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U.S. Department of Transportation
Federal Highway Administration
Idaho Division
3050 Lakeharbor Lane, Suite 126
Boise, ID 83703-6354

MAR 2 2 2017

Subject: US-12 Fish Creek Bridge Replacement and US-12 Maggie Creek Culvert Replacement Project—Idaho County, Idaho—Biological Opinion
In Reply Refer to: 01EIFW00-2017-F-0001

Dear Mr. Holman:

Enclosed is the U.S. Fish and Wildlife Service's (Service) Biological Opinion (Opinion) for the Federal Highway Administration's (FHWA) determinations of effect on species listed under the Endangered Species Act (Act) of 1973, as amended, for the proposed US-12 Fish Creek Bridge Replacement and US-12 Maggie Creek Culvert Replacement Project (Project) in Idaho County, Idaho. In a letter dated October 31, 2016, and received by the Service on November 1, 2016, the FHWA requested formal consultation on the determination under section 7 of the Act that the proposed project is likely to adversely affect bull trout (*Salvelinus confluentus*) and bull trout critical habitat. The FWHA also determined that the proposed project will have no effect on Spalding's Catchfly (*Silene spaldingii*). The Service acknowledges this determination.

The enclosed Opinion and concurrence are based primarily on our review of the proposed action, as described in your October 2016 Biological Assessment (Assessment), and the anticipated effects of the action on listed species, and were prepared in accordance with section 7 of the Act. Our Opinion concludes that the proposed project will not jeopardize the survival and recovery of bull trout and will not result in adverse modification of bull trout critical habitat. A complete record of this consultation is on file at this office.

<u>Clean Water Act Requirement Language:</u>

This Opinion is also intended to address section 7 consultation requirements for the issuance of any project-related permits required under section 404 of the Clean Water Act. Use of this letter and associated Opinion to document that the Army Corps of Engineers (Corps) has fulfilled its responsibilities under section 7 of the Act is contingent upon the following conditions:

1. The action considered by the Corps in their 404 permitting process must be consistent with the proposed project as described in the Assessment such that no detectable difference in the effects of the action on listed species will occur.

2. Any terms applied to the 404 permit must also be consistent with conservation measures and terms and conditions as described in the Assessment and addressed in this letter and Biological Opinion.

Thank you for your continued interest in the conservation of threatened and endangered species. Please contact Chris Reighn at (208) 378-5264 or Megan Kosterman at (509) 893-8013 if you have questions concerning this Opinion.

Sincerely,

Karen Cathey

Karen Cathey
For Gregory M. Hughes
State Supervisor

Enclosure

cc: FHWA (Perry, Inghram)
ITD (Sullivan, Lowe, Smith)
Corps (Braspennickx)
NOAA (Schrader)

BIOLOGICAL OPINION
FOR THE
US-12 FISH CREEK BRIDGE REPLACEMENT AND US-12 MAGGIE CREEK CULVERT REPLACEMENT PROJECT

01EIFW00-2017-F-0001

NORTHERN IDAHO FIELD OFFICE
SPOKANE VALLEY, WASHINGTON

Supervisor Karen Cathey

Date March 22, 2017

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1. BACKGROUND AND INFORMAL CONSULTATION

1.1 Introduction

The U.S. Fish and Wildlife Service (Service) has prepared this Biological Opinion (Opinion) of the effects of the US-12 Fish Creek Bridge Replacement and US-12 Maggie Creek Culvert Replacement Project on bull trout (*Salvelinus confluentus*). In a letter dated October 31, 2016 and received on November 1, 2016 the Federal Highway Administration (FHWA) requested formal consultation with the Service under section 7 of the Endangered Species Act (Act) of 1973, as amended, for its proposal to authorize the action. The FHWA determined that the proposed action is likely to adversely affect bull trout and bull trout designated critical habitat. As described in this Opinion, and based on the Biological Assessment (FHWA 2016) developed by the FHWA and other information, the Service has concluded that the action, as proposed, is not likely to jeopardize the continued existence of bull trout and is not likely to adversely modify bull trout critical habitat.

1.2 Consultation History

The following correspondence has taken place between the FHWA, Idaho Transportation Department [ITD (produced Assessment)], and the Service prior to issuance of this Opinion:

March 6, 2015	FHWA provided the Service a draft Assessment for review.
May 28, 2015	The Service provided comments on the March 6, 2015 draft Assessment.
April 25, 2016	FHWA requested formal consultation and provided the Assessment to Service.
June 8, 2016	Service provided FHWA comments on the April 2016 Assessment.
October 7, 2016	Service and FHWA coordinated on Assessment.
October 20, 2016	Service deemed Assessment adequate for formal submission.
November 1, 2016	FHWA provided Service the final Assessment and Service accepted the Assessment as final.
February 9-27, 2017	Service and ITD coordinated on the Assessment and draft Opinion.
March 2, 2017	Service provided ITD and FHWA courtesy draft Opinion for review.
March 6, 2017	ITD notified Service that the draft Opinion was sufficient.

2. BIOLOGICAL OPINION

2.1 Description of the Proposed Action

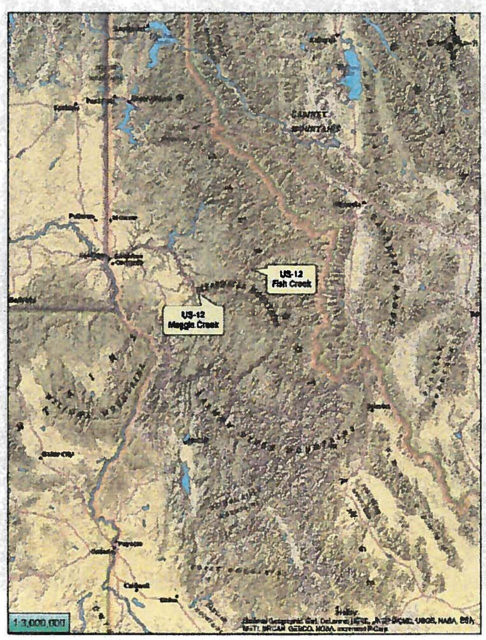
This section describes the proposed Federal action, including any measures that may avoid, minimize, or mitigate adverse effects to listed species or critical habitat, and the extent of the geographic area affected by the action (i.e., the action area). The term "action" is defined in the implementing regulations for section 7 as "all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies in the United States or upon the high seas." The term "action area" is defined in the regulations as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action."

There are two components of the proposed action; the Fish Creek Bridge Replacement and the Maggie Creek Culvert Replacement. The organizational structure of this Opinion separates the two components and the Fish Creek Bridge will generally be discussed first and the Maggie Creek Culvert will be discussed afterward.

2.1.1 Fish Creek Action Area

The Fish Creek bridge is located on US-12 at milepost 120 approximately 12 meters (m) [40 feet (ft)] upstream from the confluence of Fish Creek and the Lochsa River and approximately 32 kilometers (km) [20 miles (mi)] upstream of the confluence of the Lochsa River and the Middle Fork Clearwater River (Figure 1).

Figure 1. Locations of the Fish Creek Bridge and Maggie Creek Culvert on US-12 in northcentral Idaho.

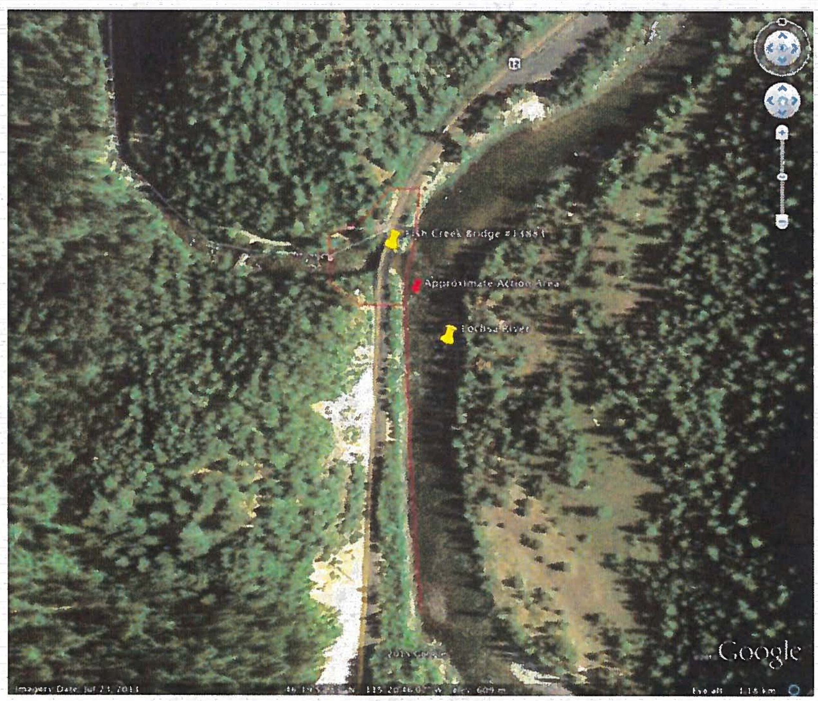


The action area for the Fish Creek Bridge Replacement is identified below:

- The existing Fish Creek bridge.
- The Fish Creek channel from the existing bridge to the confluence with the Lochsa River approximately 12 m (40 ft) downstream of the bridge. The Lochsa River channel along the west/right bank from its confluence with Fish Creek to approximately 290 m (960 ft) downstream (e.g., for potential turbidity effects). The potential 305 m (1,000 ft) sediment travel distance is estimated based on monitoring data obtained at ITD bank stabilization activities.
- The Fish Creek riparian areas from approximately 45 m (150 ft) upstream of the existing bridge to its confluence with the Lochsa River approximately 12 m (40 ft) downstream of the bridge.
- The area approximately 15 m (50 ft) wide west and 12 m (40 ft) wide east of the existing Fish Creek bridge for approximately 45 m (150 ft) upstream and downstream of the proposed bridge. No new highway right-of-way acquisition is anticipated. The project will be constructed entirely within the ITD easement from the U.S. Forest Service (USFS) for US-12.

Off-site project components (e.g., staging areas, source and waste sites, and refueling areas) will be designated by the contractor and will follow the ITD restrictions as outlined in the Best Management Practices (BMPs), Project Design Criteria, and Other Measures to Minimize Impacts section below.

Figure 2. Google Earth aerial view of the Fish Creek Bridge action area. Note, the delineated action area (red) is close to, but not exactly representative of the action area identified above.



2.1.2 Fish Creek Proposed Action

The Fish Creek bridge is located on US Highway 12, milepost 120, 3.2 km (2 mi) south of the Lochsa Ranger Station within the Clearwater National Forest (Figure 1). Fish Creek flows into the Lochsa River approximately 12 m (40 ft) downstream of the bridge location. The existing bridge was built in 1953 and has a sufficiency rating of 64.1. ITD proposes to replace the 33 m (107 ft) long, 9.4 m (31 ft) wide, three-span bridge with a 34 m (112 ft) long, 11.6 m (38 ft) wide, single-span bridge that has a load rating designed to modern standards. Bridge rehabilitation is not proposed because preserving the existing structure would not be cost effective.

It is anticipated the elevation of the new bridge deck will be similar to the existing/old bridge deck and the centerline of the proposed bridge will be the same as the existing/old bridge. US-12 will be widened by about 0.61 m (2 ft) on both the westbound and eastbound shoulders for approximately 45 m (150 ft) north and south of the bridge. The extra pavement width will require a greater embankment width. The guardrail and the end treatments in all four bridge quadrants will be replaced with guardrail that meets the most recent guardrail standards. The existing guardrail has a substandard height.

To accommodate a new Type 7 and 8 guardrail terminal in the northwest quadrant of the bridge, the approach for the USFS road will need to be shifted north. Rock excavation and possibly pre-split blasting of the hillside will be required. Rock excavation or blasting would occur approximately 30 m (100 ft) from Fish Creek and the Lochsa River. Similarly, in order to accommodate a new guardrail terminal in the southwest quadrant of the bridge, rock excavation and possibly pre-split blasting of the hillside will be required. This rock excavation or blasting would occur approximately 24 m (80 ft) from Fish Creek and the Lochsa River.

Pre-split blasting is a controlled method of blasting that involves drilled holes several centimeters (inches) wide at spacing of 0.6 to 0.9 m (2-3 ft) that are lightly loaded with distributed charges. The lightly loaded distributed charges help limit the blast so rock fragments are controlled. A blasting mat, typically composed of thick rubber, will be placed on the blasting area. The blasting mat will keep rock fragments from entering the waterways with a high confidence level.

The primary risk associated with blasting is related to explosive energy. In particular, peak particle velocities (measured in distance per second) and overpressures (measured in weight per area, usually inches) associated with blasting have been documented to cause mortality to salmonids and other fish when they exceed certain levels.

The Alaska Department of Fish and Game (ADFG) developed guidelines to protect fish and incubating embryos from the impacts of blasting in and near water bodies in 1991. These blasting standards were developed to protect fish populations and limit hydrostatic pressure change in fish habitats to levels below those known to be harmful to fish and would not result in negative impacts. These setbacks consider the potential impacts due to charge weight, distance from the waterbody (both vertically and horizontally), substrate type (underlying soil and rock located between the charge and water body), and local topography. When updated in 2013, the guidelines established that blast induced pressures should not exceed 50.3 kilopascals (7.3 pounds per square inch) in the water and vibrations/velocities should not exceed 5.1 centimeters (cm) [2.0 inches (in)] per second during the early stages of embryo incubation (ADFG 2013, p. 3).

Therefore, if blasting is necessary, the contractor will meet the minimum required explosive charge weight setbacks as established by the 2013 Alaska Department of Fish and Game Blasting Standards to minimize for harm, injury and mortality to fish (*http://www.adfg.alaska.gov/index.cfm?adfg=uselicense.explosives*). Note that these are calculated levels and will not be monitored or measured. The contractor will be required to use blasting mats at all times to capture and contain the spread of all rock and earthen/rock fragments that result from blasting and prevent them from reaching waterways.

Project implementation (construction) is proposed to begin during the spring of 2018 and be completed by November 2018.

The only instream work required for the Fish Creek bridge replacement is the removal of the existing piers immediately adjacent to the Fish Creek channel and placement of riprap along each new abutment. Instream work will occur within a cofferdam and during the July 15 and August 15 work window of any year.

2.1.2.1 Construction Phasing

Construction will be completed in two phases. In phase 1, the westbound half of the existing bridge above the ordinary high water mark (OHWM) will be removed and the westbound bridge half will be constructed. In Phase 2, the eastbound half of the existing bridge will be removed above OHWM and the eastbound half will be constructed. Traffic control for both phases is anticipated to be alternating one-way traffic with a signal.

All roadway work including widening of the highway at each bridge approach and reconstructing the USFS approach will be constructed independently of the bridge construction between spring 2018 and fall 2018.

All work below the OHWM (i.e. instream) including removal of existing piers and placement of riprap at each new abutment will be completed independent of bridge construction in Phases 1 and 2 during the July 15 and August 15 work window of any year.

2.1.2.2 New Bridge and Abutments

The new bridge is 34 m (112 ft) long, 11.6 m (38 ft) wide, single-span that uses six precast AASHTO Type IV girders to support the roadway and bridge rail. The elevation of the new bridge deck is anticipated to be similar to the existing bridge deck. The new bridge will clear span Fish Creek and its associated stream banks. The new structure will be constructed above the OHWM of both Fish Creek and the Lochsa River.

New bridge abutments will be constructed using approximately seven (per abutment) 30 cm (12 in) x 30 cm (12 in) H-piles placed in a single row. There are two abutments so approximately 14 H-piles in total will be used. H-piles are estimated to be approximately 4.5 to 9.1 m (15 - 30 ft) in length and will be driven with an impact hammer. Pre-drilling will likely be needed for each H-pile on the south abutment as shallow bedrock is anticipated. Pre-drilling will be completed using either a drill rig or a drilling attachment on an excavator or crane. The holes will be back-filled with gravel and then H-piles will be driven into the back-filled holes. No pre-drilling is anticipated on the north abutment. Piles are anticipated to be driven to refusal. Final drilling and placement of H-piles is anticipated to take approximately two to three days per quadrant. Once H-piles have been driven, new abutments will be formed and poured (using concrete) in-place.

Shallow rock in the south abutment area will be encountered during abutment construction. The rock must be excavated using mechanical methods or blasted in order to accommodate the new abutment. Rock excavation or blasting will occur approximately 6 m (20 ft) from the OHWM of Fish Creek. Should blasting be necessary, the contractor would be limited to using the amount of charge that creates velocities/vibrations and overpressures less than those levels outlined previously.

The nearest new structure to the Fish Creek channel is the north abutment. It will be constructed approximately 4.6 m (15 ft) from the OHWM of Fish Creek. The south abutment will be constructed approximately 6.1 m (20 ft) from the OHWM of Fish Creek.

An approximate 0.9 m (3 ft) thick blanket of large angular rock [e.g., riprap with an average diameter of 0.46 m (1.5 ft)] that is approximately 7.6 m (25 ft) wide (perpendicular to each new abutment) and 18.3 m (60 ft) long (parallel with each new abutment) will be placed along new abutment slopes to protect abutment footings. Riprap will be keyed 0.91 m (3 ft) beneath the channel bed elevation of Fish Creek and will be underlain with an approved geotextile filter fabric. Existing bank materials will be removed and riprap will be placed using an excavator staged atop the adjacent stream bank. The geotextile fabric will be placed by hand. This work will occur within a cofferdam and during the July 15 and August 15 work window of any year. Refer to the riprap detail in Appendix A.

Once the abutments are constructed, the six precast girders will be placed. Then the diaphragms, deck, and curb will be formed and poured (using concrete) in place.

Refer to the technical drawings in Appendix A.

2.1.2.3 Roadway and Approach Work

US-12 will be widened by about 0.61 m (2 ft) on each side of the highway for about 45 m (150 ft) north and south of the bridge. The finished roadway will be 8.5 m (28 ft) edge of oil to edge of oil. Finished lanes will then be striped at 3.7 m (12 ft) with a 0.61 m (2 ft) shoulder. Widening will occur equally on both sides of the roadway while maintaining the existing centerline. All roadway embankment widening will be above the OHWM of both Fish Creek and the Lochsa River.

To accommodate the widening, a gabion basket wall will be required in two locations and will be approximately 6.7 m (22 ft) from the centerline. The first wall begins approximately at station 1200+30 and ends approximately at station 1200+60 [9.1 m (30 ft)] and is anticipated to be one basket high [(0.91 m (3 ft)]. The second wall begins approximately at station 1202+89 and ends approximately at station 1203+61 [22 m (72 ft)] and is anticipated to be one to two baskets high [0.91 to 1.8 m (3 to 6 ft)], with the two-basket high section between station 1203+15 and 1203+36 [6.4 m (21 ft)]. Gabion basket walls will be constructed above the OHWM of Fish Creek and the Lochsa River. Material to fill baskets will be brought in from outside the action area and will be clean.

In addition to widening the roadway on US-12, the existing metal guardrail and terminals will be replaced with new metal guardrail and crashworthy terminals.

A USFS access road is located in close proximity to the existing bridge in the northwest quadrant. The existing guardrail terminal in the northwest quadrant is not crashworthy and does not meet the latest crash terminal standards. In fact, the northwest quadrant was the location of a recent fatality. A new crashworthy Type 7 and 8 terminal is proposed in the northwest quadrant. To install the Type 7 and 8 terminals, the approach to the USFS access road must be shifted to the north. Shifting the access road approach will require rock excavation or blasting. Rock excavation or blasting would occur approximately 30 m (100 ft) from Fish Creek and the Lochsa River. Should blasting be necessary, the contractor would be limited to using the amount of charge that creates velocities/vibrations and overpressures less than those levels outlined previously. Additionally, blasting mats will be required to prevent rock fragments from entering Fish Creek and the Lochsa River.

Similarly, in order to accommodate a new guardrail terminal in the southwest quadrant of the bridge, rock excavation and possibly pre-split blasting of the hillside will be required. The rock excavation or blasting would occur approximately 24 m (80 ft) from Fish Creek and the Lochsa River. Should blasting be necessary, the contractor would be limited to using the amount of charge that creates velocities/vibrations and overpressures less than those levels outlined previously. Additionally, blasting mats will be required to prevent rock fragments from entering Fish Creek and the Lochsa River.

2.1.2.4 Existing Bridge Removal Above OHWM

The existing Fish Creek bridge will be removed in two phases. In Phase 1, the westbound half of the existing bridge, except the pier below the OHWM, will be removed prior to constructing the westbound half of the new bridge. Traffic will pass through the project on a 3.7 m (12 ft) lane on the eastbound half of the existing bridge. Traffic will be controlled with an alternating one-way signal.

After the westbound half of the new bridge has been constructed, traffic will be switched to use the westbound half of the new bridge and then the remainder (eastbound half) of the bridge, except the pier below the OHWM, will be removed.

2.1.2.5 Work Below OHWM

Work below the OHWM includes removing the existing bridge piers and placing the riprap blanket along the new abutments. Removal of the old bridge piers and placing the proposed riprap will take place within a cofferdam and during the July 15 and August 15 work window of any year.

The old bridge piers (two) will be removed to a depth of 0.3 m (1 ft) below the existing Fish Creek channel bed. To complete this work, jackhammers will be used to break the piers into manageable pieces and an excavator will be used to remove those pieces.

An approximate 0.9 m (3 ft) thick blanket of large angular rock [e.g., riprap with an average diameter of 0.45 m (1.5 ft)] that is approximately 7.6 m (25 ft) wide (perpendicular to each new abutment) and 18 m (60 ft) long (parallel with each new abutment) will be placed along the new abutment slopes to protect the abutment footings. Riprap will be keyed 0.9 m (3 ft) beneath the channel bed elevation of Fish Creek and will be underlain with an approved geotextile filter fabric. Existing bank materials will be removed and riprap will be placed using an excavator staged atop the adjacent stream bank. The bank materials removed will be placed in an approved upland location. The geotextile fabric will be placed by hand. This work will occur within a cofferdam and during the July 15 and August 15 work window of any year. Refer to the riprap detail in Appendix A.

