United States Department of the Interior
U.S. Fish and Wildlife Service
Idaho Fish and Wildlife Office
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Telephone (509) 891-6839

May 3, 2019

U.S. Coast Guard Headquarters
Attn: Shelly Sugarman, CG-BRG-2
2703 Martin Luther King Jr. Avenue, SE STOP 7418
Washington, District of Columbia 20593-7418

Subject: BNSF Sandpoint Junction Connector Project, Bonner County, Idaho Biological Opinion
In Reply Refer to: 01EIFW00-2019-F-0369

Dear Ms. Shelly Sugarman:

Enclosed is the U.S. Fish and Wildlife Service's (Service) Biological Opinion (Opinion) with the United States Coast Guard's determination of effect on species listed under the Endangered Species Act (Act) of 1973, as amended, for the proposed Burlington Northern Santa Fe (BNSF) Sandpoint Junction Connector Project (Project) in Bonner County, Idaho. In a letter dated October 3, 2018, and received by the Service on October 3, 2018, the United States Coast Guard (USCG) 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 its designated critical habitat. The USCG also determined that the proposed project will have no effect on the grizzly bear (*Ursus arctos horribilis*), Canada lynx (*Lynx canadensis*), wolverine (*Gulo luscus*), or woodland caribou (*Rangifer tarandus caribou*). The regulations implementing section 7 of the Act do not require the Service to review or concur with no effect determinations.

The enclosed Opinion and concurrence are based primarily on our review of the proposed action, as described in your October 3, 2018 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 or adversely modify its designated critical habitat. A complete record of this consultation is on file at this office.

Clean Water Act Requirement Language:

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 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 Marshall Williams at (509) 893-8038 if you have questions concerning this Opinion.

Sincerely,

Patricia C. Johnson-Hughes

for Gregory M. Hughes
State Supervisor

Enclosure

cc: IDEQ, Coeur d'Alene (Berquist)
IDFG, Coeur d'Alene (Corsi)

BIOLOGICAL OPINION
FOR THE
BNSF Sandpoint Connector Project

01EIFW00-2019-F-0369

U.S. FISH AND WILDLIFE SERVICE
IDAHO FISH AND WILDLIFE OFFICE
BOISE, IDAHO

Patricia C. Johnson-Hughes

for Gregory M. Hughes
State Supervisor

Date May 3, 2019

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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 BNSF Sandpoint Connector Project on bull trout (*Salvelinus confluentus*). In a letter dated October 3, 2018, and received on October 3, 2018, the United States Coast Guard (USCG) requested formal consultation with the Service under section 7 of the Endangered Species Act (Act) of 1973, as amended, for its proposal to carry out the action. The USCG determined that the proposed action is likely to adversely affect bull trout. As described in this Opinion, and based on the Biological Assessment (Assessment) developed by the USCG and other information, the Service has concluded that implementation of the Project, as proposed, is not likely to jeopardize the continued existence of bull trout.

The USCG has also determined that implementation of the Project will have no effect on Canada lynx (*Lynx canadensis)*, grizzly bear (*Ursus arctos horribilis*), North American wolverine (*Gulo luteus*), or woodland caribou (*Rangifer tarandus caribou*).

1.2 Consultation History

The USCG is the lead federal agency associated with this action and is consulting with the Service regarding potential Project-related effects to federally listed species and designated critical habitat. Jacobs Engineering Group Inc. (Jacobs) has had informal, technical assistance discussions with the Service to review impacts, methodology, and mitigation opportunities, including phone calls and email communications beginning in 2017 (Cousins, *in litt*; Siitari, *in litt*).

An Assessment was submitted to the USCG on December 21, 2017, as part of the bridge permit application packet for the new Sand Creek and LPO BNSF bridges. The Assessment was updated on April 10, 2018, and was included in the formal Joint Application Public Notice for the U.S. Army Corps of Engineers (USACE) 404 and Section 10 permitting review and the Idaho Department of Lands (IDL) Encroachment Permit process.

Informal meetings and communications with the Service between March and June 2018 culminated with a pre-Biological Assessment technical assistance meeting on July 20, 2018, at the Service's Idaho Fish and Wildlife Office-Spokane located in Spokane, Washington.

