habitat would be enhanced and created. The project would also temporarily disturb approximately 23 acres of grass and shrubs to accommodate access roads and staging areas. To the extent practicable, every

effort would be made to preserve riparian vegetation. The project would restore and enhance habitat to improve conditions for salmonids, which would also include restoration of riparian habitat. Temporarily disturbed areas would be replanted with native vegetation appropriate for site conditions within the riparian corridor and monitored to ensure compliance with survival metrics that would be required as part of the terms and conditions of permits to be issued for the project.

Underwater Noise

A total of 672 pilings would be driven with a vibratory pile driver for the construction of the primary LWM and secondary LWM structures. Injury threshold values typically result from impact pile driving, as opposed to vibratory pile driving because sound- or pressure-related injuries, such as barotraumas, are thought to result from the rapid rise times and fluxes in over- versus under-pressure during a pile strike, which does not occur during vibratory pile driving. Impacts on fishes or other aquatic organisms have not been observed with vibratory hammers. This may be due to the slower rise time of the sound pressure levees and the fact that the energy produced is spread out over the time it takes to drive the pile. As such, vibratory driving of piles is generally considered less harmful to aquatic organisms and is the preferred method, as opposed to impact pile driving (WSDOT 2017).

Fish Removal and Exclusion

Fish exclusion and removal efforts would be required to construct many of the primary LWM structures and avoid and minimize impacts to fish, fish habitat and water quality. The approved in-water work window for Chelan County is July 15 through July 31. No work would be allowed from August 1 through mid-September, unless authorized by USFWS, NOAA Fisheries, and WDFW through the ESA consultation process. Each year there is the potential that the window can be extended to August 10, to be determined by WDFW and based on the presence/absence of adult UCR spring Chinook salmon in the project area. In water work would be allowed to proceed in isolation of flowing waters from around mid-September through October 31. Specific dates to be defined by WDFW, NOAA Fisheries, and USFWS. The flow in the Entiat River is anticipated to be low during the in-water work windows (July 15 through August 31 and mid-September through October 31), depending upon snow pack and precipitation the year of construction. Work windows and associated conditions have been developed with USFWS, NOAA Fisheries, and WDFW for the Project and are detailed in Section 2.2.3 (Work Windows, Work Area Isolation, and Dewatering).

Fish exclusion and removal would require the use of a beach seine. The beach seine would be deployed from shore and would move waterward from shore to exclude fish from the in-water work area. Juvenile salmonids that may occur in the vicinity will likely be located in the water column, above the substrate, and would move away from the beach seine as it is deployed.

Beach seining can affect fish in several ways, causing stress, scale loss, physical damage, suffocation, or desiccation. These stresses are more likely when fish are captured as a result of beach seining. For this Project, the beach seine would not be used to capture fish but to exclude fish from the in-water work area. Thus, these types of impacts are not anticipated.

No electrofishing or fish salvage is proposed or anticipated based on the methods for fish exclusion and removal and the volitional movement of fish from the in-water work area being isolated. Additionally, beach seining efforts are expected to be effective at excluding fish from the in-water work due to the low water levels, lack of complex substrate and channel structure and uniform profile of the channel bottom in much of the project area.

Once the in-water work area has been isolated with the beach seine, a cofferdam would be installed to isolate the work area from flowing water, but would be open at the downstream end and would not completely isolate the work area from the river. The beach seine would be used as a block net at the downstream end of the cofferdam. Another beach seine would be used to sweep the isolated work area to ensure no fish are located in the isolated in-water work area. Biologists would snorkel the isolated in-water work area to confirm no fish are present. Once the absence of fish from the in-water work area is confirmed, a silt curtain would be installed at the downstream end of the cofferdam to contain turbid waters within the isolated work area.

Post-construction Impacts

The post-construction impacts are intended to be beneficial for fish by improving habitat conditions. The Project would reconnect floodplain habitat; create and enhance side-channel habitat; increase habitat complexity, and; enhance habitat forming processes such as lateral channel migration, channel scour and formation and maintenance of pool/riffle habitats. Specifically, the Project would result in the following benefits to fish and fish habitat:

Installation of 86 LWM structures and placement of 37 individual logs within side channel areas to enhance cover. LWM structures would create pools in which adult salmonids could hold and create tailouts at the downstream end of pools that would contribute to suitable spawning habitat in terms of water depth, velocity and substrate sizes. The pools and cover created by the LWM structures would also provide suitable rearing habitat for juvenile salmonids, provide food resources such as aquatic insects for juvenile salmonids and other fish species. Most of the LWM structures would be wetted and provide cover for juvenile salmonids during a range of flow conditions, while some LWM structures would be dry during summer low flow conditions.

Channel modifications would increase habitat complexity for juvenile and adult salmonids and other native fish species by providing deep-water habitat, which provides rearing and holding areas for fish within the mainstem river, creating and increasing accessing to off-channel habitat, encouraging some lateral channel migration as well as protecting some

streambanks from erosion with placement of LWM structures, and reconnecting floodplain habitat. Channel modifications are intended to benefit juvenile and adult salmonids and increase productivity. Refer to Sections 2.2.2 for specific information related to LWM structures.

The creation of pools would be maintained by the hydraulic conditions created by the LWM structures. The LWM structures have been designed concentrate the current and subsequent scour to avoid bank erosion in certain instances as well as direct flow away from sensitive structures such as Entiat River Road. The LWM structures are also intended to create channel scour, develop pool habitat and create tailouts with suitable substrate for spawning by Chinook salmon and steelhead, as well as rearing habitat for juvenile salmonids. The hydraulic conditions created by the LWM structures would maintain the pool formation and prevent sediment from settling out and filling in the pool.

Overall, the channel modifications that would occur as a result of the Project would increase productivity within the Entiat River. Habitat improvement projects designed to improve natural river processes, and thus provide benefits to fisheries habitat has been recently documented in the Upper Columbia Basin. Roni et al. (2014), documented that most studies of LWM structures and biological benefit report positive biological responses for adult and juvenile salmonids. This 2014 report examined 200 published studies on wood placement that reported positive, negative, or no change in physical habitat, juvenile and adult salmonids, non-salmonids, and invertebrates. A total of 69 percent and 80 percent of the studies reported positive responses for juvenile and adult salmonids. The 2014 Annual Report on Project Effectiveness Monitoring Program for the Upper Columbia River (Tetra Tech 2014), also found that wood structure in streams have been consistently effective at improving aquatic habitat. In addition, the study found that wood structures have largely remained in place and functional over a 5-year monitoring period.

The project would result in a total of 5,240 linear feet of newly inundated side channels. This includes 4,634 linear feet of newly constructed side channels and an additional 606 linear feet of existing side channel that would be reconnected to flows from the Entiat River. Side channel habitat would provide suitable rearing habitat for juvenile salmonids (Roni et al. 2014). Increased side-channel habitat would increase opportunities for juvenile salmonids to seek areas with reduced water velocities and reduce the potential that juveniles would be swept downstream to less suitable habitats or areas with increased predation pressure (i.e., the Columbia River), allowing juveniles to grow larger before outmigrating through downstream areas with increased predation risk. Larger juvenile salmonids have increased survival during their downstream migration. Increases in rearing habitat could contribute to greater duration for juvenile salmonid rearing and opportunity for greater growth prior to beginning downstream migration.

Removal of 1,000 linear feet of existing levee would further increase the extent of potential rearing habitat for juvenile salmonids. The existing levee disconnects the Entiat River from its floodplain. Removal of the levee would reconnect floodplain habitat. Floodplain habitat can provide considerable benefits to juvenile salmonids (Roni et al. 2014), and other fish species.

Additionally, the overall increase in habitat complexity for fish is also anticipated to increase the habitat complexity for aquatic insects, and may provide suitable habitat conditions for increased diversity and density of aquatic insects, by providing increased woody material in channel, increased floodplain connectivity, increased side channel habitat and improved riparian habitat conditions with greater potential for allochthonous inputs to the aquatic environment.¹

Although project construction would result in some short-term, negative effects to ESA-listed UCR spring Chinook salmon and UCR steelhead, and other aquatic organisms, and their habitat, overall the Project would provide considerable long-term benefit to aquatic organisms and their habitat. The negative effects would be localized to the immediate area of construction and a short distance downstream, and these effects would be minimized by implementation of BMPs and general conservation measures. The post-construction condition is intended to provide beneficial effects by improved conditions for federally-protected anadromous fish, such as Chinook salmon and steelhead. The post-construction condition would also provide benefits to other anadromous and resident fish that occur in the Entiat River, similar to the benefits outlined above.

Wildlife

Construction Impacts

There would be a low likelihood that the proposed Project would impact ESA-listed Canada lynx, grizzly bear, gray wolf, or wolverine. These species are not expected to be in the Project area based on the lack of potentially suitable habitat and current level of human activity. If they were traveling through the analysis area to areas of suitable habitat, they would likely avoid the area during construction when increased human activity would occur.

Impacts to terrestrial habitat in general would be avoided and minimized during construction of the proposed Project, thus limiting the potential impacts to protected and non-protected wildlife species and migratory and resident birds. There is the potential that construction noise and activity would disturb wildlife and result in avoidance of the analysis area; however, this disturbance would be short in duration (during approximate work windows from June through November of each year, beginning with staging in 2018; Section 2.2.3), occurring only in localized areas.

¹ Allochthonous refers to organic matter and nutrients that have been naturally imported into an ecosystem.

Construction activities would occur during times that migratory birds may be breeding (June through September). Construction noise has the potential to disturb breeding and nesting birds and could result in temporary or permanent impacts to migratory birds. Noise impacts to nesting migratory birds could occur from helicopter activity, transporting logs from the staging area to each LWM structure on the southern bank of the Entiat River. Helicopter operation would be required for up to 2 to 3 days during each of the two construction seasons to complete the wood placement. Helicopter operations can generate substantial noise levels (>100 dB) that could lead to nest abandonment for birds nesting in close proximity (i.e., within 0.5-miles) of the wood storage areas and the locations of the primary, secondary and individual log placement locations and points between. Conversely, it is also possible that given the short duration of construction activity, birds would remain on their nests. Additionally, as mentioned previously under the Affected Environment section, it is expected that wildlife species that occur within the subbasin are acclimated to elevated noise levels that currently occur from the use of heavy equipment (i.e., trucks, helicopters) and hand-equipment (i.e., chain saws) related to existing land use, as well as military jets that use the Entiat subbasin as a flight corridor during training exercises. The noise levels generated by these existing and use activities and military exercises would be similar to those that would be generated by the proposed project.

Construction would result in removal of vegetation that could be used by nesting migratory and resident song birds, which would reduce the extent of suitable habitat for these birds during and after construction. Trees would be replaced, post construction, which would reduce this impact over time. See below, for further discussion.

Construction would occur in close proximity to the Entiat River and in areas that lack mature vegetation suitable for the nesting of northern spotted owls. Wood obtained for the project would be commercially procured prior to construction and would adhere to regulatory and permitting requirements related to their procurement. Thus procurement of wood for the proposed project would have no effect on northern spotted owls or their habitat.

Construction of the project would require the use of helicopters to deliver wood, boulders, and machinery. Helicopters would be used because of the large amount of wood that would need to be moved in a short period of time. Helicopters would also minimize the disturbance of riparian vegetation and crossings of the river by heavy equipment during construction. Because of the in-water work window required by NOAA Fisheries and WDFW, the project would be implemented between July 15 and July 31, which overlaps with the critical nesting period for the northern spotted owl. In addition, helicopters would begin flying in the Entiat Valley as early as July 1. The presence of spotted owl nests in the analysis area has not been documented (WDFW 2017); however, relative habitat suitability of the area that would be influenced by helicopter noise is <0.26 (Halupka 2017), reducing the likelihood of nesting owls and subsequent impacts to owls. If nesting owls were present, they could potentially be impacted during the period when helicopters are operating.

While no golden or bald eagle nest sites are documented in the analysis area, one golden eagle nest site is documented approximately 1,100 feet beyond the analysis area (WDFW 2017), or 2,100 feet from the nearest LWM structure. The golden eagle nesting season occurs from January through August, although regional variations occur and this timeline is used as a general guideline (Pagel et al. 2010). For purposes of this analysis, it is assumed that the regional timing for the golden eagle nesting season within the analysis areas is the same as the bald eagle nesting season in Washington. The bald eagle nesting season in Washington generally begins in January and extends into July. Fledging of young eaglets begins in June and extends into August (USFWS 2007). Construction would begin in July, with helicopter flights occurring in early-July and lasting approximately 2 to 3 days each year of construction, to transport the logs for the LWM structures. Nesting, egg incubation/hatching and rearing of young should be completed by early-July. Fledglings would likely be starting to fly and be mobile in early-July. Helicopter operations may cause disturbance to adult or fledged juvenile golden eagles, but would not result in nest abandonment or loss of eggs, as the eggs would be hatched and eaglets would be fledging.

Post-construction Impacts

Post-project, improvements intended to contribute toward natural functions within the Entiat River through the placement of LWM structures, creation and enhancement of side-channel habitat, reconnecting floodplain habitat, and the enhancement to the riparian corridor would result primarily in benefits to fish species but would also result in beneficial effects to wildlife. Since the Proposed Action would restore natural functions to the Entiat River, such as increased side-channel and floodplain connection, and improve riparian habitat conditions, wildlife species that rely on aquatic features such as side channels and functioning floodplain habitat as well as functioning riparian habitat would also benefit. Wetland enhancement and creation would also benefit amphibians, aquatic reptiles and birds that rely on wetlands all, or part of their life history.

Replanting of native trees in the disturbed areas post construction, would avoid and minimize long-term impacts of the Project on wildlife/riparian habitat conditions. The Project would result in an increase in vegetation in, and enhancement of the riparian areas along the Entiat River, which would provide improved habitat conditions for migratory and resident birds post-project, as vegetation becomes established.

Overall, wildlife habitat would be created or enhanced post construction through the construction and enhancement of side-channels, creation and rehabilitation of wetlands, and rehabilitation of riparian vegetation. Natural riverine processes would continue to occur post construction. The Entiat River channel is a dynamic system, changing course and its geomorphic condition over time (Reclamation 2009; 2013a; 2013b). These processes would continue in the post-construction condition. Channel migration would continue to occur, pools would form in the river, side channels would be wetted during higher flows, and floodplains would be inundated at times of higher flows. Wildlife species utilizing the

Project areas would continue to use the site and continue to adapt to changes in river conditions that may occur from the Project. Side channels would provide habitat for beavers and would be a consistent habitat use compared to existing conditions on the Entiat. As currently observed on the Entiat River, beaver would likely utilize existing or created side channels to construct dams or lodges, which is a natural river process. Where beavers modify streams, this can create important off channel rearing and overwintering habitat for salmon and steelhead (Pollack et al. 2015).

In addition, restoration actions would be protected in perpetuity where it occurs on lands owned by the CDLT, as one of their missions is to protect natural areas to promote clean air and water and provide abundant wildlife opportunities.

3.5.3 Environmental Consequences – No Action

Under the No Action alternative, there would not be disturbance to fish and wildlife or their habitats from construction activities. In addition, the post-construction habitat improvements outlined above under post-construction impacts for both fish and wildlife would not be realized, and habitat conditions for juvenile salmonids and other fish species, as outlined in Section 3.5.1, would be maintained, however the RPA Habitat Actions would not be implemented, specifically RPA Action 35: Tributary Habitat Implementation 2010-2018—Achieving Habitat Quality and Survival Improvement Targets. This RPA is intended to offset the continued operations of the FCRPS.

3.6 Visual Resources

Visual resources include the Entiat River valley within the Project area that is visible to human inhabitants and users

3.6.1 Affected Environment

The landscape of the Entiat Valley is typical of the Northeast Cascade Mountains. The parallel ridges extend east-west and have approximately uniform crest elevations. The ridge tops have jagged rocky peaks of exposed rock that can be seen from the valley below. The geologic uplift that created the Cascades resulted in steep topography resulting in the Entiat and its tributaries becoming more erosive and resulting in narrow incised canyons. In addition, alpine glaciation significantly affected the upper half of the Entiat River subbasin. During the last ice age a nearly 25-mile long glacier extended from its source at the top of the Entiat watershed to just below Potato Creek, where the debris accumulated at the front of the glacier as it moved, stopped. This feature, called a terminal moraine, indicates the furthest downstream influence of the glacier on the valley. Above the terminal moraine the Entiat

Valley has a characteristic U-shaped appearance. As the glacier cut away the valleys of smaller tributaries it created what are called “hanging valleys” while broadening out the valley floor (the bottom of the “U”) creating a moderately broad floodplain.

The Project area begins at the boundary with the OWNF. The majority of privately owned land is located within 1 mile of the mainstem Entiat River in a band that extends 26 miles upriver to the USFS Boundary above the project area. The visual component of the recreational setting for the Project area ranges from semi-primitive within the USFS boundaries to a rural designation-natural along the middle and lower reaches and is further discussed in Section 3.10.

Views within the Project area are generally restricted by vegetation growing along the river. The clearest views of the Project area are in areas closest to the Entiat River Road. Potential viewers of the Project area would be either recreational users (boaters) or people travelling along Entiat River Road to access the OWNF lands. Residences on the northeast bank of the river in Project Area F also have views of the river. Recreational users are assumed to have high visual sensitivity to the aesthetic or visual environment because, for many types of recreation, the visual quality of the outdoor setting is an important component of the experience. Views from the portion of Entiat River Road that passes through the Project area are limited to moving views because there are few places to safely pull-over. Motorists are considered to have moderate to low sensitivity to the aesthetic or visual environment because they are focused on the road and have short viewing durations of an area as they pass by.

Approximately four residences located on the northeast bank of the Entiat River in Project Area F have views of the Project area. Residents are considered to have high viewing sensitivity because of their familiarity with the landscape and long viewing duration. This is especially true for residents who have chosen to live in scenic areas such as the Entiat Valley.

Chelan County does not have regulations or ordinances related to or concerned with the visual or aesthetic quality of the Project area.

3.6.2 Environmental Consequences – Proposed Action

Construction Impacts

The majority of construction activities would be visible from July through October in 2019 and 2020. During this time, construction vehicles, construction materials, and disturbed areas would be visible. Since construction would last for up to 6 months in both 2019 and 2020 and BMPs listed in Chapter 2 would minimize effects, the visual change to the landscape would be temporary.

Post-construction Impacts

Once construction is completed, elements of the proposed Project would result in changes to the visual landscape. Many of the LWM structures would be visible from several locations along the Entiat River Road, the public access areas at Stormy Preserve, and the residences in Project Area F. LWM structures not visible from these locations would be visible to recreational boaters floating on the river and passing through the project areas. Over time, as new vegetation establishes and matures, the wood on the LWM structures bleaches, and other wood debris collects on the structures, the changes would likely resemble natural features that commonly occur along large rivers and appear visually consistent with the surrounding landscape. Figure 3-1 (Photos 1 through 4) shows a simulation of the construction of a Primary LWM structure in Project Area E. Photo 1 shows existing conditions. Photos 2 through 4 show the expected progression of the structure through construction to completion.



Figure 3-1. Photo simulations of primary LWM structure in Project Area E.

3.6.3 Environmental Consequences – No Action

Under the No Action alternative, no habitat improvement actions would occur along the Entiat River. The views, both from land and water, would still change overtime as the river bank erodes, cut banks shift, and as the river channel redeposits materials but would not be as pronounced due to lack of natural wood recruitment.

3.7 Cultural Resources

Cultural resources refers to the broad range of resources that represent or convey a place's heritage or the region's past. Cultural resources were analyzed in the locations of all proposed Project activities, including potential ground disturbance from temporary activities such as access sites and staging areas.

3.7.1 Affected Environment

Cultural resources are resources associated with human occupation or activity related to history, architecture, archaeology, engineering, and culture. Historic properties, as defined by 36 CFR 800, the implementing regulations of the NHPA (54 U.S.C. § 300101 et seq.), are a subset of cultural resources that are eligible for inclusion in the National Register of Historic Places (NRHP). Historic properties may be districts, sites, buildings, structures, artifacts, ruins, objects, works of art, or natural features important in human history. These properties may be eligible for inclusion to the NRHP at the national, state, or local level. The properties may also be of traditional religious and cultural importance to an Indian tribe. To determine how the project would affect cultural resources, BPA contracted with Cultural Resource Consultants, Inc. to conduct a cultural resource survey and prepare a cultural resources assessment that included conducting background research, a pedestrian survey of all areas where ground-disturbing activities would take place, and subsurface testing in areas with a high probability for encountering cultural resources (Berger and Hartmann 2015). An additional 1-acre parcel was identified after the completion of fieldwork that was not surveyed. Reclamation staff have completed cultural resource survey with the same field methods employed by the contractors. Archaeological survey did not identify any new historic properties.

Archaeological Overview

Comprehensive overviews of more than 10,000 years of human occupation of Plateau and Cascade environments have summarized numerous archaeological, ethnographic, and historic investigations conducted over the past few decades (Ames et al. 1998; Mierendorf 1986 cited in Berger and Hartmann 2015). The general pattern of precontact adaptation and land use through time in the Project area appears to demonstrate a change from a dispersed hunting

and foraging strategy to a seasonal and semi-sedentary, riverine-oriented subsistence (Hollenbeck and Carter 1986:75-79 cited in Berger and Hartmann 2015).

Archaeological investigations were first conducted at the mouth of the Entiat River along the Rocky Reach of the Columbia River during the 1950s (Gunkel 1961). Gunkel's (1961) research distinguished many similarities between the Rocky Reach and the southern Plateau relative to projectile point types and tool-stone raw materials (Berger and Hartmann 2015). Schalk and Mierendorf (1983) conducted investigations throughout the Rocky Reach area of the Columbia River during the 1980s and suggested that precontact subsistence patterns were reflective of the unique regional environment, meaning that there appeared to be a subsistence pattern that incorporated significant resource exploitation of upland forested biomes rather than the predicted Plateau riverine regime (Berger and Hartmann 2015). Mierendorf (1986, cited in Berger and Hartmann 2015) developed a model of precontact land use in the North Cascades based upon production zones that can be applied to the project area: Zone 1 (river channels, lakes, and their shorelines), Zone 2 (floodplains), and Zone 3 (river terraces and valley margins). Subsistence activities in Zone 1 would have consisted of building and maintaining fish traps and other structures from rock and wood to procure fish, Zone 2 areas consist of larger villages and short-term habitations, and Zone 3 would include a variety of artifacts associated with residential, ceremonial, subsistence, manufacture, and travel (Mierendorf 1986:90-92 cited in Berger and Hartmann 2015).

Cultural resources previously identified in the vicinity of the study area consist of a single cryptocrystalline silicate flake; the remains of the Tye Creek Logging Camp that was occupied in 1912; the Stormy Creek Pumice Pit, which was a 1940s pumice mining operation; an historic refuse scatter; the Mad River Trail #1409, which is an historic fire and grazing administration trail; and an earthen catchment ditch.

Although no previously recorded archaeological sites are located in the study area based on existing data from the Entiat Valley area, types of precontact and historic archaeological sites that could be present in the Project area include cairns, lithic materials, fire-modified rock or other processing features, homesteads, logging, ranching, farming, or mining operations (Berger and Hartmann 2015).

Ethnographic Overview

The Project area is within the traditional territory of the Entiat Tribe who were known for making their settlements close to watercourses and a reliance on fish and roots as food sources (Miller 1998). There were four known Entiat villages. The closest was a large permanent village located approximately 16 river miles downstream (12 miles southeast) from the Project area at the confluence of the Entiat and Columbia Rivers. During the historic period, residential structures consisted of mat lodges that replaced the use of semi-subterranean pit houses. The Entiat Tribe depended heavily upon the anadromous fish runs

in the area that ran from May to November. Fishing occurred primarily between the mouth of the river and approximately 3 miles upstream from the project (Berger and Hartmann 2015). Chinook salmon was of increased importance and accounts on spring Chinook salmon show that the average fish was 32 pounds (lbs.) with some reaching 100 lbs. Fall's Coho runs yielded an average fish size of 6 lbs.

Typically men would be responsible for catching fish, while preparation of fish was completed by women. The fish were dried on scaffolds made of poles and sun, fire, and smoke were used as drying agents. Salmon pemmican was then put stored and transported in special sacks woven from rush. Salmon oil was stored in bags made from their skin (Smith 1983).