Removal of the old piers and placement of riprap are expected to occur in wetted conditions. To separate the wetted work area from the active Fish Creek channel, a three-sided portable cofferdam will be installed. The cofferdam consists of a combination of concrete guardrail, visqueen sheeting, and gravel bags. The concrete guardrail and large gravel bags will be placed using machinery staged atop the adjacent stream bank. The visqueen sheeting and small gravel bags will be manually placed. Gravel will be clean and imported from outside the action area. After use, gravel will be placed in an approved upland location. The cofferdam will be installed beginning upstream and working downstream to provide opportunity for fish to naturally escape the cofferdam. Approximately half of the channel will be separated; the remaining approximate half of the channel will remain open and flowing and available for fish passage. A similar three-sided cofferdam was recently used at the East Fork Salmon River Bridges project to remove old piers. The cofferdam effectively diverted flow around the work area and stilled the water inside enough to prevent high turbidity events during the demolition process.

Fish will be herded from the cofferdam before complete enclosure. Although this will remove larger fish, it will not be possible to ensure removal of smaller fish that may hide in channel bed pockets or between channel bed substrate. Should fish become enclosed within the cofferdams, they will be captured and relocated upstream of the work area by ITD approved personnel following National Marine Fisheries Service (NMFS) protocols, such as using a plastic-lined dip net to minimize gill and scale injury. If the salvage method used is electrofishing, NMFS Backpack Electrofishing Guidelines (NMFS 2000) will be followed. The person leading the electrofishing effort will have a valid Scientific Collecting Permit from the Idaho Department of Fish and Game.

The cofferdam will be removed in such a manner as to return water to the river slowly at first to minimize the amount of sediment pulsed out (e.g., begin at the downstream edge). Again using the East Fork Salmon River Bridges project as an example, during the removal of north pier cofferdam turbidity measured 45 m (150 ft) downstream of the cofferdam increased 63 NTUs over the background level when the first large gravel bag was removed, but dropped to 16 NTUs over the background level within 15 minutes. The entire cofferdam was removed in two hours with no additional large sediment pulses.

Use of the cofferdam is anticipated to be a short-term duration construction activity that lasts approximately 10 days per phase for a total of approximately 20 days of use. This instream work will occur inside of the July 15 and August 15 work window of any year.

Increased turbidity may occur in the Fish Creek channel and in a narrow strip along the west/right bank of the Lochsa River during instream work. An ITD environmental monitor will conduct daily turbidity monitoring to ensure adherence to State water quality standards of 25 NTUs (chronic) and 50 NTUs (instantaneous) over ambient/background turbidity levels. Should a sediment plume be visible and turbidity levels increase greater than 50 NTUs over background levels, the environmental monitor will notify the correct personnel to cease construction activity and modify the sediment creating activity. Turbidity will be regularly measured (e.g., every 15 minutes) until levels drop (close to the background level). The size, location and duration of the plume(s) will be recorded and photo-documented, and supplied to the regulatory agencies in a monitoring report.

Existing vegetation will be protected and preserved as much as possible. For access it may be necessary to cut back some trees and shrubs near the Fish Creek bridge; however, root wads will remain in place and intact and should begin the re-vegetation process the following growing season. It is not anticipated that any vegetation will be permanently removed.

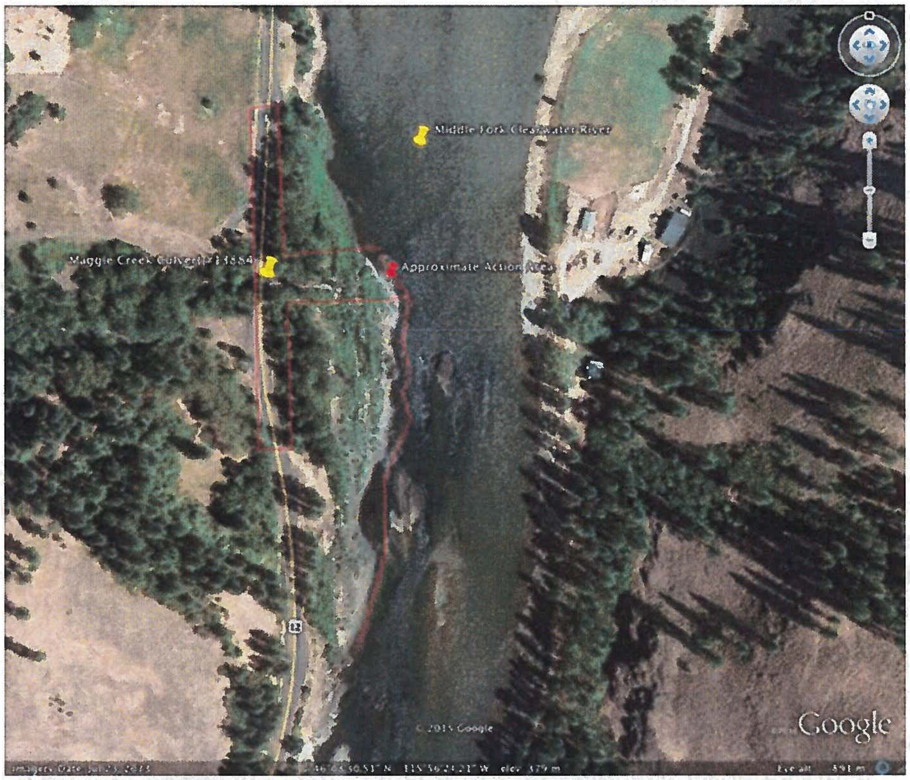
2.1.3 Maggie Creek Action Area

The existing Maggie Creek culvert occurs on US-12 milepost 76.8 approximately 5 km (3 mi) upriver from the city of Kooskia, Idaho and approximately 61 m (200 ft) upstream from the confluence of Maggie Creek and the Middle Fork Clearwater River (Figure 1).

- The existing Maggie Creek culvert.
- The Maggie Creek channel from approximately 9 m (30 ft) upstream of the existing culvert to the confluence with the Middle Fork Clearwater River approximately 61 m (200 ft) downstream of the culvert. The Middle Fork Clearwater River channel along the west/right bank from its confluence with Maggie Creek to approximately 240 m (800 ft) downriver (e.g., for potential turbidity effects). The potential 305 m (1,000 ft) sediment travel distance is estimated based on monitoring data obtained at ITD bank stabilization activities such as American Creek (NMFS) Biological Opinion (BO) No. 2006/07423) and Rough Creek (NMFS BO No. 2009/06753) projects where no turbidity impacts occurred during the instream placement of large rocks along the bank toe and river channel interface (with no diversion/barrier) and larger ITD bridge replacement projects such as Slate Creek Bridge (NMFS BO No. 2005/06344) and East Fork Salmon River Bridges (NMFS BO No. 2012/03785) where typical sediment effects were measureable at 46 m (150 ft) (and were within Idaho State water quality standards) but insignificant (had returned to near background levels) at 91 m (300 ft) during such activities as the construction and removal of cofferdams and demolition of pier footings. Turbidity plumes created during construction of log and rock barbs in the Big Wood River, Idaho in live water without a diversion/barrier were visually observed to have dissipated in less than 305 m (1,000 ft) (measurement was not required).
- The riparian area adjacent to Maggie Creek from approximately 91 m (30 ft) upstream of the bridge to approximately 9.1 m (30 ft) downstream of the bridge.
- The area 9.1 m (30 ft) from the highway centerline to the hillside on the west side of the highway and 9.1 m (30 ft) from the highway centerline toward the Middle Fork Clearwater River on the east side of the highway for approximately 114 m (375 ft) upriver and downriver of the existing culvert. No new highway right-of-way acquisition is anticipated.

The off-site project components (e.g., staging areas, source and waste sites, and refueling areas) will be designated by the contractor and will follow ITD restrictions as outlined in the Best Management Practices (BMPs), Project Design Criteria, and Other Measures to Minimize Impacts section below.

Figure 3. Google Earth aerial view of the Maggie Creek Culvert action area. Note, the delineated action area (red) is close to, but not exactly representative of the action area identified above.



2.1.4 Maggie Creek Proposed Action

The existing Maggie Creek culvert occurs on US-12 at milepost 76.8 and is east of Kooskia, Idaho (Figure 1). Maggie Creek flows into the Middle Fork of the Clearwater River approximately 61 m (200 ft) downstream of the existing culvert. The culvert was built in 1950 and has a sufficiency rating of 52.6. ITD proposes to replace the 6.1 m (20 ft) long, 9.1 m (30 ft) wide, cast-in-place, stiff-leg culvert with a 18.3 m (60 ft) long, 11 m (36 ft) wide, single-span bridge with a load rating designed to modern standards. Culvert rehabilitation is not feasible because preserving the existing structure would not be cost effective.

The elevation of the new bridge deck is anticipated to be similar to the existing road elevation and US-12 will be widened on the centerline. Sections of Mechanically Stabilized Earth (MSE) retaining walls, approximately 30 to 61 m (100 to 200 ft) long and about 3 m (10 ft) tall, may be required immediately adjacent to the bridge.

Instream work required for the new Maggie Creek bridge entails removal of stiff-leg stem walls and footings from the existing culvert, placement of riprap, and bank shaping/reconstruction. This work will occur within a cofferdam and during the July 15 and August 15 work window of any year.

2.1.4.1 Construction Phasing

Construction will be completed in two phases. In phase 1, the westbound half of the existing culvert above the OHWM of Maggie Creek will be removed and the westbound half of the new bridge will be constructed. In Phase 2, the eastbound half of the existing culvert will be removed above the OHWM and the eastbound half of the new bridge will be constructed. Traffic control for both phases is anticipated to be alternating one-way traffic with a signal.

All roadway work, including widening of the highway at each bridge approach and replacement of the existing guardrail, will be completely independently of bridge construction between spring 2018 and fall 2018.

All work below the OHWM (instream), including stem wall and foundation removal, placement of riprap, and bank shaping/reconstruction, will be completed independent of bridge construction in Phases 1 and 2 during the July 15 and August 15 work window of any year.

2.1.4.2 New Bridge

The new bridge is a 18.3 m (60 ft) long, 11 m (36 ft) wide, single-span which uses nine 53 cm (21 in) thick and 1.2 m (4 ft) wide precast voided slabs to support the roadway and bridge rail. After voided slabs are installed, a 12 cm (0.4 ft) thick asphaltic concrete overlay will be placed on the top of the bridge. The elevation of the new bridge deck is anticipated to be similar to the existing road elevation. The new bridge will clear span Maggie Creek.

New bridge abutments will be constructed using approximately six to seven (per abutment) 30 cm (12 in) x 30 cm (12 in) H-piles placed in a single row, for approximately 12 to14 H-piles total (two abutments). The H-piles will be approximately 7.6 m (25 ft) in length. H-piles will most likely be driven with an impact hammer. Pre-drilling will likely be needed for each H-pile as shallow bedrock is present approximately 4.6 m (15 ft) below the new abutments. Pre-drilling will likely be completed using either a drill rig or a drilling attachment on an excavator or crane and result in holes which will be back-filled with gravel. H-piles will then be driven into the back-filled holes. Drilling and placement of H-piles is anticipated to take approximately two to three days per quadrant. After H-piles are installed, new abutments will be formed and poured (using concrete) in place.

The nearest new structures to the Maggie Creek channel are the abutments. Both abutments will be constructed approximately 5.2 m (17 ft) from the OHWM of Maggie Creek.

An approximate 0.9 m (3 ft) thick blanket of large angular rock [e.g., riprap with an average diameter of 0.46 m (1.5 ft)] that is approximately 6.1 m (20 ft) wide (perpendicular to each new abutment) and 15.2 m (50 ft) long (parallel with each new abutment) will be placed along the new abutment slopes to protect abutment footings. Riprap will be keyed 0.91 m (3 ft) beneath the channel bed elevation of Maggie Creek at a width of 1.5 m (5 ft) and will be underlain with an approved geotextile filter fabric. Existing bank materials will be removed and riprap will be placed using an excavator staged atop the adjacent stream bank. Bank materials removed will be placed in an approved upland location. Geotextile fabric will be placed by hand. This work will occur within a cofferdam and during the July 15 and August 15 work window of any year.

Refer to the technical drawings in Appendix B.

2.1.4.3 Removal of Existing Culvert

The existing Maggie Creek culvert will be removed in two phases. In Phase 1, the westbound half of the existing culvert, except the stiff-leg stem walls and footings below the OHWM, will be removed prior to constructing the westbound half of the new bridge. The traffic will pass through the Project area via a 3.7 m (12 ft) lane on the eastbound half of the existing culvert. Traffic will be controlled with an alternating one-way traffic signal.

After the westbound half of the new bridge has been constructed, traffic will be switched to use the westbound half of the bridge and then the remainder (eastbound half) of the culvert, except the stiff-leg stem walls and footings below the OHWM, will be removed.

2.1.4.4 Roadway and Approach Work near New Bridge

US-12 will be widened on each side for approximately 36 m (120 ft) north and south of the new bridge. The roadway width will be 12.8 m (42 ft) edge of oil to edge of oil. Finished lanes will then be striped at 3.4 m (11 ft) with a 1.8 m (6 ft) shoulder and 0.61 m (2 ft) shoe. This widening will occur equally on both sides of the roadway while maintaining the existing centerline and then taper back to the existing 7.3 m (24 ft) typical roadway cross section. All roadway embankment widening will be above the OHWM.

To accommodate widening, a MSE wall will be required on the north and south sides of the new bridge and both sides of the highway. The first wall will begin approximately at station 130+48 RT and end approximately at station 132+35 [26.5 m (87 ft)] and is anticipated to be 1.4 to 2.3 m (4.5 to 7.5 ft) high. The second wall will begin approximately at station 131+55 LT and end at station 132+35 [24.4 m (80 ft)] and is anticipated to be .091 to 1.7 m (3 to 5.5 ft)] tall. Wall three will begin at Station 132+95 RT and end at Station 134+80 [26 m (85 ft)] and will be 2.0 to 2.7 m (6.5 to 9 ft) tall. Wall four will begin at Station 132+95 LT and end at Station 133+50 [16.8 m (55 ft)] and will average 0.91 to 1.5 m (3 to 5 ft) tall. All MSE walls will be constructed above OHWM.

In addition to widening the roadway on US-12, the existing metal guardrail and terminals will be replaced with new metal guardrail and crashworthy terminals.

A private approach at the northwest corner of the project will be modified to accommodate the proposed cross section.

2.1.4.5 Work Below OHWM

Work below the OHWM includes removing the old/existing stiff-leg culvert stem walls and footings and placing a riprap blanket along the proposed abutments. This work will take place during the July 15 and August 15 work window of any year.

The old stiff-leg culvert stem walls and footings will be removed to a depth of 0.3 m (1 ft) below the existing Maggie Creek channel bed. This work is expected to be completed using jackhammers to break the stem walls and footings into manageable pieces and an excavator to remove the pieces.

An approximate 0.9 m (3 ft) thick blanket of large angular rock [e.g., riprap with an average diameter of 0.46 m (1.5 ft)] that is approximately 6 m (20 ft) wide (perpendicular to each new abutment) and 15 m (50 ft) long (parallel with each new abutment) will be placed along the new abutment slopes to protect abutment footings. Riprap will be keyed 0.9 m (3 ft) beneath the channel bed elevation of Maggie Creek at a width of 1.5 m (5 ft) and will be underlain with an approved geotextile filter fabric. Existing bank materials will be removed and riprap will be placed using an excavator staged atop the adjacent stream bank. Bank materials removed will be placed in an approved upland location. Geotextile fabric will be placed by hand. This work will occur within a cofferdam and during the July 15 and August 15 work window of any year.

Refer to the riprap detail in Appendix B.

Removal of the old/existing stem walls and footings and placement of the riprap are expected to occur in wetted conditions (meaning in the stream channel but within a cofferdam and without significant flow). To separate the wetted work area from the active Maggie Creek channel, a three-sided portable cofferdam will be installed which consists of a combination of concrete guardrail, visqueen sheeting, and gravel bags. The concrete guardrail and large gravel bags will be placed using machinery staged atop the adjacent stream bank and the visqueen sheeting and small gravel bags will be manually placed. Gravel bags will be filled with clean material which will likely be roadway gravel. Upon completion, gravel from the bags will be placed in an approved upland location. The cofferdam will be installed beginning upstream and working downstream to provide opportunity for fish to volitionally escape the cofferdam. Approximately half of the channel will be separated; the remaining approximate half of the channel will remain open, flowing, and available for fish to pass. A similar three-sided cofferdam was recently used at the East Fork Salmon River Bridges project to remove old piers. The cofferdam effectively diverted flow around the work area and stilled the water inside the cofferdam enough to prevent high turbidity events during the demolition process.

Should fish become trapped in the cofferdam, they will be relocated/transferred upstream of the work area by ITD approved personnel following NMFS protocols, such as using a plastic-lined dip net to minimize gill and scale injury.

Use of the cofferdam will be short-term, lasting approximately 10 days per phase for a total of approximately 20 days.

All instream work will occur during the July 15 and August 15 work window of any year.

Increased turbidity may occur in the Maggie Creek channel and in a narrow strip along the west/right bank of the Middle Fork Clearwater River during instream work. An ITD environmental monitor will conduct daily turbidity monitoring to ensure State water quality standards of 25 NTUs (chronic) and 50 NTUs (instantaneous) over ambient/background turbidity levels are maintained. Should a sediment plume be visible and turbidity levels increase greater than 50 NTUs over background levels, the environmental monitor will notify the appropriate personnel to cease construction activity and to modify the sediment creating activity. Turbidity will be regularly measured (e.g., every 15 minutes) until levels drop (close to the background level). The size, location and duration of the plume(s) will be recorded and photo-documented, and supplied to the regulatory agencies in a monitoring report.

Existing vegetation will be protected and preserved as much as possible. For access it may be necessary to cut back some trees and shrubs near the Maggie Creek Project area; however, the root wads will remain in place and intact and should begin the re-vegetation process the following growing season. It is not anticipated that any vegetation will be permanently removed.

2.1.5 Best Management Practices (BMPs), Project Design Criteria, and Other Measures to Minimize Impacts

To minimize potential impacts resulting from the Fish Creek and Maggie Creek Projects described above, the following guidelines will be followed:

- Heavy equipment will be washed before coming on site and when moving from one area to another in order to reduce construction-generated spread of invasive plant seeds (terrestrial and aquatic). Additionally, equipment will not have damaged hoses, fittings, lines, or tanks that have the potential to release pollutants into the waterways, and will be inspected daily. Spill kits and absorption pads will be stored in machinery/equipment.
- An approved pollution and erosion control plan will be prepared and carried out to reduce the risk of pollution and erosion related to construction activities. The Storm Water Pollution Prevention Plan will be provided to ITD for inspection once completed. The plan must contain, at a minimum, the following elements and must meet requirements of all applicable laws and regulations.
  - (1) Practices to prevent erosion and sedimentation associated with access roads, construction-sites, borrow site operations, equipment and material storage sites, fueling operations, and staging areas.
  - (2) Practices to confine, remove, and dispose of excess concrete, cement, and other mortars or bonding agents, including measures for washout facilities.
  - (3) A description of any hazardous product or material that will be used for the project, including procedures for inventory, storage, handling, and monitoring.
  - (4) A Spill Containment and Control Plan that includes notification procedures, specific clean up and disposal instructions for different products available on the site, proposed methods for disposal of spilled material, and employee training for spill containment.
  - (5) Practices to prevent construction debris from dropping into any stream or waterbody, and to remove any instream material with a minimum disturbance to the streambed and water quality.
  - (6) During construction, all erosion controls will be inspected daily during precipitation events, and weekly when there is no precipitation to ensure they are working correctly. If inspection shows the erosion controls are ineffective, work crews must be mobilized immediately to make repairs, install replacements, or install additional controls as necessary. Sediment must be removed from erosion controls once it has reached one-third of the exposed height of the control. Spill kits and absorption pads will be stored in the machinery.
- Off-site project components, including staging, material source and waste sites, and refueling areas, will be determined by the construction contractor and approved by ITD prior to commencement of construction activities. The contractor will be required to submit off-site use plans to ITD for approval. Such plans will identify the proposed location on a scaled map, type of activity, and equipment to be used, in addition to specifications for all necessary sediment and erosion control BMPs. These plans will also include copies of any permits and

approvals issued by applicable federal, state or local agencies. ITD will not allow the contractor to utilize any site or construction practice that will result in an effect to T&E species or associated habitat that is not otherwise identified in this Opinion. ITD will consider the use of only those off-site components that avoid impacts to waters of the U.S. Off-site components must be located in upland area(s) at least 46 m (150 ft) from any stream, water body or wetland. If fuel storage areas cannot be located greater than 46 m (150 ft) due to topographical constraints, these areas will utilize BMPs and containments large enough to capture 125 percent of the stored fuel. All vehicles operated within 46 m (150 ft) of any water body will be inspected daily for leaks and, if necessary, repaired before leaving the staging and refueling area. In addition, ITD will consider the use of only those sites that avoid impacts to cultural resources.

- Native materials removed will be placed in an approved upland area to prevent sediment returning to the waterways.

- Should blasting be necessary, the contractor will meet the minimum required explosive charge weight setbacks as established by the 2013 Alaska Department of Fish and Game Blasting Standards to minimize for harm, injury and mortality to fish (*http://www.adfg.alaska.gov/index.cfm?adfg=uselicense.explosives*). The contractor will be required to use blasting mats at all times to contain the spread of all rock and earthen/rock fragments and keep them from reaching waterways.