Participants in that meeting (in person) included Marshall Williams and Katy Fitzgerald with the Service and Craig Broadhead, Sue PaDelford, and Diane Williams with Jacobs. Attendees via a teleconference line included Kris Swanson, Austin Hurst, and Matt Keim with BNSF and Shelly Sugarman, Steve Fischer, Danny O'Keefe, John Greene, and Kate O'Dell with the USCG.

Additional phone conversations and email correspondence occurred for clarification or requests for additional information were submitted.

June 7, 2018: Per e-mail, the Service clarified for the USCG the extent of bull trout critical habitat (CH) that includes the Lake Pend Oreille inlet leading to the mouth of the Sand Creek tributary. Bull trout CH is delineated on the Service IPaC website, and the mouth of Sand Creek was confirmed with a U.S. Geological Survey quad map. The clarification was needed to show that both the temporary and permanent 3.1 Bridges were within designated bull trout CH areas and would require appropriate conservation measures.

August 3, 2018: Per e-mail, the Service provide feedback to the USCG to ensure they address impacts to migratory birds and eagles under the Migratory Bird Treaty Act and the Bald and Gold Eagle Protection Act respectively. The Service also expressed concern over the potential for toxic metal mobilization in the lake sediments from legacy mining and smelting complexes from the Clark Fork River. This led to further discussion on mitigation measures to reduce potential exposure through minimization measures. The Service also suggested that the USCG review past hydroacoustic data from impact pile driving on Lake Pend Oreille to assist with the Assessment analysis.

November 21, 2018: Per e-mail from the USGS and Jacobs Engineering, the Service received an errata memorandum outlining minor corrections to the Assessment, revised on August 22, 2018.

November 21, 2018: Per e-mail, the Service requested additional information on the temporary threshold shift due to elevated sound pressure levels (SPLs) and the potential effects and duration of those effects to foraging and spawning success. The Service received the detailed response on November 30, 2018.

December 4, 2018: Per phone call, the Service queried the USCG about why the Assessment did not specifically state the Project would employ Best Management Practices for pile driving, to include the use of cushion blocks to help mitigate elevated SPLs. The Service received a response on December 7, stating that the use of cushion blocks for 24- and 36-inch piles is logistically problematic and that the cushion breaks early in the process and makes them ineffective. The Project will employ vibratory pile driving to the greatest extent possible to help mitigate elevated SPLs.

February 7, 2019: Per e-mail, the Service queried the USCG on the potential to use isolation casings as a mitigation measure for elevated SPLs during impact pile driving during construction of the temporary bridges; currently only turbidity curtains were planned. The Service received a response on February 12, 2019 that revised the Project so that bubble curtains in conjunction with turbidity curtains would be used during all impact pile driving operations in CH where the water is greater than 3 feet in depth. Since the 3 foot depth was different than that outlined in the Assessment, further clarification for the deviation was requested. The USCG replied on February 21, 2019, stating that the use of bubble and turbidity curtains for impact pile driving would remain at the recommended depth of 2 feet or greater water depth.

2. BIOLOGICAL OPINION

2.1 Description of the Proposed Action

2.1.1 Project Summary

BNSF Railway Company (BNSF) proposes to construct the Sandpoint Junction Connector Project (Project). The purpose of the Project is to reduce delay and improve operational efficiency between the two tracks at the north end of the BNSF Algoma main line (MP 5.1) and the BNSF Sandpoint Junction (MP 2.9) where the BNSF and Montana Rail Link (MRL) main lines converge. The proposed Project fulfills this purpose by improving the existing railroad corridor between MP 2.9 and MP 5.1. The Project will consist of a 2.2-mile-long second main line track adjacent to (west of) the existing BNSF main line track. The Project action will consist of constructing a second main line track; upgrading existing access roads, staging areas, tracks, switches and signals; constructing new bridges over Bridge Street (Bridge 3.0), Sand Creek (Bridge 3.1), an inlet of Lake Pend Oreille (LPO), and Lake Pend Oreille (Bridge. 3.9) adjacent to (west of) the existing rail bridges; building temporary construction bridges adjacent to (west of) the new bridges; filling 0.88 acre of permanent nearshore area and 0.38 acre of temporary nearshore area below the jurisdictional ordinary high water mark (OHWM) elevation of 2,062.5 feet, associated with bridge abutments and the south switch; and filling 0.28 acre of wetland south of Bridge 3.1. The improved corridor must be of sufficient width to accommodate a second track that enables safe, adjacent operations for freight and passenger trains within the BNSF right-of-way (ROW). A minimum 15-foot-wide track center is required for adjacent simultaneous train operations on upland rail grade areas, and 30- to 50-foot-wide track centers are needed at bridge locations to ensure that the pile driving for the new bridges does not impact the integrity of the piles for the existing bridges.