In late summer, people moved from the valley fishing camps into the mountains to the west for hunting, berry gathering, and fall root crops. Hunting was most productive when communal drives were used, but solitary hunts also occurred. Hunts targeted mountain goat, big horn sheep, deer, elk, and bear. The bow and arrow and spear were the primary weapons used; however, traps and snares were also placed for rabbit, mink, otter, fox, cougar and coyotes (Miller 1998; Teit 1928).

Although the proposed Project is not located on federal land, Section 106 consultation was completed. No Traditional Cultural Properties (TCP) were identified in the study area during the archaeological investigation (Berger and Hartmann 2015).

The Project area is located entirely on private land. The land is not owned by a recognized Indian tribe and does not occur on an individual tribal allotment.

Historic Overview

The first white settlers arrived in the Entiat Valley in May 1887 (Sage 1997). Settlement of the river valley upstream from Ardenvoir was sparse, but the population in the valley was large enough to support a school at McKenzie Canyon (Sage 1997), approximately one mile southeast of the project. Charles A. Harris & Son built Entiat's first lumber mill 1892 and a second mill was built at the mouth of the river in 1894 along the north bank of the Entiat River which helped establish the town of Entiat, Washington. Late nineteenth century economic pursuits in the area mainly consisted of logging, milling, and farming. Entiat's first lumber mill was constructed by Charles A. Harris & Son in 1892 and by 1894, a second lumber mill was constructed along the bank of the Entiat River (Holstine 1994; Berger and Hartmann 2015). The town grew and prospered around the second lumber mill and was reported to have a settler population of 80 individuals by 1894. Harris & Son continued to build lumber mills along the Entiat drainage as timber harvesting at the edge of the forest traveled up the valley (Holstine 1994; Berger and Hartmann 2015).

In the early twentieth century, irrigation schemes were developed and orchards and grain crops gained importance in the Entiat Valley (Luttrell 1994). Orchards were planted as far upriver as RM 14 or 15 (approximately MP 13) but no farther due to the climate (Sage 1997). Between 1910 and 1921, the Entiat watershed was administered by the Chelan National Forest. By 1912, there was a ranger station near the mouth of Brennegan Creek a few miles upstream from the project (USFS 1912). At this time, the Entiat River Road was on the east side of the river and there was a trail on the north side of Potato Creek and another from the mouth of Tyee Creek up to Tyee Mountain (USFS 1912).

In 1933, the Civilian Conservation Corps (CCC) established Camp Entiat about 3 miles upstream from the Project area. The camp served as a base for the construction of the Entiat Valley Road, which became the main transportation route from the Wenatchee National Forest downstream to Entiat. In conjunction with Chelan County, the CCC completed the project in 1936, but went on to construct additional roads, campgrounds, and other buildings in the Forest during the 1940s (Berger and Hartmann 2015).

During the 1940s and 1950s, especially in the West and Pacific Northwest, hydroelectric power development was taking place within major river systems. Hydroelectric power plants and dams quickly became an efficient and inexpensive way to provide electrical energy and by the 1940s, hydropower supplied roughly 75 percent of the Pacific Northwest's electricity (Reclamation 2017). Construction of The Rocky Reach Dam began in 1956 on the Columbia River, approximately 7 miles upstream from Wenatchee, and was an important hydropower project that brought over 2,000 jobs to the area by the late 1950s. Cofferdams, a spillway, and a powerhouse was built and additional generators added to increase the power plant's generating capability by 60 percent between the late 1960s and early 1970s. Updates to the dam and power plant since the 1970s include newer fish friendly turbines and a juvenile fish bypass system added in the 1990s and early 2000s (Chelan County PUD 2017).

3.7.2 Environmental Consequences – Proposed Action

Construction Impacts

Cultural Resource Consultants, Inc. conducted cultural resource field investigations and a records search for any historical or prehistorical artifacts recorded in the and near the project area. The consultants prepared a report describing the methods and results of the investigations (Berger and Hartmann 2015). Reclamation adopted the findings of these cultural studies that had been prepared for BPA. Reclamation's archaeologist also conducted field investigations in a 1-acre area in the southern portion of Project Area C that had inadvertently been excluded from the original Berger and Hartmann (2015) field studies. Based on the results of the field investigations and records search, there were no pre-contact archaeological sites, isolates, or historic properties identified in the Project's Area of Potential Effect. No TCPs were identified in the Project area based on the results of field

investigations and tribal consultation. Therefore, there are no anticipated project related impacts on TCPs. On October 6, 2015, Washington State Department of Archaeology and Historic Preservation (WDAHP) issued a letter that concurred with BPA's finding of "No Historic Properties Affected". Reclamation sought concurrence on adoption of BPA's findings for Section 106 of the NHPA from the WDAHP, the CCT, and the YN. The WDAHP concurred with the adoption on October 30, 2017. On November 29, 2017 the CCT concurred with a finding of "no adverse effect." The YN did not respond to a request for concurrence. In the event of a post-review discovery or inadvertent discovery during construction, Reclamation would implement the Inadvertent Discovery Plan, which would halt all ground-disturbing activity in the vicinity of the find and Reclamation cultural resource staff would be notified immediately. Reclamation has developed a similar plan regarding the procedures that would be followed in the event that human remains are inadvertently discovered. Ground-disturbing activities at the location of the discovery would be stopped until the legally required notification and evaluation processes had been completed, depending on the nature of the discovery. The project proponent would be responsible for contacting Reclamation, who would then contact other appropriate agencies and Tribes. Construction at the site would not resume until a determination is made on any appropriate mitigation or protection of the resource. The Post-Review Discovery Plan outlines procedures that comply with federal regulations specified at 36 CFR 800.13, as well as RCW 27.53. Because the project would take place on private or state lands, the Inadvertent Discovery Plan would focus on Washington State law, especially RCW 27.44: Indian Graves and Records, as opposed to the federal Native American Graves Protection and Repatriation Act.

One of the positive impacts of the proposed Project is that more fish would become available for tribal members exercising their treaty and traditional rights to fish. The greater availability of fish at locations along the Entiat River would serve to enhance tribal traditional cultural practices and could result in an overall positive benefit to cultural.

Post-construction Impacts

No post-construction impacts would occur on cultural resources. Natural river processes would continue to occur and if no further project activity occurs, no post-construction impacts are expected. If during post construction a decision is made by Reclamation or local sponsors to reshape or rebuild a LWM structure or side channel, Reclamation would reinitiate the Section 106 compliance process by consulting with the WDAHP, YN, and CCT.

3.7.3 Environmental Consequences – No Action

Under the No Action alternative, because no habitat improvement actions would be implemented, there would be no potential for effects on cultural resources.

3.8 Sacred Sites

3.8.1 Affected Environment

Executive Order 13007, Indian Sacred Sites, provides further responsibilities for federal land management agencies to accommodate access to, and ceremonial use of, Indian sacred sites located on federal land by Indian religious practitioners and to avoid adversely affecting the physical integrity of such sacred sites. It also requires agencies to develop procedures for reasonable notification of proposed actions or land management policies that may restrict access to or ceremonial use of, or adversely affect, sacred sites on federal lands. Sacred sites are defined in the executive order as “any specific, discrete, narrowly delineated location on federal land that is identified by an Indian tribe, or Indian individual determined to be an appropriately authoritative representative of an Indian religion, as sacred by virtue of its established religious significance to, or ceremonial use by, an Indian religion; provided that the tribe or appropriately authoritative representative of an Indian religion has informed the agency of the existence of such a site.” The Project area resides entirely on non-federal land.

3.8.2 Environmental Consequences – Proposed Action

None of the tribes contacted as a part of this Project have specifically identified specific, discrete, or narrowly delineated sacred sites within the Project area. Further, the Project would occur on private land. Therefore, there would be no impact of the Proposed Action on sacred sites.

3.8.3 Environmental Consequences – No Action

There have been no identified specific, discrete, or narrowly delineated sacred sites within the privately-owned project area. Therefore, there would be no impact of the No Action alternative on sacred sites.

3.9 Indian Trust Assets

3.9.1 Affected Environment

ITAs are legal interests in property held in trust by the United States for federally-recognized Indian Tribes or individual Indians. ITAs may include land, minerals, federally reserved hunting and fishing rights, federally reserved water rights, and instream flows associated with trust land. The Yakama Treaty of 1855 states that “the exclusive right of taking fish in all the streams, where running through or bordering said reservation, is further secured to said

confederated tribes and bands of Indians, as also the right of taking fish at all usual and accustomed places” (Yakama Treaty of 1855, Article 3).

As stated in the Presidential Memorandum dated April 29, 1994, *Government-to-Government Relations with Native American Tribal Governments*, Reclamation is responsible for the assessment of project effects on Tribal trust resources and federally recognized Tribal governments. Reclamation is tasked to actively engage and consult federally-recognized Tribal governments on a government-to-government basis when its actions affect ITAs.

The Department of Interior Manual Part 512.2 delegates the responsibility for ensuring protection of ITAs to the heads of bureaus and offices (DOI 1995). The Department is required to “protect and preserve ITAs from loss, damage, unlawful alienation, waste, and depletion” (DOI 2000). Reclamation is responsible for determining if a proposed project has a potential to affect ITAs.

Federally-recognized Indian Tribes with trust land are beneficiaries of the Indian trust relationship with the U.S. acts as trustee. No one can sell, lease, or otherwise encumber ITAs without approval of the U.S. Government. While the majority of ITAs are located on-reservation, ITAs can also occur outside reservation boundaries. No ITAs have been identified in the Project area. The Project occurs on private land not owned by a recognized Indian tribe or on an individual allotment.

3.9.2 Environmental Consequences – Proposed Action

Construction Impacts

Any Project related activities which might affect ITAs requires Reclamation to consult with the tribes, the Bureau of Indian Affairs, and other appropriate agencies to identify potentially affected ITAs, determine potential impacts to these assets, and provide recommendations for appropriate protection. No ITAs have been identified in the Project area; therefore, there would be no loss, damage, unlawful alienation, waste, or depletion of these sites, and no change in the ability to exercise existing treaty rights due to the proposed Project.

Post-construction Impacts

No post-construction impacts would occur on ITAs. The Project, which is located entirely on private land and does not include ITAs, would not affect current access to the river or ability to fish in the river by tribes that consider the river a traditional or treaty fishing area.

3.9.3 Environmental Consequences – No Action

Under the No Action alternative, no habitat improvement actions would be implemented, and there would be no potential for effects on ITAs.

3.10 Land Use and Recreation

Land use includes current human uses, ownership, and local land use regulations within the project area. Recreation includes the recreational resources within the Project area associated with floodplain and river-related activities.

3.10.1 Affected Environment

Land Use

Land ownership in the Project area includes state and private interests. Reclamation believes the State of Washington owns the land occupied by the Entiat River (not on federal land) below the river's the ordinary high water mark (OHWM) and the WDNR manages this land. The remainder of the Project area is on private land with more than 85 percent of the land owned by the CDLT (Figure 3-2); this land was purchased over time and managed as conservation land. In addition, the shoulder of Entiat Valley Road would be used for equipment access and staging. The roadway is owned and maintained by Chelan County.

Several houses are located along the Entiat River within the Project area. The residences are typically occupied year-round and include landscaped yards and several have horse pastures. Several of the homes are located adjacent to project activities in Project Area F.

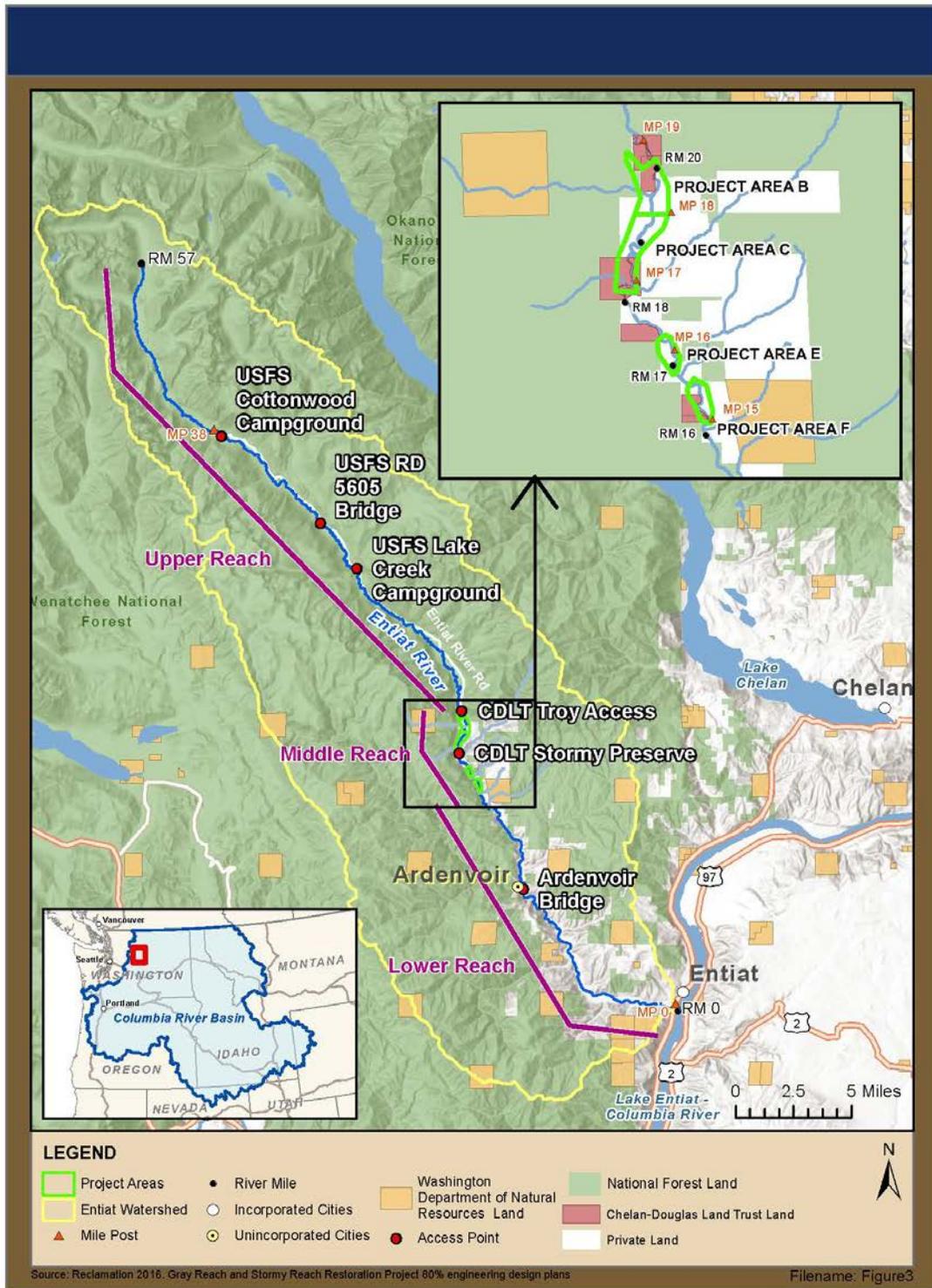


Figure 3-2. Project area is on private land with more than 85 percent of the land owned by the CDLT.

The Chelan County Comprehensive Plan was adopted February 1, 2000 and was last amended by Resolution 2016-09, effective February 16, 2015. According to the County Comprehensive Plan:

“The Entiat basin is primarily natural habitat area with rural residential primarily along the Entiat River. Development is limited by single public access up the valley. The City of Entiat and associated urban growth area are located at the base of the Entiat River along the Columbia. ”

The four projects areas (B, C, E, and F) are within the rural land use designation per Chelan County’s Comprehensive Plan. For rural land designations the plan identifies policies which encourage restoration and enhancement of critical areas, such as rivers and wetlands and their immediate riparian buffers. Chelan County is also required to develop a SMP as required by the state’s Shoreline Management Act to recognize “that the shorelines of the state are among the most valuable and fragile of its natural resources and that there is great concern throughout the state relating to their utilization, protection, restoration, and preservation” and that “coordinated planning is necessary in order to protect the public interest associated with the shorelines of the state while, at the same time, recognizing and protecting private property rights consistent with the public interest” (RCW 90.58.020).

Chelan County’s Planning Commission has prepared a draft SMP they have recommended for adoption by the County (The Watershed Company et al. 2017). The SMP recognizes the Entiat River as a shoreline of the state as its mean annual flow exceeds 20 cfs. Environmental designations along the river at Project Areas B, C, E, and F fall within the SMP’s “Natural” and “Conservancy” land designations. Restoration actions, such as the proposed Project, are consistent with these designations as the SMP states restoration activities should occur in Natural designations where there is degradation and restoration opportunities should be pursued in Conservancy designations.

Recreation

The Entiat River has three distinct sections, each offering different recreational opportunities. The upper section (RM 21.1 to RM 57) (VS 3), which flows primarily through USFS land, has a steep gradient (>1 percent), with large rapids, Class 3, 4, and 5 rapids. This section has several public access points including campgrounds and day use areas as shown in Figure 3-2. It offers a number of challenging recreational opportunities. The Middle Entiat section (VS 2; RM 16.1 to RM 21.1 [MP 15.2 to MP 19.3]), where the Proposed Action would occur, is located in what is locally known as the Stillwaters. This reach has a lower gradient stream (0.2 to 0.7 percent) that flows through primarily private land and has two public access points. The Lower Entiat River (VS 1; RM 0 to RM 16.1 [MP 0 to MP 15.3]) has a steeper gradient (1 percent) than the Middle Entiat and has a few Class 2 rapids. This section flows through primarily private land and has relatively few public access points, restricting

potential recreational opportunities along this reach. Figure 3-2 presents the Project area and public access points in reference to the Entiat River subbasin.

Recreational opportunities found within these three river sections offer distinct recreational experiences that influence the type of activities that occur, the length of stays, and the distance people are willing to travel (IEc 2013). Along the upper section, the ease of public access and close proximity to Wenatchee (Urban Population Center; 35 miles) combined with technical difficulty makes this section inviting to more experienced rafters and kayakers. The available campgrounds and day use areas provide opportunities for longer stays and therefore, visitors would generally be willing to travel longer distances to recreate there, which would correlate with annual visitation rates (IEc 2013). Here the public land offers easy access for kayaking, fishing, and camping. The Middle Entiat has limited public access and meandering flows, making this section desirable to local visitors that are more familiar with the area and that may not have the technical experience required for the upper section. Visitors to this area would tend to be less willing to drive long distances to get there, and the trip durations would be shorter; limited mainly to day use. Based on the size of the local communities (see Section 3.13.1 – Socioeconomic), the annual visitation rates would not be expected to be high, but the area is expected to receive repeat day visits from local residents. Recreational activities typically seen in this section include tubing, floating, and swimming. The lower river section, with its restricted access, often requires boaters to float the entire 14.5 miles from the Mad River, near Ardenvoir, Washington, to the mouth where it meets the Columbia River. This limits the type of activities, the length of stays, the distances people are willing to travel, and total annual visitation. Local residents with private access to these portions of the river are the primary users of this stretch. The lower river stretch does not add substantially to regional public recreational opportunities, but is considered to be valued by residents who enjoy the limited access and lower visitation rates. The recreational settings for these areas range from semi-primitive within the USFS boundaries to a rural designation along the middle and lower reaches.

The SMP integrates a shoreline public access plan that recognizes local conditions and provides a regional perspective to meet the current and future community shoreline access needs. This plan provides important information pertaining to boating and shoreline access needs within the project area. The SMP (The Watershed Company et al. 2017) focuses on areas near local communities in Chelan County and states that, at a regional scale, most of the resident and tourist populations (over 90 percent) is within 15 road miles of public access facilities. Under typical circumstances this would mean a 15-minute drive for residents or visitors to arrive at a walking trail in summer evenings or a 15-minute drive to a boat launch or a fishing spot on a weekend. Based on the location of the project area, which is a half hour drive from the town of Entiat, it is expected that the Middle Entiat would experience recreational use primarily from residents along Entiat River Road. Larger towns downstream, such as Wenatchee, Washington, are outside of the 15-mile distance presented in the SMP. Given the lower gradient, location, and availability of public access, the Middle

Entiat provides important local recreational opportunities that do not require expert watercraft skills to navigate safely.

In 2014, the CCD prepared a recreational use report for the Middle Entiat River (Cascadia Conservation District 2014). Development of the recreational use report was done in accordance with Reclamation's RBDGs (Reclamation 2014). The recreational use report used interviews, observations, and an online questionnaire targeting local users to determine the level of use and the types of users found on the project area. Recreational uses of the Project area include kayaking, canoeing, swimming, floating (tubing), and fishing. There are currently no commercial rafting or recreational boating outfitters that utilize the project area. The Project area has a relatively low-gradient, slow moving water, and no whitewater rapids. Based on results of the recreational use report questionnaire (Cascadia Conservation District 2014), 23 percent of local users reported floating in the Stormy and Gray Reaches (Middle Entiat stretch) while the other (77 percent) reported floating in other reaches in the Entiat River subbasin on USFS property and below the Project area between Ardenvoir]) and the Columbia River (see Figure 3-2). Recreational use on the Middle Entiat was found to occur mostly in the summer and fall, with limited use as early as late spring. River flows during the period of use ranges from 200 to 500 cfs.

Respondents to the CCD recreational survey showed the frequency of boater use in the project reach of the Middle Entiat is low compared to the more popular rivers in the Upper Columbia such as the Wenatchee and Methow rivers. The average age of boaters in the Project area is between 40 and 60 years of age and the majority claimed to be at a Class III or higher skill level in relation to the American Whitewater Association rating system for river difficulty. This system rates a stretch of river with Class I being the easiest and Class VI being the most difficult to navigate. Class III indicates an intermediate boater. One respondent reported that children have accompanied them on multiple occasions, but under direct supervision. Several local residents reported that usage in the reach is primarily local residents and families with extensive knowledge of obscure or private ingress and egress points (Cascadia Conservation District 2014).

Within the Project area there are currently 13 natural large wood structures that pose potential risks to recreational users (Cascadia Conservation District 2014). The large wood structures were classified on a rating scale from A to F to rate the difficulty of boater navigation around the structure. The Type A rating assumes that no active navigating action would be required by a boater to navigate the wood, and a Type F, or most difficult rating, would require a boater to leave the river and portage around the structure. Types A and B were not surveyed as they typically do not present hazards to recreational users. Ten of the large wood structures were classified as Type C, which are easily avoided through routine navigation by boaters. Three large wood hazards were identified as Type D, which require river users to actively avoid them. The LWM structures E and F are not present in the project area.

Type D is rated higher than Type C due to a few factors making the structure more hazardous; factors include the orientation of the wood to the channel, location to bend and line of sight from upriver (Cascadia Conservation District 2014). Overall, the study concluded that there is a lack of challenging or technical areas in this stretch of river, save for the need to navigate around some areas of large wood. Table 3-9 summarizes the LWM structure and number by project area.

Table 3-9. Number of LWM structures of type C – F in each Project area.

Project Area	LWM Type C	LWM Type D	LWM Type E	LWM Type F	Total
B	0	1	0	0	1
C	2	1	0	0	3
E	2	1	0	0	3
F	6	0	0	0	6
Total	10	3	0	0	13

In the summer of 2015, Reclamation was contacted by several local residents that float the river and expressed concerns for boater safety as a result of the Proposed Action. Reclamation conducted a field tour with local recreationalists on October 23, 2015. Input from the local users of the river was used to adjust structure locations where Reclamation and local users agreed that an undesired risk was going to be created (see Section 3.10.2 – Recreation).

3.10.2 Environmental Consequences – Proposed Action

Land Use

Construction Impacts

No construction impacts related to land use are associated with the proposed project. Potential noise impacts to adjacent residents are discussed in Section 3.11.2.

Post-construction Impacts

The proposed project would be consistent with the Chelan County Comprehensive Plan and the zones in which it would be located. The project is located within zones that are part of the Rural District designation. This designation allows a number of uses that would be compatible with rural character, including tourism and recreation uses. The Rural District designation also encourages creating open space and protecting environmental features while enhancing recreational opportunities, and the project is consistent with this goal.