- Turbidity monitoring (both visual and measured) will be conducted by an ITD approved environmental monitor. The typical turbidity monitoring procedure includes:

    (1) Obtaining a background measurement upstream from the work site at the beginning of each work day to determine background turbidity levels in the waterbody before construction activities begin;

    (2) Should a sediment plume occur, turbidity measurements would then be obtained on a regular basis (e.g., every 15 minutes) to monitor turbidity increases over background levels. Should turbidity levels approach 35 NTUs over background levels, the construction activity would be halted for the time necessary to allow sediment to settle out prior to reaching the 50 NTU increase in order to comply with Idaho Department of Environmental Quality (DEQ) standards of 25 NTUs (chronic) and 50 NTUs (instantaneous).

    (3) Should a very large sediment plume occur and turbidity levels increase greater than 50 NTUs over background levels, the construction activity would be halted, and turbidity measurements would be obtained on a regular basis (e.g., every 15 minutes) until levels drop close to the background level. At this point the construction activity would need to be evaluated to determine appropriate modifications to procedures to prevent further violations before reinitiating any work.

    Turbidity measurement sites will be determined in cooperation with the resource agencies and ITD.

In addition to turbidity measurements, visual observations will also be recorded regarding the size (width and length), location (e.g., along one bank or across the entire river channel), and duration of the plume. Photographs will be taken for verification purposes. The full extent of the sedimentation must be documented and supplied to the regulatory agencies in a monitoring report.

- All materials placed below the OHWM (e.g., riprap) will be washed and clean of fines.
- Gravel bags used for construction of cofferdams will be new without tears or leaks, and will be filled with clean gravel, not sand or other fines. After use, gravel will be placed in an approved upland location.
- Should fish be trapped in the cofferdam(s), they will be relocated/transferred upstream of the work area by ITD approved personnel following NMFS protocols, such as using a plastic-lined dip net to minimize gill and scale injury.
- Fish passage will be maintained at all times. Construction activities will be limited to daylight hours to allow migrating fish to pass.
- Should it be necessary to draft water (e.g., for dust abatement purposes, etc.) the water intake will be operated and maintained according to NMFS fish screen criteria. For example, the intake hose will be fitted with screens having a 2.4 mm (3/32 in) mesh size and the appropriate surface area such that water velocities at the screen do no exceed 12.2 cm (0.4 ft) per second rate of withdrawal to prevent impingement.

2.2 Analytical Framework for the Jeopardy and Adverse Modification Determinations

2.2.1 Jeopardy Determination

In accordance with policy and regulation, the jeopardy analysis in this Opinion relies on four components:

1. The *Status of the Species*, which evaluates the bull trout's rangewide condition, the factors responsible for that condition, and its survival and recovery needs.
2. The *Environmental Baseline*, which evaluates the condition of the bull trout in the action area, the factors responsible for that condition, and the relationship of the action area to the survival and recovery of the bull trout.
3. The *Effects of the Action*, which determines the direct and indirect impacts of the proposed Federal action and the effects of any interrelated or interdependent activities on the bull trout.
4. *Cumulative Effects*, which evaluates the effects of future, non-Federal activities reasonably certain to occur in the action area on the bull trout.

In accordance with policy and regulation, the jeopardy determination is made by evaluating the effects of the proposed Federal action in the context of the bull trout's current status, taken together with cumulative effects, to determine if implementation of the proposed action is likely to cause an appreciable reduction in the likelihood of both the survival and recovery of the bull trout in the wild.

Recovery Units (RUs) for the bull trout were defined in the final *Recovery Plan for the Coterminous United States Population of [the] Bull Trout* (USFWS 2015a, entire). Pursuant to Service policy, when a proposed Federal action impairs or precludes the capacity of a RU from providing both the survival and recovery function assigned to it, that action may represent jeopardy to the species. When using this type of analysis, the biological opinion describes how the proposed action affects not only the capability of the RU, but the relationship of the RU to both the survival and recovery of the listed species as a whole.

The jeopardy analysis for the bull trout in this biological opinion considers the relationship of the action area and affected core areas (discussed below under the *Status of the Species* section) to the RU and the relationship of the RU to both the survival and recovery of the bull trout as a whole as the context for evaluating the significance of the effects of the proposed Federal action, taken together with cumulative effects, for purposes of making the jeopardy determination.

Within the above context, the Service also considers how the effects of the proposed Federal action and any cumulative effects impact bull trout local and core area populations in determining the aggregate effect to the RU(s). Generally, if the effects of a proposed Federal action, taken together with cumulative effects, are likely to impair the viability of a core area population(s), such an effect is likely to impair the survival and recovery function assigned to a RU(s) and may represent jeopardy to the species (USFWS 2005a, 70 FR 56258).

2.2.2 Adverse Modification Determination

Section 7(a)(2) of the Act requires that Federal agencies ensure that any action they authorize, fund, or carry out is not likely to destroy or to adversely modify designated critical habitat. A final rule revising the regulatory definition of "destruction or adverse modification of critical habitat" was published on February 11, 2016 (USFWS and NMFS 2016, 81 FR 7214). The final rule became effective on March 14, 2016. The revised definition states: "Destruction or adverse modification means a direct or indirect alteration that appreciably diminishes the value of critical habitat for the conservation of a listed species. Such alterations may include, but are not limited to, those that alter the physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features."

The destruction or adverse modification analysis in this biological opinion relies on four components:

1. The *Status of Critical Habitat*, which describes the range-wide condition of designated critical habitat for the bull trout in terms of the key components of the critical habitat that provide for the conservation of the bull trout, the factors responsible for that condition, and the intended value of the critical habitat overall for the conservation/recovery of the bull trout.
2. The *Environmental Baseline*, which analyzes the condition of the critical habitat in the action area, the factors responsible for that condition, and the value of the critical habitat in the action area for the conservation/recovery of the listed species.

3. The *Effects of the Action*, which determines the direct and indirect impacts of the proposed Federal action and the effects of any interrelated and interdependent activities on the key components of critical habitat that provide for the conservation of the listed species, and how those impacts are likely to influence the value of the affected critical habitat units for the conservation/recovery of the listed species.
4. The *Cumulative Effects*, which evaluate the effects of future non-Federal activities that are reasonably certain to occur in the action area on the key components of critical habitat that provide for the conservation of the listed species and how those impacts are likely to influence the value of the affected critical habitat units for the conservation/recovery of the listed species.

For purposes of making the destruction or adverse modification determination, the effects of the proposed Federal action, together with any cumulative effects, are evaluated to determine if the value of the critical habitat rangewide for the conservation/recovery of the listed species would remain functional or would retain the current ability for the key components of the critical habitat that provide for the conservation of the listed species to be functionally re-established in areas of currently unsuitable but capable habitat.

Note: Past designations of critical habitat have used the terms "primary constituent elements" (PCEs), "physical and biological features" (PBFs) or "essential features" to characterize the key components of critical habitat that provide for the conservation of the listed species. The new critical habitat regulations (USFWS and NMFS 2016, 81 FR 7214) discontinue use of the terms "PCEs" or "essential features" and rely exclusively on use of the term PBFs for that purpose because that term is contained in the statute. To be consistent with that shift in terminology and in recognition that the terms PBFs, PCEs, and essential habit features are synonymous in meaning, we are only referring to PBFs herein. Therefore, if a past critical habitat designation defined essential habitat features or PCEs, they will be referred to as PBFs in this document. This does not change the approach outlined above for conducting the ''destruction or adverse modification'' analysis, which is the same regardless of whether the original designation identified PCEs, PBFs or essential features.

2.3 Status of the Species and Critical Habitat

This section presents information about the regulatory, biological and ecological status of the bull trout and its critical habitat that provides context for evaluating the significance of probable effects caused by the proposed action.

2.3.1 Bull Trout

2.3.1.1 Listing Status

The coterminous United States population of the bull trout was listed as threatened on November 1, 1999 (USFWS 1999, 64 FR 58910-58933). The threatened bull trout occurs in the Klamath River Basin of south-central Oregon; the Jarbidge River in Nevada; the Willamette River Basin in Oregon; Pacific Coast drainages of Washington, including Puget Sound; major rivers in Idaho, Oregon, Washington, and Montana, within the Columbia River Basin; and the St. Mary-Belly River, east of the Continental Divide in northwestern Montana (Bond 1992, p. 2; Brewin and

Brewin 1997, p. 215; Cavender 1978, pp. 165-166; Howell and Buchanan 1992, entire; Leary and Allendorf 1997, pp. 716-719; USFWS 1999, 64 FR 58910).

The final listing rule for the United States coterminous population of the bull trout discusses the consolidation of five Distinct Population Segments (DPSs) into one listed taxon and the application of the jeopardy standard under section 7 of the Endangered Species Act (Act) relative to this species, and established five interim recovery units for each of these DPSs for the purposes of Consultation and Recovery (USFWS 1999, 64 FR 58930).

The 2010 final bull trout critical habitat rule (USFWS 2010a, 75 FR 63898-64070) identified six draft recovery units based on new information that confirmed they were needed to ensure a resilient, redundant, and representative distribution of bull trout populations throughout the range of the listed entity. The final bull trout recovery plan (RP) (USFWS 2015a, pp. 36-43) formalized these six recovery units: Coastal, Klamath, Mid-Columbia, Columbia Headwaters, Saint Mary, and Upper Snake. The final recovery units replace the previous five interim recovery units and will be used in the application of the jeopardy standard for Section 7 consultation procedures.

2.3.1.2 Reasons for Listing and Emerging Threats

Throughout its range, the bull trout is threatened by the combined effects of habitat degradation, fragmentation, and alterations associated with dewatering, road construction and maintenance, mining, grazing, the blockage of migratory corridors by dams or other diversion structures, poor water quality; incidental angler harvest; entrainment (a process by which aquatic organisms are pulled through a diversion or other device) into diversion channels; and introduced non-native species (USFWS 1999, 64 FR 58910). Poaching and incidental mortality of bull trout during other targeted fisheries are additional threats.

Since the time of coterminous listing the species (64 FR 58910) and designation of its critical habitat (USFWS 2004a, 69 FR 59996; USFWS 2005a, 70 FR 56212; USFWS 2010a, 75 FR 63898) a great deal of new information has been collected on the status of bull trout. The Service's Science Team Report (Whitesel et al. 2004, entire), the bull trout core areas templates (USFWS 2005a, entire; 2009, entire), Conservation Status Assessment (USFWS 2005c, entire), and 5-year Reviews (USFWS 2008, entire; 2015h, entire) have provided additional information about threats and status. The final RP lists many other documents and meetings that compiled information about the status of bull trout (USFWS 2015a, p. 3). As did the prior 5-year review (2008), the 2015 5-year status review maintains the listing status as threatened based on the information compiled in the final bull trout RP (USFWS 2015a, entire) and the Recovery Unit Implementation Plans (RUIPs) (USFWS 2015b-g, entire).

When first listed, the status of bull trout and its threats were reported by the Service at subpopulation scales. In 2002 and 2004, the draft recovery plans (USFWS 2002a, entire; 2004a, entire; 2004b, entire) included detailed information on threats at the recovery unit scale (i.e. similar to subbasin or regional watersheds), thus incorporating the metapopulation concept with core areas and local populations. In the 5-year Reviews, the Service established threats categories (i.e. dams, forest management, grazing, agricultural practices, transportation networks, mining, development and urbanization, fisheries management, small populations, limited habitat, and wild fire) (USFWS 2008, pp. 39-42; USFWS 2015h, p. 3). In the final RP, threats and recovery actions are described for 109 core areas, forage/migration and overwintering areas, historical core areas, and research needs areas in each of the six recovery units (USFWS 2015a, p 10). Primary threats are described in three broad categories: Habitat, Demographic, and Nonnative Fish for all recovery areas within the coterminously listed range of the species.

The 2015 5-year status review references the final RP and the RUIPs and incorporates by reference the threats described therein (USFWS 2015h, pp. 2-3). Although significant recovery actions have been implemented since the time of listing, the 5-year review concluded that the listing status should remain as "threatened" (USFWS 2015h, p. 3).

New or Emerging Threats

The 2015 RP (USFWS 2015a, entire) describes new or emerging threats such as climate change and other threats. Climate change was not addressed as a known threat when bull trout was listed. The 2015 bull trout RP and RUIPs summarize the threat of climate change and acknowledge that some bull trout local populations and core areas may not persist into the future due to anthropogenic effects such as climate change. The RP further states that use of best available information will ensure future conservation efforts that offer the greatest long-term benefit to sustain bull trout and their required coldwater habitats (USFWS 2015a, pp. vii, 17-20).

Mote et al. (2014, pp. 487-513) summarized climate change effects in the Pacific Northwest to include rising air temperature, changes in the timing of streamflow related to changing snowmelt, increases in extreme precipitation events, lower summer stream flows, and other changes. A warming trend in the mountains of western North America is expected to decrease snowpack, hasten spring runoff, reduce summer stream flows, and increase summer water temperatures (Poff et al. 2002, p. 34; Koopman et al. 2009, entire; Point Reyes Bird Observatory (PRBO) Conservation Science 2011, p. 13). Lower flows as a result of smaller snowpack could reduce habitat, which might adversely affect bull trout reproduction and survival. Warmer water temperatures could lead to physiological stress and could also benefit nonnative fishes that prey on or compete with bull trout. Increases in the number and size of forest fires could also result from climate change (Westerling et al. 2006, p. 940) and could adversely affect watershed function by resulting in faster runoff, lower base flows during the summer and fall, and increased sedimentation rates. Lower flows also may result in increased groundwater withdrawal for agricultural purposes and resultant reduced water availability in certain stream reaches occupied by bull trout (USFWS 2015c, p. B-10).

Although all salmonids are likely to be affected by climate change, bull trout are especially vulnerable given that spawning and rearing are constrained by their location in upper watersheds and the requirement for cold water temperatures (Rieman et al. 2007, p. 1552). Climate change is expected to reduce the extent of cold water habitat (Isaak et al. 2015, p. 2549, Figure 7), and increase competition with other fish species (lake trout, brown trout, brook trout, and northern pike) for resources in remaining suitable habitat. Several authors project that brook trout, a fish species that competes for resources with and predates on the bull trout, will continue increasing their range in several areas (an upward shift in elevation) due to the effects from climate change (e.g., warmer water temperatures) (Wenger et al. 2011, p. 998, Figure 2a, Isaak et al. 2014, p. 114).

2.3.1.3 Species Description

Bull trout, member of the family Salmonidae, are char native to the Pacific Northwest and western Canada. The bull trout and the closely related Dolly Varden (*Salvelinus malma*) were not officially recognized as separate species until 1980 (Robins et al. 1980, p. 19). Bull trout historically occurred in major river drainages in the Pacific Northwest from the southern limits in the McCloud River in northern California (now extirpated (Rode 1990, p. 1)), Klamath River basin of south central Oregon, and the Jarbidge River in Nevada to the headwaters of the Yukon River in the Northwest Territories, Canada (Cavender 1978, pp. 165-169; Bond 1992, pp. 2-3). To the west, the bull trout's current range includes Puget Sound, coastal rivers of British Columbia, Canada, and southeast Alaska (Bond 1992, p. 2-3). East of the Continental Divide bull trout are found in the headwaters of the Saskatchewan River in Alberta and the MacKenzie River system in Alberta and British Columbia (Cavender 1978, p. 165-169; Brewin and Brewin 1997, pp. 209-216). Bull trout are wide spread throughout the Columbia River basin, including its headwaters in Montana and Canada.

2.3.1.4 Life History

Bull trout exhibit resident and migratory life history strategies throughout much of the current range (Rieman and McIntyre 1993, p. 2). Resident bull trout complete their entire life cycle in the streams where they spawn and rear. Migratory bull trout spawn and rear in streams for 1 to 4 years before migrating to either a lake (adfluvial), river (fluvial), or, in certain coastal areas, to saltwater (anadromous) where they reach maturity (Fraley and Shepard 1989, p. 1; Goetz 1989, pp. 15-16). Resident and migratory forms often occur together and it is suspected that individual bull trout may give rise to offspring exhibiting both resident and migratory behavior (Rieman and McIntyre 1993, p. 2).

Bull trout have more specific habitat requirements than other salmonids (Rieman and McIntyre 1993, p. 4). Watson and Hillman (1997, p. 248) concluded that watersheds must have specific physical characteristics to provide habitat requirements for bull trout to successfully spawn and rear. It was also concluded that these characteristics are not necessarily ubiquitous throughout these watersheds, thus resulting in patchy distributions even in pristine habitats.

Bull trout are found primarily in colder streams, although individual fish are migratory in larger, warmer river systems throughout the range (Fraley and Shepard 1989, pp. 135-137; Rieman and McIntyre 1993, p. 2 and 1995, p. 288; Buchanan and Gregory 1997, pp. 121-122; Rieman et al. 1997, p. 1114). Water temperature above 15°C (59°F) is believed to limit bull trout distribution, which may partially explain the patchy distribution within a watershed (Fraley and Shepard 1989, p. 133; Rieman and McIntyre 1995, pp. 255-296). Spawning areas are often associated with cold water springs, groundwater infiltration, and the coldest streams in a given watershed (Pratt 1992, p. 6; Rieman and McIntyre 1993, p. 7; Rieman et al. 1997, p. 1117). Goetz (1989, pp. 22, 24) suggested optimum water temperatures for rearing of less than 10°C (50°F) and optimum water temperatures for egg incubation of 2 to 4°C (35 to 39°F).

All life history stages of bull trout are associated with complex forms of cover, including large woody debris, undercut banks, boulders, and pools (Goetz 1989, pp. 22-25; Pratt 1992, p. 6; Thomas 1992, pp. 4-5; Rich 1996, pp. 35-38; Sexauer and James 1997, pp. 367-369; Watson and Hillman 1997, pp. 247-249). Jakober (1995, p. 42) observed bull trout overwintering in deep beaver ponds or pools containing large woody debris in the Bitterroot River drainage, Montana, and suggested that suitable winter habitat may be more restrictive than summer habitat. Bull trout prefer relatively stable channel and water flow conditions (Rieman and McIntyre 1993, p. 6). Juvenile and adult bull trout frequently inhabit side channels, stream margins, and pools with suitable cover (Sexauer and James 1997, pp. 368-369).

The size and age of bull trout at maturity depend upon life history strategy. Growth of resident fish is generally slower than migratory fish; resident fish tend to be smaller at maturity and less fecund (Goetz 1989, p. 15). Bull trout normally reach sexual maturity in 4 to 7 years and live as long as 12 years. Bull trout are iteroparous (they spawn more than once in a lifetime), and both repeat- and alternate-year spawning has been reported, although repeat-spawning frequency and post-spawning mortality are not well documented (Leathe and Graham 1982, p. 95; Fraley and Shepard 1989, p. 135; Pratt 1992, p. 8; Rieman and McIntyre 1996, p. 133).

Bull trout typically spawn from August to November during periods of decreasing water temperatures. Migratory bull trout frequently begin spawning migrations as early as April, and have been known to move upstream as far as 250 km (155 mi) to spawning grounds (Fraley and Shepard 1989, p. 135). Depending on water temperature, incubation is normally 100 to 145 days (Pratt 1992, p.1) and, after hatching, fry remain in the substrate. Time from egg deposition to emergence may exceed 200 days. Fry normally emerge from early April through May depending upon water temperatures and increasing stream flows (Pratt 1992, p. 1).

The iteroparous reproductive system of bull trout has important repercussions for the management of this species. Bull trout require two-way passage up and downstream, not only for repeat spawning, but also for foraging. Most fish ladders, however, were designed specifically for anadromous semelparous (fishes that spawn once and then die, and therefore require only one-way passage upstream) salmonids. Therefore, even dams or other barriers with fish passage facilities may be a factor in isolating bull trout populations if they do not provide a downstream passage route.

Bull trout are opportunistic feeders with food habits primarily a function of size and life history strategy. Resident and juvenile migratory bull trout prey on terrestrial and aquatic insects, macro zooplankton and small fish (Boag 1987, p. 58; Goetz 1989, pp. 33-34; Donald and Alger 1993, pp. 239-243). Adult migratory bull trout are primarily piscivores, known to feed on various fish species (Fraley and Shepard 1989, p. 135; Donald and Alger 1993, p. 242).

2.3.1.5 Population Dynamics

Population Structure

As indicated above, bull trout exhibit both resident and migratory life history strategies. Both resident and migratory forms may be found together, and either form may produce offspring exhibiting either resident or migratory behavior (Rieman and McIntyre 1993, p. 2). Resident bull trout complete their entire life cycle in the tributary (or nearby) streams in which they spawn and rear. The resident form tends to be smaller than the migratory form at maturity and also produces fewer eggs (Goetz 1989, p. 15). Migratory bull trout spawn in tributary streams where juvenile fish rear 1 to 4 years before migrating to either a lake (adfluvial form), river (fluvial form) (Fraley and Shepard 1989, p. 138; Goetz 1989, p. 24), or saltwater (anadromous form) to rear as subadults and to live as adults (Brenkman and Corbett 2005, entire; McPhail and Baxter 1996, p. i). Bull trout normally reach sexual maturity in 4 to 7 years and may live longer than 12 years. Repeat- and alternate-year spawning has been reported, although repeat-spawning frequency and post-spawning mortality are not well documented (Fraley and Shepard 1989, p. 135; Leathe and Graham 1982, p. 95; Pratt 1992, p. 8; Rieman and McIntyre 1996, p. 133).

Bull trout are naturally migratory, which allows them to capitalize on temporally abundant food resources and larger downstream habitats. Resident forms may develop where barriers (either natural or manmade) occur or where foraging, migrating, or overwintering habitats for migratory fish are minimized (Brenkman and Corbett 2005, pp. 1075-1076; Starcevich et al. 2012, p. 10; Barrows et al. 2016, p. 98). For example, multiple life history forms (e.g., resident and fluvial) and multiple migration patterns have been noted in the Grande Ronde River (Baxter 2002, pp. 96, 98-106) and Wenatchee River (Ringel et al. 2014, pp. 61-64). Parts of these river systems have retained habitat conditions that allow free movement between spawning and rearing areas and the mainstem rivers. Such multiple life history strategies help to maintain the stability and persistence of bull trout populations to environmental changes.