The Project is located in the Panhandle Basin, LPO Subbasin, Hydrologic Unit Code 17010214 Pend Oreille Lake, on the BNSF Montana Division, Kootenai River Subdivision, Line Segment 45, within the existing BNSF rights-of-way (ROWs) from MP 2.9+/– to MP 5.1+/– in Bonner County, Idaho (Figure 1).

2.1.2 Existing Conditions and Structures

The current track configuration involves an MRL siding and two main line tracks, BNSF and MRL, meeting at the Sandpoint Junction (BNSF MP 2.9) just north of the Sandpoint Amtrak Station, becoming a single main line track through Sandpoint and over Sand Creek and LPO to the BNSF Algoma (East) main line track (BNSF MP 5.1) where the single main line transitions to two main lines. Key features of the Project corridor are described below:

- The north end of the Project (BNSF MP 2.9) is within the City of Sandpoint and is designated as an Urban Transportation Corridor.
- From BNSF MP 2.9 to 3.9, the existing BNSF main line track is surrounded by a BNSF maintenance road, the Sandpoint Amtrak Depot, U.S. Highway 95 (US 95), and the Sandpoint Marina to the west and Sandpoint Avenue, the Seasons of Sandpoint

Condominiums, the Best Western Edgewater Resort, the Sandpoint Edgewater RV Park, and a portion of the Sandpoint City Beach Marina to the east.

- BNSF Bridge 3.0 spans Bridge Street in Sandpoint.
- BNSF Bridge 3.1 spans Sand Creek in Sandpoint.
- BNSF Bridge 3.9 spans the open water of LPO from MP 3.9–4.9.
- The south end of the Project (BNSF MP 5.1) is designated as a Rural-Residential Transportation Corridor.

The existing BNSF Bridge 3.1 over Sand Creek is a fixed, single-track bridge measuring 155 feet long and 19 feet wide with four concrete piers, two of which are abutments. It was originally constructed in 1902 but was modified in 1990 with replacement of the superstructure, concrete pier caps, deck, and walk. The existing Bridge 3.9 is a fixed bridge that has both open-deck and ballast-deck spans and measures 4,769 feet long with 88 piers. Thirty-two of the original over 100-year-old, single-column concrete piers on wood pilings (16 on the north end and 16 on the south end of the bridge) were replaced in 2007 to 2008 with steel bents, each composed of six closed-end steel pipe piles. The existing bridge also has a non-operable swing span over the two existing, published 76.6-foot-wide navigation channels.

Figure 1. Project Location

2.1.3 Construction Details, Schedule, and Quantities

The Project construction to build the 2.2-mile-long second main line track west of the existing BNSF main line consists of the following general elements:

- Constructing a new main line track west of the existing BNSF main line track.
- Constructing a new bridge over Bridge Street (Bridge 3.0) adjacent to (west of) the existing rail bridge).
- Constructing a new bridge over Sand Creek (Bridge 3.1) adjacent to (west of) the existing rail bridge.

- Constructing a new bridge over LPO (Bridge. 3.9) adjacent to (west of) the existing rail bridge.
- Upgrading tracks, switches, and signals.
- Building and removing temporary construction bridges over LPO and Sand Creek.
- Improving temporary construction material and equipment work staging areas.
- Filling 0.88 acre of permanent and 0.38 acre of temporary nearshore areas below the jurisdictional OHWM elevation of 2,062.50 feet, associated with bridge abutments and the south switch.
- Filling 0.28 acre of wetland in one location between the rail grade and the multiuse public pathway, south of Bridge 3.1.