Recreation

Construction Impacts

Construction of the LWM structures would require operation of tracked equipment within the river channel, isolation by cofferdams of construction areas, and helicopter flights over the river channel to deliver materials. These activities would require closure of the river channel through the project areas during construction to ensure public safety. The closure would be temporary and occur only during the in-water work period as defined in Chapter 2, Section 2.2.3 which occurs during the typical summer low-flow recreational season.

Post-construction Impacts

The implementation of the proposed Project, specifically the placement of LWM structures, would alter the river in ways that could affect how recreational boaters experience the river but is unlikely to result in conditions that would prevent boats from navigating the river or be considered unsafe. Because the affected section of river does not receive high recreational use like the Wenatchee or the Methow rivers, the number of users affected would be low. In addition, users typically boat the river during low water levels when depths and velocities result in conditions that allow boaters to avoid LWM structures. Boaters on the river are already required to actively avoid existing woody structures on the river (Table 3-9); therefore, based on the reaction time and placement of the proposed LWM structures, substantial changes to the quality of recreation experience and safety of boaters are not anticipated as discussed further below. While the placement of some structures would result in boaters needing to alter the path they travel along the river, boaters would experience these changes as they would any other changes that occur as a result of natural occurrences of wood and rock. As noted in Table 2-6 in Section 2.3, BMPs include posting public notifications at usual river public access points to facilitate public awareness of habitat improvement work and LWM structure presence. Signs would also contain an educational element to describe the different project locations, the types of structures, and benefits they provide. No existing public access points would be removed by the Project.

Risk Based Design Guidelines

Minimizing risk to the public was a primary design criterion for all of the structures that would be built. Designs for the proposed project were developed following Reclamation's Large Woody Material - RBDGs (Reclamation 2014). The RBDGs were used to assess and evaluate watershed-level, reach-level, and site-level characteristics as part of the design approach. In addition, by following the guidelines, the design team was able to document the decision-making process and follow a consistent evaluation methodology for identifying the potential risks from each LWM structures.

Per the Risk Guidelines, the 10 steps of the risk-based design approach are as follows:

1. Pre-project planning and site visit
2. Watershed and reach level risk assessment
3. Project concept development
4. Site level risk assessment
5. Risk level determination
6. Define minimal design criteria including design team members
7. Risk-based design
8. Design team review
9. Design completion
10. Documentation

Step 1 was completed in May 2014 with a review of the Project area and field reconnaissance. Following the field visit, an assessment of the risk posed by proposed LWM structures at the conceptual design level was conducted at the watershed- and reach-level and site level (Steps 2 and 4). The information gathered during the risk assessment was used to develop a risk-matrix for each of the proposed LWM structures. Together, information at the watershed- and reach-level (Step 2) and the site-level (Step 4) were used to determine the level of risk (Step 5) of low or high for public safety and for property damage. This risk level determination defined the minimal design criteria and design team members that should be used for ensuring stability and safety for each of the proposed LWM structures (Step 6). The risk-based design process was then conducted based on the established design criteria (Step 7). During Step 7, the project designs went through four iterations. With each of the four iterations, the project design was assessed and evaluated to determine the potential risks to people and property, after which the design was refined and modified. The proposed Project reflects the fourth iteration of this process.

The design team conducted a field survey of the 30 percent LWM structures on July 30, 2015 and conducted a field tour with local recreationalists on October 23, 2015. These field efforts informed the recreational safety review of the proposed LWM structures and was used to adjust structure locations where the team or local users agreed that an undesired risk was going to be created.

By following the RBDGs and evaluating how each structure would potentially interact with recreational users, and requesting input from users of the river, five planned LWM structures were eliminated from the project design and eight LWM structures were modified, either by changing the type or the location of the structure, to reduce conflicts with recreational boaters. These modifications are reflected in the 80 percent design upon which this analysis is based. Final design will be completed prior to construction.

Recreationalists typically boat the river during months when flow depths and velocities result in conditions that allow boaters to avoid LWM structures. There would be a total of 86 LWM structures placed in an approximately 4 mile stretch of river, with only 66 of those structures located within the mainstem flows that would require avoidance during boating (Figure 2-12, Chapter 2). The other 20 structures are located within floodplain or side channel habitats not generally accessible to boaters. During design of the LWM structure the RBDG were used in combination with the field survey to estimate boater sight distance and reaction times in association with each LWM structure grouping. Structure “groups” were those structures that would be placed within close proximity of each other and would work together to perform a hydraulic function. The 66 instream structures create a total of 39 structure groups.

Conflicts with recreational boaters have been further reduced through the location of the structures. Many of the structures that would be installed have been designed to interact with the river at higher flows (>500cfs). This is because high flows provide the energy necessary to achieve the desired hydrological response. Also, at higher flows many of the structures are intended to provide low-velocity refuge for juvenile fish, giving them safe places to hide during high flows. Recreational use through the Project area is most common in the summer and fall, with limited use as early as late spring, when the mean discharge ranges from 200 – 500 cfs (USGS 2017) when the river is calmer/safer and warmer with lower flows. At low flows, many structures would likely be in shallow water or not in the water at all. This would reduce the risk for recreational users by removing the structure from the water and through reduced depths and velocities adjacent to the structure.

For the analysis of risk following the RBDG, a 500 cfs event was used to establish depth and velocity criteria that represents typical June or July boating conditions. The assessment also evaluated the location of the structure (if a LWM structure is located on the outside of a meander it increases the risk of collision), the strainer potential (the risk that a structure could pin or trap a person against it), egress potential (availability of a clear navigable or walkable path of avoidance), and typical water depth and velocity. Based on these criteria, there is a minimum of 150-foot sight distance for each structure grouping which would provide approximately 40 seconds of reaction time during the June and July typical flow conditions to safely maneuver a water craft around the structure. In summer months, as flows decrease and slow, reaction times would lengthen and more of the structures would be out of the water.

As detailed in the RBDG, structures located on outer meander bends typically require the greatest level of boater avoidance and thus provide a greater risk to recreational boaters. A total of 9 of the 39 instream LWM structure groups would be placed along the outside bank of existing stream meanders, however, each of these locations provide adequate sight distance (minimum 150 feet), and reaction time to be safely avoided. Within the proposed Project Areas B, C, E, and F, the average distance between structure groups is 296 feet.

During a typical flow in June or July this provides approximately 74 seconds of reaction time. Within the RBDG, the reach-user and structure characteristic risk scores were plotted on the Public Safety Risk Matrix for each hydraulic group to determine the public safety risk rating. The final RBDG evaluation concluded that the public safety risk rating for all of the structure groups is “low.”

The implementation of the proposed Project would result in changes to the river that would affect how recreational boaters see and interact with the Entiat River. The Middle Entiat does not have the regional draw of the Wenatchee or the Methow rivers; therefore, the number of local users affected would be relatively low in comparison. The primary user effected would consist mainly of local residents who are knowledgeable about the existing conditions of the river. The proposed Project would require boaters to adjust their path to avoid the additional LWM structures that would be placed throughout the Project area. While this would add additional obstacles, the RBDG demonstrate that the public safety risk rating for all of the structure groups is “low,” and during the summer months, flow is lower, and many of the structures would be out of the water. In addition, the proposed project would have beneficial impacts to recreational future sport fishing opportunities. The overall quality of local fishing opportunities would improve with the proposed instream structures and channel adjustments as they would provide additional rearing, resting and feeding areas to all fishes within the Project area.

3.10.3 Environmental Consequences – No Action

Under the No Action alternative, Reclamation would not fund the implementation of the Project and no construction or post-construction effects would occur and land use and recreation would remain unchanged.

3.11 Noise, Air Quality, and Public Health and Safety

This section discusses noise, air quality, and public health and safety for the proposed Project areas. The analysis area for this section includes the Entiat River valley along the four project areas where project construction activity occurs.

3.11.1 Affected Environment

Noise

Noise is defined as unwanted sound. Airborne sound is a rapid fluctuation of air pressure above and below atmospheric pressure. Noise can be measured in several different ways depending on the source of the noise, the receiver, and the reason for the noise measurement.

Audible noise is measured in decibels on the A-weighted scale. The A-weighted sound pressure level on a decibel (dBA) scale describes sound that corresponds to human perception. Table 3-10 shows the relative A-weighted sound pressure levels of common sounds measured in the environment and in industry for various sound levels.

Table 3-10. Common activities and associated noise levels.

Noise Source at a Given Distance	Sound Level (dBA) ^a
Civil defense siren (100 feet)	130
Jet takeoff (200 feet)	120
Vibratory pile driver (50 feet)	101
Ambulance siren (100 feet)	90
Freight cars (50 feet)	84
Pneumatic drill (50 feet)	80
Freeway (100 feet)	70
Vacuum cleaner (10 feet)	60
Department store; light traffic (100 feet)	50
Large transformer (200 feet)	40
Note: an A-Weighted Sound Level in Decibels (dBA) (Beranek 1988).	

Decibels on the A-weighted scale cannot be directly added arithmetically; that is, 50 dBA + 50 dBA does not equal 100 dBA. When two sources of equal level are added together the result will always be 3 dB greater; that is 50 dBA + 50 dBA = 53 dBA and 70 dBA + 70 dBA = 73 dBA. If the difference between the two sources is 10 dBA, the level (when rounded to the nearest whole decibel [dB]) will not increase; that is 40 dBA + 50 dBA = 50 dBA and 60 dBA + 70 dBA = 70 dBA.

The action area for noise consists of any area within the vicinity of the project that could be affected by noise from construction equipment used on the ground and would include homes nearby the four project areas. In addition, the action area for noise would include the Entiat River valley for 2 to 3 days each construction season when helicopters would be used to deliver logs.

Sensitive noise receptors consist of homes located along the Entiat River Road near the Project areas. Given the noise levels associated with the type of construction equipment that

would be used for the Project, homes within 2,000 feet of the construction areas in this rural setting where ambient noise can generally be low. A total of 41 homes are located within 2,000 feet of the construction areas at the 4 project sites. At Area B there are 4 homes located approximately 2,000 feet from the Entiat River where the levee removal and LWM structure construction would occur; at Area C there are 10 homes approximately 2,000 feet from where LWM structures would be constructed; at area E there are 11 homes approximately 2,000 feet from construction activity with the closest home approximately 800 feet from where project activity would occur; and in area F there are 16 additional homes within 2,000 feet (not already considered in area F) with several homes within 200 feet from where project activity would occur at area. Additional sensitive noise receptors in the action area could consist of recreational users on or along the shoreline of the Entiat River.

Existing noise sources consist of traffic along the Entiat River Road. Background noise levels in rural areas such as those in the action area are roughly 45 dBA during the day and 35 dBA at night (EPA 1974). To provide a reference of noise generated by common activities, Table 3-10 shows a range of noise levels from 40 to 130 dBA.

No federal regulations apply to noise generated by the project. Washington has not established statewide limits on noise levels from construction equipment. However, Chelan County has a noise control ordinance that limits noise emissions on motorboats and vehicles. Any vehicle operating for the purpose of on-site construction of structures between the hours of 7:00 a.m. and 10:00 p.m. are exempt from the county ordinance.

The ability to perceive a new noise source intruding into background conditions depends on the nature of the intruding sound, and the background sound. For situations where the nature of the new sound is similar to the background sound (e.g., new traffic noise added to background traffic noise), a noise of 3 dBA is just noticeable, a change of 5 dBA is clearly noticeable, and a change of 10 dBA is perceived as doubling (or halving, if the sound is reduced) the sound level. For situations where the nature of the new intruding sound is different from background sound (e.g., construction noise in an otherwise quiet setting), the new sound (including sporadic “clanks” from construction equipment) can be easily perceived, even if it only raises the overall noise level by less than 1 dBA.

Air Quality

The WDOE administers an air quality regulation and permitting program for commercial and industrial sources of air contaminants. There are no registered sources within the project area, although there are a few regulated sources within the City of Entiat. Although WDOE monitors airsheds across the state, no monitoring data exist for the Entiat airshed. The nearest monitoring site is in the Wenatchee area, where the WDOE has been collecting information since 1998. The Project area is classified by the WDOE as being in attainment of the National Ambient Air Quality Standards. WDOE has no immediate plans to expand their air monitoring to include the Entiat airshed.

Public Health and Safety

The affected environment for public health and safety includes the areas where construction, log storage, and equipment staging activities would occur, 18 miles along the Entiat Valley Road from the junction with U.S. 97, and the Entiat River and its floodplain for each of the Project areas.

Areas where construction, log storage, and equipment staging activities would occur are located on private land. The majority of the private land within the Project areas is owned and managed by Chelan Douglas Land Trust. Entiat Valley Road is a county road and is the primary transportation corridor up and down the valley. Entiat Valley Road is used by local residents and visitors. It also provides access to USFS property upstream of the Project area. The Entiat River and its adjacent floodplain are utilized and enjoyed by local residents and recreationalists who float and swim in and along the river.

Currently, the Project area supports mosquito breeding. For example, the wetlands that are present behind the Bremmer Levee are typically ponded or have wet soil surface during portions of the growing season that can support mosquitos. Mosquito populations associated with annual flooding typically increase with the spring freshets (i.e., sudden rise in the level of a stream caused by heavy rains or the rapid melting of snow and ice) and can produce millions of mosquitos per acre. At this time there are no known measures being taken to control mosquitos along the Entiat River.

3.11.2 Environmental Consequences – Proposed Action

Noise

Construction Impacts

One of the more recent and complete compilations of construction equipment noise is the Roadway Construction Noise Model (FHA 2006). Noise levels from the Roadway Construction Noise Model User's Guide are shown in Table 3-11 for the equipment anticipated to be used during the project. All listed noise levels are maximum A-weighted sound pressure levels at a reference distance of 50 feet.

Table 3-11. Construction equipment noise levels (FHA 2016).

Construction Equipment	Noise Level (dBA) ^a
Backhoe	80
Compressor (air)	80
Dozer	85
Dump truck	84
Excavator	85
Generator	82
Grader	85
Vibratory pile driver	101
Loader	80
Pickup truck	55
Tractor	84
Notes: ^a Specified A-weighted sound pressure level (<i>L_{max}</i>) at 50 feet.	

The intensity of sound attenuates, or diminishes, by about 6 dBA as distance doubles (FHA 2006). Review of the table of construction equipment noise levels indicates that, with the exception of pile driving, the loudest equipment generally emits noise in the range of 80 to 90 dBA at 50 feet. The types and numbers of construction equipment near any specific receptor location would vary over time. Individual equipment operating in the construction zone could be discernible above ambient noise up to 2,000 feet away from the construction zone. Individuals at homes near the project construction zones would likely hear noises associated while construction equipment is in use if no other noise associated with individual use at the homes would override the construction noise. Length of time the equipment would run during the day would vary, depending on how the construction contractor utilizes equipment to construct the project. However, work hours would be defined to limit the construction generally from no earlier than 7 a.m. through late afternoon (as defined by the construction contractor but within the Chelan County noise ordinance requirements).

A vibratory pile-driver (see Figure 2-16) is a large device that is attached to the arm of an excavator. The excavator lifts the pile into place and applies downward pressure on the pile while the vibratory driver shakes the pile, driving it into the ground. The noise from the vibratory pile-driver comes from the vibratory mechanism and engine noise from the excavator. These levels can vary depending on the type and condition of the material.

A helicopter would also be used to deliver logs to site locations. Logs would first be placed at several staging area locations, sorted and bundled with the specific logs needed for each LWM structure. Helicopters would then be used to deliver those bundles to the location of each LWM structure location. Some LWM structures would be constructed by the helicopter lifting and placing the logs and boulder and chain ballast direct to their location in the river.

Noise associated with helicopter use would be temporary and intermittent with the anticipated total time for helicopter use at 2 to 3 days during each construction year. A helicopter produces a peak noise level of 110 dBA at 50 feet (WSDOT 2015; Tatic et al. 2012). During the 2 to 3 days each construction season the helicopters are used, homes within approximately 1 mile of the helicopters would be exposed to temporary noise levels above 65 dBA. Noise from helicopters would not be a new source of noise in the area as helicopters are used for timber harvest and to suppress wildfires that occur in the Entiat and surrounding watersheds. Other aircraft have also been observed by design team members to fly in or across the valley including jets from military bases located in Washington that have flown over the river at low elevations.

Assuming maximum construction-generated noise level of 110 dBA at 50 feet, and an average exterior or interior structural attenuation of 15 dBA, inhabitants of residences within approximately 2,000 feet of the construction areas and material yards could experience increases in ambient noise levels of greater than 10 dBA. There are approximately 41 residences within 2,000 feet of the proposed construction areas. Construction activities would not occur during the more noise-sensitive periods of the day (i.e., evening and nighttime hours), to avoid sleep disruption to occupants of these residential dwellings.

For all other general construction activities, noise generated during construction would likely be only slightly louder than existing background levels. Overall, noise levels associated with construction equipment would range from 55 dBA to 110 dBA and would be short in duration during the construction period.

Air Quality

Construction Impacts

Air pollutant emissions would be generated during the construction of the Proposed Action. Pollutants, when emitted in substantial amounts, can be hazardous to public health, especially for people with respiratory ailments. Emissions can also reduce visibility on roads, highways, and in scenic areas, to the detriment of public safety or enjoyment. In addition, vehicle emissions and combustion of fossil fuels during project operations, as well as during construction, could emit greenhouse gases. Emissions would be temporary in nature and controlled through BMPs as described below, and therefore are considered insubstantial.

The pollutants that could increase because of project construction are carbon monoxide, carbon dioxide, ozone, other gases produced by combustion, and particulate matter (dust). Dust could be created during construction by vehicles travelling on unpaved surfaces and from ground-disturbing activities. Sixteen houses are within 1,000 feet of construction and staging areas and could experience an increase in dust and particulate matter during construction depending on wind patterns and amount of construction in a given day.

However, dust effects would be temporary, occur only during construction (approximate work windows from June through November of each year, beginning with staging in 2018; Section 2.3), and would occur in localized areas.

Particulate matter, such as dust, would impact air quality during the ground-disturbing activities and travel along unpaved access roads. BMPs such as use of water trucks to reduce dust, would be applied, to maintain air quality standards (Table 2-6). (See Figures 2-2 through 2-5 and Section 2.2.1 for locations of access roads and staging areas where dust sources could occur.) Project emissions would be temporary and localized in nature, and with the use of BMPs would reduce and minimize release of particulate matter in the air.

Project vehicle trips during construction, which would produce emissions, are described in Section 3.12.2. Due to the localized nature of the activities, the total vehicle emissions from the proposed Project would be low compared to emissions from other regional, national and worldwide contributors. When the Project is complete, all construction-related emissions and other air pollutants are expected to cease.

Public Health and Safety

Construction Impacts

Construction activity at the construction, log storage, and equipment staging areas would pose a potential risk of injury to workers using heavy equipment while working in and near the water and during access road construction and earthwork. As part of the Project, Reclamation would require the construction contractor to submit a work safety plan to reduce and minimize risk to workers and public. The work plan would state that anyone entering the work site would be required to wear personal protective equipment to reduce and minimize exposure to hazards that cause serious workplace injuries and illnesses. This safety plan would include other safety features as well as features necessary to provide a safe work environment in and around water. As described in Chapter 2, river crossings include wet crossing where equipment would cross the river. Work around water would occur during low flow periods to further reduce and minimize water related safety hazards.

Construction trucks and vehicles entering or leaving the Project site from Entiat Valley Road could increase safety hazards for vehicles and travelers using the road. Safety hazards related to construction traffic on Entiat Valley Road would be greatest during the weekends when highway use is greater. The level of daily vehicle trips would be approximately 85 to 175 trips during construction and would be within the design capacity of the roadway.

Post-construction Impacts

Impacts on noise and air would not occur once project construction is completed.

The proposed Project's potential public health and safety effects from the creation of wetlands and ponded water can provide breeding habitat for mosquitoes, which are considered both a nuisance and a public health threat since they can serve as vectors for diseases such as West Nile virus. Washington State is not considered as a risk area for the Zika virus as there are no known occurrences in Washington State. Within the United States only small portions of southern Texas and Florida have reported cases of Zika spread by local mosquitoes (CDC 2017).

Mosquitos that spread West Nile virus become infected when they feed on infected birds. Infected mosquitoes can then spread the virus to humans and other animals. West Nile was first detected in North America in 1999 and has since spread across the continental United States and Canada. The risk of infection is highest for people who work outside or participate in outdoor activities because of greater exposure to mosquitoes. West Nile virus has been reported in Washington State although the Centers for Disease Control and Prevention (CDC) indicates most people who are infected would not get sick (as the CDC reports an incidence rate of 0.01 to 0.24 per 100,000 population for those with severe symptoms² or a neuro-invasive disease from West Nile virus, CDC 2017).

Increased inundation of the Entiat River floodplain would likely increase the specific habitats supporting mosquito populations. The additional wetland and floodplain habitat that would be flooded has been designed to facilitate flow through and off floodplain areas that would prevent the stagnation of waters supporting nuisance mosquito populations. While there would be an increase in the floodplain areas inundated during seasonal floods, these areas are not expected to result in a problematic mosquito population beyond that which is experienced under existing conditions, so the risk to public health and safety is not greater than under current floodplain conditions.

Section 3.10.2 discussed the potential risks to recreational boaters. Additional potential public safety risks could also be associated with logs from LWM structures installed as part of the Proposed Action. Although LWM structures would be added, Figure 2-12 shows that only a small percent of the river main channel would be affected by the Project. There is a risk that logs could potentially come loose and cause damage to people and property. To reduce and minimize this risk, designs for the proposed Project were developed by licensed engineers that followed Reclamation's RBDG to ensure stability of each structure (Reclamation 2014). As the designs for each Project area were developed, with licensed engineers, a 2D hydraulic model, developed by Reclamation's Technical Service Center in Denver, Colorado, was used to evaluate the effects of the structure and also the stability of each structure. Although the minimum stability design flow criteria in the Risk-Based Design Criteria is the 25-year flow, the designs were evaluated using the 100-year design

² Severe symptoms may include headache, high fever, neck stiffness, stupor, disorientation, tremors, convulsions, muscle weakness, paralysis, and coma (Washington DOH 2017).

flow to meet RCW 77.85.050 for the design of LWM structures. The same RCW requires habitat improvement projects to be led by professional engineers or licensed geologists. The Project's design was consistent with this requirement.

The design life of the proposed LWM structures would be 25 years. The design life is based on the materials used, delivery methods, construction methods, climate conditions, and hydrologic conditions (Reclamation 2014). While wood elements naturally decay at variable rates dependent upon their species, size, and their environment there is little research on the absolute decay rates of different types of wood (Abbe et al. 2003). Wood used for the proposed project would be primarily Douglas fir which has been shown to decay by approximately 20 percent over a period of approximately 30 to 50 years in a forest environment (Harmon et al. 1986).

The modeling of the proposed project showed that all of the proposed structures would meet the risk-based design criteria for stability (Reclamation 2016b). To meet RBDG requirements, additional mechanical anchoring would be used but no cable would be used in any of the LWM structures. Anchoring the LWM structure along with other design features following the risk-based design process would reduce and minimize the potential risk to public safety.

Recognizing concerns of landowners along the Entiat River, LWM structures for the Project were designed using the latest technological tools and engineering approach used by river engineers. Large wood design and placement has been one of the more common restoration techniques and as early as the 1890s landowners have placed wood in channels to improve fish habitat. Between 1980 and 2005 nearly 6,000 restoration projects in the United States used wood placement to improve stream habitat. Over the last 40+ years, structures have been designed for different purposes, with different expectations for stability, different expectations on life of the structure, and factors of risk. Therefore, any consideration of "failure" of a structure must consider why and how the structure was built. Some LWM structures designed 15 to 30+ years are indeed considered to have "failed." However, studies have shown those structures with lower success rates are typically structures that were designed over 20 years ago (Roni et al. 2014), and modern design techniques are much improved over earlier methods.

The LWM structures are designed to span no more than 30 percent of the channel width to allow debris to move downstream and not create a channel spanning structure causing risk to river users. The LWM structures would be primarily stabilized through driven piles. The only structural connections used to secure logs used in LWM structures would be threaded bolts that "pin" logs to one another. For helicopter constructed LWM structures, short lengths of chain would be used to create "rock collars" used to create ballast intended to secure logs. As the wood deteriorates over the expected 25-year lifespan, individual logs may break from the larger structure. Since these logs are not cabled together multiple logs are not expected to move together downstream. This also reduces the risk of logs "rafting"

together and causing damage to downstream properties or creating channel spanning conditions that would increase risk to boaters.