Benefits of connected habitat to migratory bull trout include greater growth in the more productive waters of larger streams, lakes, and marine waters; greater fecundity resulting in increased reproductive potential; and dispersing the population across space and time so that spawning streams may be recolonized should local populations suffer a catastrophic loss (Frissell 1999, pp. 861-863; MBTSG 1998, p. 13; Rieman and McIntyre 1993, pp. 2-3). In the absence of the migratory bull trout life form, isolated populations cannot be replenished when disturbances make local habitats temporarily unsuitable. Therefore, the range of the species is diminished, and the potential for a greater reproductive contribution from larger size fish with higher fecundity is lost (Rieman and McIntyre 1993, p. 2).

Whitesel et al. (2004, p. 2) noted that although there are multiple resources that contribute to the subject, Spruell et al. (2003, entire) best summarized genetic information on bull trout population structure. Spruell et al. (2003, entire) analyzed 1,847 bull trout from 65 sampling locations, four located in three coastal drainages (Klamath, Queets, and Skagit Rivers), one in the Saskatchewan River drainage (Belly River), and 60 scattered throughout the Columbia River Basin. They concluded that there is a consistent pattern among genetic studies of bull trout, regardless of whether examining allozymes, mitochondrial DNA, or most recently microsatellite loci. Typically, the genetic pattern shows relatively little genetic variation within populations, but substantial divergence among populations. Microsatellite loci analysis supports the existence of at least three major genetically differentiated groups (or evolutionary lineages) of bull trout (Spruell et al. 2003, p. 17). They were characterized as:

i. "Coastal", including the Deschutes River and all of the Columbia River drainage downstream, as well as most coastal streams in Washington, Oregon, and British Columbia. A compelling case also exists that the Klamath Basin represents a unique evolutionary lineage within the coastal group.

ii. "Snake River", which also included the John Day, Umatilla, and Walla Walla rivers. Despite close proximity of the John Day and Deschutes Rivers, a striking level of divergence between bull trout in these two systems was observed.

iii. "Upper Columbia River" which includes the entire basin in Montana and northern Idaho. A tentative assignment was made by Spruell et al. (2003, p. 25) of the Saskatchewan River drainage populations (east of the continental divide), grouping them with the upper Columbia River group.

Spruell et al. (2003, p. 17) noted that within the major assemblages, populations were further subdivided, primarily at the level of major river basins. Taylor et al. (1999, entire) surveyed bull trout populations, primarily from Canada, and found a major divergence between inland and coastal populations. Costello et al. (2003, p. 328) suggested the patterns reflected the existence of two glacial refugia, consistent with the conclusions of Spruell et al. (2003, p. 26) and the biogeographic analysis of Haas and McPhail (2001, entire). Both Taylor et al. (1999, p. 1166) and Spruell et al. (2003, p. 21) concluded that the Deschutes River represented the most upstream limit of the coastal lineage in the Columbia River Basin.

More recently, the USFWS identified additional genetic units within the coastal and interior lineages (Ardren et al. 2011, pp. 519-523). Based on a recommendation in the USFWS's 5-year review of the species' status (USFWS 2008, p. 45), the USFWS reanalyzed the 27 recovery units identified in the 2002 draft bull trout recovery plan (USFWS 2002a, p. 48) by utilizing, in part, information from previous genetic studies and new information from additional analysis (Ardren et al. 2011, entire). In this examination, the USFWS applied relevant factors from the joint USFWS and NMFS Distinct Population Segment (DPS) policy (USFWS and NMFS 1996, 61 FR 4722-4725) and subsequently identified six draft recovery units that contain assemblages of core areas that retain genetic and ecological integrity across the range of bull trout in the coterminous United States. These six recovery units were used to inform designation of critical habitat for bull trout by providing a context for deciding what habitats are essential for recovery (USFWS 2010a, 75 FR 63898). These six recovery units, which were identified in the final bull trout recovery plan (USFWS 2015a) and described further in the RUIPs (USFWS 2015b-g) include: Coastal, Klamath, Mid-Columbia, Columbia Headwaters, Saint Mary, and Upper Snake.

Population Dynamics

Although bull trout are widely distributed over a large geographic area, they exhibit a patchy distribution, even in pristine habitats (Rieman and McIntyre 1993, p. 4). Increased habitat fragmentation reduces the amount of available habitat and increases isolation from other populations of the same species (Saunders et al. 1991, entire). Burkey (1989, entire) concluded that when species are isolated by fragmented habitats, low rates of population growth are typical in local populations and their probability of extinction is directly related to the degree of isolation and fragmentation. Without sufficient immigration, growth for local populations may be low and probability of extinction high (Burkey 1989, entire).

A metapopulation is an interacting network of local populations with varying frequencies of migration and gene flow among them (Meefe and Carroll 1994, pp. 189-190). For inland bull trout, metapopulation theory is likely most applicable at the watershed scale where habitat consists of discrete patches or collections of habitat capable of supporting local populations; local populations are for the most part independent and represent discrete reproductive units; and long-term, low-rate dispersal patterns among component populations influences the persistence of at least some of the local populations (Rieman and Dunham 2000, entire). Ideally, multiple local populations distributed throughout a watershed provide a mechanism for spreading risk because the simultaneous loss of all local populations is unlikely. However, habitat alteration, primarily through the construction of impoundments, dams, and water diversions has fragmented habitats, eliminated migratory corridors, and in many cases isolated bull trout in the headwaters of tributaries (Rieman and Clayton 1997, pp. 10-12; Dunham and Rieman 1999, p. 645; Spruell et al. 1999, pp. 118-120; Rieman and Dunham 2000, p. 55).

Human-induced factors as well as natural factors affecting bull trout distribution have likely limited the expression of the metapopulation concept for bull trout to patches of habitat within the overall distribution of the species (Dunham and Rieman 1999, entire). However, despite the theoretical fit, the relatively recent and brief time period during which bull trout investigations have taken place does not provide certainty as to whether a metapopulation dynamic is occurring (e.g., a balance between local extirpations and recolonizations) across the range of the bull trout or whether the persistence of bull trout in large or closely interconnected habitat patches (Dunham and Rieman 1999, entire) is simply reflective of a general deterministic trend towards extinction of the species where the larger or interconnected patches are relics of historically wider distribution (Rieman and Dunham 2000, pp. 56-57). Research does, however, provide genetic evidence for the presence of a metapopulation process for bull trout, at least in the Boise River Basin of Idaho (Whiteley et al. 2003, entire). Whitesel et al. (2004 pp. 14-23) summarizes metapopulation models and their applicability to bull trout).

2.3.1.6 Status and Distribution

The following is a summary of the description and current status of the bull trout within the six recovery units (RUs) (shown in Figure 4, below). A comprehensive discussion is found in the Service's 2015 RP for the bull trout (USFWS 2015a, entire) and the 2015 RUIPs (USFWS 2015b-g, entire). Each of these RUs is necessary to maintain the bull trout's distribution, as well as its genetic and phenotypic diversity, all of which are important to ensure the species' resilience to changing environmental conditions.

The proposed project occurs in the Mid-Columbia Recovery Unit.

Coastal Recovery Unit

The Coastal RUIP describes the threats to bull trout and the site-specific management actions necessary for recovery of the species within the unit (USFWS 2015b, entire). The Coastal RU is located within western Oregon and Washington. The RU is divided into three regions: Puget Sound, Olympic Peninsula, and the Lower Columbia River Regions. This RU contains 20 core areas comprising 84 local populations and a single potential local population in the historic Clackamas River core area where bull trout had been extirpated and were reintroduced in 2011, and identified four historically occupied core areas that could be re-established (USFWS 2015a, p. 47; USFWS 2015b, p. A-2). Core areas within Puget Sound and the Olympic Peninsula currently support the only anadromous local populations of bull trout. This RU also contains ten shared FMO habitats which are outside core areas and allows for the continued natural population dynamics in which the core areas have evolved (USFWS 2015b, p. A-5).

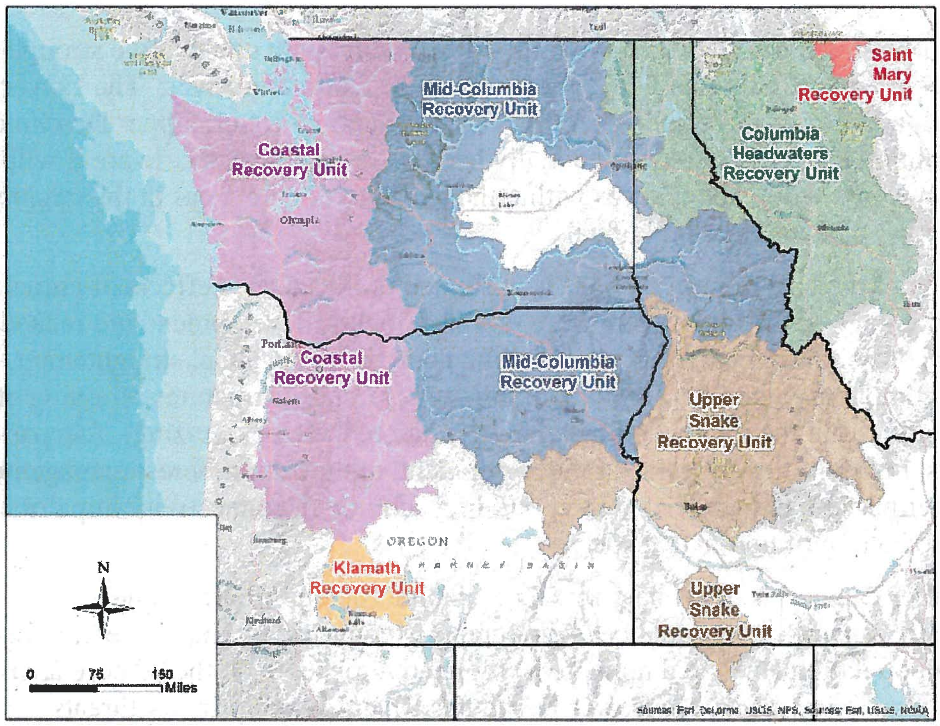


Figure 4. Map showing the location of the six bull trout Recovery Units.

There are four core areas within the Coastal RU that have been identified as current population strongholds: Lower Skagit, Upper Skagit, Quinault River, and Lower Deschutes River (USFWS 2015a, p.79). These are the most stable and abundant bull trout populations in the RU.

Most core areas in the Puget Sound region support a mix of anadromous and fluvial life history forms, with at least two core areas containing a natural adfluvial life history (Chilliwack River core area [Chilliwack Lake] and Chester Morse Lake core area). Overall demographic status of core areas generally improves as you move from south Puget Sound to north Puget Sound. Although comprehensive trend data are lacking, the current condition of core areas within the Puget Sound region are likely stable overall, although some at depressed abundances. Most core areas in this region still have significant amounts of headwater habitat within protected and relatively pristine areas (e.g., North Cascades National Park, Mount Rainier National Park, Skagit Valley Provincial Park, Manning Provincial Park, and various wilderness or recreation areas).

Within the Olympic Peninsula region, demographic status of core areas is poorest in Hood Canal and Strait of Juan de Fuca, while core areas along the Pacific Coast of Washington likely have the best demographic status in this region. The connectivity between core areas in these disjunct regions is believed to be naturally low due to the geographic distance between them. Internal connectivity is currently poor within the Skokomish River core area (Hood Canal) and is being restored in the Elwha River core area (Strait of Juan de Fuca). Most core areas in this region still have their headwater habitats within relatively protected areas (Olympic National Park and wilderness areas).

Across the Lower Columbia River region, status is highly variable, with one relative stronghold (Lower Deschutes core area) existing on the Oregon side of the Columbia River. The Lower Columbia River region also contains three watersheds (North Santiam River, Upper Deschutes River, and White Salmon River) that could potentially become re-established core areas within the Coastal Recovery Unit. Adult abundances within the majority of core areas in this region are relatively low, generally 300 or fewer individuals.

The current condition of the bull trout in this RU is attributed to the adverse effects of climate change, loss of functioning estuarine and nearshore marine habitats, development and related impacts (e.g., flood control, floodplain disconnection, bank armoring, channel straightening, loss of instream habitat complexity), agriculture (e.g., diking, water control structures, draining of wetlands, channelization, and the removal of riparian vegetation, livestock grazing), fish passage (e.g., dams, culverts, instream flows) residential development, urbanization, forest management practices (e.g., timber harvest and associated road building activities), connectivity impairment, mining, and the introduction of non-native species.

The RP identifies three categories of primary threats[1]: Habitat (upland/riparian land management, instream impacts, water quality), demographic (connectivity impairment, fisheries management, small population size), and nonnatives (nonnative fishes). Of the 20 core areas in the Coastal RU, only one (5 percent), the Lower Deschutes River, has no primary threats identified (USFWS 2015b, Table A-1).

Conservation measures or recovery actions implemented in this RU include relicensing of major hydropower facilities that have provided upstream and downstream fish passage or complete removal of dams, land acquisition to conserve bull trout habitat, floodplain restoration, culvert removal, riparian revegetation, levee setbacks, road removal, and projects to protect and restore important nearshore marine habitats. For more information on conservation actions see section 2.3.1.7 below.

Klamath Recovery Unit

The Klamath RUIP describes the threats to bull trout and the site-specific management actions necessary for recovery of the species within the unit (USFWS 2015c, entire). This RU is located in southern Oregon and northwestern California. The Klamath RU is the most significantly imperiled RU, having experienced considerable extirpation and geographic contraction of local populations and declining demographic condition, and natural re-colonization is constrained by dispersal barriers and presence of nonnative brook trout (USFWS 2015a, p. 39). This RU currently contains three core areas and eight local populations (USFWS 2015a, p. 47; USFWS 2015c, p. B-1). Nine historic local populations of bull trout have become extirpated (USFWS

[1] Primary Threats are factors known or likely (i.e., non-speculative) to negatively impact bull trout populations at the core area level, and accordingly require actions to assure bull trout persistence to a degree necessary that bull trout will not be at risk of extirpation within that core area in the foreseeable future (4 to 10 bull trout generations, approximately 50 years).

2015c, p. B-1). All three core areas have been isolated from other bull trout populations for the past 10,000 years (USFWS 2015c, p. B-3).

The current condition of the bull trout in this RU is attributed to the adverse effects of climate change, habitat degradation and fragmentation, past and present land use practices, agricultural water diversions, nonnative species, and past fisheries management practices. Identified primary threats for all three core areas include upland/ riparian land management, connectivity impairment, small population size, and nonnative fishes (USFWS 2015c, Table B-1).

Conservation measures or recovery actions implemented include removal of nonnative fish (e.g., brook trout, brown trout, and hybrids), acquiring water rights for instream flows, replacing diversion structures, installing fish screens, constructing bypass channels, installing riparian fencing, culvert replacement, and habitat restoration. For more information on conservation actions see section 2.3.1.7 below.

Mid-Columbia Recovery Unit

The Mid-Columbia RUIP describes the threats to bull trout and the site-specific management actions necessary for recovery of the species within the unit (USFWS 2015d, entire). The Mid-Columbia RU is located within eastern Washington, eastern Oregon, and portions of central Idaho. The Mid-Columbia RU is divided into four geographic regions: Lower Mid-Columbia, Upper Mid-Columbia, Lower Snake, and Mid-Snake Geographic Regions. This RU contains 24 occupied core areas comprising 142 local populations, two historically occupied core areas, one research needs area, and seven FMO habitats (USFWS 2015a, p. 47; USFWS 2015d, p. C-1 – C4).

The current demographic status of bull trout in the Mid-Columbia Recovery Unit is highly variable at both the RU and geographic region scale. Some core areas, such as the Umatilla, Asotin, and Powder Rivers, contain populations so depressed they are likely suffering from the deleterious effects of small population size. Conversely, strongholds do exist within the RU, predominantly in the Lower Snake geographic area. Populations in the Imnaha, Little Minam, Clearwater, and Wenaha Rivers are likely some of the most abundant. These populations are all completely or partially within the bounds of protected wilderness areas and have some of the most intact habitat in the recovery unit. Status in some core areas is relatively unknown, but all indications in these core areas suggest population trends are declining, particularly in the core areas of the John Day Basin. More detailed description of bull trout distribution, trends, and survey data within individual core areas is provided in Appendix II of the RUIP (USFWS 2015d).

The current condition of the bull trout in this RU is attributed to the adverse effects of climate change, agricultural practices (e.g., irrigation, water withdrawals, livestock grazing), fish passage (e.g. dams, culverts), nonnative species, forest management practices, and mining. Of the 24 occupied core areas, six (25 percent) have no identified primary threats (USFWS 2015d, Table C-2).

Conservation measures or recovery actions implemented include road removal, channel restoration, mine reclamation, improved grazing management, removal of fish barriers, and instream flow requirements. For more information on conservation actions see section 2.3.1.7 below.

Columbia Headwaters Recovery Unit

The Columbia Headwaters RUIP describes the threats to bull trout and the site-specific management actions necessary for recovery of the species within the unit (USFWS 2015e, entire). The Columbia Headwaters RU is located in western Montana, northern Idaho, and the northeastern corner of Washington. The RU is divided into five geographic regions: Upper Clark Fork, Lower Clark Fork, Flathead, Kootenai, and Coeur d'Alene Geographic Regions (USFWS 2015e, pp. D-2 – D-4). This RU contains 35 bull trout core areas; 15 of which are complex core areas as they represent larger interconnected habitats and 20 simple core areas as they are isolated headwater lakes with single local populations. The 20 simple core areas are each represented by a single local population, many of which may have persisted for thousands of years despite small populations and isolated existence (USFWS 2015e, p. D-1). Fish passage improvements within the RU have reconnected some previously fragmented habitats (USFWS 2015e, p. D-1), while others remain fragmented. Unlike the other RUs in Washington, Idaho and Oregon, the Columbia Headwaters RU does not have any anadromous fish overlap. Therefore, bull trout within the Columbia Headwaters RU do not benefit from the recovery actions for salmon (USFWS 2015e, p. D-41).

Conclusions from the 2008 5-year review (USFWS 2008, Table 1) were that 13 of the Columbia Headwaters RU core areas were at High Risk (37.1 percent), 12 were considered At Risk (34.3 percent), 9 were considered at Potential Risk (25.7 percent), and only 1 core area (Lake Koocanusa; 2.9 percent) was considered at Low Risk. Simple core areas, due to limited demographic capacity and single local populations were generally more inherently at risk than complex core areas under the model. While this assessment was conducted nearly a decade ago, little has changed in regard to individual core area status in the interim (USFWS 2015e, p. D-7).

The current condition of the bull trout in this RU is attributed to the adverse effects of climate change, mostly historical mining and contamination by heavy metals, expanding populations of nonnative fish predators and competitors, modified instream flows, migratory barriers (e.g., dams), habitat fragmentation, forest practices (e.g., logging, roads), agriculture practices (e.g. irrigation, livestock grazing), and residential development. Of the 34 occupied core areas, nine (26 percent) have no identified primary threats (USFWS 2015e, Table D-2).

Conservation measures or recovery actions implemented include habitat improvement, fish passage, and removal of nonnative species. For more information on conservation actions see section 2.3.1.7 below.

Upper Snake Recovery Unit

The Upper Snake RUIP describes the threats to bull trout and the site-specific management actions necessary for recovery of the species within the unit (USFWS 2015f, entire). The Upper Snake RU is located in central Idaho, northern Nevada, and eastern Oregon. The Upper Snake RU is divided into seven geographic regions: Salmon River, Boise River, Payette River, Little Lost River, Malheur River, Jarbidge River, and Weiser River. This RU contains 22 core areas and 207 local populations (USFWS 2015a, p. 47), with almost 60 percent being present in the Salmon River Region.

The population trends for the 22 core areas in the Upper Snake RU are summarized in Table E-2 of the Upper Snake RUIP (USFWS 2015f, pp. E-5 – E-7): six are classified as increasing, two are stable; two are likely stable; three are unknown, but likely stable; two are unknown, but likely decreasing; and, seven are unknown.

The current condition of the bull trout in this RU is attributed to the adverse effects of climate change, dams, mining, forest management practices, nonnative species, and agriculture (e.g., water diversions, grazing). Of the 22 occupied core areas, 13 (59 percent) have no identified primary threats (USFWS 2015f, Table E-3).

Conservation measures or recovery actions implemented include instream habitat restoration, instream flow requirements, screening of irrigation diversions, and riparian restoration. For more details on conservation actions in this unit see section 2.3.1.7 below.

St. Mary Recovery Unit

The St. Mary RUIP describes the threats to bull trout and the site-specific management actions necessary for recovery of the species within the unit (USFWS 2015g). The Saint Mary RU is located in Montana but is heavily linked to downstream resources in southern Alberta, Canada. Most of the Saskatchewan River watershed which the St. Mary flows into is located in Canada. The United States portion includes headwater spawning and rearing habitat and the upper reaches of FMO habitat. This RU contains four core areas (St. Mary River, Slide Lake, Cracker Lake, and Red Eagle Lake), and seven local populations (USFWS 2015g, p. F-1) in the U.S. headwaters.

Current status of bull trout in the Saint Mary River complex core area (U.S.) is considered strong. The three simple core areas (Slide Lake, Cracker Lake, and Red Eagle Lake) appear to be self-sustaining and fluctuating within known historical population demographic bounds. Note: the NatureServe status assessment tool ranks this RU as imperiled (Figure 5).

The current condition of the bull trout in this RU is attributed primarily to the outdated design and operations of the Saint Mary Diversion operated by the Bureau of Reclamation (e.g., entrainment, fish passage, instream flows), and, to a lesser extent habitat impacts from development and nonnative species. Of the four core areas, the three simple core areas (all lakes) have no identified primary threats (USFWS 2015g, Table F-1).