Construction is expected to go on for approximately three years, beginning in spring 2019. Preliminary work would begin with improving access and staging areas. Work on the bridges would take approximately 12 months, dependent on weather or other interruptions to complete. After a 4-month head start on the work bridges, the new bridges' overall construction would take approximately 36 months or 3 years. This schedule allows for minimal or no production over a 2- to 3-month period each winter. Project elements, timing and duration are provided in table 1. Work vehicles and equipment for upland activities such as grading and rail grade embankment developing would be typical of heavy construction.

Table 1. Project Elements (Estimated Timing and Duration)

No.	Project Element	Timing	Work Description
1	Mobilize and Improve Access Roads and Staging Areas	2019: March, April, May	• Minor expansion/improvement of existing BNSF roads/staging areas • Land clearing for safety and staging
2	Identify Work Limits	2019: March, April, May	• Stake/flag work limits in jurisdictional areas • Stake/flag best management practice (BMP) protection locations
3	Install Environmental BMPs	2019: March, April, May	• Install upland perimeter protection BMPs throughout the Project, and, in particular, adjacent to jurisdictional areas not being impacted by the Project
4	Vegetation Removal	2019: March, April, May	• Riparian vegetation removal in nearshore and wetland fill areas. • Upland vegetation removal for placement of structural rock fill.
5	Nearshore and Wetland Fills	2019: March, April, May	• Place fill during lake drawdown when no water is present in the impacted area: - 0.38-acre temporary nearshore fill - 0.88-acre permanent nearshore fill - 0.28-acre permanent wetland fill • Install perimeter water quality BMP at the edges of fill
6	Upland Work Adjacent to Nearshore and Wetland Fills	2019: May and June	• Upland work associated with bridge abutments • Grading for new rail grade

7	Construct Temporary Work Bridge 3.1 (Sand Creek)	2019–2020: start in October; start in 2020 for pile removal and reinstallation in the navigation channel	• 48, 24-inch-diameter steel piles, up to 40 extend below the ordinary high water mark (OHWM) • Vibratory pile driver; 10 piles (1 per pier) to be proofed with an impact hammer • Estimate 1-month duration for pile driving, dependent on weather or other interruptions. • Work to occur during daylight hours • Drive piles below the OHWM during winter pool/low water conditions, where possible • Bubble curtains/turbidity curtains used when pile driving in water 2 feet deep or more (Sugarman 2019, *in litt*) • Remove piles/spans directly over and immediately adjacent to the navigation channel by May 2020 (if still in place at the start of the boating season) and reinstall in October 2020 if needed. • Piles to be slowly vibrated out of creek bed during winter pool/low water conditions and stockpiled in upland staging areas
8	Construct Temporary Work Bridge 3.9 (LPO)	2019–2020: Year round, weather permitting	• 700, 24-inch-diameter steel piles; 600 extend below the OHWM • Vibratory pile driver; 76 piles (1 per pier) to be proofed with an impact hammer • Bubble curtains/turbidity curtains used when pile driving in water 2 feet deep or more (Sugarman 2019, *in litt*) • Estimate 1-year duration for pile driving, dependent on weather or other interruptions. • Work to occur during daylight hours • To remain in place up to 3 years (i.e., 2022)
9	Construct New Bridge 3.1 (Sand Creek)	2019–2020: Assumes two low water, lake drawdown construction seasons	• 64, 24-inch-diameter steel piles; 22 below the OHWM • Piles vibrated to resistance then driven with an impact hammer • Work to occur during daylight hours • Estimate 1-month duration for pile driving, dependent on weather or other interruptions. • Drive piles below the OHWM during winter pool/low water conditions, where possible • Construction primarily during low water season(s) • Bubble curtains/turbidity curtains used when pile driving in water 2 feet deep or more • Pile driving may occur at either end, but likely at the south end towards the north
10	Construct New Bridge 3.9 (LPO)	2020–2022: Year round, weather permitting	• 288, 36-inch-diameter steel piles; all below the OHWM • Piles vibrated to resistance then driven with an impact hammer • Work to occur during daylight hours • Bubble curtains/turbidity curtains used when pile driving in water 2 feet deep or more • Estimate 6-month duration for pile driving, dependent on weather or other interruptions. • Work to start prior to completion of temporary work bridge