The Proposed Action (See Chapter 2.2.3) includes a post-construction inspection process to survey and inspect status of LWM structures. Any LWM structures or side channels that have changed from their constructed conditions would be subject to modification if they are not meeting the Project's purpose or cause an increased risk to public safety or structures. As stated in Section 2.2.3, the adaptive management program allows local sponsors and Reclamation to be engaged with the Project after construction as a way of proactively preventing detrimental impacts to landowners at project sites and downstream landowners. In the event a LWM structure should need any modification, CCNRD would be responsible for all adaptive management of structures on/adjacent to Chelan Douglas Land Trust property (Project Areas B, C, and F), per *Adaptive Management Program Agreement between CDLT and Chelan County Natural Resource Department for Entiat Restoration Projects* (Chelan County 2017), and CCD would be responsible for the same in Area E unless agreements are made with CCNRD to assume responsibility. The CDLT and CCNRD agreement include the following provisions to address the post-construction condition of the LWM structures:

- CCNRD would implement an Adaptive Management Program occurring in 5-year increments up to 25 years;
- CCNRD would monitor and maintain (including modification or removal) of restoration projects;
- CCNRD would take action to protect public health and safety and/or natural river function to immediately address any health or safety emergencies, and non-emergency actions after consulting with an adaptive management team;
- CDLT/CCNRD would cooperate to ensure restoration project meet requirements of RCW 77.85.050, which in part, requires the project to be designed by a licensed professional engineer or geologist.

In addition to this agreement, Reclamation and CCNRD signed an agreement that provides funding for CCNRD to implement the Adaptive Management Program described above. The agreement is for a 5-year period, but provides options to renew on 5-year increments.

3.11.3 Environmental Consequences – No Action

Under the No Action alternative, there would be no change from current levels of noise, which would continue to be low to negligible. There would be no construction-related emissions, and air quality in the region would remain similar to current conditions and the potential risks to public health and safety associated with the Project would not occur.

3.12 Transportation

The analysis area for transportation resources includes the existing roads and temporary construction access within the project area, as well as roads used by construction equipment within the Entiat River Valley.

3.12.1 Affected Environment

The only public road found within the Project area is Entiat River Road which starts at the junction with US 97, where the Entiat River joins the Columbia River and continues 37 miles upriver. The lower 19 miles is owned and maintained by Chelan County. Once Entiat River Road enters USFS property, it becomes National Forest Road-51. Entiat River Road provides access to residences and businesses in the Entiat Valley and for recreational and commercial activities on USFS land.

3.12.2 Environmental Consequences – Proposed Action

Construction Impacts

The construction of the proposed project would result in increased truck and equipment traffic on Entiat River Road during the years 2019 and 2020. Actual timing of increased traffic would depend on the contractor's schedule. Construction activity at each of the project areas would also result in traffic delays when machinery and construction equipment enters the roadway. Also, primarily for Project Areas B and F, haul trucks would be moving excavated material off-site and down the Entiat Valley Road. Each of the construction contractors would develop a traffic management plan to ensure public safety for trucks entering and leaving the Entiat River Road to and from the Project area sites.

At Project Area B, the removal of the levee would require 9,500 cubic yard of material to be excavated, loaded into dump trucks, and hauled away. Dump trucks used to haul the material would transport 18 to 20 cubic yards of material at a time. Hauling 9,500 cubic yards of material would require 600 round trips down the valley. Once the material was dumped, those trucks would make a return trip for another load. Because neither the method for removing and loading the material nor the location to which it would be hauled is known, the number of trucks traveling Entiat Valley Road per day is not known. The range of potential daily truck trips would be between 5 to 10 round trips per day, each year of construction, depending on the number of days for construction, which could range from 60 to 109 days. Each truck arriving to and leaving from the Project area would require a flagger to halt traffic in both directions resulting in some travel delays. Transportation effects from the removal of the levee at Project Area B would occur during the summer of 2019 and would be from the

increased truck traffic necessary to haul materials and allow off site and traffic delays as trucks enter and exit the site.

In 2020, construction of the ford at Project Area E would require the removal and offhaul of 96 cubic yards of material. This would generate approximately 6 round trip truck trips down the Entiat River Road.

In 2020, material excavated for the side channel enhancements, fill removal, and floodplain bench construction in Project Area F would require 10,801 cubic yards of material to be hauled offsite. This would generate approximately 675 truck round trips down the Entiat River Road. Transportation effects from the removal of the soils at Project Area F would occur during the summer months and would be from the increased truck traffic necessary to haul materials and allow off site and traffic delays as trucks enter and exit the site.

Post-construction Impacts

The Project would not require upgrades to expand the capacity of Entiat Valley Road and travel delays and traffic volumes would be temporary, occurring only during construction. Therefore, the Project would have no effects after construction.

3.12.3 Environmental Consequences – No Action

Under the No Action alternative, Reclamation would not fund any habitat improvement actions and no transportation effects from construction activities would occur.

3.13 Socioeconomics

The analysis area for socioeconomics is the Entiat River Valley, which is where most of the direct effects during construction and operation would occur. The larger geographic area of Chelan County was also identified as the economic study area because it is at the county level where most of the economic benefits may manifest, including spending on goods and services from the workers and the materials and equipment to construct the project.

3.13.1 Affected Environment

The Project is located in Chelan County, Washington. Entiat, Washington (population 1,112) is the closest town and is approximately 16 miles southeast of the project at the mouth of the river. Ardenvoir (population ~87), is an unincorporated community 5 miles south of Project Area F. Wenatchee, the largest city in Chelan County, is located about 20 miles south of Entiat, Washington. The Entiat River valley is within U.S. Census Tract 9601. U.S. Census

Bureau data for Census Tract 9601, Chelan County, and the City of Wenatchee were used for this analysis.

Population

The total population for Census Tract 9601 in 2014 was 1,225 people. The largest city in Chelan County is Wenatchee, Washington, with a 2014 population of 32,627. The population of Chelan County in 2014 was 73,664 (see Table 3-12) (U.S. Census Bureau 2016).

Table 3-12. Total population of Chelan County in 2014 (U.S. Census Bureau 2016).

	Census Tract 9601	Wenatchee, WA	Chelan County
Total Population	1,225	32,627	73,664
Minority population	146 (5.7 percent)	574 (5.2 percent)	171,095 (10.9 percent)
Low-income population	23.9 (+/- 7.9)	16.1 (+/- 3.8)	15.0 percent (+/- 0.3)

Employment and Income

About 1,016 people age 16 and over had jobs in some capacity in Census Tract 9601 in 2014 (U.S. Census Bureau 2016). The unemployment rate in Census Tract 9601 on 2014 was 6.6 percent. In Wenatchee the unemployment rate was 4.8 percent, and in Chelan County the unemployment rate was 5.7 percent. In 2014, per-capita personal income in the Census Tract 9601 was \$23,532, for Wenatchee per capita income was \$23,922, and Chelan County per capita income was \$25,619. In Census Tract 9601 15.5 percent of the population had an income below the poverty level, and in Wenatchee there were 13.7 percent, and in Chelan County 14.8 percent.

Environmental Justice

Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations was signed by President Clinton on February 11, 1994. This Executive Order directs federal agencies to take the appropriate and necessary steps to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of federal programs, policies, and activities on the health or environment of minority populations and low-income populations (collectively, the environmental justice populations) to the greatest extent practicable and permitted by law.

Guidelines provided by the CEQ (1997) and EPA (1998) indicate that a minority community may be defined where either 1) the minority population comprises more than 50 percent of the total population, or 2) the minority population of the affected area is meaningfully greater than the minority population in the general population of an appropriate benchmark region

used for comparison. Based on the Census Tract 9601 data, Environmental Justice is not considered an associated socioeconomic condition for the Project.

3.13.2 Environmental Consequences – Proposed Action

Construction Impacts

Population and Housing

Because staging and construction for the Proposed Action would occur between 2018 and 2020, the duration of the work would likely not be long enough to induce any permanent changes to population in Entiat Valley. Construction would require approximately 20 to 50 workers, with the workforce coming from both inside and outside Chelan County. Workers from outside Chelan County would likely reside temporarily within the county and have an indiscernible effect on the overall population of the study area. Any workers from out of the area would require temporary lodging in the local area and would likely occupy recreational vehicle parks and hotels or motels within a 35-mile driving distance from Project Area F (most downstream site). There is expected to be sufficient temporary lodging to accommodate this small increase in demand over the construction period.

Employment and Income

The temporary increase in jobs during construction would represent a very small proportion of the current workforce in the project area. For those people who get construction jobs, especially if they are currently unemployed, the individual effect would be beneficial and positive.

Construction of the Proposed Action is expected to cost approximately \$5.2 million as estimated in the Project's Basis of Design Report (Reclamation 2016b). This cost would include expenditures on materials and equipment, and expenditures on Reclamation – some of which would be spent locally in the project area. These local expenditures would have ripple effects on the economy, as workers and businesses that receive that money would spend some locally, and so on. These temporary direct and indirect expenditures would represent a small proportion of the total annual income in the study area.

Environmental Justice

During construction, properties adjacent to the project areas would experience short-term disturbances, including noise and dust from construction equipment and activities, and traffic delays from construction traffic. These effects would be greatest for the residences within Project Areas E and F. Projects are being constructed primarily on land owned by CDLT and would avoid directly affecting private land owners, with exceptions at Project Area E and F.

A private landowner at Area E (with no residence at Project Area E) and three landowners at Area F have been notified of the project and the need to construct temporary access roads on their property. To minimize disturbance on their properties, input from landowners on Areas E and F has been incorporated into the location of access roads across their properties, and LWM structure design on the river adjacent to their properties. To further minimize and reduce potential impacts of work at all project areas, the proposed work would be scheduled during daylight hours and would be limited to the appropriate allowed in water work window of approximately 60 to 90 days (other than some staging in upland areas could occur beyond the work window).

Because of the low population densities in Entiat Valley, census tracts are large, and do not provide sufficient detail on the race or income level area within each of the Project Area B, C, E, or F. As described above, construction of the Proposed Action would have a small but beneficial impact on the economy and temporary impacts on noise and air quality in the affected area. Individual landowners at Project Area E and F have been notified of the project. Minority and low income populations make up less than 6 percent and 25 percent, respectively, of the population in the census tract as shown in Table 3-12. Additionally, all persons, regardless of race or income, would experience the same effects associated with construction. Thus, construction of the Proposed Action would likely have no adverse or disproportionate effects on minority or low-income populations in the Project area or in Chelan County.

Post-construction Impacts

No known post-construction impacts on socioeconomic conditions would occur. The Project would be completed and no activities would occur that affect population, employment, or environmental justice.

3.13.3 Environmental Consequences – No Action

Under the No Action alternative, the Proposed Action would not occur; therefore, the effects related to construction would not happen, and there would be no effect on socioeconomics or environmental justice populations.

3.14 Cumulative Effects Analysis

Cumulative effects are the effects on the environment that result from the incremental effect of a proposed project when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time (40 CFR 1508.7). For the cumulative effects

analysis for this project, past and current actions are considered in the affected environment and environmental consequences sections for the different human and natural resources previously discussed in Chapter 3.

3.14.1 Past Actions

The nature and extent of resource management efforts that have resulted from past actions in the vicinity of the Project area are included in this chapter as part of the “Affected Environment” sections for each resource. Past actions with effects to the Entiat subbasin started in the early 1900s and include commercial timber harvest, road building, mining, sheep grazing, hayfields, commercial and residential development, stocking of non-native fish species, and other management actions with the potential to effect aquatic habitat. Wildfire suppression occurs as a land management activity and to protect property, structures, and human lives.

Natural processes such as wildfires occur in the Entiat Watershed and are expected to continue to occur on a semi-regular basis. Wildfires are part of the natural ecosystem process, but their intensity and extent may be affected by past actions such as timber harvest (that may affect stand density and forest age) and road building (that may serve as fire breaks). As part of the Basis of Design report (Reclamation 2016b), a fire history memorandum was prepared acknowledging the fires that have occurred in the Entiat Watershed (Wolverine fire of 2015, Duncan fire in 2014, Tyee fire in 1994, and Entiat and Gold Ridge fires in 1970). The most recent fires occurring in the last 10 years (Wolverine and Duncan fires) were located approximately 12 miles upstream of the Project location) and burned approximately 38,000 acres of the 270,000 acre Entiat Watershed.

Past actions also include habitat improvement projects that have been implemented in the Entiat Watershed in the past 5 to 10 years. Habitat improvement projects have been constructed both upstream of the Project area and downstream. Reclamation has implemented projects along the Tyee and Preston reaches upstream of the Project that total approximately 2 miles of restoration actions along the Entiat River. These two projects included 2,000 linear feet of side channel development, installation of forty LWM structures and numerous single logs, and riparian plantings and enhancement. Approximately 12 miles downstream of the Project, Reclamation developed the 1,500-foot-long Harrison side channel enhancement and habitat complexity project that included five LWM structures. Other habitat projects have been constructed along the Entiat River by other project sponsors such as the YN. The YN has treated approximately 1 mile of instream river habitat that includes 7 LWM structures, 0.75 mile of created side channel, and 9 acres of improved riparian habitat. These habitat improvement efforts have focused on improving the quantity and quality of habitats available to ESA-listed fish species.

3.14.2 Present and Reasonably Foreseeable Future Actions

Present actions are those projects, developments, and other actions that are currently underway, because they are either under construction or occurring on an ongoing basis. Reasonably foreseeable future actions generally include those actions formally proposed or planned, or highly likely to occur based on available information. Various sources, including local, state, and federal agency websites and city and county staff, were consulted to obtain information about any current and potential future development in the project vicinity. For this analysis, a reasonably foreseeable time period of the next 10 years is considered when other projects may occur. This is based on several factors such as:

- Anticipated continuance of state and federal funding opportunities for salmon recovery habitat projects,
- USACE's Nationwide Permit No. 27 (Aquatic Habitat Restoration Activities) that can be issued for restoration projects is valid through 2022,
- Monitoring programs commonly associated with state and federal permits for aquatic habitat projects are typically 5-10 years for projects where scrub shrub and forested wetlands are restored (Section 401 water quality certification and Section 404 wetland fill permit of the Clean Water Act) (WDOE, USACE, and EPA 2006; USACE 2008), and
- Anticipated continued listing of UCR spring Chinook salmon and UCR steelhead under the Endangered Species Act and Reclamation's ongoing commitment to meet the FCRPS BiOp habitat complexity goals as noted in Chapter 1.

Although Reclamation does not currently have other projects planned in the foreseeable future on the Entiat River, there are two known projects planned by other project proponents.

The USFS, in partnership with the YN and BPA, is proposing to implement a fish habitat enhancement project on the Entiat River in 2018 and a FONSI was signed April 2017. This project known as the Upper Stillwater Restoration Project is planned for construction by the YN on USFS property approximately 5.5 miles upstream of the project area. The purpose of the Stillwater project is to improve aquatic habitat within the Entiat River at key locations along the Entiat River Road, re-establish river processes along the margins of the Entiat River via placement of approximately 75 LWM structures, and re-connect a 2,000-foot long side channel to promote continued improvement in aquatic and riparian conditions.

Another proposed project would be located immediately upstream of Project Area B. The Yakama Nation is proposing a restoration project that would likely include placement of LWM structures in the river and a side channel reconnection. A NEPA decision document has not yet been completed and the timing of the project construction is unknown at this time, but anticipated within the next several years.

Other restoration projects may be proposed by local sponsors as part of ongoing state and federal funding associated with salmon recovery; but none are currently known.

The cumulative effects analysis assumes that many of the same construction techniques, equipment, and types of river crossings would likely apply to these future projects as described for the Project in Chapters 2 and 3. Construction periods would be similar (i.e., 60 to 90 days per construction season) to meet the restricted periods when work can occur in aquatic resources. Because of the similar nature of the restoration features in these potential future projects to the proposed Project (i.e., LWM structures, side channel enhancement, and access roads required to construct the project), it is assumed the types of impacts on human and natural resources would be similar. The cumulative effects of these projects is discussed in the following sections.

3.14.3 Soils and Geology

The proposed project and other foreseeable projects would contribute to the cumulative effects on soils and geology when added to the past, present and reasonable foreseeable future actions. The cumulative effect as realized in the post-construction condition would result in more channel migration, sediment transport, and during higher river flows, increased sediment movement onto floodplains through the reconnection of river flows to side channels and floodplain (as compared to naturally low summer flows). These are natural river processes, which is one of the goals of river restoration projects. As stated in Section 3.4, any potential for an increased response to runoff, erosion, flash floods, debris flows and sediment deposition from post fire is generally limited to within 3 years after a fire, once watershed vegetation and soils recover (Reclamation 2016b). This analysis considers the soils and geology within the Project area and upstream to the other two reasonably foreseeable projects.

3.14.4 Vegetation and Wetlands

Vegetation and wetlands are considered for the proposed Project and area where the foreseeable projects would occur. The proposed Project would contribute to the cumulative effects on vegetation and wetlands. There would be a very small permanent loss of vegetation from the construction of LWM structures and side channels (compared to all the naturally vegetated areas in the floodplain at the project sites and in the watershed); and a temporary loss of vegetation to develop construction access roads and staging areas. However, during the foreseeable future, revegetation with native plants of construction disturbance areas, upper banks of side channels, and other floodplain areas would result in the establishment of native riparian floodplain vegetation. Wetlands would benefit from the project and reasonably foreseeable projects through the creation of new wetlands and rehabilitation of existing wetlands.

3.14.5 Water Resources

The Project and other foreseeable projects would contribute to cumulatively impact water resources through sediment discharges and vegetation removal from construction actions within the subbasin where the Project and foreseeable projects would occur. Cumulative impacts on water resources would occur during project construction as localized turbidity and sediment discharge. BMPs and design features would minimize and reduce these impacts (see Table 2-6) during the post-construction period. For the reasonable foreseeable future, Project effects would cumulatively benefit water resources by restoring connections to adjacent floodplains and historical side channels that would increase flood storage capacity, reducing flood risk to downstream properties and infrastructure. The placement of LWM structures would improve floodplain sediment storage as part of the re-establishment of natural river processes. By capturing sediment on the floodplains and behind LWM structures, the project would help to decrease potential effects from natural sediment run off. While some sediment would likely be released during construction, once implementation of the project was complete the project would, in combination with past, present, and future habitat improvement actions, contribute to improving flood storage, sediment storage, and overall water quality in the Entiat River subbasin. As discussed in Section 3.4, any water resource issues related to post-fire conditions are not expected to occur.

3.14.6 Fish and Wildlife Habitat

Within the context of the foreseeable future for fish habitat, the cumulative effects of the Project and past/present/foreseeable actions would result in beneficial conditions for fish. Projects are designed to provide increased cover, forage, rearing, and resting habitat for UCR spring Chinook salmon and UCR steelhead. Creation and reconnection of side channels would provide juvenile rearing habitat and the construction of LWM structures would result in the development of increased pool holding habitat and cover. These restoration projects are specifically targeted to cumulatively address the need for improvements in habitat quality in the Entiat River as identified in the FCRPS BiOp (NOAA Fisheries 2008, 2014; USFWS 2013).

Wildlife habitat would also be created or enhanced following construction of the Project and the other foreseeable projects through the creation of side channels, creation and rehabilitation of wetlands, and riparian revegetation. In addition, restoration actions would be protected where it occurs on CDLT owned lands, as one of their missions is to protect natural areas to promote clean air and water and provide abundant wildlife opportunities. Aquatic permits issued by regulatory agencies for project construction also typically require 5 to 10-year monitoring to ensure riparian and wetland habitats persist, with these restoration sites protected in perpetuity.

3.14.7 Visual Resources

There are no major construction projects or other development planned in the immediate vicinity of the Project area that would be visible to the same sensitive viewer groups (see Section 3.6). Residents along the Entiat River Road would see more truck use on the road and would be able to see some construction equipment in places where the road is adjacent to the river. The impact would be during the construction seasons for the individual projects. During the post-construction period, more LWM structures would be visible to recreationists using the river. However, LWM structures would be designed to replicate the look of natural structures and over time as wood bleaches and other wood debris collects on the structures, they would resemble natural features.

3.14.8 Cultural Resources, Sacred Sites, and Indian Trust Assets

Within the context of this Project there would be no direct or indirect impacts to historic properties, cultural resources, ITAs, or Sacred Sites, and therefore no contribution to cumulative impacts (See Sections 3.7, 3.8, and 3.9). In the event of a post-review discovery during construction, Reclamation would implement an Inadvertent Discovery Plan that would be prepared before construction occurs, which would halt all ground-disturbing activity in the vicinity of the find and immediately notify Reclamation cultural resource staff. In the context of a post-construction time frame, the Project could provide more fish that would become available for tribal members exercising their treaty and traditional rights to fish. The greater availability of fish at locations along the Entiat River would serve to enhance tribal traditional cultural practices and could result in overall positive benefit to cultural resources.

3.14.9 Land Use and Recreation

The geographical area considered for cumulative effects on land use and recreational resources is the Project area along with the area associated with the two foreseeable future projects. Land use and recreation in the Entiat River subbasin have incrementally changed because of past and present development, and this trend is expected to continue. However, there would be no cumulative effects from the project to land use because land use is not expected to change in the action area. While recreational users of the river would encounter additional LWM structures in the river, the Project's structures have been designed using Reclamation's RBDGs and adjusting the design and location of LWM structures based on input received during a field meeting with recreational river users.

According to the 2010 Chelan County SMP, the town of Entiat is planning on adding three additional access points for boating in anticipation of additional tourism over the next 10

years. As of 2018 these three new access points are still in the planning stage. Entiat is also planning for additional fishing access points, shoreline trails and parks and open space. The proposed project would be in conformance with the Chelan County SMP. The final placement of LWM would not prevent access to the river immediately downstream of both the existing and previously planned boats ramps to ensure boater safety. The creation of side channels and alcoves would be consistent with objective of securing additional open space.

3.14.10 Noise, Air Quality, and Public Health and Safety

The Proposed Action would cause a temporary increase in noise levels for nearby residents, and recreationalists during construction. Noise levels and sources of noise from the other foreseeable future projects would be similar to the incremental impact of the Proposed Action's noise when added to existing noise sources (cars on Entiat River Road) described in Section 3.11. The cumulative effect of the Project and other foreseeable projects would be temporary and limited to the 60 to 90 day construction periods during each year of the construction period associated with the projects. No noise impacts post construction would occur.

Ongoing vehicular use, wildfires (and the management and suppression of fires), timber harvest, and residential sources in the Entiat River subbasin all contribute to ambient air pollutant emissions. These sources of pollutants would continue to occur. When the Proposed Action's construction impacts are combined with present and reasonably foreseeable future actions in the affected area, there would be a small amount of pollutant levels during the each year of the construction period. No air quality impacts would occur post construction. The cumulative effect of the Project when combined with the reasonable foreseeable projects would be minor.

3.14.11 Transportation

The Proposed Action would cause noticeable increases in traffic during construction with associated truck traffic. Construction of the Upper Stillwater Restoration project and the project upstream of Area B would also contribute to construction traffic along Entiat River Road from the Upper Stillwater project to its intersection with U.S. 97 as described in Section 3.12. The primary sources of traffic along Entiat River Road are residential, recreational, and agricultural and these sources are expected to continue. Traffic increases would be limited to the time the different projects are scheduled for construction and would not result in extended periods of increased traffic during the post-construction time frame.

3.14.12 Socioeconomics

Construction of the Project, the Upper Stillwater project, and the project upstream of Area B in the Entiat River subbasin may contribute to the local economy, as well as temporarily affect population and housing, employment, and income. The effects of the Proposed Action and other foreseeable projects would primarily be limited during the construction period when construction workers could spend money associated with lodging and supplies needed during the construction periods; no post-construction impacts are anticipated. There is no anticipated effect on environmental justice populations from the Project or other restoration projects.

This page intentionally left blank.