For more information on conservation actions see section 2.3.1.7 below.

Status Summary

The Service applied the NatureServe status assessment tool[2] to evaluate the tentative status of the six RUs. The tool rated the Klamath RU as the least robust, most vulnerable RU and the Upper Snake RU the most robust and least vulnerable recovery unit, with others at intermediate values (Figure 5).

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[2] This tool consists of a spreadsheet that generates conservation status rank scores for species or other biodiversity elements (e.g. bull trout Recovery Units) based on various user inputs of status and threats (see USFWS 2015, p. 8 and Faber-Langendoen et al. 2012, entire, for more details on this status assessment tool).

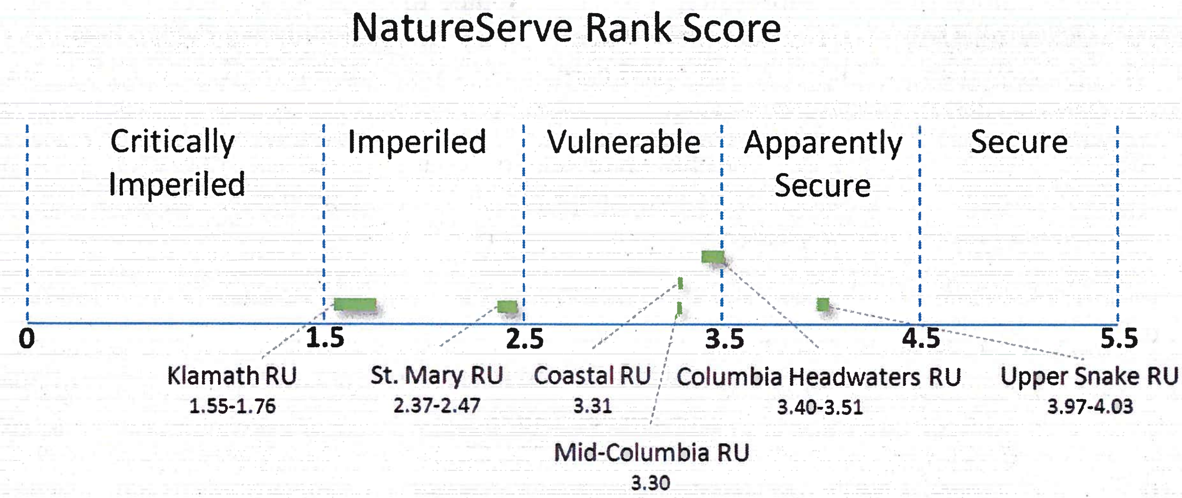


Figure 5. NatureServe status assessment tool scores for each of the six bull trout recovery units. The Klamath RU is considered the least robust and most vulnerable, and the Upper Snake RU the most robust and least vulnerable (from USFWS 2015, Figure 2).

2.3.1.7 Conservation Needs

The 2015 RP for bull trout established the primary strategy for recovery of bull trout in the coterminous United States: (1) conserve bull trout so that they are geographically widespread across representative habitats and demographically stable in six RUs; (2) effectively manage and ameliorate the primary threats in each of six RUs at the core area scale such that bull trout are not likely to become endangered in the foreseeable future; (3) build upon the numerous and ongoing conservation actions implemented on behalf of bull trout since their listing in 1999, and improve our understanding of how various threat factors potentially affect the species; (4) use that information to work cooperatively with our partners to design, fund, prioritize, and implement effective conservation actions in those areas that offer the greatest long-term benefit to sustain bull trout and where recovery can be achieved; and (5) apply adaptive management principles to implementing the bull trout recovery program to account for new information (USFWS 2015a, p. 24.).

Information presented in prior draft recovery plans published in 2002 and 2004 (USFWS 2002a, entire; 2004b, entire; 2004c, entire) provided information that identified recovery actions across the range of the species and to provide a framework for implementing numerous recovery actions by our partner agencies, local working groups, and others with an interest in bull trout conservation. Many recovery actions were completed prior to finalizing the RP in 2015.

The 2015 RP (USFWS 2015a, entire) integrates new information collected since the 1999 listing regarding bull trout life history, distribution, demographics, conservation successes, etc., and integrates and updates previous bull trout recovery planning efforts across the coterminous range of the bull trout.

The Service has developed a recovery approach that: (1) focuses on the identification of and effective management of known and remaining threat factors to bull trout in each core area; (2) acknowledges that some extant bull trout core area habitats will likely change (and may be lost) over time; and (3) identifies and focuses recovery actions in those areas where success is likely to meet our goal of ensuring the certainty of conservation of genetic diversity, life history features, and broad geographical representation of remaining bull trout populations so that the protections of the Act are no longer necessary (USFWS 2015a, p. 45-46).

To implement the recovery strategy, the 2015 RP establishes three categories of recovery actions for each of the six RUs (USFWS 2015a, pp. 50-51):

1. Protect, restore, and maintain suitable habitat conditions for bull trout.
2. Minimize demographic threats to bull trout by restoring connectivity or populations where appropriate to promote diverse life history strategies and conserve genetic diversity.
3. Prevent and reduce negative effects of nonnative fishes and other nonnative taxa on bull trout.
4. Work with partners to conduct research and monitoring to implement and evaluate bull trout recovery activities, consistent with an adaptive management approach using feedback from implemented, site-specific recovery tasks, and considering the effects of climate change.

Bull trout recovery is based on a geographical hierarchical approach. Bull trout are listed as a single DPS within the five-state area of the coterminous United States. The single DPS is subdivided into six biological-based recovery units: (1) Coastal Recovery Unit; (2) Klamath Recovery Unit; (3) Mid-Columbia Recovery Unit; (4) Columbia Headwaters Recovery Unit (5) Upper Snake Recovery Unit; and (6) Saint Mary Recovery Unit (USFWS 2015a, p. 23). A viable recovery unit should demonstrate that the three primary principles of biodiversity have been met: representation (conserving the genetic makeup of the species); resiliency (ensuring that each population is sufficiently large to withstand stochastic events); and redundancy (ensuring a sufficient number of populations to withstand catastrophic events) (USFWS 2015a, p. 33).

Each of the six recovery units contain multiple bull trout core areas, 109 total, which are non-overlapping watershed-based polygons, and each core area includes one or more local populations. Currently there are 109 occupied core areas, which comprise 611 local populations (USFWS 2015a, pp. 3, 47, Appendix F). There are also six core areas where bull trout historically occurred but are now extirpated, and one research needs area where bull trout were known to occur historically, but their current presence and use of the area are uncertain (USFWS 2015a, p. 3). Core areas can be further described as complex or simple (USFWS 2015a, p. 3-4). Complex core areas contain multiple local bull trout populations, are found in large watersheds, have multiple life history forms, and have migratory connectivity between spawning and rearing habitat and foraging, migration, and overwintering habitats (FMO). Simple core areas are those that contain one bull trout local population. Simple core areas are small in scope, isolated from other core areas by natural barriers, and may contain unique genetic or life history adaptations.

A core area is a combination of core habitat (i.e., habitat that could supply all elements for the long-term security of bull trout) and a core population (a group of one or more local bull trout populations that exist within core habitat) and constitutes the basic unit on which to gauge recovery within a recovery unit. Core areas require both habitat and bull trout to function, and the number (replication) and characteristics of local populations inhabiting a core area provide a relative indication of the core area's likelihood to persist. A core area represents the closest approximation of a biologically functioning unit for bull trout. Core areas are presumed to reflect the metapopulation structure of bull trout.

A local population is a group of bull trout that spawn within a particular stream or portion of a stream system (USFWS 2015a, p. 73). A local population is considered to be the smallest group of fish that is known to represent an interacting reproductive unit. For most waters where specific information is lacking, a local population may be represented by a single headwater tributary or complex of headwater tributaries. Gene flow may occur between local populations (e.g., those within a core population), but is assumed to be infrequent compared with that among individuals within a local population.

2.3.1.8 Federal, State, and Tribal Conservation Actions Since Listing

Since our listing of bull trout in 1999, numerous conservation measures that contribute to the conservation and recovery of bull trout have been and continue to be implemented across its range in the coterminous United States. These measures are being undertaken by a wide variety of local and regional partnerships, including State fish and game agencies, State and Federal land management and water resource agencies, Tribal governments, power companies, watershed working groups, water users, ranchers, and landowners.

In many cases, these bull trout conservation measures incorporate or are closely interrelated with work being done for recovery of salmon and steelhead, which are limited by many of the same threats. These include removal of migration barriers (culvert removal or redesign at stream crossings, fish ladder construction, dam removal, etc.) to allow access to spawning or FMO habitat; screening of water diversions to prevent entrainment into unsuitable habitat in irrigation systems; habitat improvement (riparian revegetation or fencing, placement of coarse woody debris in streams) to improve spawning suitability, habitat complexity, and water temperature; instream flow enhancement to allow effective passage at appropriate seasonal times and prevent channel dewatering; and water quality improvement (decommissioning roads, implementing best management practices for grazing or logging, setting pesticide use guidelines) to minimize impacts from sedimentation, agricultural chemicals, or warm temperatures.

At sites that are vulnerable to development, protection of land through fee title acquisition or conservation easements is important to prevent adverse impacts or allow conservation actions to be implemented. In several bull trout core areas, fisheries management to manage or suppress non-native species (particularly brown trout, brook trout, lake trout, and northern pike) is ongoing and has been identified as important in addressing effects of non-native fish competition, predation, or hybridization.

A more comprehensive overview of conservation successes since 1999, described for each recovery unit, is found in the Summary of Bull Trout Conservation Successes and Actions since 1999 (Available at: (http://www.fws.gov/pacific/ecoservices/endangered/recovery/documents/USFWS_2013_summary_of_conservation_successes.pdf).

2.3.1.9 Contemporaneous Federal Actions

Projects subject to Section 7 consultation under the Act have occurred throughout the range of bull trout. Singly or in aggregate, these projects could affect the species' status. The Service reviewed 137 opinions produced by the Service from the time of listing in June 1998 until August 2003 (Nuss 2003, entire). The Service analyzed 24 different activity types (e.g., grazing, road maintenance, habitat restoration, timber sales, hydropower, etc.). Twenty opinions involved multiple projects, including restorative actions for bull trout.

The geographic scale of projects analyzed in these opinions varied from individual actions (e.g., construction of a bridge or pipeline) within one basin, to multiple-project actions, occurring across several basins. Some large-scale projects affected more than one recovery unit.

The Service's assessment of opinions from the time of listing until August 2003 (137 opinions), confirmed that no actions that had undergone Section 7 consultation during this period, considered either singly or cumulatively, would appreciably reduce the likelihood of survival and recovery of the bull trout or result in the loss of any (sub) populations (USFWS 2006, pp. B-36 – B-37).

2.3.2 Bull Trout Critical Habitat

2.3.2.1 Legal Status

Ongoing litigation resulted in the U.S. District Court for the District of Oregon granting the Service a voluntary remand of the 2005 critical habitat designation. Subsequently the Service published a proposed critical habitat rule on January 14, 2010 (USFWS 2010b, 75 FR 2260) and a final rule on October 18, 2010 (USFWS 2010a, 75 FR 63898). The rule became effective on November 17, 2010. A justification document was also developed to support the rule and is available on our website (http://www.fws.gov/pacific/bulltrout). The scope of the designation involved the species' coterminous range within the Coastal, Klamath, Mid-Columbia, Columbia Headwaters, Upper Snake, and St. Mary recovery units[3].

Rangewide, the Service designated reservoirs/lakes and stream/shoreline miles in 32 critical habitat units (CHU) as bull trout critical habitat (see Table 1). Designated bull trout critical habitat is of two primary use types: (1) spawning and rearing; and (2) foraging, migrating, and overwintering (FMO).

[3] Note: the adverse modification analysis does not rely on recovery units.

Table 1. Stream/shoreline distance and reservoir/lake area designated as bull trout critical habitat by state.

State	Stream/Shoreline Miles	Stream/Shoreline Kilometers	Reservoir/ Lake Acres	Reservoir/ Lake Hectares
Idaho	8,771.6	14,116.5	170,217.5	68,884.9
Montana	3,056.5	4,918.9	221,470.7	89,626.4
Nevada	71.8	115.6	-	-
Oregon	2,835.9	4,563.9	30,255.5	12,244.0
Oregon/Idaho	107.7	173.3	-	-
Washington	3,793.3	6,104.8	66,308.1	26,834.0
Washington (marine)	753.8	1,213.2	-	-
Washington/Idaho	37.2	59.9	-	-
Washington/Oregon	301.3	484.8	-	-
Total	**19,729.0**	**31,750.8**	**488,251.7**	**197,589.2**

Compared to the 2005 designation, the final rule increases the amount of designated bull trout critical habitat by approximately 76 percent for miles of stream/shoreline and by approximately 71 percent for acres of lakes and reservoirs.

This rule also identifies and designates as critical habitat approximately 1,323.7 km (822.5 mi) of streams/shorelines and 6,758.8 ha (16,701.3 acres) of lakes/reservoirs of unoccupied habitat to address bull trout conservation needs in specific geographic areas in several areas not occupied at the time of listing. No unoccupied habitat was included in the 2005 designation. These unoccupied areas were determined by the Service to be essential for restoring functioning migratory bull trout populations based on currently available scientific information. These unoccupied areas often include lower mainstem river environments that can provide seasonally important migration habitat for bull trout. This type of habitat is essential in areas where bull trout habitat and population loss over time necessitates reestablishing bull trout in currently unoccupied habitat areas to achieve recovery.

The final rule continues to exclude some critical habitat segments based on a careful balancing of the benefits of inclusion versus the benefits of exclusion. Critical habitat does not include: (1) waters adjacent to non-Federal lands covered by legally operative incidental take permits for habitat conservation plans (HCPs) issued under section 10(a)(1)(B) of the Endangered Species Act of 1973, as amended, in which bull trout is a covered species on or before the publication of this final rule; (2) waters within or adjacent to Tribal lands subject to certain commitments to conserve bull trout or a conservation program that provides aquatic resource protection and restoration through collaborative efforts, and where the Tribes indicated that inclusion would impair their relationship with the Service; or (3) waters where impacts to national security have been identified (USFWS 2010a, 75 FR 63898). Excluded areas are approximately 10 percent of the stream/shoreline miles and 4 percent of the lakes and reservoir acreage of designated critical habitat. Each excluded area is identified in the relevant CHU text, as identified in paragraphs (e)(8) through (e)(41) of the final rule. It is important to note that the exclusion of waterbodies from designated critical habitat does not negate or diminish their importance for bull trout conservation. Because exclusions reflect the often complex pattern of land ownership, designated critical habitat is often fragmented and interspersed with excluded stream segments.

2.3.2.2 Conservation Role and Description of Critical Habitat

The conservation role of bull trout critical habitat is to support viable core area populations (USFWS 2010a, 75 FR 63943). The core areas reflect the metapopulation structure of bull trout and are the closest approximation of a biologically functioning unit for the purposes of recovery planning and risk analyses. CHUs generally encompass one or more core areas and may include FMO areas, outside of core areas, that are important to the survival and recovery of bull trout.

As previously noted, 32 CHUs within the geographical area occupied by the species at the time of listing are designated under the final rule. Twenty-nine of the CHUs contain all of the physical or biological features identified in this final rule and support multiple life-history requirements. Three of the mainstem river units in the Columbia and Snake River basins contain most of the physical or biological features necessary to support the bull trout's particular use of that habitat, other than those physical and biological features associated with Physical and Biological Features (PBFs) 5 and 6, which relate to breeding habitat (see list below).

The primary function of individual CHUs is to maintain and support core areas, which (1) contain bull trout populations with the demographic characteristics needed to ensure their persistence and contain the habitat needed to sustain those characteristics (Rieman and McIntyre 1993, p. 19); (2) provide for persistence of strong local populations, in part, by providing habitat conditions that encourage movement of migratory fish (MBTSG 1998, pp. 48-49; Rieman and McIntyre 1993, pp. 22-23); (3) are large enough to incorporate genetic and phenotypic diversity, but small enough to ensure connectivity between populations (MBTSG 1998, pp. 48-49; Rieman and McIntyre 1993, pp. 22-23); and (4) are distributed throughout the historic range of the species to preserve both genetic and phenotypic adaptations (MBTSG 1998, pp. 13-16; Rieman and Allendorf 2001, p. 763; Rieman and McIntyre 1993, p. 23).

The Olympic Peninsula and Puget Sound CHUs are essential to the conservation of amphidromous bull trout, which are unique to the Coastal-Puget Sound population segment. These CHUs contain marine nearshore and freshwater habitats, outside of core areas, that are used by bull trout from one or more core areas. These habitats, outside of core areas, contain PBFs that are critical to adult and subadult foraging, migrating, and overwintering.

In determining which areas to propose as critical habitat, the Service considered the physical and biological features that are essential to the conservation of bull trout and that may require special management considerations or protection. These features are the PBFs laid out in the appropriate quantity and spatial arrangement for conservation of the species. The PBFs of designated critical habitat are:

1. Springs, seeps, groundwater sources, and subsurface water connectivity (hyporheic flows) to contribute to water quality and quantity and provide thermal refugia.
2. Migration habitats with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and freshwater and marine foraging habitats, including, but not limited to, permanent, partial, intermittent, or seasonal barriers.
3. An abundant food base, including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish.
4. Complex river, stream, lake, reservoir, and marine shoreline aquatic environments and processes that establish and maintain these aquatic environments, with features such as large wood, side channels, pools, undercut banks and unembedded substrates, to provide a variety of depths, gradients, velocities, and structure.
5. Water temperatures ranging from 2 to 15 °C (36 to 59 °F), with adequate thermal refugia available for temperatures that exceed the upper end of this range. Specific temperatures within this range will depend on bull trout life-history stage and form; geography; elevation; diurnal and seasonal variation; shading, such as that provided by riparian habitat; streamflow; and local groundwater influence.
6. In spawning and rearing areas, substrate of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. A minimal amount of fine sediment, generally ranging in size from silt to coarse sand, embedded in larger substrates, is characteristic of these conditions. The size and amounts of fine sediment suitable to bull trout will likely vary from system to system.
7. A natural hydrograph, including peak, high, low, and base flows within historic and seasonal ranges or, if flows are controlled, minimal flow departures from a natural hydrograph.
8. Sufficient water quality and quantity such that normal reproduction, growth, and survival are not inhibited.
9. Sufficiently low levels of occurrence of nonnative predatory (e.g., lake trout, walleye, northern pike, smallmouth bass); interbreeding (e.g., brook trout); or competing (e.g., brown trout) species that, if present, are adequately temporally and spatially isolated from bull trout.

2.3.2.3 Current Rangewide Condition of Bull Trout Critical Habitat

The condition of bull trout critical habitat varies across its range from poor to good. Although still relatively widely distributed across its historic range, the bull trout occurs in low numbers in many areas, and populations are considered depressed or declining across much of its range (USFWS 2002b, 67 FR 71240). This condition reflects the condition of bull trout habitat.

The primary land and water management activities impacting the physical and biological features essential to the conservation of bull trout include timber harvest and road building, agriculture and agricultural diversions, livestock grazing, dams, mining, urbanization and residential development, and nonnative species presence or introduction (USFWS 2010b, 75 FR 2282).

There is widespread agreement in the scientific literature that many factors related to human activities have impacted bull trout and their habitat, and continue to do so. Among the many factors that contribute to degraded PBFs, those which appear to be particularly significant and have resulted in a legacy of degraded habitat conditions are as follows:

1. Fragmentation and isolation of local populations due to the proliferation of dams and water diversions that have eliminated habitat, altered water flow and temperature regimes, and impeded migratory movements (Dunham and Rieman 1999, p. 652; Rieman and McIntyre 1993, p. 7).
2. Degradation of spawning and rearing habitat and upper watershed areas, particularly alterations in sedimentation rates and water temperature, resulting from forest and rangeland practices and intensive development of roads (Fraley and Shepard 1989, p. 141; MBTSG 1998, pp. ii - v, 20-45).
3. The introduction and spread of nonnative fish species, particularly brook trout and lake trout, as a result of fish stocking and degraded habitat conditions, which compete with bull trout for limited resources and, in the case of brook trout, hybridize with bull trout (Leary et al. 1993, p. 857; Rieman et al. 2006, pp. 73-76).
4. In the Coastal-Puget Sound region where amphidromous bull trout occur, degradation of mainstem river FMO habitat, and the degradation and loss of marine nearshore foraging and migration habitat due to urban and residential development.
5. Degradation of FMO habitat resulting from reduced prey base, roads, agriculture, development, and dams.

The bull trout critical habitat final rule also aimed to identify and protect those habitats that provide resiliency for bull trout use in the face of climate change. Over a period of decades, climate change may directly threaten the integrity of the essential physical or biological features described in PBFs 1, 2, 3, 5, 7, 8, and 9. Protecting bull trout strongholds and cold water refugia from disturbance and ensuring connectivity among populations were important considerations in addressing this potential impact. Additionally, climate change may exacerbate habitat degradation impacts both physically (e.g., decreased base flows, increased water temperatures) and biologically (e.g., increased competition with nonnative fishes).

2.4 Environmental Baseline of the Action Area

This section assesses the effects of past and ongoing human and natural factors that have led to the current status of the species, its habitat and ecosystem in the action area. Also included in the environmental baseline are the anticipated impacts of all proposed Federal projects in the action area that have already undergone section 7 consultations, and the impacts of state and private actions which are contemporaneous with this consultation.