			• Piles may be driven simultaneously at either bridge end • Cast-in-place concrete deck
11	Remove Temporary Work Bridge 3.1 (Sand Creek)	2021: February, March, April	• Dismantle temporary bridge spans • Piles to be slowly vibrated out of creek bed during winter pool/low water conditions • Turbidity curtains to be used during pile removal in water 2 feet deep or more • Materials removed to staging areas until Project demobilization
12	Remove Temporary Work Bridge 3.9 (LPO)	2021–2022: Year round, weather permitting; start July/August	• Dismantle temporary bridge spans • Piles to be slowly vibrated out of lakebed • Full containment turbidity curtains to be used during pile removal • Materials removed to staging areas until Project demobilization
13	Remove Temporary Nearshore Fills	2022: October	• Remove in the dry during winter drawdown when no water present in impacted areas: • Install BMPs to prevent sedimentation to LPO or Sand Creek
14	Demobilize and Stabilize/Restore Disturbed Areas	2022: October to November	• Final grading • Removal of access road fills and temporary at-grade crossings • Seeding/mulching and native riparian plantings • Removal of temporary fencing, signage, etc. • Performed during low/no water conditions as necessary • Materials removed from staging areas • Staging areas restored to BNSF standards

2.1.4 Avoidance Measures

Avoidance measures were used to limit in-water impacts since the Project crosses Sand Creek and LPO.

Constructing the Project to the west of the existing track and bridges, rather than to the east, will avoid the placement of an estimated 3.82 to 5.82 additional acres of in-water fill as follows (taking into account a reduction of wetland fill of 0.28 acre south of Bridge 3.1):

- Additional nearshore fill of approximately 2.9 acres from Bridge 3.1 (Sand Creek) to Bridge 3.9 (LPO); approximately 0.5-mile of rail grade was already constructed on the west side of the tracks at the time of the US 95 Sandpoint bypass Project.
- Additional nearshore fill of approximately 1.2 acres for equipment and materials staging that would need to be brought in by barge over LPO (otherwise all Project equipment/materials would be brought in on Bridge Street in Sandpoint).
- Lake bottom excavation and fill of undetermined quantity (estimated up to 2 acres) for a large work barge landing area.

Constructing the Project within the existing BNSF ROW and within the proposed Project area would avoid the following:

- Development of a new transportation corridor outside of the existing BNSF ROW that would still have to cross Sand Creek and LPO.
- Additional environmental impacts at newly acquired properties for a new 100-foot-wide ROW that may have resulted in 13 to 18 acres of aquatic impacts.

Changes to initial Project designs avoided the following:

- Temporary nearshore fill of 0.17 acre by extending the southern-most span of the LPO temporary work bridge.
- Permanent nearshore fill of 1.97 acres by extending the north and south ends of Bridge 3.1, a design change to the north end and an extension to the south end of Bridge 3.9, and a design change to the Algoma Switch area at the south end of the Project.

2.1.5 Minimization Measures

Project specific conservation measures and best management practices (BMP) to reduce impact to bull trout and designated bull trout critical habitat are as follows:

- MM1 - Removal of vegetation will be limited to what is necessary for Project construction and for safe operation of equipment.
- MM2 - Temporary and permanent nearshore fills will be placed, and temporary fills will be removed, during LPO drawdown or winter pool when no is water present in the fill impact areas.
- MM3 - In-water steel piles for the temporary and permanent work bridges will be driven to refusal with a vibratory driver. One pile per pier of the temporary work bridge (10 of 48 piles for Bridge 3.1; 76 of 700 piles for Bridge 3.9) and all piles for the permanent bridges will be proofed with an impact hammer. Primary use of a vibratory driver will reduce the amount and duration of in-water sound.
- MM4 – Where possible, piles for the Bridge 3.1 temporary work bridge and the new, permanent bridge will be driven during LPO lake drawdown/winter pool/low-water conditions since sound does not propagate well in shallow water.
- MM5 – During impact driving for the new, temporary (USCG 2018, *in litt)* and permanent Bridges 3.1 and 3.9, air bubble curtains will be used to attenuate sound.
- MM6 - Open-ended piles will reduce the number of strikes required to install the piles and thereby reduce the duration of in-water sound (Singh 2014, p. 1; Karlowskis 2014, i; FHWA/IN/JTRP-2002 to 2004, p. 4).
- MM7 - Dispersal strikes will be utilized when an impact hammer is used to proof and/or install temporary and permanent in-water piles to minimize the potential for fish to be in the vicinity when production pile driving occurs.
- MM8 - During impact driving in water that is greater than 2 feet deep turbidity curtains (silt curtains) will be utilized to minimize in-water sediment suspension (WSDOT 2018).
- MM9 - Silt curtains must be reliable, in good condition, and maintained. Use of silt curtains should be in accordance with manufacturer's guidance (Idaho Department of Environmental Quality [IDEQ] 2018, entire).
- MM10 - Turbidity monitoring per ID WQ standards and the Project's 401 Water Quality Certification must be conducted to ensure silt curtains are functioning correctly.