Chapter 4 ENVIRONMENTAL CONSULTATION, REVIEW, AND PERMIT REQUIREMENTS

This chapter briefly describes the overall environmental consultation and coordination with responsible agencies associated with the local, state, and federal laws, regulation, executive orders, and policies that are pertinent to the Project.

4.1. National Environmental Policy Act

Reclamation prepared this Draft EA pursuant to regulations implementing NEPA (42 U.S.C. 4321 et seq.), which requires federal agencies to assess the effects that their actions may have on the environment. NEPA requires preparation of an EIS for major federal actions significantly affecting the quality of the human environment. Reclamation prepared this Draft EA to determine if the Proposed Action would create significant environmental effects that would warrant preparing an EIS, or if a FONSI is justified.

4.2. Wetlands, Floodplains, and Water Resources

Executive Order 11988, dated May 24, 1977, instructs federal agencies to determine prior to taking an action whether the Proposed Action would occur in a floodplain. If the action does occur in a floodplain, the agency must consider alternatives to avoid adverse effects to the greatest extent practicable. If the only feasible alternatives are located within a floodplain, the agency shall take action to design or modify its action to minimize potential harm to or within the floodplain consistent with regulations accompanying Executive Order 11988. Section 3.4 Water Resources addresses floodplains.

Executive Order 11990, dated May 24, 1977, directs federal agencies to take action to minimize the destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial value of wetlands in carrying out programs affecting land use. Wetlands provide great natural productivity, hydrological utility, environmental diversity, natural flood control, improved water quality, recharge of aquifers, flow stabilization of

streams and rivers, and habitat for fish and wildlife resources. Section 3.3 Vegetation and Wetlands addresses wetlands and Section 3.5 addresses fish and wildlife resources.

Several sections of the Clean Water Act (33 U.S.C 1251 et seq.) and Washington State's Shoreline Management Act (90.58 RCW) address wetland and waterway management, regulation, and protection. The project Sponsors would submit a Joint Aquatic Resources Permit Application (JARPA) to the USACE, WDOE, and WDFW before construction. The applicable regulations to the project are discussed below.

4.2.1 Clean Water Act Section 401

A federal permit to conduct an activity that causes discharges into navigable waters is issued only after the State of Washington certifies that existing water quality standards would not be violated if the permit were issued. The WDOE would review the project's Section 401 and Section 404 permit applications for compliance with Washington water quality standards and grant certification if the permits comply with these standards. In the state of Washington, the JARPA process is used for project applicants to apply for Section 401 project review and certification. For the Project, the local sponsor associated with each project area (i.e., CCNRD for Project Area B, CCFEG for Project Area C, CCD for Project Areas E and F) would be responsible for completing the JARPA and submitting application materials to the WDOE for the 401 water quality certification.

4.2.2 Clean Water Act Section 402

This section authorizes National Pollutant Discharge Elimination System permits for the discharge of pollutants, such as stormwater. The EPA, Region 10, has a general permit for discharges from construction activities. The Sponsors would issue a Notice of Intent to get coverage under this general permit, and would prepare a stormwater pollution prevention plan to address stabilization practices, structural practices, stormwater management, and other controls.

4.2.3 Clean Water Act Section 404

When dredged or fill material discharges into waters of the United States, including wetlands, it requires authorization from the USACE in accordance with the provisions of Section 404 of the Clean Water Act. The Sponsors would work with the USACE to get a Section 404 permit for fill placed in wetlands or other waters, and work with DOE to get Section 401 water quality certification (see Section 4.2.1). Sections 3.3 (Vegetation and Wetlands) and 3.4 (Water Resources) of this EA describe potential effects on wetlands and other waters. In the State of Washington, the JARPA process is used for project applicants to apply for Section 404 project review and approval. For the Project, the local sponsor associated with each

project area (i.e., CCNRD for Project Area B, CCFEG for Project Area C, CCD for Project Areas E and F) would be responsible for completing the JARPA and submitting to USACE for the 404 wetland fill permit.

Wetland permits issued by the USACE may be an individual permit, or a permit authorized under the nationwide permit (NWP) process per 33 CFR Chapter II, FR V82 No.4. Currently there are 54 NWP's with one of the NWP's designated for aquatic habitat restoration, establishment, and enhancement activities (NWP 27). The USACE determines if the proposed project meets the general, national, and regional conditions associated with the NWP process. If not, the project is reviewed under the individual permit process.

4.3. Fish and Wildlife

4.3.1 Endangered Species Act

The ESA and its amendments (16 U.S.C. 1531 et seq.) require federal agencies to ensure that the actions they authorize, fund, and carry out do not jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat. The effects on species listed under the ESA are discussed in Chapter 3.5 of the EA. As a federal agency, Reclamation has met its ESA Section 7 responsibilities using various mechanisms. For spotted owls, Reclamation used the technical memorandum approach as directed by the USFWS. Reclamation addressed the remaining listed species under the USFWS purview using the Washington State Fish Passage and Habitat Enhancement Restoration Programmatic Consultation BiOp issued to the USACE (NOAA Fisheries and USFWS 2008). On January 11, 2018, USFWS agreed that the Project is consistent with the Programmatic, and effects to Bull Trout and Bull Trout critical habitat are covered therein. The Programmatic BiOp is set to expire before Project completion. Consultation on effects to Bull Trout and its designated critical habitat will need to be reinitiated if the Project is not consistent with any future Programmatic and Incidental Take Statement issued prior to Project completion. USFWS also concurred with the determination of "may affect, not likely to adversely affect" for the northern spotted owl.

Relative to ESA-listed anadromous salmonids, Reclamation used the current USACE programmatic consultation process with NOAA Fisheries (Fish Passage and Restoration Actions in Washington State – NOAA Fisheries 2017). On January 11, 2018, NOAA Fisheries concurred that the Project is consistent with the Programmatic BiOp and approved the minor requested modification of in-water work windows and staging areas in the programmatic, as described in the EA.

For spotted owls, Reclamation would use the technical memorandum approach as directed by the USFWS. Reclamation would address the remaining listed species under the USFWS purview using the Restoration Programmatic for the State of Washington issued to the USACE. This process requires Reclamation to complete a Specific Project Information Form. Relative to ESA-listed anadromous salmonids, Reclamation would either prepare a project-specific biological assessment for review and approval by NOAA Fisheries, or use the current USACE programmatic consultation process with NOAA Fisheries (NOAA Fisheries 2017).

4.3.2 Fish and Wildlife Conservation Act and Fish and Wildlife Coordination Act

The Fish and Wildlife Conservation Act of 1980 (16 U.S.C 2901 et seq.) encourages federal agencies to conserve and promote conservation of non-game fish and wildlife and their habitats. The Fish and Wildlife Coordination Act (16 U.S.C. 661 et seq.) requires federal agencies with projects affecting water resources to consult with USFWS and the state agency responsible for fish and wildlife resources. Section 3.5 provides an analysis of the Project's benefits and impacts relative to fish and wildlife species and habitat. Impacts that may occur during construction may be reduced and minimized by BMPs and the Project's design features as described in Chapter 2. Beneficial impacts would be realized during the post-construction time frame as the project increases off channel habitat for juvenile fish, improves in stream habitat complexity for various fish life stages, and increases wildlife habitat through creation and rehabilitation of wetlands. Reclamation is addressing the potential effects of the project on ESA-listed fish and wildlife species through Section 7 ESA consultation with both USFWS and NOAA Fisheries. The USFWS, NOAA Fisheries, and WDFW have been notified of the project and will be sent copies of the Draft and Final EA.

4.3.3 Migratory Bird Treaty Act and Federal Memorandum of Understanding

The MBTA of 1918, as amended, implements various treaties and conventions between the United States and other countries, including Canada, Japan, Mexico, and Russia, for the protection of migratory birds (16 U.S.C 703–712). Under the act, taking, killing, or possessing migratory birds, or their eggs or nests, is unlawful. The act classifies most species of birds as migratory, except for upland and nonnative birds such as pheasant, chukar, gray partridge, house sparrow, European starling, and rock dove.

Reclamation (through the DOI) and USFWS have a memorandum of understanding to address migratory bird conservation in accordance with Executive Order 13186 (Responsibilities to Federal Agencies to Protect Migratory Birds). This order directs each federal agency taking actions that could negatively affect migratory birds to work with the USFWS to develop an agreement to conserve those birds (DOE and USFWS 2013). The memorandum of

understanding addresses how both agencies can work cooperatively to address migratory bird conservation, and includes specific measures to consider implementing during project planning and implementation.

The analysis in Section 3.5.2 of this EA describes the Project's effect on migratory birds and how the Project requires revegetation of areas that would restore habitat temporarily disturbed during construction. Project construction would be conducted between July and October, which is outside the nesting period for many migratory birds.

4.3.4 Bald Eagle and Golden Eagle Protection Act

The B&GEPA (16 U.S.C. 668–668d) addresses taking or possessing of and commerce in bald and golden eagles, with limited exceptions. The Act only covers intentional acts or acts in “wanton disregard” of the safety of bald or golden eagles.

Bald and golden eagles may occur in the project site (Section 3.5). However, PHS data do not indicate the presence of any bald eagle nest sites or winter roost sites, or the presence of golden eagle breeding activity in the project area. Because the project would not involve knowing take or other acts in wanton disregard of bald or golden eagles, its implementation would not violate the provisions of the B&GEPA.

4.4. Land Use Plan Consistency

The Chelan County Comprehensive Plan (Chelan County 2016) establishes policies to guide development of the county. Zoning and other development regulations must be consistent with the comprehensive plan. The Comprehensive Plan identifies policies for Natural Resources and Environment and Title 11 and 13 of the associated County's Code provide regulations for environment and critical areas. As indicated in Section 3.10 construction activities would occur in the main channel of the Entiat River and result in no changes to land use. Also, there would be no change in land use from temporary access road construction and staging of materials. The Project is designed for consistency with planning policies, the County Code, and Chelan County's Shoreline Master Plan's Conservancy shoreline designation (Chelan County 1980), and Chelan County's draft 2017 SMP recommended for adoption that recognizes the Entiat River shoreline within the four project areas as “Natural” and “Conservancy” land designations (The Watershed Company et al. 2017).

Chelan County would be applying for the following state and county permits and approvals:

- Washington Department of Fish and Wildlife Hydraulic Project Approval
- Chelan County State Environmental Policy Act Determination
- Chelan County Shoreline Permit Exemption.

4.5. Cultural and Historic Resources

Laws and regulations govern the management of cultural resources. A cultural resource is an object, structure, building, site, or district that provides irreplaceable evidence of natural or human history of national, state, or local significance, such as National Landmarks, archaeological sites, and properties listed (or eligible for listing) in the NRHP. Cultural resource-related laws and regulations include the following:

- Antiquities Act of 1906, (54 U.S.C. Subtitle III, National Preservation Programs, Division C-American Antiquities § 320101-320303); 18 U.S.C. § 1866(b),
- Historic Sites Act of 1935, (54 U.S.C. § 320101- 320106; 54 U.S.C. § 102303, 102304; 54 U.S.C. § 309101),
- Section 106 of the NHPA (54 U.S.C. § 300101 et seq.), as amended,
- Archaeological Data Preservation Act of 1974, (54 U.S.C. § 312501-312508),
- Archaeological Resources Protection Act of 1979 (16 U.S.C. 470aa-mm), as amended,
- Native American Graves Protection and Repatriation Act (25 U.S.C. 3001 et seq.),
- Executive Order 13007 Indian Sacred Sites, and
- American Indian Religious Freedom Act of 1978 (42 U.S.C. 1996, 1996a).

Section 106 of the NHPA requires federal agencies to consider the effects of their actions on historic properties. The regulations that implement Section 106 define “historic property” as follows:

Historic property means any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places maintained by the Secretary of the Interior. This term includes artifacts, records, and remains that are related to and located within such properties. The term includes properties of traditional religious and cultural importance to an Indian tribe or Native Hawaiian organization and that meet the National Register criteria [36 CFR 800.16(l)(1)].

After historic properties have been identified, federal agencies then assess effects to historic properties along with interested and affected parties such as tribes and state historic preservation offices, and then work to resolve those adverse effects.

To this end, BPA provided information about the Proposed Action to, and requested information from various agencies and tribes, on the level and type of proposed identification and evaluation efforts of the prehistoric resources. Agencies consulted include the WDAHP, CCT, and YN. Public notification was also made regarding the project. The WDAHP concurred with BPA’s Finding of No Historic Properties Affected. Reclamation has not changed the project design from when BPA consulted on the project. Reclamation has

adopted the documentation and findings prepared by BPA. Reclamation received concurrence on the adoption from WDAHP on October 30, 2017. On November 29, 2017 CCT provided an email to Reclamation documenting concurrence with the undertaking, APE, level of effort, and the finding of “no adverse effect.” The YN have been consulted, but no response has been received after receipt of letters from BPA or Reclamation.

A Finding of No Historic Properties Affected and No Adverse Effect means that Reclamation would have no further obligations under the Section 106 process for this project other than making sure that any post-review or inadvertent discoveries are properly addressed. However, a change in project design as a part of adaptive management would likely require reinitiation of the Section 106 consultation process for the proposed work and a change in project footprint would require reinitiation of the consultation process.

4.6. Sacred Sites

Executive Order 13007, dated May 24, 1996, instructs federal agencies to promote accommodation of access to, and protect the physical integrity of, American Indian sacred sites. A sacred site is a specific, discrete, and narrowly delineated location on federal land. An Indian tribe or an Indian individual determined to be an appropriately authoritative representative of an Indian religion must identify a site as sacred by virtue of its established religious significance to, or ceremonial use by, an Indian religion, provided that the tribe or individual is an appropriate authoritative representative of an Indian religion. No Sacred Sites were identified during consultation with tribes. See Chapter 3.8 for a discussion of Sacred Sites.

4.7. Indian Trust Assets

ITAs are addressed in Chapter 3.9. ITAs are legal interests in property held in trust by the United States (with the Secretary of the Interior acting as trustee) for Indian tribes or Indian individuals. Examples of ITAs are lands, minerals, hunting and fishing rights, and water rights. In many cases, ITAs are on-reservation; however, they may also be found off-reservation.

The United States has an Indian trust responsibility to protect and maintain rights reserved by or granted to Indian tribes or Indian individuals by treaties, statutes, and Executive Orders (Secretarial Order 3175: Department Responsibilities for Indian Trust Assets). These rights are sometimes further interpreted through court decisions and regulations. This trust responsibility requires that officials from federal agencies, including Reclamation, take all actions reasonably necessary to protect ITAs when administering programs under their control. As stated in Chapter 3.9, there would be no change in the ability to exercise existing

treaty rights from this project. No ITAs have been identified in the affected area and there would be no loss, damage, unlawful alienation, waste, and depletion of ITAs.

4.8. Air Quality

The Clean Air Act, as amended (42 U.S.C. 7401 et seq.), requires the EPA and states to carry out a wide range of regulatory programs intended to comply with the National Ambient Air Quality Standards. In Washington, both the EPA and DOE are responsible for air quality. The Project area is classified by the WDOE as being in attainment of the National Ambient Air Quality Standards. Air quality standards would be maintained as Project emissions from construction activities would be temporary and localized in nature, and the use of BMPs would reduce and minimize release of particulate matter in the air.

4.9. Noise

The Noise Control Act of 1972 (42 U.S.C. 4901 et seq.) sets forth a broad goal of protecting all people from noise that jeopardizes their health or welfare. The Act further authorizes federal agencies to carry out the programs within their control to further this policy. The noise effects from the Project would be temporary during the construction period for people within 2,000 feet of construction. Section 3.11 describes the noise effects associated with the Project.

4.10. Spill Prevention and Control

Several federal laws related to petroleum products and toxic substances potentially apply to the project, depending upon the quantities and types of materials being used.

4.10.1 The Spill Prevention, Control, and Countermeasures Rule

The Spill Prevention Control and Countermeasures Rule (40 CFR Part 112) includes requirements to prevent discharges of oil and oil-related materials from reaching navigable waters and adjoining shorelines. It applies to facilities with total aboveground oil storage capacity (not actual gallons onsite) of greater than 1,320 gallons, and facilities with belowground storage capacity of 42,000 gallons. This project does not propose onsite below ground storage of oil or oil-related materials. Chapter 2 recognizes it is the responsibility of the construction contractor to adhere to all spill prevention, containment/ and counter measures described in the construction plans and specifications that would be prepared for the Project.

4.11. Environmental Justice

In February 1994, the President released Executive Order 12898, Federal Actions to Address Environmental Justice in Minority and Low-Income Populations. This order directs federal agencies to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority and low-income populations. The proposed project would not cause disproportionately high and adverse effects on minority and low-income populations (see Section 3.14).

Page intentionally left blank.

Chapter 5 CONSULTATION AND COORDINATION

5.1 Introduction

Those consulted include local, state, and federal agencies and tribes in the project vicinity. Specific individuals were consulted to gather information and data about the project area and applicable requirements, as part of consultation, or for permit applications. This chapter closes with a list of preparers of this EA.

5.2 Federal Agencies

- NOAA Fisheries Service
- BPA
- USACE
- USFWS

5.3 State Agencies

- WDFW
- WDAHP
- WDOE

5.4 Tribes

- CCT
- YN

5.5 Local Governments

- Chelan County – Chelan County Natural Resource Department
- Entiat, Washington

5.6 Others

- Chelan Douglas Land Trust
- Cascadia Conservation District
- Cascade Columbia Fisheries Enhancement Group

5.7 Preparers

The following contributors to the EA are part of Reclamation’s Pacific Northwest Region Office and their contractors and subcontractors.

- Reclamation
 - Ecosystems Analysis
 - Columbia-Snake Salmon Recovery Office
 - Columbia-Cascades Area Office
 - Land Resources
 - Project Management and Coordination
- Contractors
 - ICF International
 - Natural Systems Design

Chapter 6 REFERENCES

Parenthetical Reference	Bibliographic Citation
77 FR 71875	Federal Register. 2012. <i>Endangered and Threatened Wildlife and Plants: Designation of Revised Critical Habitat for the Northern Spotted Owl; Final Rule</i> . No. 233 December 4, 2012. Part II Department of the Interior Fish and Wildlife Service. 50 CFR Part 17. Vol. 77, No. 233, pp. 71876-72068.
79 FR 19594	Federal Register. 2008. Department of the Army, Corps of Engineers. 33CFR Parts 325 and 332 Environmental Protection Agency. 40 CFR Part 230 Compensatory Mitigation for Losses of Aquatic Resources: Final Rule. Vol. 79, No. 70, pp. 19594-19705
Abbe and Montgomery 2003	Abbe, T.B., and D.R. Montgomery. 2003. "Patterns and processes of wood debris accumulation in the Queets river basin, Washington." <i>Geomorphology</i> 51 (1-3): 81–107 DOI: 10.1016/S0169-555X(02)00326-4
Abbe et al. 2003	Abbe, T.A., A.P. Brooks, and D.R. Montgomery. 2003. "Wood in river rehabilitation and management." Pages 367-389 in S. V. Gregory, K. 1. Boyer, and A. M. Gurnell, editors. <i>The ecology and management of wood in world rivers</i> . American Fisheries Society, Symposium 37, Bethesda, Maryland.
Aho and Beielser 2007	Aho, T. L., & Beielser, V. 2007. <i>Soil Survey of Cashmere Mountain Area, Washington, Parts of Chelan and Okanogan Counties</i> . Natural Resources Conservation Service.
Ames et al. 1998	Ames, K. M., D. E. Dumond, J. R. Galm, and R. Minor 1998. "Prehistory of the Southern Plateau." In <i>Handbook of North American Indians, Volume 12: Plateau</i> , edited by D. E. Walker, pp. 103-119. Smithsonian Institution Press, Washington, D.C.
Andonaegui 1999	Andonaegui, C. 1999. <i>Salmon and steelhead habitat limiting factors report for the Entiat Watershed Water Resource Inventory Area (WRIA) 46, Version 3</i> . Olympia, Washington: Washington State Conservation Commission.

References

Parenthetical Reference	Bibliographic Citation
Aubrey et al. 2014	Aubrey, K.B; Rohrer, J; Raley, C.M.; Fitkin, S. 2014. "Wolverine Distribution and Ecology in the North Cascades Ecosystem - 2014 Annual Report (December 30, 2014)."
Bash et al. 2001	Bash, J., C. Berman, and S. Bolton. 2001. <i>Effects of Turbidity and Suspended Solids on Salmonids</i> . Center for Streamside Studies, College of Forest Resources. University of Washington. In press for Washington State Department of Transportation. Seattle, WA.
Bellmore et al. 2012	Bellmore, J. R., C. V. Baxter, K. Martens, and P. J. Connolly. 2012. "The floodplain food web mosaic: a study of its importance to salmon and steelhead with implications for their recovery." <i>Ecological Applications</i> 23(1):189-207.
Beranek 1988	Beranek, Leo, L. 1988. <i>Noise and Vibration Control</i> . McGraw-Hill, Inc. Published by Institute of Noise Control Engineering. Washington, D.C.
Berger and Hartmann 2015	Berger and Hartmann. 2015. <i>Cultural Resources Assessment of the Middle Entiat Restoration Project, Chelan County, Washington</i> . Prepared for Bonneville Power Administration. August 28, 2015, Revised September 9, 2015. CRC Project #1504J
BPA 2016	Bonneville Power Administration. 2016. HIP III Handbook, Version 3.0. Downloaded: July 5, 2016. https://www.bpa.gov/efw/Analysis/NEPADocuments/esa/2016HIPIIIHandbookVer3.0.pdf
Cascadia Conservation District 2014	Cascadia Conservation District. 2014. <i>Middle Entiat Recreational Use Report</i> . Wenatchee, Washington.
CCCD 2004	Chelan County Conservation District. 2004. <i>Entiat Water Resource Inventory Area (WRIA) 46 Management Plan</i> . Chelan County Conservation District.
CDC 2017	Center for Disease Control and Prevention. 2017. World Map of Areas with Risk of Zika. Online at: https://wwwnc.cdc.gov/travel/page/world-map-areas-with-zika , Accessed June 8, 2017.
CEQ 1997	Council on Environmental Quality Executive Office of the President. 1997. Environmental Justice Guidance Under the National Environmental Policy Act. Washington, D.C. 20502. December 10. https://www.energy.gov/sites/prod/files/nepapub/nepa_documents/RedDont/G-CEQ-EJGuidance.pdf

Parenthetical Reference	Bibliographic Citation
Chapman 1995	Chapman, D. 1995. <i>Status of sockeye salmon in the mid-Columbia Region</i> . Boise, Idaho: Don Chapman Consultants, Inc.
Chelan County 1980	Chelan County. 1980. Shoreline Master Program for Chelan County.
Chelan County 2016	Chelan County. 2016. <i>Chelan County Comprehensive Plan</i> . Approved February 1, 2000 and last amended by Resolution 2016-109, effective December 20, 2016.
Chelan County 2017	Chelan County. 2017. Adaptive Management Program Agreement between Chelan-Douglas Land Trust and Chelan County Natural Resources Department for Entiat Restoration Projects.
Chelan County PUD 2017	Chelan County Public Utility District 2017. Rocky Reach Dam. Chelan County P.U.D. Electronic document. Accessed 14 June 2017. https://www.chelanpud.org/hydropower/rocky-reach-dam
Clemens et al. 2013	Clemens, B. J., S. van de Wetering, S. A. Sower, and C. B. Schreck. 2013. "Maturation Characteristics and Life-History Strategies of the Pacific Lamprey, <i>Entosphenus tridentatus</i> ." Canadian Journal of Zoology 91:775–788.
Conservation Northwest 2017	Conservation Northwest. 2017. Wolverine. Accessed online: https://www.conservationnw.org/our-work/wildlife/wolverine , October 26, 2017.
Craig and Suomela 1941	Craig, J., and Suomela, A. J. 1941. <i>Time of appearance of the runs of salmon and steelhead trout native to the Wenatchee, Entiat, Methow, and Okanogan rivers</i> . Unpub. MS. U.S. Fish and Wildlife Service.
DOE and USFWS 2013	Department of Energy and U.S. Fish and Wildlife Service. 2013. Memorandum of Understanding, Responsibilities of Federal Agencies to Protect Migratory Birds. Office of Enterprise Assessment. http://energy.gov/hss/downloads/memorandum-understanding-responsibilities-federal-agencies-protect-migratory-birds
DOI 1995	Department of the Interior. 1995. U.S. Department of the Interior Departmental Manual Part 512.2. Departmental Responsibilities for Indian Trust Resources. Available at: https://www.usbr.gov/native/policy/DM_Final_12-1-95_512%20DM%202.pdf .