2.4.1 Bull Trout

2.4.1.1 Status and Factors Affecting Bull Trout in the Action Area

2.4.1.1.1 Fish Creek

The action area is within the Lochsa River core area and is composed of eight local populations that use spawning and rearing habitat within the Lochsa River basin (USFWS 2014). The Lochsa River is within the larger Clearwater River basin. Table 2 identifies all lifestages of bull trout and when and where those lifestages occur in the Clearwater River Subbasin. Migration corridors exist between the local populations within the Lochsa core area and together they make up a larger metapopulation. The Clearwater National Forest estimates the metapopulation is composed of 500-2000 adults (USFWS 2002). The lower mainstem and Middle Fork Clearwater Rivers support only a relatively small metapopulation of bull trout which is estimated by the Clearwater National Forest to be less than 50 adults (USFWS 2002). All documented spawning and rearing habitat within the Lochsa River core area is upstream of the action area, and no spawning or rearing habitat has been documented in tributaries of the Middle Fork Clearwater River. However, bull trout from the Lochsa core area are known to use the Middle Fork Clearwater River as well as the Lochsa River as FMO habitat by adults and subadults (Schiff *et al* 2004, p. 13). In addition, bull trout may use the lower reaches of Lochsa River tributaries as thermal refugia during periods of high summer water temperatures. Bull trout use of tributaries to the Middle Fork Clearwater River as thermal refugia is expected to be low due to high temperatures in many of the tributaries (ITD 2007).

Table 2. Timing and location of bull trout life stages within the Clearwater River Subbasin (BLM 2009).

Lifestage	Adult Migration	Adult Spawning	Adult Overwintering	Adult/Subadult Rearing	Incubation & Emergence	Juvenile rearing
Timing & Location	JUN–AUG Clearwater R	Late AUG-SEP tributaries	NOV-MAR Clearwater R	YEARLONG Clearwater R & tributaries	SEP-MAY tributaries	2-3 YEARS tributaries

Substantial data is not available for bull trout in Fish Creek. However, Idaho Department of Fish and Game (IDFG) reports capturing bull trout in their Fish Creek traps on a regular basis but in low numbers (Table 3). The screw trap and weir are located 1.3 km (0.81 mi) upstream from the confluence with the Lochsa River and are operated annually from early March to late November (Hennekey *in litt* 2017, p. 1). The weir is designed to trap adult steelhead (*Oncorhynchus mykiss*) so the pickets are spaced relatively far apart. The weir cannot efficiently trap bull trout less than at least 380 millimeters (mm) (15 in) but it does trap fish moving both upstream and downstream in Fish Creek (Hennekey *in litt* 2017, p. 4).

Neither IDFG nor the Clearwater National Forest have conducted bull trout spawning surveys in Fish Creek but because both juvenile and adult bull trout are annually captured in traps, bull trout spawning most likely occurs in Fish Creek and/or Hungery Creek (Schiff *et al* 2004, p. 17). All presumed spawning activity occurs at least 7.2 km (4.5 mi) upstream from the Project area and above the confluence of Hungery Creek. Fish Creek below Hungery Creek is too large to provide bull trout spawning habitat (Schiff *et al* 2004, p. 17).

Table 3. Summary of bull trout captured in Fish Creek from 2010 to 2014 by the Idaho Department of Fish and Game.

Year	Screw Trap ≤ 300 mm[1]	Screw Trap > 300 mm	Snorkeling ≤ 300 mm	Snorkeling > 300 mm	Weir ≤ 300 mm	Weir > 300 mm
2010[2]	3	3	1	5	0	0
2011[3]	3	13	NA[4]	NA	NA	NA
2012[5]	5	6	0	1	NA	NA
2013[6]	8	5	NA	NA	0	2
2014[7]	3	6	NA	NA	0	0

1 300 mm (11.8 in) is commonly used to differentiate adult from subadult bull trout.
2 Grunder 2011
3 Grunder 2012
4 NA - capture method not used.
5 Grunder 2013
6 Grunder 2014
7 Hennekey *in litt* 2017

Bull trout captures (n=9) in Fish Creek during 2016 are provided in Table 4. All were caught using a rotary screw trap and none were caught at the weir (Hennekey *in litt* 2017, p. 1).

Table 4. Records of bull trout captured using a rotary screw trap in Fish Creek during 2016; sorted by age and date of capture (Hennekey *in litt* 2017).

Date	Fork Length (mm)	Age[4]	Species
28-Jun	264	Subadult	Bull Trout
15-Jul	146	Subadult	Bull Trout
5-Sep	162	Subadult	Bull Trout
21-Jun	356	Adult	Bull Trout
30-Jun	387	Adult	Bull Trout

[4] 300 mm (11.8 in) fork length is commonly used to differentiate adult from subadult bull trout.

2-Jul	360	Adult	Bull Trout
15-Jul	310	Adult	Bull Trout
24-Aug	310	Adult	Bull Trout
20-Sep	395	Adult	Bull Trout

In 2016, one subadult and one adult bull trout were the only ones captured in the screw trap during the instream work window of July 15 to August 15. Both were caught on July 15, the first day of the work window for this Project. Other bull trout caught nearest the work window were adults; one on July 2 and one on August 24, both of which were more than a week outside the window. The screw trap can only catch fish which are moving in downstream direction. However, this does not mean fish trapped were necessarily making long distance movements (i.e. migrating) downstream. We do not know what captured bull trout were doing other than making an instream movement in a downstream direction.

Table 5 provides bull observations made by the Nez Perce Tribe in 2008 and 2010 through 2012. We do not know if snorkeling activities occurred before 2008, in 2009 or after 2012.

Table 5. Nez Perce Tribe bull trout observations using snorkel gear in Fish Creek from 2008 and 2010 -2012 (Nez Perce Tribe *in litt* 2016).

Day	Year	Length (mm)	Length[1] (in)	Amount	Temp (°C)
July 13	2010	420	*16"< 17"	1	13
July 13	2010	470	*18"<19"	1	13
July 13	2010	470	18"<19"	1	14
July 24	2011	370	*14"< 15"	2	15
July 24	2011	420	*16"< 17"	1	15
July 24	2012	370	14"< 15"	1	15
July 28	2008	320	12"< 13"	1	12
July 28	2010	140	*5"< 6"	1	12
July 28	2008	390	15"< 16"	1	14

[1] Snorkelers estimated length to the nearest inch. Length in millimeters was calculated using the mid-point of the range in inches.

* Denotes bull trout observed within the uppermost third of Fish Creek [15 km (9.3 mi) upstream from the confluence with Hungery Creek]. All other bull trout were observed within 0.5 km (0.3 mi) of the weir.

Large [300 to 470 mm (12 to 19 in], likely fluvial, bull trout have been observed in Fish Creek approximately 17 km (11 mi) above its confluence with the Lochsa River. Given that a juvenile bull trout [140 mm (5 in)], as well as a number of other bull trout over the years, was observed in the upper reaches of Fish Creek, a reproducing bull trout local population likely exists. Because large bull trout have been observed in Fish Creek on a consistent basis, the population is likely to have a fluvial component.

2.4.1.1.2 Maggie Creek

IDFG is not aware of bull trout presence in Maggie Creek but stated bull trout use the Middle Fork Clearwater River as FMO habitat (Deeds pers. comm. 2014 *in* FHWA 2016). The Nez Perce Tribe (NPT) conducted electrofishing surveys in Maggie Creek from 2008 to 2012 and did not find any bull trout (NPT *in litt.* 2013, entire). While not sufficient to statistically prove absence, the surveys were substantive. In addition, water temperature during a late July survey was 21 degrees centigrade (°C) [70 degrees Fahrenheit (F)] (NPT *in litt.* 2013, p. 1), which is far in excess of the 15°C (59°F) threshold thought to limit bull trout distribution and the elevation of Maggie Creek is low compared to other streams occupied by bull trout. For the reasons above, we assume Maggie Creek is not occupied by bull trout for this analysis.

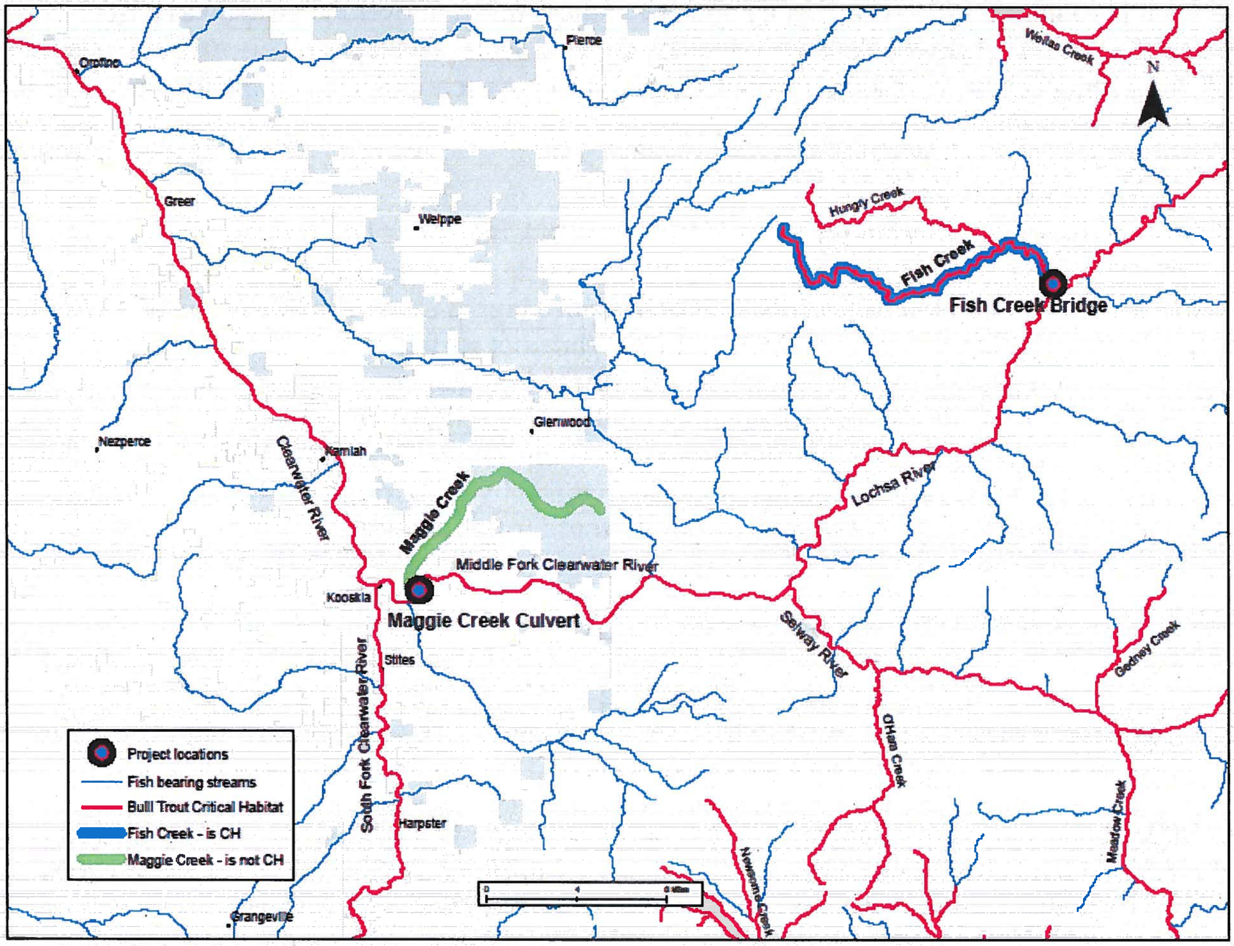
2.4.2 Bull Trout Critical Habitat

2.4.2.1 Status and Factors Affecting Bull Trout Critical Habitat in the Action Area

Bull trout critical habitat within and near the action areas is displayed in Figure 6. Fish Creek is designated bull trout critical habitat from its confluence with the Lochsa River to its headwaters. For 7.4 km (4.6 mi) from its mouth to its confluence with Hungery Creek, Fish Creek provides FMO habitat and is known to be used by bull trout (USFWS 2010, p. 553 and 557). For 25.1 km (15.6 mi) from its confluence with Hungery Creek to the headwaters, Fish Creek provides spawning and rearing habitat (USFWS 2010, p. 553). The Lochsa River, from its confluence with the Selway River upstream 111 km (69 mi) to the confluence of Crooked Fork and Colt Killed Creek is designated critical habitat and provides FMO habitat (USFWS 2010, p. 553). Hungery Creek, a tributary to Fish Creek, is designated critical habitat for its entire length of 21.8 km (13.6 mi), provides spawning habitat, and is known to be used by bull trout (USFWS 2010, p. 553 and 557).

Maggie Creek is not designated bull trout critical habitat. However, Maggie Creek flows into the Middle Fork Clearwater River which is designated critical habitat. The Middle Fork Clearwater River from its confluence with the South Fork Clearwater River upstream 36.9 km (22.9 mi) to the confluence of the Lochsa and Selway Rivers provides FMO habitat (USFWS 2010, p. 527).

Figure 6. Designated bull trout critical habitat in and near the Fish Creek Bridge and Maggie Creek Culvert action areas.



Stream temperature data are not available for Maggie Creek but Fish Creek has a few years of information. NorweST (2011) contains four years of data for Fish Creek collected at approximately 200 m (650 ft) upstream from its confluence with the Lochsa River (FC1) and one year for a site 1.1 km (0.7 mi) upstream (FC2). The average daily (minimum, mean and maximum) temperature for the month of August at these two locations on Fish Creek are provided in Table 6.

Water temperature above 15 degrees C (59°F) is believed to limit bull trout distribution (Fraley and Shepard 1989, p. 133; Rieman and McIntyre 1995, pp. 255-296). Spawning areas are often the coldest streams in a given watershed (Rieman et al. 1997, p. 1117). Goetz (1989, pp. 22, 24) suggested optimum water temperatures for rearing bull trout are less than 10 degrees C (50°F) and optimum water temperatures for egg incubation are two to four degrees C (35 to 39°F).

Table 6. August stream temperature information for Fish Creek (NorweST 2011).

Year-site	Ave. Daily Minimum (°C)	Ave. Daily Mean (°C)	Ave. Daily Maximum (°C)
1997-FC1	13.4	15.9	18.3

1995-FC1	11.8	14.5	17.1
1994-FC1	14.4	17.4	20.3
1993-FC1	12.1	14.7	17.1
2011-FC2	13.3	15.7	17.8
Ave. of all years	**13.0**	**15.6**	**18.1**

Changes in hydrology and temperature caused by changing climate have the potential to negatively impact aquatic ecosystems in Idaho, with salmonid fishes being especially sensitive. Average annual temperature increases due to increased carbon dioxide are affecting snowpack, peak runoff, and base flows of streams and rivers (Mote et al. 2003, p. 45). Increases in water temperature may cause a shift in the thermal suitability of aquatic habitats (Poff et al. 2002, p. iii). For species that require colder water temperatures to survive and reproduce, warmer temperatures could lead to significant decreases in available suitable habitat. Increased frequency and severity of flood flows during winter can affect incubating eggs and alevins in the streambed and over-wintering juvenile fish. Eggs of fall spawning fish, such as bull trout, may suffer high levels of mortality when exposed to increased flood flows (Independent Scientific Advisory Board 2007, p. iv).

2.5 Effects of the Proposed Action

Effects of the action considers the direct and indirect effects of an action on the listed species and/or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action. These effects are considered along with the environmental baseline and the predicted cumulative effects to determine the overall effects to the species. Direct effects are defined as those that result from the proposed action and directly or immediately impact the species or its habitat. Indirect effects are those that are caused by, or will result from, the proposed action and are later in time, but still reasonably certain to occur.

2.5.1 Bull Trout

2.5.1.1 Direct and Indirect Effects of the Proposed Action

2.5.1.1.1 Fish Creek

During the instream (for purposes of the analysis, instream means below OHWM) work period of July 15 to August 15 of any year, bull trout may occur within the action area as juveniles and adults. The lowest 7.4 km (4.6 mi) of Fish Creek likely does not provide spawning habitat for bull trout as it is identified as FMO habitat by the Service (2010). Therefore, we do not expect any spawning habitat or young-of-year bull trout to be affected by Project activities.

There are no instream activities proposed in the mainstem Lochsa or Middle Fork Clearwater Rivers.

Due to normally high water temperatures (NorweST 2011) during the work window for instream activities, most bull trout will likely not be present within the action area but instead will be in much cooler water than that found in lower Fish Creek. Stream temperatures in lower Fish Creek during August (Table 6) appear to be too warm for bull trout for much of the month as the average daily mean temperature over five years has been 15.6 degrees C (60.1 degrees F), which is higher than the threshold believed to limit bull trout distribution (Fraley and Shepard 1989, p. 133; Rieman and McIntyre 1995, pp. 255-296). Bull trout are highly unlikely to use lower Fish Creek as pre-spawn holding habitat or thermal refugia during the late summer due to high temperatures.

The potential for bull trout (juveniles and/or adults) to move through the action area during the July 15 to Aug 15 work window exists, although is not likely. In 2016, one subadult and one adult bull trout were captured in the screw trap during the instream work window of July 15 to August 15. Both were caught on July 15, the first day of the work window for this Project. Other bull trout caught nearest the work window were adults; one on July 2 and one on August 24, both of which were more than a week outside the window. The screw trap can only catch fish which are moving in downstream direction [the screw trap is located upstream 1.3 km (0.81 mi) on Fish Creek near the weir]. However, this does not mean fish caught were necessarily making long distance movements (i.e. migrating) downstream to and past the Project area. We do not know the purpose for these movements of captured bull trout but we know they were making an instream movement in a downstream direction. Regardless, the instream work window will likely be effective in minimizing, but may not preclude, the possibility of bull trout being present within the action area when instream Project activities are occurring.

If a bull trout was to move into the action area during the work window, it is highly unlikely to spend significant time there (more than a few minutes) since water temperatures are normally warm and springs providing pockets of cold water refugia are highly unlikely to be present. Regardless, there is potential for bull trout to be present during the work window.

During some portions of the year, bull trout are much more likely to occur within the action area than during the instream work window, and would likely be in low densities. The greatest potential for bull trout (only in a low density) to be in the action area is during pre-spawn migration (likely to be May and June) and post-spawn migration (late September and October). Subadult bull trout (commonly referred to as wanderers) have the potential to be present during the entire year, but are least likely to occur when water temperatures exceed 15° C (late July/August).

For purposes of this analysis, we assume presence of bull trout within the action area during the instream work window, although we believe the likelihood of absence is much greater than the likelihood of presence.

Installation and removal of cofferdams, excavation and placement of riprap within cofferdams, salvage (prior to Project activities occurring within cofferdams), driving piles and blasting have the potential for direct and indirect impacts on bull trout and are discussed below.

2.5.1.1.1.1 Effects of installation and removal of cofferdams and excavation and placement of riprap

As outlined in the project description above, 3-sided cofferdams will be used to separate the instream work area (e.g., old structure removal and placement of riprap for abutments) from the active channel and act as a barrier between the instream work area and potentially occurring bull trout. Construction activities in and adjacent to Fish Creek are anticipated to cause adult and most juvenile bull trout to flee/avoid the work area.

Temporary increases in sediment levels resulting from installation and removal of cofferdams have the potential to cause direct and indirect impacts on bull trout. These potential impacts have been minimized by design features, including conducting most instream work within a cofferdam and turbidity monitoring to ensure State water quality standards are met. Any exceedance of turbidity will be recorded, photo-documented and corrective actions taken such that individuals occurring in and near the action area will only be affected for a brief period of time. Effects to the subpopulation will be insignificant and discountable.

The excavation and placement of materials (riprap to protect abutments) in the wetted creek channel may cause short-term disturbance/displacement of bull trout occurring in Fish Creek. Because this work will be conducted within a cofferdam, no significant turbidity is expected until the cofferdam is removed and moving water comes in contact with the work area.

Turbidity pulses generated during cofferdam installation and removal are expected to cause fish to leave and/or avoid a small area of Fish Creek. Turbidity concentrations are not expected to cause mortality of bull trout because State water quality standards will be met. Project induced turbidity plumes are not anticipated to result in measurable downstream sediment deposition in the Lochsa River. Any effects in the Lochsa River are anticipated to be negligible.

2.5.1.1.1.2 Effects of salvage (prior to use of the cofferdams)

Salvage will occur with the use of plastic lined dip-nets or electrofishing. Both methods will follow established NMFS protocols. Although efforts will be made to herd fish from cofferdams prior to complete enclosure, this will primarily remove larger fish. It will not be possible to ensure removal of smaller fish that may hide in channel bed pockets or between channel bed substrate; some fish may be trapped in the cofferdam and potentially be injured or killed during instream work. The amount of bull trout affected will not be sufficient to affect the subpopulation, and only those individuals within the cofferdam area will be impacted.

2.5.1.1.1.3 Effects of driving piles

Pile driving is likely to adversely affect all bull trout within calculated impact zones. Driving piles with impact hammers can produce sound pressure waves having sublethal or lethal effects, depending upon variables such as the type and size of the pile, firmness of the substrate, water depth, type and size of the pile driver, number of strikes and attenuation methods used.

Fish Creek bridge abutments (one on the north-side and one on the south-side) will be located above the OWHM and will be constructed using 30 cm (12 in) wide steel H-piles up to 9.1 m (30 ft) in length. Each abutment will have seven piles (14 piles for both abutments) which will be driven until refusal with an impact hammer. The north abutment is 4.6 m (15 ft) and the south abutment is 6.1 m (20 ft) from the OHWM.

Details on the analysis and likely effects to bull trout are presented in the following discussion.

Sound generated by vibratory and impact hammers differ in intensity, frequency, and impulse energy. Vibratory hammers produce peak pressures that are approximately 10-20 dB lower than those from impact hammers (CalTrans 2007, p. 6), and no fish-kills have been linked to the use of vibratory hammers. Most of the sound energy of impact hammers is concentrated between

100 and 800 Hertz (Hz), the frequencies thought to be most harmful to fish, while the sound energy from the vibratory hammer is concentrated around 20 to 30 Hz.