- MM11 - Work will be performed during daylight hours; bull trout migrations are mostly nocturnal.
- MM12 - Bridge 3.9 temporary work bridge and the new, permanent bridge were designed at a height of 14 to 15 feet at the deepest part of LPO, which will allow penetration of ambient light during most of the day.
- MM13 - To contain sediments when removing piles for the Bridge 3.1 temporary work bridge, piles will be slowly vibrated out of the creek bed, will be removed during winter pool low water conditions, and turbidity curtains will be used where possible.
- MM14 - To contain and settle sediments when removing piles for the Bridge 3.9 temporary work bridge, piles will be slowly vibrated out of the lakebed at a rate of approximately one-quarter inch per second and turbidity curtains will be used around each pile or bent being removed; curtains will be anchored to the lakebed for total water column seal and tied off to withstand maximum current conditions.
- MM15 - Existing staging areas and access roads on the BNSF ROW will be utilized to avoid additional impacts to environmentally sensitive areas.
- MM16 - A Temporary Erosion and Sediment Control Plan and BMPs will be installed to reduce erosion from exposed soils and maintained throughout Project construction.
- MM17 - The contractor will install and maintain BMPs to keep construction debris from entering waters of the United States.
- MM18 - A Storm Water Pollution Prevention Plan (SWPPP) will be implemented as part of the NPDES Permit (USEPA 2017, pp 26-33).
- MM19 - A Water Quality Monitoring and Protection Plan (WQMPP) will be implemented as part of the 401 Water Quality Certification (IDEQ, 2018, entire).
- MM20 - A Spill Prevention, Control, and Countermeasure plan will be implemented to control and contain pollutants and product.
- MM21 - Prior to transport to the Project work site, equipment will be cleaned of accumulated grease, oil, or mud.
- MM22 - Equipment and machinery on the Project work site will be inspected daily to check for leaks or problems.
- MM23 - Equipment and machinery used in or over water will be pressure washed or steam cleaned of oils, grease, or other aquatic pollutants such as invasive species, in an upland location or staging area with appropriate wastewater controls and treatment prior to entering on or over waters of the United States (LPO or Sand Creek). Any wastewater or wash water will not be allowed to enter waters of the United States (IDEQ 2018).
- MM24 - Fully stocked petroleum containment spill kits will be kept and maintained onsite at power equipment work sites, portable fuel container sites, and construction staging areas during construction. Spill containment systems will be adequate to contain one and a half times the volume of fuel or fluids associated with each piece of equipment or machinery staged on the work bridge (USEPA n.d.; IDEQ 2018).
- MM25 - Full, secondary containment will be under equipment that use fuels or other hazardous materials on the temporary work bridge or within 100 feet of Sand Creek or LPO (USEPA n.d.; IDEQ 2018).
- MM26 - Equipment and machinery working on the temporary bridges will utilize biodegradable products when possible.

- MM27 - Fuel containers will not be stored on the temporary work bridge. Fueling and maintenance work will occur with secondary containment when on the temporary work bridge. Fuel and hazardous material storage and staging will occur 50 feet away from waters of the United States within staging areas on the BNSF ROW.
- MM28 - Fuel containers or other hazardous materials will not be stored unsecured at the Project site during nonwork hours.
- MM29 - A concrete handling BMP will be developed and approved by the IDEQ prior to concrete pumping or pours associated with the new bridge sections (IDEQ 2018).
- MM30 - BNSF will assign an inspector to document that minimization measures proposed and/or conditioned by regulatory agencies are implemented, maintained, and adaptively managed as needed (USEPA n.d.).