References

Parenthetical Reference	Bibliographic Citation
DOI 2000	Department of the Interior. 2000. Secretarial Order 3215. Trust Principles. Office of the Special Trustee for American Indians (OST). April 2000. Online at: https://www.doi.gov/ost/about_us/Trust
English et al. 2001	English, K.K., C. Sliwinski, B.L. Nass, and J.R. Stevenson. 2001. <i>Assessment of adult steelhead migration through the Mid-Columbia River using radio-telemetry techniques, 1999-2000</i> . Report prepared by LGL Limited for Public Utility District No. 1 of Douglas County.
EPA 1974	Environmental Protection Agency. 1974. Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety. EPA 550/9 74-004. March.
EPA 1998	Environmental Protection Agency. 1998. Final Guidance For Incorporating Environmental Justice Concerns in EPA's NEPA Compliance Analyses. April 1998. https://www.epa.gov/sites/production/files/2014-08/documents/ej_guidance_nepa_epa0498.pdf
FEMA 1982	Federal Emergency Management Agency. 1982. <i>Flood Insurance Rate MapChelan County, Washington , Panel 375 of 1075</i> , Community-Panel 530015 0375 A.
FHA 2006	Federal Highway Administration. 2006. <i>Roadway Construction Noise Model (RCNM) User's Guide. Final Report</i> . FHWA-HEP-05-054, DOT-VNTSC-FHWA-05-01.
Fox and Bolton 2007	Fox, M. and S. Bolton. 2007. "A regional and geomorphic reference for quantities and volumes of instream wood in unmanaged forested basins of Washington state." <i>North American Journal of Fisheries Management</i> , 27, 342-359
Franklin and Dyrness 1988	Franklin, J., and Dyrness, C. 1988. <i>Natural Vegetation of Oregon and Washington</i> . Corvallis, Oregon: Oregon State University Press.
Gunkel 1961	Gunkel, Alexander 1961. A Comparative Cultural Analysis of Four Archaeological Sites in the Rocky Reach Reservoir Region, Washington. Theses in Anthropology No. 1. Department of Sociology and Anthropology, Washington State University, Pullman.
Halupka 2017	Halupka, Karl. 2017. Year. U.S. Fish and Wildlife Service. Fish and Wildlife Biologist. Central Washington Office. Wenatchee, Washington. Personal communication March 10.

Parenthetical Reference	Bibliographic Citation
Hamstreet 2012	Hamstreet, C.O. 2012. <i>Spring and summer Chinook salmon spawning ground surveys on the Entiat River, 2011</i> . U.S. Fish and Wildlife Service, Leavenworth, Washington.
Hamstreet and Carie 2002	Hamstreet, C., and D. Carie. 2002. <i>Spring and Summer Chinook Salmon Spawning Ground Surveys on the Entiat River, 2001</i> . Leavenworth, Washington: U.S. Fish and Wildlife Service Mid-Columbia R. Fishery Resource Office.
Harmon et al. 1986	Harmon, M.E., J.F. Franklin, F.J. Swanson, P. Sollins, S.V. Gregory, J.D. Lattin, N.H. Anderson, S.P. Cline, N.G. Aumen, J.R. Sedell, G.W. Lienkaemper, K. Cromack, Jr., and K.W. Cummins. 1986. "The ecology of coarse woody debris in temperate ecosystems." Pages 133-302 in A. MacFadyen and E. D. Ford, editors. <i>Advances in ecological research</i> . Volume 15. Academic Press, New York.
Holstine 1994	Holstine, Craig. 1994. "Timber Industry. In <i>An Historical Overview of the Wenatchee National Forest</i> ." Prepared for Wenatchee National Forest, Wenatchee, edited by Craig Holstine, pp. 8.1- 8.26. Archaeological and Historical Services Report No. 100-80, Eastern Washington University, Cheney.
Hruby 2014	Hruby, T. 2014. "Washington State Wetland Rating System for Eastern Washington: 2014 Update." Published by Department of Ecology. Publication Number 14-06-018
ICF International 2015	ICF International. 2015. <i>Wetland Delineation Report: Gray Reach and Stormy Reach Restoration Projects</i> . Seattle, Washington.
IEc 2013	Industrial Economics, Incorporated. 2013. <i>Upper Columbia River Recreational Use Survey: Summary of Visitor Characteristics</i> . Final Report. Prepared for National Park Service.
Julien 2002	Julien, P.Y. 2002. <i>River Mechanics</i> . Cambridge University Press. 434 pp.
Luttrell 1994	Luttrell, Charles. 1994. <i>Settlement In An Historical Overview of the Wenatchee National Forest Washington</i> , edited by Craig Holstine, pp. 3.1-3.34. Eastern Washington University Reports in Archaeology and History 100-80. Archaeological and Historical Services, Cheney, Washington.

References

Parenthetical Reference	Bibliographic Citation
Martens and Connolly 2014	Martens, K.D., and P.J. Connolly. 2014. "Juvenile Anadromous Salmonid Production in Upper Columbia River Side Channels with Different Levels of Hydrological Connection." Transactions of the American Fisheries Society. 30 April, 2014.
Meehan 1991	Meehan, W. R. (ed.). 1991. "Influences of Forest and Rangeland Management on Salmonid Fishes and Their Habitats." Special publication 19. American Fisheries Society. Bethesda, MD.
Miller 1998	Miller, Jay. 1998. "Middle Columbia River Salishans." In: Handbook of <i>North American Indians</i> , vol. 12, Plateau, edited by D.E. Walker, JR. pp. 253-270. Smithsonian Institution, Washington, D.C.
Mosey and Murphy 2000	Mosey, T. and Murphy, L. 2000. <i>Spring and Summer Chinook Spawning Ground Surveys on the Wenatchee River Basin, 2000</i> . Public Utility District No. 1 of Chelan County, Wenatchee, WA
Moyle 2002	Moyle, P.B. 2002. <i>Inland Fishes of California</i> . Revised and Expanded. Berkeley, CA: University of 7 California Press.
Mullan 1986	Mullan, J. W. 1986. <i>Determinants of sockeye salmon abundance in the Columbia River, 1880s -1982: a review and synthesis</i> . Leavenworth, Washington: U.S. Fish and Wildlife Service.
Nelson 2014	Nelson, M.C. 2014. <i>Spawning migrations of adult fluvial bull trout in the Entiat River, WA 2007-2013</i> . U.S. Fish and Wildlife Service, Leavenworth WA. 55pp.
NOAA Fisheries 2008	National Oceanic and Atmospheric Administration's National Marine Fisheries Service. 2008. <i>Endangered Species Act Section 7(a)(2) Consultation Biological Opinion And Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation</i> . Northwest Region. May 5, 2008.
NOAA Fisheries 2010	National Oceanic and Atmospheric Administration's National Marine Fisheries Service. 2010. <i>Endangered Species Act Section 7 (a)(2) Supplemental Biological Opinion. Supplemental Consultation on Remand for Operation of the Federal Columbia River Power System, 11 Bureau of Reclamation Projects in the Columbia Basin and ESA Section 10(a)(1)(A) Permit for Juvenile Fish Transportation Program</i> .

Parenthetical Reference	Bibliographic Citation
NOAA Fisheries 2013	National Oceanic and Atmospheric Administration's National Marine Fisheries Service. 2013. <i>Endangered Species Act Section 7 Formal Programmatic Biological and Conference Opinion, Letter of Concurrence, and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for Bonneville Power Administration's Habitat Improvement Program III (HIP III) KEC-4</i>
NOAA Fisheries 2014	National Oceanic and Atmospheric Administration's National Marine Fisheries Service. 2014. <i>Endangered Species Act Section 7 (a)(2) Supplemental Biological Opinion</i> . Consultation on Remand for Operation of the Federal Columbia River Power System NOAA Fisheries Log Number NWR-2013-9562
NOAA Fisheries 2017	National Oceanic and Atmospheric Administration's National Marine Fisheries Service. 2017. <i>Endangered Species Act Section 7(a)(2) Programmatic Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for the Fish Passage and Restoration Actions in Washington State (FPRP III)</i> . Action Agency: U.S. Department of the Army, Corps of Engineers. Issued June 21, 2017
NOAA Fisheries and USFWS 2008	National Marine Fisheries Service and U.S. Fish and Wildlife Service. 2008. <i>Endangered Species Act Section 7 Formal Consultation and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for the Washington State Fish Passage and Habitat Enhancement Restoration Programmatic</i> . Lead agency U.S. Army Corps of Engineers. Consultation conducted by National Marine Fisheries Service and U.S. Fish and Wildlife Service. Issued July 8, 2008.
NPCC 2004	Northwest Power and Conservation Council. 2004. <i>Entiat Subbasin Plan</i> .
Opperman et al. 2010	Opperman, J. J., R. Luster, B. A. McKenney, M. Roberts, and A. W. Meadows. 2010. "Ecologically Functional Floodplains: Connectivity, Flow Regime, and Scale." <i>JAWRA Journal of the American Water Resources Association</i> 46(2):211-226.
Pagel et al. 2010	Pagel, J.E., D.M. Whittington, and G.T. Allen. 2010. <i>Interim Golden Eagle inventory and monitoring protocols; and other recommendations</i> . Division of Migratory Bird Management, U.S. Fish and Wildlife Service.

References

Parenthetical Reference	Bibliographic Citation
Peven 1992	Peven, C.M. 1992. <i>Population status of selected stocks of salmonids from the mid-Columbia River basin</i> . Wenatchee, Washington: Chelan County Public Utility District.
Pollock et al. 2015	Pollock, M.M., G. Lewallen, K. Woodruff, C.E. Jordan and J.M. Castro (Editors) 2015. <i>The Beaver Restoration Guidebook: Working with Beaver to Restore Streams, Wetlands, and Floodplains</i> . Version 1.0. United States Fish and Wildlife Service, Portland, Oregon. 189 pp.
Reclamation 2009	Bureau of Reclamation. 2009. <i>Entiat Tributary Assessment, Chelan County, Washington</i> . Denver, Colorado: Technical Service Center.
Reclamation 2013a	Bureau of Reclamation. 2013. <i>Final Gray Reach Assessment Entiat River, Chelan County, Washington</i> . U.S. Bureau of Reclamation. Pacific Northwest Region. U.S. Department of the Interior. Boise, Idaho.
Reclamation 2013b	Bureau of Reclamation, 2013b. <i>Final Stormy Reach Assessment Entiat River, Chelan County, Washington</i> . U.S. Bureau of Reclamation. Pacific Northwest Region. U.S. Department of the Interior. Boise, Idaho.
Reclamation 2014	Bureau of Reclamation. 2014. <i>Large Woody Material – Risk Based Design Guidelines</i> . Boise, Idaho. U.S. Bureau of Reclamation. Pacific Northwest Region. U.S. Department of the Interior. Boise, Idaho.
Reclamation 2016a	Bureau of Reclamation. 2016a. <i>80% Preliminary Plans Not for Construction. Stormy Reach Project Area B; Project Area C; Gray Reach Project Area E; Project Area F</i> . Prepared by ICF, Natural Systems Design, Ch2M. Seattle, WA.
Reclamation 2016b	Bureau of Reclamation. 2016b. Post Construction Inspection Report (Draft), Entiat River, Gray & Stormy Reaches, Habitat Restoration Project. DRAFT. November 2016. (ICF 00070.16 and 00071.16) Seattle, WA. Prepared for the U.S. Bureau of Reclamation, Boise, ID.
Reclamation 2016c	Bureau of Reclamation. 2016c. <i>Basis of Design Report (80% Draft), Entiat River – Gray & Stormy, Habitat Restoration Projects</i> ; Seattle, Washington: Prepared by ICF and Natural Systems Design.
Reclamation 2017	Bureau of Reclamation. 2017. The History of Hydropower Development in the United States. Bureau of Reclamation, Hydropower Program. Electronic document. Accessed 14 June 2017. https://www.usbr.gov/power/edu/history.html

Parenthetical Reference	Bibliographic Citation
Roni et al. 2014	R Roni, P., G.R. Pess, T.J. Beechie, and K.M. Hanson. 2014. Fish-habitat relationships and the effectiveness of habitat restoration. U.S. Dept. Commer., NOAA Tech. Memo. NMFS-NWFSC-127.
Sage 1997	Sage, Ginger. 1998. Entiat Remembers: An Anthology of Pioneer Strengths (1 st ed). Ginger Sage Books, Entiat, Washington.
Schalk and Mierendorf 1983	Schalk, R.F., and R. Mierendorf (editors) 1983. Cultural Resources of the Rocky Reach of the Columbia River, Volumes I and II. Center for Northwest Anthropology, Washington State University, Pullman.
Smith 1983	Smith, Allan H. 1983. <i>The Native Peoples. In Cultural Resources of the Rocky Reach of the Columbia River</i> , edited by Randall F. Schalk and Robert R. Mierendorf, pp. 135-333. Center for Northwest Anthropology, Washington State University, Project Report 7, Pullman, Washington.
Stratten 2017	Stratten, Danny. 2017. ICF International. Restoration Designer/GIS Specialist. Bellingham, Washington. May 3, 2017 email.
Tatic et al. 2012	Tatic, B., N. Bogajevic, S. Todosijeovic, and Z Soskic. 2012. "Analysis of noise level generated by helicopters with various numbers of blades in the main rotor." 5pp.
Teit 1928	Teit, James A. 1928. <i>The Middle Columbia Salish</i> . University of Washington Publications in Anthropology 2:83-128. University of Washington Press, Seattle, WA
Tetra Tech 2014.	Tetra Tech. 2014. "2014 Annual Report Project Effectiveness Monitoring Program." Prepared for Washington State Recreation and Conservation Office Salmon Recovery Funding Board
The Watershed Company 2017	The Watershed Company, BERK, Chelan County Natural Resource Department and Chelan County Community Development Department. 2017. Chelan County Master Shoreline Program. Planning Commission Recommended Adoption. Online at http://www.co.chelan.wa.us/community-development/pages/shoreline-master-program?parent=Codes
U.S. Census Bureau 2016	U.S. Census Bureau. 2016. State and County QuickFacts. Available online at https://www.census.gov/quickfacts/table/PST045216/53007,00
USACE 2008	U.S. Army Corps of Engineers. 2008. Regulatory Guidance Letter No. 08-03. 10 October 2008. Washington, D.C.

References

Parenthetical Reference	Bibliographic Citation
USFS 1912	U.S. Forest Service. 1912. Chelan National Forest, Washington. U.S. Geological Survey, Washington, D.C. 2015 A Brief History of the Okanogan-Wenatchee National Forest. Electronic resource, http://www.fs.usda.gov/detail/okawen/about-forest/?cid=fsbdev3_053644#wen , accessed May 19, 2015.
USFS 1996	U.S. Forest Service. 1996. <i>Watershed Assessment Entiat Analysis Area, Version 2.0</i> . Wenatchee National Forest, Entiat Ranger District. Entiat, Washington.
USFWS 2004	U.S. Fish and Wildlife Service. 2004. Spring and summer Chinook salmon spawning ground surveys on the Entiat River, 2003. 18 pp
USFWS 2007	U.S. Fish and Wildlife Service. 2007. <i>National Bald Eagle Management Guidelines</i> . 23pp.
USFWS 2013	U.S. Fish and Wildlife Service. 2013. <i>Formal section 7 programmatic consultation on BPA's Columbia River Basin Habitat Improvement Program – Biological Opinion</i> . Oregon Fish and Wildlife Office, Portland, Oregon. TAILS no. 01EOFW00-2013-F-0199.
USFWS 2015	U.S. Fish and Wildlife Service. 2015. Recovery plan for the coterminous United States population of bull trout (<i>Salvelinus confluentus</i>). Portland, Oregon. Xii+179pp.
USFWS 2017a	U.S. Fish and Wildlife Service. 2017a. Accessed May 12, 2017 https://www.fws.gov/leavenworthfisheriescomplex/OurWork.cfm#ENFHWork
USFWS 2017b	U.S. Fish and Wildlife Service. 2017b. IPaC Resource List. Requested and received via USFWS IPaC web site on May 10, 2017: https://ecos.fws.gov/ipac/
USFWS and WNF 1996	U.S. Fish and Wildlife Service and Wenatchee National Forest. 1996. <i>Watershed assessment Entiat analysis area, v2.0</i> . U.S. Forest Service Wenatchee National Forest, Entiat Ranger District, Entiat, WA.
USGS 2017	U.S. Geological Survey. 2017. USGS 12452990 Entiat River Near Entiat, WA. https://waterdata.usgs.gov/nwis/uv?site_no=12452990

Parenthetical Reference	Bibliographic Citation
Washington DOH 2017	Washington State Department of Health. 2017. <i>West Nile Virus</i> . Online at: http://www.doh.wa.gov/YouandYourFamily/IllnessandDisease/WestNileVirus Accessed June 8, 2017.
WDFW 2013a	Washington Department of Fish and Wildlife. 2013a. Threatened and Endangered Wildlife in Washington: 2012 Annual Report. Listing and Recovery Section, Wildlife Program, Washington Department of Fish and Wildlife, Olympia. 251pp
WDFW 2013b	Washington Department of Fish and Wildlife. 2013b. Wildlife Program Weekly Report; Week of February 11-17, 2013.
WDFW 2017	Washington Department of Fish and Wildlife. 2017. Priority Habitat and Species data for the Gray and Stormy Project. Olympia, Washington.
WDOE, USACE, and EPA 2006	Washington Department of Ecology, U.S. Army Corps of Engineers, and Environmental Protection Agency. Region 10. 2006. Wetland Mitigation in Washington State, Parts I and 2. Publication # 06-06-11a, 11b. Olympia, Washington
Whitehall 2015	Whitehall, R. 2015. Letter to Chris Clemons and Matt Wilderding of the Yakima Nation Fisheries, Yakama. Wenatchee, Washington: Okanogan – Wenatchee National Forest, U.S. Department of Agriculture Forest Service.
Wiles et al. 2011	Wiles, G. J., H. L. Allen, and G. E. Hayes. 2011. Wolf conservation and management plan for Washington. Washington Department of Fish and Wildlife, Olympia, Washington. 297 pp
WSDOT 2015	Washington State Department of Transportation. 2015. <i>Biological Assessment Preparation Advanced Training Manual Version 02-2015 – Construction Noise Impact Assessment</i> . Version 4-2017. Available at https://www.wsdot.wa.gov/Environment/Biology/BA/BAguidance.htm # Manual Accessed on August 25, 2017.
WSDOT 2017	Washington Department of Transportation. 2017. Biological Assessment Preparation Advanced Training Manual Version 4-2017; 7.0 Construction Noise Impact Assessment. Olympia, Washington. 89pp.

This page intentionally left blank.

APPENDICES

APPENDIX A
COMMENT AND RECLAMATION'S RESPONSES
TO 2017 DRAFT EA

Commenter	No.	Comment	Reclamation's Response	Revisions to Final EA
Childers, Wes (and Rose, Sharon)	C1	<p>"The EA does not adequately evaluate the downstream impacts of this project."</p> <p>"The potential project poses a potential threat to downstream structures and inhabitants."</p>	<ul style="list-style-type: none"> The commenter makes an introductory statement that the EA does not evaluate downstream effects and proceeds to provide specific comments to support the statement (per comments C2-C7). The EA addresses flooding and risk in Sections 3.4, 3.10, and 3.11. Additional information on downstream impacts has been added to the EA. Also, please see responses to comments C2-C7. 	<p>Section 3.4.2 has been revised to include a qualitative discussion on downstream effects of the project.</p>
Childers, Wes (and Rose, Sharon)	C2	<p>"The "big flood" of 1948 had a flow of 10, 800 cfs (page #58 of EA) and has been classified as a 500 year flood."</p> <p>"Additionally, the peak flow data and modeling does not take into account the potential for flash flooding caused by mud slides or ice dams."</p> <p>"Thus, this project is not engineered to withstand historical flooding events on the Entiat River"</p>	<ul style="list-style-type: none"> As discussed in Sections 3.10.2 and 3.11.2 the project design engineers followed Reclamation's Risk Based Design Guidelines to establish the design standards for wood structures. The EA states that although the minimum stability design flow criteria in the Risk Based Design Guidelines (RBDG) criteria is the 25-year flow, the designs were evaluated using the 100-year design flow to meet Washington State code for the design of LWM structures (Registered Code of Washington [RCW] 77.85.050). The same RCW requires habitat improvement projects to be led by professional engineers or licensed geologists. The Project's design was consistent with this requirement. The design of LWM structures is supported by flood frequency analysis using the Ardenvoir gage (12452800) at RM 18 which is 1/10 of a mile upstream 	<p>Section 2.2.2 has been revised to state the LWM structures were designed to a minimum of a 25-year life. Additional analysis summarizing how the effects of fire have been incorporated into the design process have been incorporated into Section 3.4.2.</p>

Commenter	No.	Comment	Reclamation's Response	Revisions to Final EA
			<p>from the Gray Reach and provides the best hydrologic data for the project area. This gage has a period of record from 1958 to present. This period of record includes the 1972 peak event (approximately a 100 year event) which resulted in the debris torrent at Preston Creek which was generated through the burned area caused by the 1970 fire events upstream of the project area. These design criteria represent a reasonable and robust attempt at engineering for unforeseen events (as per bullet one).</p> <ul style="list-style-type: none"> The EA has been updated to describe how fire-related flows and debris events have been incorporated into the analysis. In summary, the LWM structures have been designed to the 100-year flood event at the project area. The 100-year flood event is based on long-term recorded stream gauge history of the Entiat which incorporates a long history of floods and fires in the Entiat River Watershed. Additionally, the Wolverine Fire in 2015 was analyzed to determine the behavior of potential debris flows from that fire. Design of the LWM structures included this debris accumulation on structure stability. 	
Childers, Rose	C3	"Artificial log jams or LWM (large woody material structures) will fail and break apart over time and be carried down river during a high water event."	<ul style="list-style-type: none"> As discussed in Section 2.2.2, these LWM structures are primarily stabilized through driven piles. The only structural connections used to secure logs used in LWM structures would be threaded bolts that "pin" logs to one another. For helicopter-constructed LWM Structures, 	Sections and 3.11.2 are revised to state LWM structures are pinned and not cabled together, therefore would not move

Commenter	No.	Comment	Reclamation's Response	Revisions to Final EA
		<p>“Despite being designed to withstand a 100 year flood event, studies show that over time LWM structures can and will fail; therefore, they are likely to break apart over time.”</p> <p>“LWM structure design is a <u>new technology and has been called experimental</u> in some engineering reports. There is little or no data showing that these structures have proven the test of time structurally or in terms of intended function.”</p> <p>“<u>LWM structures are subject to all the forces of the river: erosion, scouring, stream channel changes, flooding, flash-flooding, mud flows, freezing, log jams, ice dams, etc.</u> Additionally, they are subject to the general deterioration and rotting of the wood which makes up the structures. It is very difficult to predict how these structure will hold up over time--<u>the predictability or certainty factor for this type of structure is very low.</u>”</p>	<p>short lengths of chain would be used to create “rock collars” used to create ballast intended to secure logs. As the wood deteriorates over the expected 25-year lifespan (see Sections 2.2.2 and 3.11.2), individual logs may break from the larger structure. Since these logs are not cabled together we do not expect multiple logs to move together downstream.</p> <ul style="list-style-type: none"> Large wood design and placement has been one of the more common restoration techniques and as early as the 1890s landowners have placed wood in channels to improve fish habitat. Between 1980 and 2005 nearly 6,000 restoration projects in the United States used wood placement to improve stream habitat. Over the last 40+ years, structures have been designed for different purposes, with different expectations for stability, different expectations on life of the structure, and factors of risk. Therefore, any consideration of “failure” of a structure must consider why and how the structure was built. As recognized in the studies provided by the commenter, LWM structures designed 15-30+ years ago have shown some structures have “failed”. Studies have shown those structures with lower success rates are typically structures that were designed over 20 years ago (Roni et al. 2014). Recognizing concerns of landowners along the Entiat River, LWM structures for the Project were designed using the latest technological tools and engineering approach used by river engineers: 	<p>downstream as multiple logs or an intact structure.</p> <p>Section 3.11.2 has been updated to discuss the history of wood placement.</p> <p>A description of the 2-dimensional model has been added to Section 2.2.2</p>