The behavioral responses of fish differ with the noise from the two hammer types. The sound pressure levels (SPL) generated by impact hammers driving hollow steel piles have severely injured fish. Fish may react to the first few strikes of an impact hammer with a "startle" response. After these initial strikes, the startle response wanes and the fish may remain within the field of a potentially harmful sound. Small fish are typically more vulnerable to sound impacts (Hastings and Popper 2005, pp. 77-78). Thus, impact hammers may be more harmful than vibratory hammers for two reasons: (1) They produce pressure waves with greater potential to harm fish; and (2) the sounds produced do not elicit an avoidance response in fish, which causes them to be exposed for longer periods to harmful pressures. More information regarding the effects of sound on fish can be found in the review by Popper and Hastings (2009) and the literature cited above.

The Fisheries Hydroacoustic Working Group (FHWG), a group which includes WFLHD and NMFS, has established interim sound pressure level criteria (FHWG 2008). These criteria establish thresholds of injury to ESA-listed fish resulting from pile driving activities. The agreed upon criteria identify that injury of fish two grams or larger[5] is expected if either:

(1) The peak pressure of any strike exceeds 206 decibels (dB) micropascal (re: 1μPa); or

(2) Sound exposure level (SEL), a measure of the physical work done on fish (i.e., swim bladder), accumulated over all pile strikes (cumulative SEL), exceeds 187 dB (re: 1 μPa2•sec).

Sounds less than 150 dB RMS are assumed to have no behavioral effect on ESA-listed fish (NMFS 2015).

Table 7. Hydroacoustic injury and disturbance thresholds for fish.*

Underwater Sound Criteria (decibels (dB) measured at 10 meters from source)		
Size class	**Injury threshold**	**Disturbance threshold**
Fish ≥ 2 grams	206 dB_{peak}; 187 SEL_{cum}	150 dB_{RMS}

Note: *Where cumulative SEL (SELcum) is calculated as: SEL(cum) = SEL(single strike at ~10 meters from the pile) + 10 log * (# strikes).

Proposed pile installations are likely to produce underwater sound pressures resulting in adverse effects to bull trout. Although there is little information regarding what pile driving sound levels cause which specific effects (Anderson and Reyff 2006; Laughlin 2006; Popper and Hastings 2009), laboratory research has documented the effects of sound on a variety of fish species (Hastings and Popper 2005; Popper and Clarke 1976; Hastings *et al.* 1996; Scholik and Yan 2002). Hastings and Popper (2005) provide information regarding the effects of pile driving on fish. Substrate type and firmness, pile type, water depth and type and size of the pile driver all influence the intensity of sound generated and the waveform of the sound. For example, SPL,

[5] Bull trout less than two grams will not be present in the action area as it is not spawning or early rearing habitat.

measured in dB, generally increase with the size of the pile and as substrate firmness increases as both variables require more energy to drive the pile. Hollow steel piles produce higher SPLs than similarly sized solid steel, wood, or concrete piles (Hastings and Popper 2005). Sound waves are reduced (attenuated) more rapidly in shallow waters than in deep waters (Rogers and Cox 1988).

Impact Hammer Pile Driving Effects

The Sound Exposure Level Calculator (USFWS *in litt.* 2015) was used to analyze sound effects to bull trout resulting from impact hammer pile driving activities associated with the Project. Results from the analysis were then used to infer the severity and location of impacts from proposed pile driving. In this analysis, the following assumptions were made:

1. Lacking site-specific transmission loss information, a transmission loss constant of 15 dB is appropriate.
2. Impact hammer pile driving will only take place on-shore (above the OHWM), making it appropriate to use ITD's EFSR Bridge Project Hydroacoustic Monitoring Report (Illingworth and Rodkin, Inc. 2014, Attachment A, p. 3) for 35 cm (14 in) steel H-piles driven on land as the input data for calculations. This project will use 30 cm (12 in) piles and pile driving will occur 4.6 m (15 ft) (closest pile for the north abutment) and 6.1 m (20 ft) (closest pile for the south abutment) from the OHWM. While slightly different than the proposed action, we used the information above because it best represents this Project.
3. ITD estimated 400 strikes per pile to be the maximum needed for the Project. Seven piles will be driven per abutment.
4. Maximum potential total daily impact hammer strikes equal 1,600 (4 piles/day * 400 strikes).

The analysis identifies the following likely adverse effects to bull trout from impact driven piles on land:

(1) The 206 dB single strike injury threshold will not be exceeded;

(2) cumulative SEL levels will exceed the 187 dB threshold and cause physical injury within approximately 40 m (131 ft) (line-of-sight) of the impact hammer pile strikes; however, all impact hammered piles (14) are on land and no closer than 4.6 m (15 ft) from the OHWM; and

(3) behavior modifications are likely to occur within approximately 736 m (2,415 ft), extending outward in all directions (including the Lochsa River), from all piles driven by impact hammers on land.

It is uncertain how conditions of the action area will moderate these estimates without any site-specific data.

The EFSR Bridge Project recorded data for piles impact hammer driven on land (Illingworth and Rodkin, Inc. 2014, p. 3). For this Project, the difference in site-specific characteristics identifies a potential hydroacoustic data gap. Based on available data, piles driven on land may physically injure fish in Fish Creek. However, available data do not allow estimation of the exact area that will exceed the threshold for injury. Using the Sound Exposure Calculator, distance to injury threshold exceedance is estimated to be 40 m (131 ft) but may be more or less than this distance. This is an adverse effect.

The actual response of bull trout or any other fish exposed to these sounds is not known, but we expect that subadult fish will move short distances away from the sounds of the hammer as well as from visual stimulus of the equipment itself. Such movements can expose subadult bull trout to potential predation in excess of what would occur without the action. Similarly, predatory fish may also be displaced. This could increase the number of encounters between predatory fish and subadult bull trout, potentially decreasing survival for the latter. Sounds produced from pile driving may also mask natural sounds which may negatively influence foraging and/or escape behavior.

Existing information precludes our ability to predict if bull trout will move, the distance individual bull trout will move, how frequently they will move or the number of subadult bull trout preyed upon as a result of project-induced movement. Similarly, existing information is inadequate to accurately determine the effect of pile driving on foraging or predator avoidance if fish do not move (Popper and Hastings 2009). Overwintering and rearing fish displaced by the action may also experience reduced growth if their selected refugium provides less suitable foraging conditions.

The small ensonified (affected by noise) area suggests only small numbers of bull trout, if any, will be exposed (and only for portions of each 12-hour work day) to pile driving. If bull trout do move away from the sounds, alternative refugia sites are likely to provide conditions similar to the ensonified area but without the sound. Together, this means that most bull trout will be only briefly exposed to the action's sounds. Although some negative foraging impacts are likely to occur, impacts will only occur for a few hours each day, for approximately seven days total (average of two piles per day and 14 total piles). Both situations (i.e., avoidance of predators and sound interference) should result in only minor (i.e. undetectable) effects to growth of affected bull trout.

Adult bull trout may be discouraged from passing through the ensonified area when SPLs exceed 150 dB RMS. Because of project activities, we expect that if present and/or migrating through the area, bull trout will move quickly away or through to more desirable foraging and resting habitats. However, they may be reluctant to move through the action area during the day, resulting in a temporary delay of a few hours as they avoid construction activities and noise. Because bull trout move mostly at night, from dusk to dawn (Homel and Budy 2008, p. 876), and all work will be completed during daylight hours, bull trout movement could resume unimpeded by noise or construction during the night every day. This potential delay in bull trout moving through the action area is expected to be minor and insignificant.

2.5.1.1.1.4 Effects of blasting

Should blasting be necessary for rock removal, the contractor will meet the minimum required explosive charge weight setbacks identified by ADFG (2013). These are calculated levels and will not be monitored or measured during this Project. The contractor will be required to use blasting mats at all times during blasting activities to keep all rock and earthen/rock fragments from reaching Fish Creek and the Lochsa River.

All blasting will occur at a distance and charge weight so that any adverse effects associated with noise and/or any risk of injury or direct or delayed mortality as a result of barotrauma effects are not anticipated to occur, and therefore discountable.

2.5.1.1.1.5 Watershed Condition Index (WCI)

The Watershed Condition Indicator (WCI) matrix for bull trout was used to evaluate and document baseline conditions and to aid in determining whether a project is likely to adversely affect bull trout.

The effects of the proposed action on relevant bull trout indicators (USFWS 1998) are provided in Table 8. The term "short-term" is used to describe potential effects that may occur within one year of project implementation while "long-term" describes incremental effects occurring beyond one year post-construction to allow for the action to be exposed to a full range of seasonal conditions. An "X" signifies that the watershed condition indicator will be maintained and no significant effects on the indicator are expected.

Table 8. Checklist for documenting the environmental baseline and effects of actions on relevant Watershed Condition Indicators for the action area (USFWS and NMFS 1998).

PATHWAYS:	ENVIRONMENTAL BASELINE[6]			EFFECTS OF THE ACTION		
INDICATORS	Properly Functioning	At Risk	Unacceptable Risk	Improve[7]	Maintain[8]	Degrade[9]
Watershed Conditions:						
Watershed Road Density	X	X			X	
Streamside Road Density		X			X	
Landslide Prone Road Density		X			X	
Riparian Vegetation Condition		X			X(-)	
Peak/Base Flow		X			X	
Water Yield (ECA)	X				X	
Sediment Yield	X	X			X(-)	

PATHWAYS: INDICATORS	ENVIRONMENTAL BASELINE[6]			EFFECTS OF THE ACTION		
	Properly Functioning	At Risk	Unacceptable Risk	Improve[7]	Maintain[8]	Degrade[9]
Channel Condition & Dynamics:						
Width/Depth Ratio	X				X	
Streambank Stability	X				X	
Floodplain Connectivity		X			X	
Water Quality:						
Spawning Temp			X		X	
Rear/Mig Temp					X	
Suspended Sediment	X				Long term	Short term
Chemical Contamination/Nutrients	X				X	
Habitat Access:						
Physical Barriers			X		Long term	Short term
Habitat Elements:						
Cobble Embeddedness			X		X(-)	
Percent Surface Fines		X			X(-)	
Percent Fines by Depth			X		X	
Large Woody Debris			X		X	
Pool Frequency			X		X	
Pool Quality		X			X	
Off-Channel Habitat		X			X	
Habitat Refugia		X			X	

[1] Indicators of properly functioning, functioning at risk, and not properly functioning habitat condition.
[2] For the purposes of this checklist, "improve" means to change the function of an indicator for the better, or that the rate of restoration is increased.
[3] For the purposes of this checklist, "maintain" means that the function of an indicator will not be degraded and that the natural rate of restoration for this indicator will not be retarded.

[4] For the purposes of this checklist, "degrade" means to change the function of an indicator for the worse, or that the natural rate of restoration for this indicator is retarded. In some cases, a low environmental baseline indicator may be further worsened, and this should be noted.
X(-) = short-term, site-specific impact during project implementation

2.5.1.1.1 Maggie Creek

Maggie Creek is not known or likely to be occupied by bull trout. Therefore, we do not provide further details on potential effects to bull trout or habitat in Maggie Creek. However, Maggie Creek is tributary to the Middle Fork Clearwater River which is designated critical habitat and provides FMO habitat. Activities affecting a stream (Maggie Creek) may also affect the waterbody into which that stream flows (Lochsa River). Activities in Maggie Creek have the potential to adversely affect bull trout and its habitat downstream in the Middle Fork Clearwater River. However, increased sediment/turbidity is the only effect occurring in Maggie Creek which has the potential to affect the Middle Fork Clearwater River and/or its bull trout. The amount of sediment and duration of turbidity leaving Maggie Creek will not be sufficiently large (i.e. will be within State water quality standards nearly all the time) to have a measurable effect on bull trout in the Middle Fork Clearwater River. Therefore, the Maggie Creek portion of the Project is not likely to adversely affect bull trout.

2.5.1.2 Effects of Interrelated or Interdependent Actions

The implementing regulations for section 7 define interrelated actions as those that are a part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration. The Service has not identified any actions that are interrelated or interdependent with the proposed project; the bridge is not necessarily intended to increase use of the area, but rather make existing travel conditions safer.

2.5.2 Bull Trout Critical Habitat

2.5.2.1 Direct and Indirect Effects of the Proposed Action

2.5.2.1.1 Fish Creek

PBFs are used to describe biological and physical habitat features which are essential to the conservation of bull trout. The matrix of watershed condition indicators (WCIs) in Table 7 provides a means to assess the baseline condition of the PBFs in the action area and the potential effects of the action on the PBFs. Analysis of the affected WCIs provides a thorough evaluation of the existing baseline condition and potential impacts of the proposed action on the PBFs of bull trout critical habitat (Table 9).

Table 9. Relationship of Watershed Condition Indicators to the Physical and Biological Features of bull trout critical habitat and anticipated effects to PBFs.

PBF #	PBF Description	Associated Watershed Condition Indicator	Indicators Affected by the Proposed Action	Anticipated Effect to PBF
1	Springs, seeps, groundwater sources, and subsurface water	Sediment/turbidity, Channel Conditions and Dynamics (wetted	Temporary adverse effect to Sediment/Turbidity	Although one of the indicators used to describe this PBF will be adversely

PBF #	PBF Description	Associated Watershed Condition Indicator	Indicators Affected by the Proposed Action	Anticipated Effect to PBF
	connectivity (hyporheic flows) to contribute to water quality and quantity and provide thermal refugia.	width/maximum depth ratio, stream bank condition, floodplain connectivity), riparian conservation areas.		affected, the sediment/turbidity indicator is not the primary driver for what this PBF is intended to provide. Therefore, this PBF will not be adversely affected and functionality of this PBF will be maintained in all time frames.
2	Migration habitats with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and freshwater and marine foraging habitats, including, but not limited to permanent, partial, intermittent or seasonal barriers.	Temperature, sediment/turbidity, chemical contamination/nutrients, physical barriers, change in peak/base flow, width/depth ratio, refugia	Temporary adverse effect to Sediment/Turbidity.	Reduced water quality due to increases in suspended sediment/ turbidity, noise, and presence of construction personnel and equipment are likely to cause temporary periods of time when bull trout will be effectively prohibited from moving through the action area during implementation. Therefore, this PBF will be adversely affected at times during construction activities. In long-term, this PBF will be maintained.
3	An abundant food base, including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish.	Water quality (temperature, sediment/turbidity, chemical and nutrient contaminants), substrate embeddedness, Channel Conditions and Dynamics (wetted width/maximum depth ratio, stream bank condition, floodplain connectivity), changes in peak/base flows, riparian conservation areas	Temporary adverse effect to Sediment/Turbidity, Riparian Conservation Areas, and Streambank Condition.	There will be a temporary, insignificant increase in suspended sediment/turbidity but due to relatively minor increases in sediment and the amount of unaffected sources for macroinvertebrates, effects will be insignificant. Effects to riparian conservation areas from trimming will not be significant enough to affect this PBF. Effects to stream bank condition will be maintained or improved. Riprap may provide higher quality/complex habitat, depending on what is present there currently. Overall, the Project will not result in significant effects to this PBF.

PBF #	PBF Description	Associated Watershed Condition Indicator	Indicators Affected by the Proposed Action	Anticipated Effect to PBF
4	Complex river, stream, lake, reservoir, and marine shoreline aquatic environments, and processes that establish and maintain these aquatic environments, with features such as large wood, side channels, pools, undercut banks and unembedded substrates to provide a variety of depths, gradients, velocities, and structure.	Habitat elements (substrate embeddedness, large woody debris, pools frequency and quality, large pools, off-channel habitat, and refugia)	Substrate Embeddedness	There will be a temporary, insignificant increase in suspended sediment/turbidity due to relatively minor increases in project induced sediment mobilization. Increases are not enough to impact unembedded substrates significantly. Functionality of this PBF will be maintained.
5	Water temperatures ranging from 2 to 15 °C (36 to 59 °F), with adequate thermal refugia available for temperatures that exceed the upper end of this range. Specific temperatures within this range depend on bull trout life-history stage and form; geography; elevation; diurnal and seasonal variation; shading, such as that provided by riparian habitat; streamflow; and local groundwater influence.	Temperature	None.	This PBF will be maintained. Some streamside vegetation may need to be removed and will result in reduced stream shading, but such a small amount will have essentially no effect on temperature. Stream temperature will not be measurably affected by the Project.
6	In spawning and rearing areas, substrate of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. A minimal amount of fine sediment, generally ranging in size from silt to coarse sand, embedded in larger substrates, is characteristic of these conditions. The size and amounts of fine sediment suitable to	Sediment/turbidity, substrate embeddedness	See discussion above regarding sediment/turbidity and substrate embeddedness.	No spawning areas exist within or downstream from the action area. This PBF will not be affected.

PBF #	PBF Description	Associated Watershed Condition Indicator	Indicators Affected by the Proposed Action	Anticipated Effect to PBF
	bull trout likely varies from system to system.			
7	A natural hydrograph, including peak, high, low, and base flows within historic and seasonal ranges or, if flows are controlled, minimal flow departure from a natural hydrograph.	Flow/ Hydrology (Changes in Peak /Base flows and Drainage Network Increase)	None.	This PBF will be maintained. The natural hydrograph will not be affected by the Project.
8	Sufficient water quality and quantity such that normal reproduction, growth, and survival are not inhibited.	Floodplain connectivity, peak/base flow, water quality (Temperature, sediment/turbidity, Chemical Contaminants and Nutrients)	Temporary adverse effect to Sediment/Turbidity.	Water quality within the action area will be temporarily affected due to increases in sediment/ turbidity. If realized, this effect will negatively affect normal reproduction, growth, and survival of bull trout. Therefore, effects to the PBF will be significant, although localized and temporary. In the long-term, this PBF will be maintained.
9	Sufficiently low levels of occurrence of nonnative predatory (e.g., lake trout, walleye, northern pike, smallmouth bass); interbreeding (e.g., brook trout); or competing (e.g., brown trout) species that, if present, are adequately temporally and spatially isolated from bull trout.	Persistence and Genetic Integrity	None.	This PBF will be maintained.

As described in the table above, project activities will adversely affect PBFs 2 and 8 in the short-term. Water quality will be degraded for short periods due to Project-induced sediment production. Noise and the presence of a cofferdam will also result in reduced effectiveness of migration habitat. Effects to PBFs 2 and 8 will be localized to the action area and will occur only during daylight hours (except for cofferdams which will remove complex habitat and affect migratory conditions 24 hours per day as long they are in place).

Activities likely to produce sediment and temporarily degrade water quality are construction and removal of cofferdams, excavation and removal of materials to provide space for riprap, and placement of riprap. The volume of sediment becoming suspended as a result of Project activities is not sufficiently substantial to have a measurable effect on substrate embeddedness or macroinvertebrate production downstream from the bridge in Fish Creek or in the Lochsa River.

Project activities will have temporary adverse effects to migration habitat as a result of constructing, using and removing cofferdams, excavation and removal of materials to provide space for riprap, pile driving, blasting, and other construction related noise and movement. These activities will increase turbidity and produce noise likely resulting in Fish Creek providing a reduced quality of migratory habitat for bull trout. Because a portion of Fish Creek will be enclosed within a cofferdam, its capacity to provide fully effective migration habitat will be reduced. Although bull trout are highly unlikely to be within the action area when work is occurring below OHWM, construction activities may, at times, impede daytime movement of fish, as they will likely avoid the area. Because bull trout generally move at night and construction activities will only be occurring during the day, bull trout should be able to move through the Project area at least eight hours per day.

Although adverse effects to PBFs are expected as described above, we do not anticipate the proposed Project will adversely modify the function of designated critical habitat for bull trout in or near the action area as well as the overall designated CHU.

2.5.2.1.1 Maggie Creek

Maggie Creek is not designated bull trout critical habitat. However, Maggie Creek is tributary to the Middle Fork Clearwater River which is designated critical habitat and provides FMO habitat. Activities affecting a stream may also affect the waterbody into which it flows. Increased sediment/turbidity is the only effect occurring in Maggie Creek which may affect the Middle Fork Clearwater River. The amount and duration of turbidity leaving Maggie Creek will not be sufficiently large (within State water quality standards) to have a measurable effect in the Middle Fork Clearwater River. Therefore, the Maggie Creek portion of the Project is not likely to adversely affect bull trout critical habitat.

2.5.2.2 Effects of Interrelated or Interdependent Actions

The implementing regulations for section 7 define interrelated actions as those that are a part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration. The Service has not identified any actions that are interrelated or interdependent with the proposed project.

2.6 Cumulative Effects

The implementing regulations for section 7 define cumulative effects to include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this Opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

An additional cumulative effect to bull trout is global climate change. Warming of the global climate seems quite certain. Changes have already been observed in many species' ranges consistent with changes in climate (Independent Scientific Advisory Board 2007, p. iii; Hansen et al. 2001, p. 767). Global climate change threatens bull trout throughout its range in the coterminous United States. Downscaled regional climate models for the Columbia River basin predict a general air temperature warming of 1.0 to 2.5 degrees C (1.8 to 4.5 °F) or more by 2050 (Rieman et al. 2007, p. 1552). This predicted temperature trend may have important effects on the regional distribution and local extent of habitats available to salmonids (Rieman et al. 2007, p. 1552), although the relationship between changes in air temperature and water temperature are not well understood. Bull trout spawning and early rearing areas are currently largely constrained by low fall and winter water temperatures that define the spatial structuring of local populations or habitat patches across larger river basins; habitat patches represent networks of thermally suitable habitat that may lie in adjacent watersheds and are disconnected (or fragmented) by intervening stream segments of seasonally unsuitable habitat or by actual physical barriers (Rieman et al. 2007, p. 1553).