2.1.6 Mitigation Components

The Project will result in a total of 0.28 acre of permanent wetland fill. The impacted wetland is not utilized by Endangered Species Act (ESA)-listed species, therefore, mitigation is related to Clean Water Act regulations. Per mitigation regulations outlined in Section 332.3 of Title 33 of the Code of Federal Regulations (33 CFR 332.3), compensatory wetland mitigation options should be considered in the following order: mitigation banks, purchasing in-lieu fee program credits, or creating permittee-responsible mitigation sites. A mitigation bank is available within the impacted watershed and will therefore be utilized to compensate for unavoidable impacts to the wetland.

BNSF plans to purchase 0.95 credits (Jacobs 2018a, entire; PaDelford 2018, *in litt*) at the bank for compensatory wetland mitigation. The bank currently has approximately 1,000 credits available for purchase (Valencia Wetlands Trust 2017).

Proposed mitigation for 0.88 acre of nearshore fills will be satisfied via LPO and Sand Creek stakeholders through a consensus-based process, including but not limited to the Service, Idaho Department of Fish and Game (IDFG), and other participating non-government organizations. Ongoing stakeholder meetings and communications are focused on identifying current watershed projects that are underway and/or planned in the near future that are suitable and appropriate to mitigate impacts to affected nearshore areas and to threatened bull trout, and will provide the most benefit to the affected aquatic resources. The nearshore fill mitigation project will be identified in the future and will be performed under a separate permitting process.

2.1.7 Action Area

ESA regulations define the term "action area" as all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action (50 CFR 402.02). The action area for the Project is based on all potential impacts from construction activities, both temporary and permanent, to terrestrial and aquatic species. The action area was delineated by evaluating the farthest reaching physical, chemical, and biotic effects of the action on the environment (Figure 2).

Project implementation will cause temporary increases in noise and turbidity from pile driving and nearshore fills (when the first flush occurs). However, because increases in turbidity will be localized to several feet around piles during pile-driving activities, whereas the zone of increased noise levels will be significantly larger, the extent of the action area in both terrestrial and aquatic environments is defined by the extent of increased noise levels.

2.1.7.1 Terrestrial Impact Zone

Ambient terrestrial noise levels in the Project area are influenced by the local population level, traffic volumes on US 95, rail traffic, and commercial enterprises. The local population center is the City of Sandpoint. US 95 is located adjacent to the north end of the Project and diverges from the rail line near the north end of BNSF Bridge 3.9 to ab out 2,500 feet west of the south end of Bridge 3.9. Ambient noise level projected at 55 A-weighted decibels (dBA) is expected based on the local population (Washington State Department of Transportation [WSDOT] 2018, p. 7.17).

Typical noise levels for construction and equipment were obtained from Chapter 7.0, Construction Noise Impact Assessment, of WSDOT's Biological Assessment Preparation Manual (2018). The impact hammer produces noise levels at 110 dBA at 50 feet from the source. In the event that two simultaneous pile drivers are utilized, 3 dBA was added to the 110 dBA value resulting in 113 dBA as the highest noise level proposed during Project construction. Ambient noise within the study area includes vehicle traffic from US 95 and train traffic with peak noise levels of 140 decibels (dB), which represents a locomotive horn/whistle. Using an ambient noise level of 55, construction noise will attenuate between 25,600 and 51,200 linear feet (4.8 and 9.7 miles) from the site or, more precisely, 39,716 feet (7.52 miles). This assessment does not consider topography or vegetated landforms. When considering topography, construction noise is anticipated to travel a maximum of approximately six miles, which is the furthest open-water distance between the bridge and an elevated landform.

The Project also includes acquiring fill material and rock. However, because the fill and rock will be sourced from existing local commercial sites, the acquisition of the fill and rock will have no effect on listed species. Therefore the source(s) of the rock and fill are not within the action area.