Committer	No.	Comment	Reclamation's Response	Revisions to Final EA
			<p>Reclamation's RBDG and Reclamation's SRH-2D, which is a two-dimensional (2D) fixed-bed hydraulics model focused on the hydraulics of river systems developed by Reclamation's Technical Service Center. These tools allow engineers to design structures with a factor of safety that incorporates forces generated by river flow volumes, velocities, and capacities based on a 100-year flood event. Reclamation's use of the RBDG, 2D model, construction oversight, and the post-construction adaptive management program, all led by engineers, enables the Project to be constructed successfully and addresses concerns the public and private property owners may have.</p> <ul style="list-style-type: none"> • The use of the RBDGs represent the most recent approach to designing structures to consider risk and increasing design stability. Through this design process, representative apex and deflector structures were evaluated for stability related to debris jams which represented wood or ice. • Per Section 3.11.2, the structures are designed for a 25-year life expectancy. The design life is based on the materials used, delivery methods, construction methods, climate conditions, and hydrologic conditions, and decay rates for wood (Reclamation 2014). Annual inspection (Section 2.2.3) is intended to identify any LWM structures that have changed from their constructed condition and would be subject to modification if they are not meeting the project's purpose 	

Commenter	No.	Comment	Reclamation's Response	Revisions to Final EA
			or cause an increased risk to public safety or homes.	
Childers, Rose	C4	Monitoring of LWM structures is largely ineffective as structures can only be repaired during low water summer months."	<ul style="list-style-type: none"> The Inspection Plan specifically addresses an approach for annual inspection during both high flows and again during low flows. Specific information that can be safely and easily obtained through engineer's survey of the structures and river's condition will be collected at low flows. Information or actions that can be safely conducted at high flows will augment low flow activities. Annual inspection (Section 2.2.3) is intended to identify any LWM structures that have changed from their constructed condition and would be subject to modification if they are not meeting the project's purpose or cause an increased risk to public safety or homes. 	Section 2.2.3 was updated to provide more detail on the post-construction inspection plan and how monitoring occurs in both low and high flows. This section also provides more detail on the agreements made between local sponsors and Reclamation regarding roles, responsibilities, and funding associated with post construction inspection and repair.
Childers, Rose	C5	<p>"The EA states that the project will decrease flooding in the Entiat valley. However, this project has the potential to increase flooding during a catastrophic flood by impeding debris flows and impounding water."</p> <p>"In a catastrophic flood immense amounts of debris are moved downstream. These structures will act to create huge backs ups of material, damming the river and increasing the</p>	<ul style="list-style-type: none"> The design engineers and Reclamation modeled post-project conditions to examine the flooding effects of the wood structures relative to the 100-year flood event. No additional human structures would be flooded as the result of the effects of the wood structures from existing conditions (see Sections 3.4). The project design considered historic flooding and debris flow in the Entiat Valley. This included expected increases in debris flow and hydrology due to fire. The design of the LWM structures is intended to allow the racking and shedding 	Section 2.2.2 was revised to state the LWM structures are designed to not span the channel. Section 3.11.2 was revised to discuss potential post construction impacts associated with the non-channel spanning structures. Section 3.4.2 has been updated to discuss the potential

Committer	No.	Comment	Reclamation's Response	Revisions to Final EA
		<p>potential for flash flooding when the dam breaks or completely diverting the river.”</p> <p>“<u>This happened just this spring on Beaver Creek in Okanogan County</u> when a LWM structure blocked some of the 40,000 to 50,000 cubic yards of material that washed out upstream.”</p> <p>“<u>Similar conditions exist in the Entiat River Valley.</u> Large amounts of logs and debris resulting in large part from approximately 40,000 acres of the Entiat Water Shed that burned during the Duncan Fire and Wolverine Fire in 2014 and 2015 have accumulated in the upper Entiat River above Entiat Falls.”</p>	<p>of woody material that is transported through the reach. The structures themselves are not intended to create channel spanning conditions. Structures have been positioned to not block more than 30 percent of the channel and to allow the largest observed logs (~100 feet) to pass without creating a channel spanning condition. LWM structures were also designed to be inundated at flood flows. This would allow debris floating on river to avoid collecting on LWM and resulting in debris jams. These design considerations are intended to minimize the likelihood and effect of debris jams, and given the smaller size of woody material likely transported to the project site at any given event, it is unlikely that material will accumulate in quantities to create a channel spanning debris jam.</p> <ul style="list-style-type: none"> • The debris event that occurred at Beaver Creek following the Carlton Complex Fire (2014) is not analogous to conditions within the middle Entiat. The primary difference is floodplain capacity. The floodplain width within the middle Entiat ranges from 800 to 1,500 feet, and floodplain width in lower Beaver Creek averages 100 feet. The additional floodplain capacity within the middle Entiat allows for the dissipation and retention of flood and debris flows. In addition, the Beaver Creek event occurred during heavy rains soon after the catastrophic fires in 2014 when soils were most susceptible to erosion. 	<p>for accumulation of materials on the LWM structures.</p>

Commenter	No.	Comment	Reclamation's Response	Revisions to Final EA
			<ul style="list-style-type: none"> As discussed in Section 3.4, the burned watershed areas above the proposed Project are most at risk to experience increased runoff and debris during a 3-year period following fire. Since the proposed middle Entiat projects would be constructed in 2019 and 2020, this further reduces concerns about soil erosion and debris flows related to the 2014 and 2015 Duncan and Wolverine fires. The commenter is referring to Section 1.3 (Purpose and Need) of the EA, "The purpose of the Project is to restore hydraulic connectivity between the Middle Entiat River and its floodplain and improve connectivity of flows with adjacent floodplain wetlands." Hydraulic connectivity and floodplain availability serve to lessen flooding compared to a channelized system because of increase capacity. 	
Childers, Rose	C6	<p>"LWM structures pose a much larger risk to downstream structures than natural logs and debris."</p> <p>"The logs are pinned together and in the case of structures put in place by helicopter; chained down. Natural logs in the Entiat River system are a variety of species; a small part of which is Douglas Fir. The natural material is various ages and various stages of decay. Natural material will tend to break up and migrate down river in</p>	<ul style="list-style-type: none"> Commenter has provided many references to support their comments, however, this appears to be a subjective statement related found in comment E in the letter. The EA endeavors to show that the design considerations led to designed structures built in a way that do not "pose a much larger risk to downstream structures than natural logs and debris" as supported by using the most current design standards for wood structure design. See Section 2.2.2 and response to comment C2 bullet one for detail about the 	Section 2.2.2 revised to state the design life is 25 years. Section 3.11.2 revised to clarify LWM structures are not expected to move together downstream.

Commenter	No.	Comment	Reclamation's Response	Revisions to Final EA
		<p>pieces. When LWM break loose, the logs are likely to stay tied together and come down stream in a mass which can cause considerably more damage.”</p> <p><i>“The Large Woody Material Risk Based Design Guidelines specify that a <u>written risk assessment</u> should be done when designing LWD projects. As a part of this EA, a written risk assessment should be done by the engineering company preparing the plans for this project. The assessment should include: the design life of the LWD structures, the predictability factor of the designs, potential impacts of catastrophic flooding and design methodology. Also, the assessment should be <u>signed by the lead professional engineer on the project and stamped with his PE stamp.</u>”</i></p>	<p>design, construction, and longevity of the LWM structures. Since these logs are not cabled together, Reclamation does not expect multiple logs to move together downstream and therefore, risk of structures causing damage to downstream properties is greatly reduced.</p> <ul style="list-style-type: none"> The design of the LWM structures was led by an engineer licensed in Washington State. As discussed in Sections 3.10 and 3.11, to reduce and minimize risk to public safety from structures, designs for the proposed project were developed following Reclamation's RBDGs to ensure stability of each structure (Reclamation 2014). As the designs for each project area were developed, a 2D hydraulic model, developed by Reclamation's Technical Service Center in Denver, Colorado, was used to evaluate the effects of the structure and also the stability of each structure. The design life of the proposed LWM structures would be 25 years. The design life is based on the materials used, delivery methods, construction methods, climate conditions, and hydrologic conditions (Reclamation 2014). The modeling of the proposed project showed that all of the proposed structures would meet the risk-based design criteria for stability (Reclamation 2016b). To meet risk-based design criteria requirements, additional mechanical anchoring would be used but no cable would be used in any of the LWM structures. Designs will be stamped by the lead engineer. 	

Commenter	No.	Comment	Reclamation's Response	Revisions to Final EA
Childers, Rose	C7	<p>"Given the uncertainty in evaluating these risks a full EIS should be done on this project. Also, when this project is built, bonding or some sort of insurance should be put in place to mitigate the potential for downstream property damage."</p>	<ul style="list-style-type: none"> The EA analyzed the impacts to the natural and human environment. Based on this analysis, impacts were not identified that would trigger the threshold of significance in terms of context and intensity (40 CFR 1508.27). If the decision maker supports this assertion of non-significance, a FONSI will be issued. If not, then a decision will be made to either select the No Action alternative or issue a notice of intent to prepare an Environmental Impact Statement (EIS). The project engineers have designed the wood structures to meet Registered Code of Washington (RCW) 77.85.050(5). In addition, Reclamation will be funding an inspection and maintenance program that will be undertaken by the local project sponsors. See also response to C2. 	None
Craven, John	Cr1	<p>"I am including a link to a video I took from my back yard last December. It shows an ice flow in which the river rose approx. three feet in almost as many minutes. It was a normal December day, with no ongoing weather issues, i.e., severe cold, thaw, or large amounts of precipitation. Judging by the amount of burned material floating downriver, it was obviously a buildup of logs and debris from the fires of 2014 and 2015. With stable weather and temperatures in the high twenty degree range, one can assume it was the sheer quantity of</p>	<ul style="list-style-type: none"> Section 3.2.2 and 3.4 describe that erosion and recruitment of wood and the formation of ice are current and common natural processes on the Entiat River. The project design considered both of these processes during the development of the LWM structures. <p>See also response to C2, C3, C5, and C6 regarding design of the project relative to flood flows and river debris.</p>	None

Commenter	No.	Comment	Reclamation's Response	Revisions to Final EA
		woody material temporarily backing up and breaking loose causing the flow, rather than ice."		
Craven, John	Cr2	<u>"I would strongly support "no action", with reassessment in a few years, after the Upper Entiat stabilizes and becomes more predictable.</u>	<ul style="list-style-type: none"> The No Action alternative is one of the two alternatives assessed in the EA and will be evaluated by the decision maker. The selection of one of the alternatives will be supported in the project decision. 	Craven, John
Eisenhard	E1	<p>"I noticed the draft EA indicated that signs would be posted to notify the public of the dangers of the new structures to allow them to avoid these."</p> <p>"I also do not feel there is enough evidence to support taking the possible risks to human health and property in the event of failure of these structures. Even with proper signage, I fear someone will eventually get hurt or killed due to the presence of these structures in the main channel."</p>	<ul style="list-style-type: none"> Signs will be posted at usual public river access points within the middle Entiat. No signs will be placed at the individual structure sites, however, each of these sites have been evaluated relative to boater safety and reaction time as required in the RBDG (Section 3.10). Annual inspection (Section 2.2.3) is intended to identify any LWM structures that have changed from their constructed condition and location and would be subject to modification if they are not meeting the project's purpose or cause an increased risk to public safety or property. Also, see response to comment C3 and C4. RBDGs demonstrate that the public safety risk rating for all of the structure groups is low (Section 3.10.2). 	<p>Text added in Section 3.10.2 cross referencing BMP's for signage in Section 2.3.</p> <p>Additional analysis in Section 3.10 included that quantifies and explains low risk to recreational boaters based on sighting and reaction time.</p>
Eisenhard	E2	"The amount of structures being placed will have a significant impact on recreation opportunities for tubing, rafting, canoeing, kayaking and just plain enjoying the river safely."	<ul style="list-style-type: none"> Per Section 3.10, the risk to recreation has been assessed as part of the RBDG. Per the RBDG analysis, the public safety rating for all of the proposed structures is low. The assessment of each structure includes criteria related to the potential to create "strainers" to rack additional wood 	Sections 1.2 and 3.5.2 have been revised to cite recent studies that document the use of wood to promote natural river processes

Commenter	No.	Comment	Reclamation's Response	Revisions to Final EA
		<p>"This would be easier to accept as a necessity if there were reliable statistics supporting increased species health and return numbers associated with the implementation of woody structures in the main channel."</p> <p>"Yet I do not feel there is strong enough evidence of a benefit from the main channel woody structures to support taking of public land and access to recreation."</p>	<p>that could endanger boaters; the sight distance for boaters which is related to the time allowed for boaters to make corrective or avoidance maneuvers; and egress potential. While the placement of LWM structures would alter the river in ways that could affect the way recreational boaters experience the river, it is unlikely to result in conditions that would prevent boats from navigating the river or be considered unsafe. No access points would be removed due to this project.</p> <ul style="list-style-type: none"> Impacts and benefits to fisheries resources associated with this project are discussed in Section 3.5.2 per Roni et al. 2014, most studies of LWM structures and biological benefit report positive biological responses for adult and juvenile salmonids. This 2014 study examined 200 published studies on wood placement that reported positive, negative, or no change in physical habitat, juvenile and adult salmonids, non-salmonids, and invertebrates. A total of 69 percent and 80 percent of the studies reported positive responses for juvenile and adult salmonids, respectively. The 2014 Annual Report on Project Effectiveness Monitoring Program for the Upper Columbia River (Tetra Tech 2014), found that wood structure in streams have been consistently effective at improving aquatic habitat. In addition, the study found that wood structures have largely remained in place and functional over a 5-year monitoring period. 	<p>that provide benefits to fish.</p> <p>Section 3.10.2 is revised to acknowledge no access points would be removed, and additional text relative to how the project affects recreational river users and response times to avoid LWM structures.</p> <p>Section 3.10 has been revised to include a land ownership figure (Figure 3-2).</p>

Commenter	No.	Comment	Reclamation's Response	Revisions to Final EA
			<ul style="list-style-type: none"> • Specific data regarding the biological benefits associated with the projects that the commenter references is unavailable. • The entire Project occurs on non-federal lands. There would be no taking of public lands. Additionally, the Washington Department of Natural Resources is not currently asserting State Owned Aquatic Lands status of the riverbed. A land ownership map has been included in the Final EA in Section 3.10.1. 	
Eisenhard	E3	<p>"I feel that that the improvement of side channels and available floodplain area have the evidence to support the success of habitat improvement, without the risk to human safety and property. I would be in support of the project if the installation of the LWM structures were not in the main channel of the Entiat River."</p>	<ul style="list-style-type: none"> • Placing LWM structures only in side channels would not meet the Project's Purpose and Need (Section 1.3). The role of LWM structures in natural river processes has been further clarified in the EA. As stated in the August 27, 2017 version of the EA (see Sections 1.1 through 1.3), the Project is proposed to address habitat complexity and floodplain connection projects to meet the requirements of the FCRPS Biological Opinion (BiOp). To do so, Reclamation has proposed a project that includes habitat improvement actions that promote natural river processes that benefit salmon species. The EA has been further clarified in Sections 1.2, and 3.5.2 to document how habitat complexity and floodplain connection projects in the Pacific Northwest benefit salmon species. • With regards to public safety, the EA addresses the design process that incorporates a risk analysis (See Section 3.10.2 and 3.11.2), requirements of 	<p>Revisions made to Sections 1.2 and 3.5.2 to clarify benefit of project to salmonids.</p> <p>Section 2.2.3 has been revised to include more detail on the post-construction inspection process as a measure to address safety and structure stability.</p>

Committer	No.	Comment	Reclamation's Response	Revisions to Final EA
			professional engineers to be involved in the design process and during construction.	
Kelly	K1	"It seems to me that the potential affects to the Affected Environment might lead you to consider that an EIS is required to account for the total effects."	<ul style="list-style-type: none"> The EA analyzed the impacts to the natural and human environment. Based on this analysis, impacts were not identified that would trigger the threshold of significance in terms of context and intensity (40 CFR 1508.27). If the decision maker supports this assertion of non-significance, a FONSI will be issued. If not, then a decision will be made to either select the No Action alternative or issue a notice of intent to prepare an Environmental Impact Statement (EIS). 	None.
Kelly	K2	"There have been many document sightings of wolverines in the Entiat Valley above the project site. These include photographs and radio collars on wolverines."	<ul style="list-style-type: none"> The EA was revised to reference estimated wolverine population numbers in Washington based on U.S. Forest Service (USFS) and WDFW research and telemetry data in Entiat Valley. 	Document revised in Section 3.5.1 and Table 3-8
Kelly	K3	"Include more information on the effects upon salmon migration and salmon numbers from the building in the 1930s, 40's and 50's of mainstem dams in the Columbia River. Rocky Reach was completed in 1957. By then many fish runs had been exterminated and major efforts were being made to reintroduce hatchery fish to all the tributaries."	<ul style="list-style-type: none"> The comment is appreciated, but a historic overview is not necessary to fulfill the NEPA requirements. It is notable that compliance with the FCRPS BiOp is a central need for the project, and the projects' intent is clearly stated. For example, Section 1.3 of the EA states: "Re-establishment of natural riverine processes and a properly functioning and self-sustaining riverine floodplain ecosystem would aim to provide critical spawning, rearing, and off-channel refuge habitat for fish species..." 	None.

Commenter	No.	Comment	Reclamation's Response	Revisions to Final EA
Kelly	K4	<p>“You need to be much clearer in defining recreation in the lower, middle, and upper sections of the Entiat River. Unless you have proof otherwise I would say that the Upper Section above the Stillwaters is seldom used by kayaks and floaters.”</p> <p>“The middle section Stillwaters access points for floating have been much improved by several CDLT purchases in the last 10 years.”</p> <p>“When discussing floating, canoeing, kayaking, swimming, and tubing in the Stillwaters middle section be sure to be specific and quote the survey that I did in July 2015 and turned over to the Cascadia Conservation District. They only surveyed on Thursdays, and I surveyed 6 weekends in a row in June, July, Aug. and came up with close to 150 user days in the Stillwaters.”</p> <p>“Frequency of use (in Stillwaters) is low compared to more popular reaches” That’s like comparing apples to oranges. The frequency of land based camping is low in the Stillwaters, because there are no campgrounds, but the frequency of floating, boating, tubing and swimming is much higher in the Stillwaters than in the Upper section above the project area which is</p>	<ul style="list-style-type: none"> No survey data of boater use upstream of the project area is available, however due to the Class III and IV rapids, the upper Entiat requires a higher level of boater skill than the middle Entiat reach (Cascadia Conservation District 2014). The middle Entiat flows through primarily private lands but currently has two public access points all on CDLT lands. This typically limits boater use in the middle section to local residents compared to the multiple USFS campgrounds and access points to the river in the upper section. Cascadia Conservation District (CCD) included interviews with recreationists, including Mr. Kelly, in development of Cascadia’s study of river users, including Mr. Kelly’s involvement in the recreational field tour in 2015 noted in Section 3.10. The EA includes the results of CCD’s study in Section 3.10. <p>There are no data to compare boater use between the upper and middle Entiat. Reclamation agrees while some cross-over is expected these sections provide different recreational opportunities and are therefore utilized by people with differing interests. Reclamation has completed a more detailed analysis.</p>	<p>Section 3.10.1 updated to describe and compare differing recreational opportunities in each river section. Section revised to remove reference to the quantity of boater use in the upper Middle Entiat section versus the middle section as there is no user data to compare the reaches.</p>

Commenter	No.	Comment	Reclamation's Response	Revisions to Final EA
		only floatable by semiprofessional kayakers.		
Kelly	K5	"I would suggest that the BOR continue the interface started by Cascadia with the local floaters. It has to be an on the ground discussion once you have stakes in the gravel. Then we can walk or float the area with your design engineers and discuss if the proposed log jams present a hazard to floating."	<ul style="list-style-type: none"> Reclamation appreciates the comment. Public involvement is described in Section 1.6 of the EA. Local recreationalists participated in a field tour on October 23, 2015 as part of the RBDG design process. Reclamation and project sponsors will continue to provide opportunities for input from interested public as the design process moves forward to finalize designs. Information on meetings and events, (e.g. monthly public Entiat Habitat Sub Committee meetings) are posted to the Cascadia Conservation District website: http://cascadiacd.org/meetings-and-events_13-n.html. Public participation is welcome at any time during the final design process. 	Public Involvement was updated in Section 1.6 and the Risk-based design language in 3.10.2 was updated to indicate a clear and step-wise assessment that included recreationalist and floaters
Leigh	L1	"No conclusion is drawn in the draft EA as to whether the Bureau of Reclamation believes a FONSI or an EIS is required under NEPA. Based on the information provided in the draft EA, it seems clear that an EIS must be prepared prior to finalizing this project."	<ul style="list-style-type: none"> The purpose of the EA is to determine if the Project is likely to significantly affect the environment. A conclusion will be drawn by the Reclamation decision maker following review of the Final EA and completion of associated consultation and coordination. The decision will be published as a separate document or with the Final EA. The EA analyzed the impacts to the natural and human environment. Based on this analysis, impacts were not identified that would trigger the threshold of significance in terms of context and intensity (40 CFR 1508.27). If the 	None

Commenter	No.	Comment	Reclamation's Response	Revisions to Final EA
			<p>decision maker supports this assertion of non-significance, a FONSI will be issued. If not, then a decision will be made to either select the No Action alternative or issue a notice of intent to prepare an EIS.</p>	
Leigh	L2	<p>"This project meets the requirements of a major federal action. The Bureau of Reclamation is budgeting over \$5,000,000 of construction funding, plus has contributed significant funding and personnel for the engineering and design work. Without the federal expertise and funding, this project would not move forward."</p>	<ul style="list-style-type: none"> Funding is not the sole determinant for major federal action. Rather, whether a federal action crosses the threshold for major is identified with reference to effects on the human environment. <p>Federal financial assistance is needed to fully fund construction of the project. Federal funding to the sponsors per Section 255 of the Reclamation Department Manual subsection 1 1.B authorizes funding in support of the 2008 BiOp and 2014 BiOp update.</p> <p>Since the proposal is a federal action and would be implemented with federal funds, Reclamation prepared an EA to determine the potential impacts to the human and natural environment. Based on this analysis, impacts were not identified that would trigger the threshold of significance in terms of context and intensity (40 CFR 1508.27).</p>	<p>Section 1.5.5 was updated to clarify Reclamation's involvement in funding/or construction authority</p>
Leigh	L3	<p>"The project also meets the second requirement of having a significant effect on the human environment. In short, to enhance fish habitat on the middle Entiat, this project intends to change the course of the Entiat River,</p>	<p>The proposed action is not believed to have significant impact to the human environment for the following reasons:</p> <ul style="list-style-type: none"> From Section 1.1: "The Project is intended to increase the amount of suitable habitat for fish and wildlife species that utilize the Entiat River with specific focus on the 	<p>The EA has been prepared and updated in a manner supporting non-significant impacts to the natural and human environment per a context and</p>

Commenter	No.	Comment	Reclamation's Response	Revisions to Final EA
		<p>open side channels, and create new channels.”</p> <p>“Under NEPA, significant effects include beneficial as well as detrimental ones. Placement of this large number of logs in the river has the possibility of causing significant damage to downstream structures should a major flood occur in the river. During high water this past spring, I watched whole trees and large logs float downriver, at some points getting stuck diagonally across the river. Two trees beached themselves off our property. Upriver, on Forest Service property, the flood waters left a huge natural logjam. This flood event wasn't even close to a 100 year event.”</p>	<p>needs of Upper Columbia River steelhead (UCR Steelhead) (i) and Upper Columbia River spring-run Chinook (UCR Spring Chinook salmon) (<i>O. tshawytscha</i>) which are listed as threatened and endangered, under the ESA (16 U.S.C. 1531 et seq.).”</p> <p>Per Section 3.2.2, the placement of wood structures is expected to direct flows toward river banks as part of the natural lateral migration associated with rivers in floodplains. This could cause localized soil erosion as banks lose sediment from river flows (Julien 2002).</p> <ul style="list-style-type: none"> • As discussed in Section 2.2.2, these LWM structures are primarily stabilized through driven piles. The only structural connections used to secure logs used in LWM structures would be threaded bolts that “pin” logs to one another. For helicopter constructed LWM Structures, short lengths of chain would be used to create “rock collars” used to create ballast intended to secure logs. As the wood deteriorates over the expected 25-year lifespan, individual logs may break from the larger structure. Since these logs are not cabled together we do not expect multiple logs to move together downstream. This reduces the risk of logs “rafting” together and causing damage to downstream properties. • The design of the LWM structures is intended to allow the racking and shedding of woody material that is transported through the reach. The 	<p>intensity analysis for use in the FONSI determination (40 CFR 1508.27).</p> <p>Section 2.2.2 revised to state the design life is 25 years. Section 3.11.2 revised to clarify LWM structures are not expected to move together downstream.</p>