With a warming climate, thermally suitable bull trout spawning and rearing areas are predicted to shrink during warm seasons, in some cases very dramatically, becoming even more isolated from one another under moderate climate change scenarios (Rieman et al. 2007, pp. 1558–1562; Porter and Nelitz 2009, pp. 5–7). Climate change will likely interact with other stressors, such as habitat loss and fragmentation (Rieman et al. 2007, pp. 1558–1560; Porter and Nelitz 2009, p. 3); invasions of nonnative fish (Rahel et al. 2008, pp. 552–553); diseases and parasites (McCullough et al. 2009, p. 104); predators and competitors (McMahon et al. 2007, pp. 1313–1323; Rahel et al. 2008, pp. 552–553); and flow alteration (McCullough et al. 2009, pp. 106–108), rendering some current spawning, rearing, and migratory habitats marginal or wholly unsuitable. Over a period of decades, climate change may directly threaten the integrity of the essential PBFs 1, 2, 3, 5, 7, 8 and 9.

2.7 Conclusion

2.7.1 Bull Trout

2.7.1.1 Conclusion

The Service has reviewed the current status of the bull trout, the environmental baseline in the action area, effects of the proposed action, and cumulative effects, and it is our conclusion that the proposed action is not likely to jeopardize the species continued existence.

2.7.2 Bull Trout Critical Habitat

2.7.2.1 Conclusion

The Service has reviewed the current status of bull trout critical habitat, the environmental baseline in the action area, effects of the proposed action, and cumulative effects, and it is our conclusion that the proposed action is not likely to destroy or adversely modify designated critical habitat for bull trout.

2.8 Incidental Take Statement

Section 9 of the Act and Federal regulations pursuant to section 4(d) of the Act prohibit the take of endangered and threatened fish and wildlife species, respectively, without specific exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm in the definition of take in the Act means an act which actually kills or injures wildlife. Such act may include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as an intentional or negligent act or omission which creates the likelihood of injury to listed species by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering.

Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The FHWA has a continuing duty to regulate the activity covered by this incidental take statement. If the FHWA fails to assume and implement the terms and conditions the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the FWHA must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement [50 CFR §402.14(i)(3)].

2.8.1 Form and Amount or Extent of Take Anticipated

The proposed action is reasonably certain to result in the incidental take of bull trout. Bull trout are known to occur in the action area; however it is difficult to anticipate the exact number of bull trout that will be taken as a result of Project implementation because bull trout density in the action are is so low and seasonal. Therefore, we estimate numbers of bull trout taken using the best available information which has been provided in the environmental baseline section of this Opinion. To address take associated with pile driving and turbidity spikes we use the amount of habitat affected as a surrogate.

- We anticipate that all bull trout (adult and subadult) present within 600 ft downstream (i.e. the estimated downstream extent of substantial sediment effects) of the bridge replacement, including the Lochsa River, will be subject to take in the form of harassment or harm as a result of their moving away from habitat affected by increased levels of suspended sediment and turbidity. Incidental take of bull trout due to sediment is anticipated to occur only during installation and removal of cofferdams. No lethal take of bull trout is expected from sediment/turbidity.

- Harassment of adult and subadult bull trout could occur during installation and removal of cofferdams. Although most, if not all, fish are anticipated to volitionally move out of the affected area while cofferdams are being constructed and in response to other previous and concurrent project activities, including herding, some bull trout may still be present and need to be salvaged. Electrofishing or netting will be used to capture bull trout, if any, remaining within the cofferdam. This salvage is considered take in the form of capture. To provide adequate coverage and allow the project to proceed in a timely manner, we anticipate take resulting from salvage efforts in the form of non-lethal harm.

- We anticipate all adult and subadult bull trout within the area of potential hydroacoustic effects are subject to take in the form of harassment or harm due to hydroacoustic impacts resulting from the use of impact hammers to drive piles for new bridge abutments. We expect take in the form of harm within 40 m (131 ft) and take in the form of harassment from behavioral changes within 736 m (2,415 ft) of piles being driven. This incidental take is anticipated to occur intermittently from August 16 until July 14 of any year during the Project when piles are being driven for abutments.

If incidental take anticipated by this Project is exceeded, all Project activities will cease and the FWHA will immediately contact the Service to determine if consultation should be reinitiated. Authorized take will be exceeded during Project implementation if:

1. Suspended sediment/turbidity exposure (concentration and duration) levels determined to have more than minor physiological effects to bull trout (i.e., turbidity levels greater than 50 NTUs above background levels for more than 90 minutes) is observed further than 600 ft downstream of instream work.
2. Salvage efforts result in capture of two bull trout.
3. Impact hammer driving exceeds 1600 strikes per day (four piles per day) at any time during implementation.

2.8.2 Effect of the Take

In the accompanying Opinion, the Service determined that this level of anticipated take is not likely to jeopardize the continued existence of the bull trout across its range.

2.8.3 Reasonable and Prudent Measures

The Service concludes that the following reasonable and prudent measures are necessary and appropriate to minimize the take of bull trout caused by the proposed action.

No reasonable and prudent measures are necessary and appropriate. ITD and the Service worked together to identify and incorporate into the proposed action all necessary and appropriate project design features, BMPs, and conservation measures which minimize take of bull trout resulting from Project implementation.

2.8.4 Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the Act, the FHWA must comply with the following terms and conditions, which implement the reasonable and prudent measure described above:

Because no reasonable and prudent measures were determined to be necessary and appropriate, there are no terms and conditions identified.

2.8.5 Reporting and Monitoring Requirement

In order to monitor the impacts of incidental take, the Federal agency or any applicant must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement [(50 CFR 402.14 (i)(3)].

2.9 Conservation Recommendations

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery programs, or to develop new information on listed species.

1. To the extent possible, limit the number of consecutive days pile driving occurs.
2. Conduct surveys for eagles nests one mile upstream and one mile downstream (including the Lochsa River); if found, coordinate with the Service (Megan Kosterman) to ensure compliance with the Bald and Golden Eagle Protection Act (BGEPA) and Migratory Bird Treaty Act (MBTA).

2.10 Reinitiation Notice

This concludes formal consultation on the US-12 Fish Creek Bridge Replacement and US-12 Maggie Creek Culvert Replacement Project. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been maintained (or is authorized by law) and if:

1. The amount or extent of incidental take is exceeded.
2. New information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this Opinion.
3. The agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this Opinion.
4. A new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

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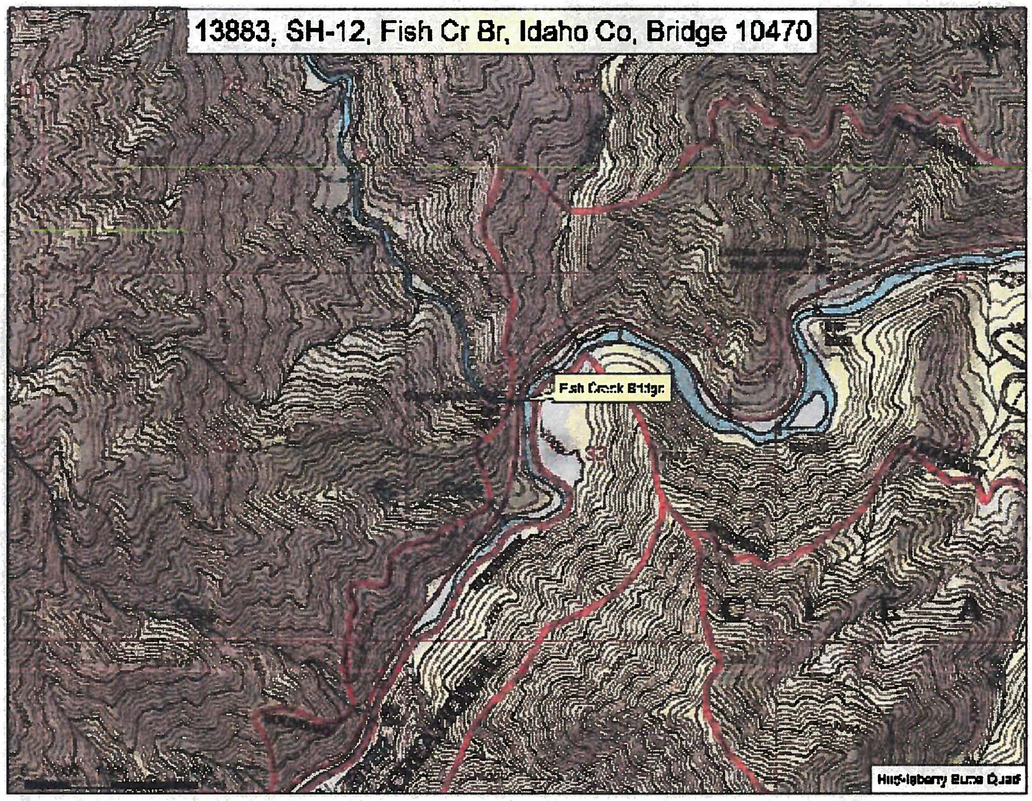
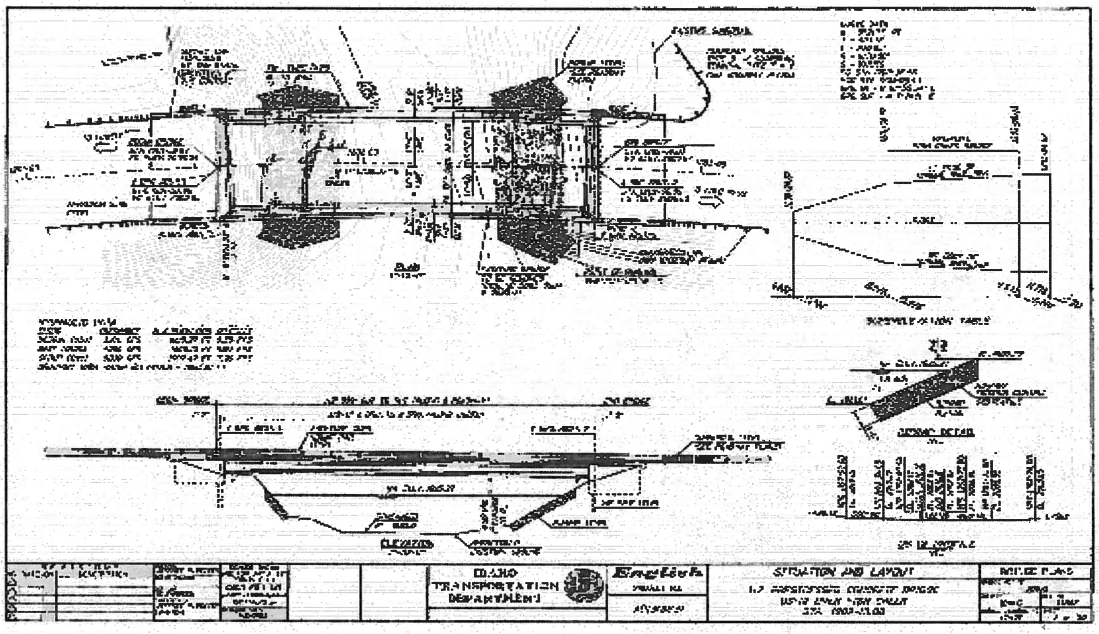
4. APPENDICES

4.1 Appendix A – Fish Creek Bridge Plans

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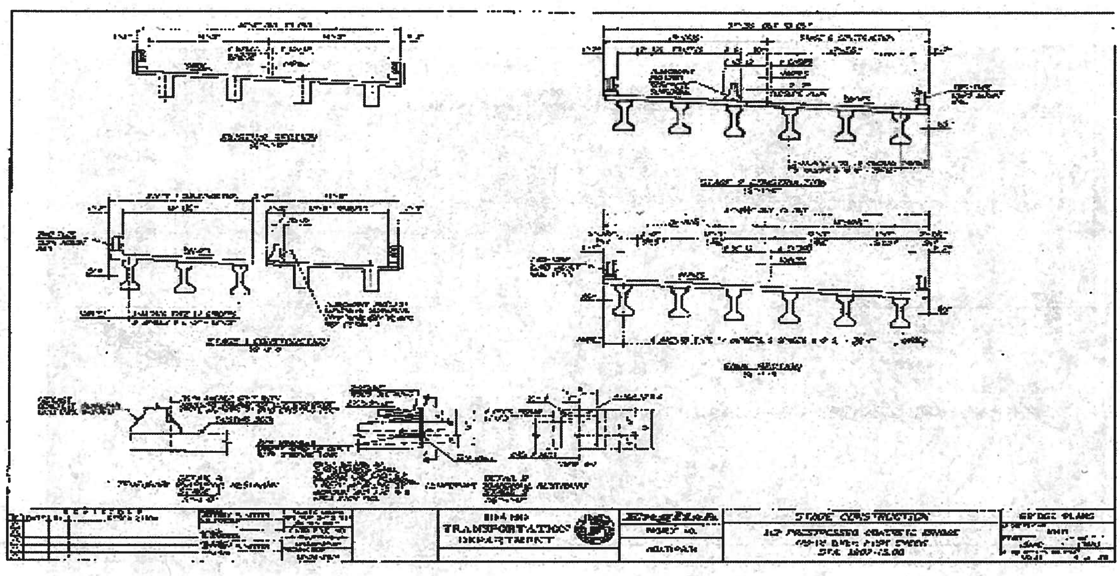
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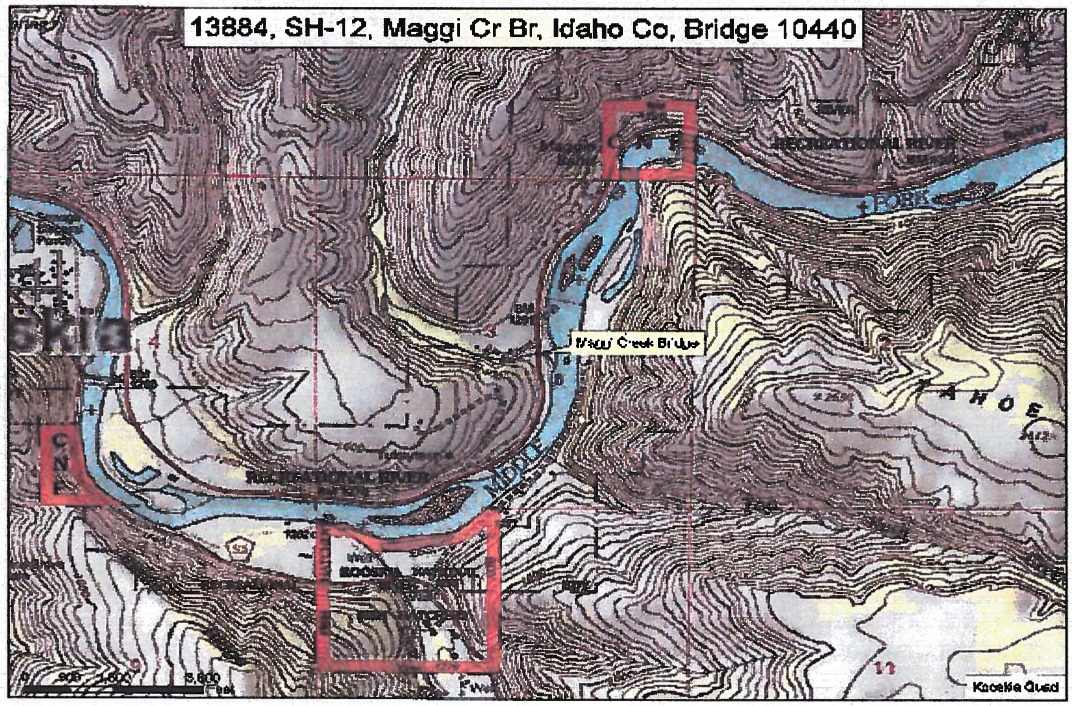
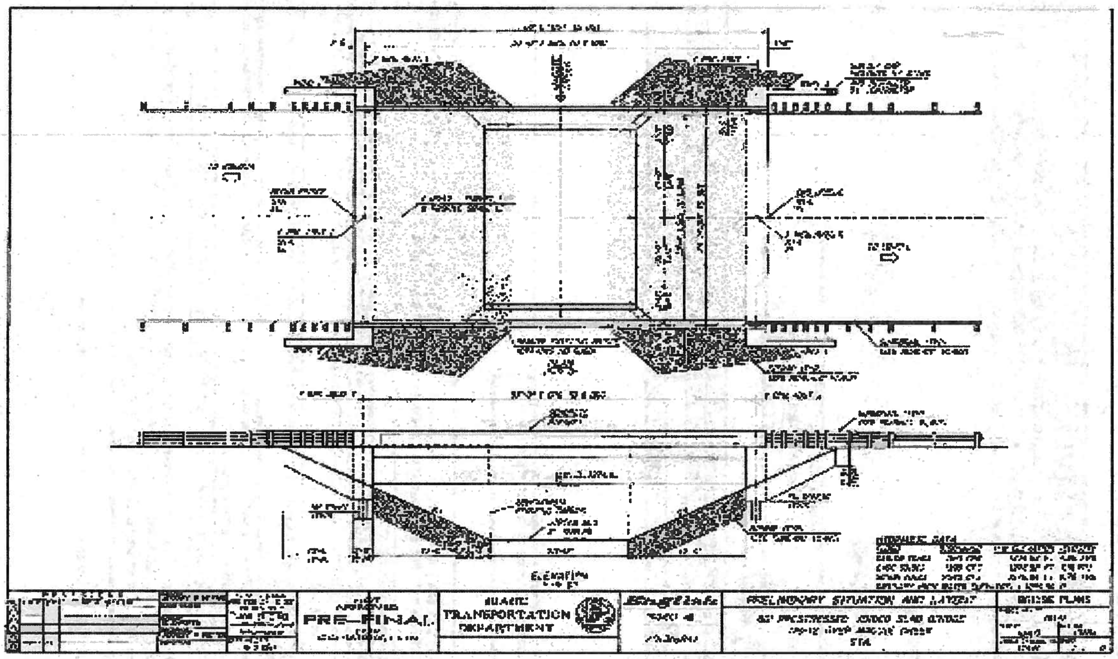
STAGE CONSTRUCTION

4.2 Appendix B – Maggie Creek Bridge Plan Sheet

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4.3 Appendix C – Sound Exposure Level Calculator

Sound Exposure Level Calculator for Marbled Murrelet and Bull Trout

This spreadsheet was developed as an in-house tool for USFWS staff to use when assessing the effects to marbled murrelets (MAMU) and/or bull trout from impact pile driving. The USFWS makes this spreadsheet available to other users, and assumes no responsibility for errors when this tool is used by non-USFWS staff. Use this spreadsheet to calculate the distance to various thresholds for both MAMU and bull trout. The calculations incorporate the concept of effective quiet (EQ) wherein we assume that the energy from pile strikes below a certain SEL does not accumulate to cause injury.

Please contact the following USFWS staff member to report errors or submit questions:
Lindsy Wright, USFWS, Washington Fish and Wildlife Office, Lacey, WA, 360-753-6037, lindsy_wright@fws.gov

Green cells = input. Input expected sound levels, distance, attenuation, and pile strikes
Blue cells = results. Results shown are based on the information in the green and yellow cells. DO NOT CHANGE
Yellow cells = threshold values and transmission loss constant. DO NOT CHANGE

	Peak	SEL	RMS	Single Strike SEL for Effective Quiet	Attenuation
Unattenuated single strike (dB)	193	184	178	150	0
Attenuated single strike (dB)	193	184	178		
Distance (m)	10	10	10		
Piles per day	4				
Estimated maximum # strikes per pile	400				
Estimated maximum # strikes per day	1600				
Cum SEL at measured distance	196.0	>>——>>>			
Transmission loss constant	15				

Distance (m) to Bull Trout thresholds (SEL)							Distance to EQ
Fish ≤ 2g	Fish > 2g						
183	187						
74	40						86

	Behavior dBrms
Potential Behavioral Response Zone	150
Distance (m)	736

* Note: If you have a project with different sized piles, you will run this analysis for each size of pile, and use the greater distance of the two to determine the distance to murrelet auditory injury threshold.

Version 3/3/14 L.Wright

Key:

Distance (m) [B12-D12]	This is the distance that the sound pressure levels you are entering were measured at. The hydrophones were placed at this distance from pile driving locations during sound measurements. This distance can vary, so be sure to verify the distance that the measurements were taken from.
Piles per day [B3]	Enter the maximum number of piles that would be installed in a day.
Attenuation [F10]	Enter the amount of attenuation that will be verified by hydroacoustic monitoring. If hydroacoustic monitoring would not occur, enter zero.
Masking Zone; piles <36-inch [F16]	For projects that entail impact-pile-driving steel piles that is more than intermittent proofing and the pile sizes are less than 36-inch diameter. Monitoring for marbled murrelets in the masking zone should only occur from land-based locations.
Masking Zone; piles ≥ 36-inch [G16]	For projects that entail impact-pile-driving steel piles that is more than intermittent proofing and pile sizes are 36-inch-diameter or larger. Monitoring for marbled murrelets in the masking zone should only occur from land-based locations.
Area of effect Auditory Injury (m) [H16]	This value represents the radius of the "area of effect" where we would anticipate auditory injury could occur. Monitoring for marbled murrelets in the area of auditory injury can be done from boats or land (see USFWS Marbled Murrelet Monitoring Protocol).
Distance to EQ [J16]	This is the distance with which the energy from pile driving would no longer be accumulating and harmful to fish. It is not ambient.
Distance (m) Potential Behavioral Response Zone [B22]	This is the distance that sound would travel underwater until the sound pressure levels drop below 150 dB RMS. This is only a guideline for when we would no longer expect potential behavioral effects to salmonids. We use it for bull trout and marbled murrelets. This is not the distance that sound would travel until attenuating to ambient conditions or when it would be undetectable (background is the sound in an area in the absence of your project noise).

February 2017 - Input data is based on Illingworth and Rodkin 2014, Hydroacoustic Monitoring Summary Table p. 3, impact hammer, 14", on shore.