Commenter	No.	Comment	Reclamation's Response	Revisions to Final EA
			<p>structures themselves are not intended to create channel spanning conditions. Structures have been positioned to not block more than 30 percent of the channel and to allow the largest observed logs (~100 feet) to pass without creating a channel spanning condition. They have also been designed to be overtopped at flood flows to allow buoyant debris to avoid racking and resulting in debris jams. These design considerations are intended to minimize the likelihood and effect of debris jams, and given the smaller size of woody material likely transported to the project site at any given event, it is unlikely that material will accumulate in quantities to create a channel spanning debris jam. Unpredictable events are not foreseeable, but design criteria represents a reasonable and robust attempt at engineering for unforeseen events (as per bullet one). Also, see responses to C2, C3, C5, and C6.</p>	
Leigh	L4	<p>"The draft EA does not adequately address all of the potential environmental effects. For example, no mention is made of effects of the project on invertebrates in the river."</p>	<p>Invertebrates are an important component of aquatic ecology and a food source for fish. The document has been revised to recognize the role of aquatic invertebrates and potential effects of the project.</p>	<p>Section 3.5.1 (Affected Environment) and Section 3.5.2 (Environmental Consequences) has been revised to include a discussion on aquatic invertebrates.</p>
Leigh	L5	<p>"It doesn't adequately address the potential for beavers to block the newly created side channels and the environmental effects if beavers were</p>	<p>The Draft EA (Section 3.5.1) identified that terrestrial habitat occurs within the wildlife analysis area, and is located in floodplains, valley bottom, riparian areas, and upland</p>	<p>Revisions made to wildlife sections of Section 3.5.1 and 3.5.2</p>

Commenter	No.	Comment	Reclamation's Response	Revisions to Final EA
		<p>to do so. Bobcats are not mentioned under wildlife and they are present in the area. I have seen them at my house at the 20 mile marker on the Entiat. Moose also have been photographed in the river. I have observed that deer have preferred spots for crossing the river. What impacts will the channel alteration have on their use of the river? The EA states there is not documented observations or reptiles along the river channel. In the past few weeks, I have encountered 3 rattlesnakes at the river's edge and one of my neighbors has also encountered 3.</p>	<p>areas. The EA does state mammals, birds, amphibians and reptiles are expected to occur in the Entiat River subbasin, without naming each species. The EA does list numerous non-protected wildlife species in the Entiat River Subbasin and was not intended to be an exhaustive list of all species likely to occur within the area, but list representative mammals, avian species, reptiles (including snakes), and amphibians. The EA states that WDFW's Priority Habitat Species (PHS) database does not identify any of the species shown in Table 3-8 of the EA in the project area; other species not in the table may occur in the project area. Reclamation recognizes other common wildlife species that typically occur in rural (and urban) areas could occur in the project area. The EA is revised to include additional species that could occur. Additional analysis is provided for the effect of the project on these common species, including beavers.</p>	<p>to address these additional species.</p>
Leigh	L6	<p>"The Cascadia study regarding recreational use of the river doesn't support the information in the draft EA. The only observational data shows that the Middle Entiat River can have as many as 150 users over a 3 month period in the summer. This figure resulted even though a significant number of the days surveyed occurred during the week, rather than on the week end when most people use the river. The conclusions regarding a</p>	<p>The commenter is correct in that there is no data to compare boater use between the upper and middle Entiat; however, we can conclude that due to the higher difficulty of boating in the upper section that only skilled kayakers and canoeists are able to safely use the upper section.</p> <p>The middle Entiat flows through primarily private lands but does have two public access points all on CDLT lands. Additional access is through local private landowners.</p>	<p>Section 3.10.1 has been revised to remove reference to the quantity of use in the upper section versus the middle section as there is no user data to compare the reaches.</p> <p>Section 3.10.1 (Recreation) has been</p>

Commenter	No.	Comment	Reclamation's Response	Revisions to Final EA
		<p>higher use on the upper and lower reaches is based solely on indirect data from organizations who have not verified the information provided them by individuals.”</p> <p>“However, the best place to access the river is at the 19 mile marker. It is well known and used often by boaters and picnickers. Landowners have been generous in allowing boaters to ingress and egress from their properties.”</p> <p>“The draft EA implies that the Middle Entiat River is of lesser value to recreational boaters because of fewer public access points.</p>	<p>The EA asserts that the number of users affected by the project in the middle Entiat would be low relative to the use on the Wenatchee and Methow rivers which are both more popular for river recreation and have more public access points. Also, please see responses to comment number K4.</p>	<p>updated to describe available recreational opportunities along the river, and the local importance of the middle Entiat reach. Figure 3-2 has been added to Section 3.10.1 to clarify land ownership, access, and other important features.</p>
Leigh	L7	<p>“Therefore, the actual number of people who can use those stretches is significantly lower than those who can float the calmer, middle Entiat. In fact, river tubes are used often by people to float the middle Entiat. The upper and lower reaches are too dangerous for river tubing. Given the different safety conditions of utilizing the middle versus other parts of the Entiat, the number of people who use the river outside the project area is irrelevant to the impacts the project has on instream recreational users.</p>	<p>The level and type of use of reaches upstream and downstream of the middle Entiat are referenced in order to put the use in the middle Entiat in regional context.</p>	<p>Section 3.10.1 (Recreation) has been updated to describe available recreational opportunities along the river, and the local importance of the middle Entiat reach.</p>
Leigh	L8	<p>“It is not helpful to refer solely to river miles when talking about the project. I,</p>	<p>Road mile posts (Entiat River Road) have been added to the EA.</p>	<p>EA revised to include road mile post</p>

Commenter	No.	Comment	Reclamation's Response	Revisions to Final EA
		as well as my friends, and I suspect most of the public, have no idea where the river miles are. However, we are very familiar with road miles. If you decide to produce a Final EA or an EIS, please include road miles when you refer to river miles.”		wherever river miles are mentioned.
Moura, Colville Confederated Tribes	M1	“... it may be important to point out early in the review process that there are serious concerns to be addressed. For example, the ethnographic section is inadequate and incomplete creating historical error by omission of pertinent data. We will need to assess the archaeological methodologies, field strategies and findings in Berger and Hartmann 2015, to see if we concur with a determination that post-review and inadvertent discovery clauses are adequate safeguards for protecting cultural resources.”	The ethnographic section in the EA has been updated.	Section 3.7.1 - Ethnographic section has been updated.
Moura, Colville Confederated Tribes	M2	Our Office is misleadingly cited (CCT 2015) as having “... no objections to the Project...” The cited CCT letter is attached; nowhere does it state we have no objections, nor does it indicate we considered consultation complete. Consultation on this undertaking remains incomplete.	<ul style="list-style-type: none"> • We apologize for misquoting the letter. The EA no longer cites the 2015 correspondence. • Our archaeological staff had subsequent correspondence with CCT on this topic and received concurrence via an email on 11/29/2017 for the undertaking, Area of Potential Effect, Level of Effort, and finding of no adverse effect. The email states: “We concur with the APE. We concur with the level of effort to identify 	Section 3.7.2 and 4.5 have been updated to reflect the content of the CCT 11/29/2017 e-mail on concurrence and successful conclusion of consultation.

Committer	No.	Comment	Reclamation's Response	Revisions to Final EA
			significant historic properties. We concur with a finding of "no adverse effect."	
Wilcox	W1	"She told us that they put the dike in to help with a mosquito problem and flooding problem."	<ul style="list-style-type: none"> Section 3.11 of the EA under Public Health and Safety includes a discussion on mosquitos. The EA acknowledges the project could increase specific habitats for mosquitos, although the project is design to facilitate flow through side channels to minimize ponding water. Wetlands currently located behind the Bremmer Levee often contain standing water during parts of the growing season that provide habitat for mosquitos. Any flooding that could occur during non-breeding mosquito seasons (late fall/winter/early spring) would have little if any change in mosquito populations compared to current conditions. Currently we are not aware of any mosquito control district in the Entiat Valley. Mosquito control is not included as part of the project's purpose and need, nor part of the proposed action. The removal of Bremmer levee would not cause flooding at the 100-year event at existing human structures. The levee removal and addition of LWM structures would change the pattern of flooding within the immediate vicinity of the levee removal area at flows greater than the 1-year event. 	Section 3.11.2 revised to identify potential mosquito impacts in post construction time period.
Wilcox	W2	"When I first heard the dike was going to be removed I was told it was intended to put the river back to its original state? I have been to most of	The commenter is referred to Section 1.1: "The Project is intended to increase the amount of suitable habitat for fish and wildlife species that utilize the Entiat River with	None

Commenter	No.	Comment	Reclamation's Response	Revisions to Final EA
		<p>the area where the dike is and you can't tell there is a dike, it appears natural. I'll attach a picture to this email showing part of the area that will be flooded if the river is put it back to its original state."</p>	<p>specific focus on the needs of Upper Columbia River steelhead (UCR Steelhead) (i) and Upper Columbia River spring-run Chinook (UCR Spring Chinook salmon) (<i>O. tshawytscha</i>) which are listed as threatened and endangered, under the ESA (16 U.S.C. 1531 et seq.)." Removal of the Bremmer levee would alter the patterns of inundation adjacent to the levee removal area at flows higher than the 1-year event and it will restore natural river migration processes at this location. This is generally considered a beneficial process that maintains habitat for fish and wildlife within the Entiat. Also see response to E2.</p> <p>The reader is referred to Section 3.2.2 where we discuss how restoring natural riverine processes are improved by removing the constructed levee. The reader is also referred to Section 3.5.2 under "Post Construction Impacts" where we discuss how improving natural river processes is beneficial for fish habitat.</p>	
Wilcox	W3	<p>"I think there has been 3 different years that logs with root balls have been put in the river to help the bull trout recover. We are talking hundreds of logs. Last time the staging area was the size of a football field. These log have actually contributed to changing the river not to mention trashing areas. And did it help. Apparently not."</p>	<ul style="list-style-type: none"> • There is currently no empirical data for past restoration actions on the Entiat River that have shown that constructed wood structures have changed the course of the river. • Per Roni et al. 2014, most studies of LWM structures and biological benefit report positive biological responses for adult and juvenile salmonids. Also please see response to E2. Specific data regarding the biological benefits associated with the 	<p>Sections 1.2 and 3.5.2 have been revised to cite recent studies that document the use of wood to promote natural river processes that provide benefits to fish.</p>

Commenter	No.	Comment	Reclamation's Response	Revisions to Final EA
			projects that the commenter references is unavailable.	
Wilcox	W4	"Your memo states "the project is intended to increase the amount of suitable habitat for fish and wildlife species that utilize the Entiat River". I'm a hunter and have seen most of the river and will say this area that will be flooded is possibly the best wildlife habitat on the river."	The intent of the EA is improve fisheries and wildlife habitat in the four project areas. It is not to evaluate the habitat conditions along the whole river. Section 3.5 provides an assessment of habitat conditions in the analysis area of the four projects along with construction and post construction impacts. The EA states the CDLT owns a large portion of the property where the project is proposed and, which is consistent with CDLT's mission (see Section 1.5.4. Also, please see the response to comment number E3.)	Section 1.5.4 has been revised to clarify CDLT's role in the project.
Wilcox	W5	"I'm not sure of the cost of all this. If this is a case where the money needs to be spent I would have a suggestion to put fiber internet up the river road so the school kids can use their computers."	Comment noted; suggestion is inconsistent with project's purpose and need (Section 1.3)	None.

APPENDIX B
USACE PROGRAMMATIC GENERAL
CONSERVATION MEASURES

Listed below are the Seattle USACE's Programmatic General Conservation Measures from the June 21, 2017 agreement between the USACE and NOAA Fisheries for fish passage and restoration actions taken in Washington State.¹

GCM 1 – Pre-construction Activities

1. All native, non-invasive organic material (large and small wood) cleared from the action area for access will remain on site.
2. The removal of riparian vegetation for access will be minimized.
3. The number of temporary access roads will be minimized and roads will be designed to avoid adverse effects like creating excessive erosion.
4. Temporary roads and trails across slopes greater than 30 percent will be avoided when feasible. If temporary access needs to cross slope greater than 30 percent it will be indicated in the Project Information Form.
5. No permanent roads and trails will be built. All temporary access will be removed (including gravel surfaces) and planted after project completion.
6. New temporary stream crossings will avoid potential spawning habitat (i.e. pool tailouts) and pools to the maximum extent possible. They will minimize sedimentation impacts by using BMPs like mats and boards to cross a stream. After project completion temporary stream crossings will be removed and the stream channel restored where necessary.
7. Boundaries of clearing limits associated with site access and construction will be marked to avoid or minimize disturbance of riparian vegetation, wetlands, and other sensitive sites.
8. A Temporary Erosion and Sediment Control plan and a Spill Prevention Control and Containment plan, commensurate with the size of the project, must be prepared and carried out to prevent pollution caused by surveying or construction operations. The plan will be available to the Corps and NMFS by request.
9. A supply of emergency erosion control materials will be on hand and temporary erosion controls will be installed and maintained in place until site restoration is complete.
10. Prepare a Work Area Isolation plan for all work below the bankfull elevation requiring flow diversion or isolation. Include the sequencing and schedule of dewatering and rewatering activities, plan view of all isolation elements, as well as a

¹ National Oceanic and Atmospheric Administration's National Marine Fisheries Service. 2017. *Endangered Species Act Section 7(a)(2) Programmatic Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for the Fish Passage and Restoration Actions in Washington State (FPRP III)*. Action Agency: U.S. Department of the Army, Corps of Engineers. Issued June 21, 2017

list of equipment and materials to adequately provide appropriate redundancy of all key plan functions (e.g., an operational, properly sized backup pump and/or generator). The work area isolation plan does not need to be submitted with a Project Information Form. However, it needs to be available to the Corps and NMFS at their request.

11. A Spill Prevention, Control, and Clean-up plan will be prepared prior to construction for every project that utilizes motorized equipment or vehicles. The plan will be available to the Corps and NMFS by request.

GCM 2 – Construction Requirements

1. Work windows will be applied to avoid and minimize impacts to listed salmonids and forage fish. Please work with local WDFW biologist or see latest work windows on the Corps' website.
2. Electrofishing for fish relocation/work area isolation must follow the most recent NMFS guidelines.
3. Sandbags may be placed to temporarily keep fish out of work areas. Sandbags will be removed after completion of the project.
4. Temporary roads in wet or flooded areas will be abandoned and restored by the end of the in-water work period.
5. Existing roadways or travel paths will be used whenever possible.
6. If listed fish are likely to be present, the applicant will assess which is less impacting to fish: isolation of the in-water work area or work in-water (see GCM 6, Isolation of Work Site).
7. Any water intakes used for the project, including pumps used to dewater the work isolation area, will have a fish screen installed, operated and maintained according to NMFS' fish screen criteria.
8. The site will be stabilized during any significant break in work.
9. Project operations will cease under high flow conditions that could inundate the project area, except as necessary to avoid or minimize resource damage.
10. All discharge water created by construction (e.g. concrete washout, pumping for work area isolation, vehicle wash water, drilling fluids) will be treated to avoid negative water quality and quantity impacts. Removal of fines may be accomplished with bioswales; concrete washout water with an altered pH, may be infiltrated.
11. Prepare a Work Area Isolation Plan for all work below the bankfull elevation requiring flow diversion or isolation. Include the sequencing and schedule of dewatering and rewatering activities, plan view of all isolation elements, as well as a list of equipment and materials to adequately provide appropriate redundancy of all key plan functions (e.g., an operational, properly sized backup pump and/or

generator). This standard material does not need to be submitted with a SPIF. However, it needs to be available to the Services at their request. FWS

12. Work below the OHWL or mean lower low tide line will be completed during preferred in-water work windows, when listed salmonids or forage fish are least likely to be present in the action area. Exceptions will be requested in the SPIF. FWS
13. Any large wood, native vegetation, weed-free topsoil, and native channel material displaced by construction will be stockpiled for use during site restoration. FWS
14. When construction is finished, the construction area will be cleaned up and rehabilitated (replanted and reseeded) as necessary to renew ecosystem processes that form and maintain productive fish habitats. FWS

GCM 3 – Equipment and Barge Use

1. Heavy equipment will be limited to that with the least adverse effects on the environment (e.g., minimally-sized, low ground pressure equipment, use of matting, etc.).
2. When not in use, vehicles and equipment containing oil, fuel, and/or chemicals will be stored in a staging area located at least 150 feet from the Corps' jurisdictional boundary of wetlands and waterbodies. If possible staging will be located at least 300 feet away from the Corps' jurisdictional boundary of wetlands and waterbodies, and on impervious surfaces to prevent spills from reaching ground water. When moving equipment daily at least 150 feet of waterbodies would create unacceptable levels of disturbance (multiple stream crossings, multiple passes over sensitive vegetation) a closer staging location with an adequate spill prevention plan may be proposed and approved as described in Minor Project Modifications as described below.
3. When conducting in-water or bank work, machine hydraulic lines will be filled with vegetable oil for the duration of the project to minimize impacts of potential spills and leaks. If this conservation measure is not practicable, the applicant will propose alternative BMPs in the to avoid the discharge of hydraulic fluids to the aquatic environment as described in Minor Project Modifications as described below. If this conservation measure is not practical the applicant will use low-hour machinery.
4. Spill prevention and clean-up kits will be on site when heavy equipment is operating within 25 feet of the water.
5. To the extent feasible, work requiring use of heavy equipment will be completed by working from the top of the bank (i.e., landward of the OHWM or extreme high tide line).
6. Equipment shall be checked daily for leaks and any necessary repairs shall be completed prior to commencing work activities around the water.
7. Equipment will cross the stream in-water only under the following conditions:

- A. Equipment is free of external petroleum-based products, soil and debris has been removed from the drive mechanisms and undercarriage; and
 - B. The substrate is bedrock or coarse rock and gravel; or
 - C. Mats or logs are used in soft bottom situations to minimize compaction while driving across streams; and
 - D. Stream crossings will be performed at right angles (90 degrees) to the bank if possible; and
 - E. No stream crossings will be performed at spawning sites when spawners of ESA-listed fishes are present or eggs or alevins could be in the gravel; and
 - F. The number of crossings will be minimized.
8. If a construction barge is to be used, a preconstruction vegetation survey must be conducted to determine presence and extent of aquatic vegetation, and the barge shall not ground or rest on the substrate at any time or anchor over submerged aquatic vegetation such as eelgrass. NMFS

GCM 4 – Planting and Erosion Control

1. Within 7 calendar days from project completion, any disturbed bank and riparian areas shall be protected using native vegetation or other erosion control measures as appropriate. For erosion control, sterile grasses may be used in lieu of native seed mixes. Alternative methods (e.g. spreading timber harvest slash) may be used for erosion control if approved by the Corps.
2. If native riparian vegetation is disturbed it will be replanted with native herbaceous and/or woody vegetation after project completion. Planting will be completed between October 1 and April 15 of the year following construction. Plantings will be maintained as necessary for 3 years to ensure 50 percent herbaceous and/or 70 percent woody cover in year 3, whatever is applicable. For riparian impact areas greater than 0.5 of an acre, a final monitoring report will be submitted to the Corps in year 3. Failure to achieve the 50 percent herbaceous and 70 percent woody cover in year 3 will require the permittee to submit a plan with contingency measures to achieve standards or reasons to modify standards.
3. Fencing will be installed as necessary to prevent access to revegetated sites by livestock, beavers or unauthorized persons. Beaver fencing will be installed around individual plants where necessary.

GCM 5 – Water Quality

1. Landward erosion control methods shall be used to prevent silt-laden water from entering waters of the U.S. These may include, but are not limited to, filter fabric, temporary sediment ponds, check dams of pea gravel-filled burlap bags or other material, and/or immediate mulching of exposed areas.

2. Wastewater from project activities and water removed from within the work area shall be routed to an upland disposal site (landward of the OHWM or extreme high tide line) to allow removal of fine sediment and other contaminants prior to being discharged to the waters of the U.S.
3. All waste material such as construction debris, silt, excess dirt or overburden resulting from this project will generally be deposited above the limits of flood water in an upland disposal site. However, material from pushup dikes may be used to restore microtopography (e.g., filling drainage channels).
4. If high flow or high tide conditions that may cause siltation are encountered during a project, work shall stop until the flow subsides or the tide falls.
5. Measures shall be taken to ensure that no petroleum products, hydraulic fluid, fresh cement, sediments, sediment-laden water, chemicals, or any other toxic or deleterious materials are allowed to enter or leach into waters of the U.S.
6. Where practicable, a turbidity and/or debris containment device shall be installed prior to commencing in-water work. NMFS
7. A spill prevention plan will be prepared for every project that utilizes motorized equipment or vehicles. Plan will be available to Service by request. FWS
8. An erosion control plan will be prepared for every project that results in ground disturbance. Plan will be available to Service by request. FWS

GCM 6 – Turbidity Monitoring

1. When working in-water, some turbidity monitoring may be required, subject to potential the Corps permit requirements or CWA section 401 certification. Turbidity monitoring generally is required when working in streams with more than 40 percent fines (silt/clay) in the substrate. Turbidity will be monitored only when turbidity generating work takes place, for example, installation of coffer dams, pulling the culvert in-water, reintroducing water. The applicant will measure the duration and extent of the turbidity plume (visible turbidity above background) generated. The data will be submitted to the Corps and NMFS immediately following project construction. Turbidity measurements will be taken in NTUs and are used by project proponents to develop procedures to minimize turbidity and estimate take for future projects.

GCM 7 – Piling

1. In-water pile driving:
 - A. Steel round or H piles to be installed shall not exceed 12 inches in diameter/width unless the piles to be driven are in uplands adjacent to the waterbody.
 - B. Only vibratory installation is allowed for steel round or H piles.

- C. If a bubble curtain is proposed it will meet or exceed NMFS design recommendations (NMFS and USFWS 2006).
 - D. Prior to submittal to the Corps, applicants proposing projects in marine waters must coordinate with NMFS to determine whether a marine mammal monitoring plan will be required. If NMFS requires a monitoring plan it must be appended to the Project Information Form. In addition, the applicant must include in the Project Information Form the following information regarding the coordination:
 - a. NMFS biologist with whom the coordination took place.
 - b. Outcome of the coordination.
2. Installation of treated wood pilings for the construction of temporary structures needed to remove debris or derelict structures is not proposed.

GCM 8 – Treated Wood

- 1. All extracted piling, piling fragments, treated wood debris, and adhering sediment will be placed in a temporary containment area. The containment area will be of sufficient size and durability (e.g. impervious plastic sheeting with sidewalls) to prevent contaminated materials from entering a waterbody. Discharge from the containment basin may be returned to surface waters following sufficient filtration (e.g., through filter fabric or other media) to remove suspended sediment and contaminated wood fragments.
- 2. Treated wood will be disposed of at an approved upland facility.

GCM 9 – Listed Species Considerations

- 1. Effects on all ESA listed species, their designated critical habitat, and their prey must be considered when proposing a restoration project.

GCM 10 – Minor Project Modifications

- 1. Minor modification to the proposed actions will be approved by the Corps and NMFS when the effects from those modifications are consistent with all effects considered in this opinion. Modification will be limited to the following:
 - A. Modification to the in-water work window
 - B. Location of staging area.
 - C. Use of substances other than vegetable oil in hydraulic lines.