2.1.7.2 Aquatic Impact Zone

The aquatic impact zone was delineated by evaluating the farthest-reaching physical, chemical, and biotic effects of the action on the environment, which was determined to be underwater sound pressure levels (SPLs) from the loudest construction activity.

There will be four distinct pile installation activities for the Project, including temporary and permanent pile installation at Bridges 3.1 and 3.9. The temporary Bridge 3.1 will require 48, 24-inch-diameter steel piles, with up to 40 extending below the OHWM. These will be installed with a vibratory pile driver and 10 piles (1 per pier) will be proofed with an impact hammer. The permanent Bridge 3.1 will require 64, 24-inch diameter piles with 22 located below the OHWM. These piles will receive up to 1,200 strikes per pile.

The permanent Bridge 3.9 will include 288, 36-inch-diameter steel piles, all below the OHWM, which will be vibrated to resistance then proofed with an impact hammer. During installation of the piles, bubble and turbidity curtains will be used in water 2 feet deep or more. These piles will receive up to 1,600 strikes per day. The temporary Bridge 3.9 will include 700, 24-inch-diameter steel piles (all installed to resistance via vibratory hammer) but only 76 piles (1 per pier) will be proofed with an impact hammer. Impact pile driving is anticipated to take between 1 to 3 hours per pile that requires proofing.

For the purposes of defining a conservative action area, the highest SPLs associated with impact-driving steel pipe piles for Bridges 3.1 and 3.9 are assumed. Therefore, the aquatic impact zone includes the farthest distance that underwater sound would travel from impact pile driving activities at Bridges 3.1 and 3.9 until reaching land, or attenuating to background noise levels.

It is likely the contractor will impact-drive piles at both ends of permanent Bridge 3.9 simultaneously, which will increase the SPLs within LPO. Underwater sound attenuation is modeled in the equation below. The National Oceanic and Atmospheric Administration (NOAA) Pile Driving Impact Calculator was also used to assess sound impacts to specific species (Appendix A) and that analysis is presented in the Direct Effects section. SPLs from impact pile driving at Bridge 3.9 create a majority of the action area within LPO; however, sound from pile installation at Bridge 3.1 will extend up into Sand Creek.

Impact driving a 36-inch-diameter steel pipe pile will generate the loudest underwater sound level of 193 dB root-mean-square (RMS) measured at 10 meters (WSDOT 2018, p. 7.40). During previous improvements on Bridge 3.9, acoustic monitoring demonstrated that the use of a bubble curtain during impact pile driving, reduced underwater sound levels by 3 dB. The 3 dB reduction is based on average results of underwater sound monitoring conducted in July 2008, when bubble curtains were activated during impact pile driving while replacing piers at the south end of the existing Bridge 3.9 (Miner 2008, entire). Background sound levels in deep freshwater lakes or deep, slow-moving rivers are approximately 120 dB RMS, similar to marine levels near developed shorelines (WSDOT 2018, p. 7.34).

The extent of the action area was modeled in the equation below using an ambient underwater noise level of 120 dB RMS and a 190 dB RMS measured at 10 meters (32.81 feet) associated with the 36-inch-diameter steel pile and the use of a bubble curtain. Applying the normal attenuation rate of 4.5 dBA per underwater doubling distance results in construction noise attenuation of 288 miles from the Project site.

Distance from Construction Noise to Underwater Ambient Noise

$R_1 = R_2 \times 10^{[(\text{construction noise – ambient sound level in dBA})/\alpha]}$

R_1 is the range or distance at which the transmission loss is estimated R_2 is the range or distance of the known or measured sound level

$\alpha = 15$, the alpha (α) value assumes a 4.5 dBA reduction per doubling distance underwater; therefore,

$R_1 = 10 \text{ meters} \times 10^{[(190 - 120)/15]}$

This distance does not consider bathymetry or landforms. The furthest distance construction noise is anticipated to travel is approximately 6 miles, which is the furthest open water distance between Bridge 3.9 and an elevated landform. The action area is defined by the farthest distance that underwater sound will travel before encountering land and therefore extends out to the LPO shoreline (Figure 2) The aquatic impact zone is approximately 8 percent (PaDelford 2018, *in litt*) of the total water surface area of LPO.

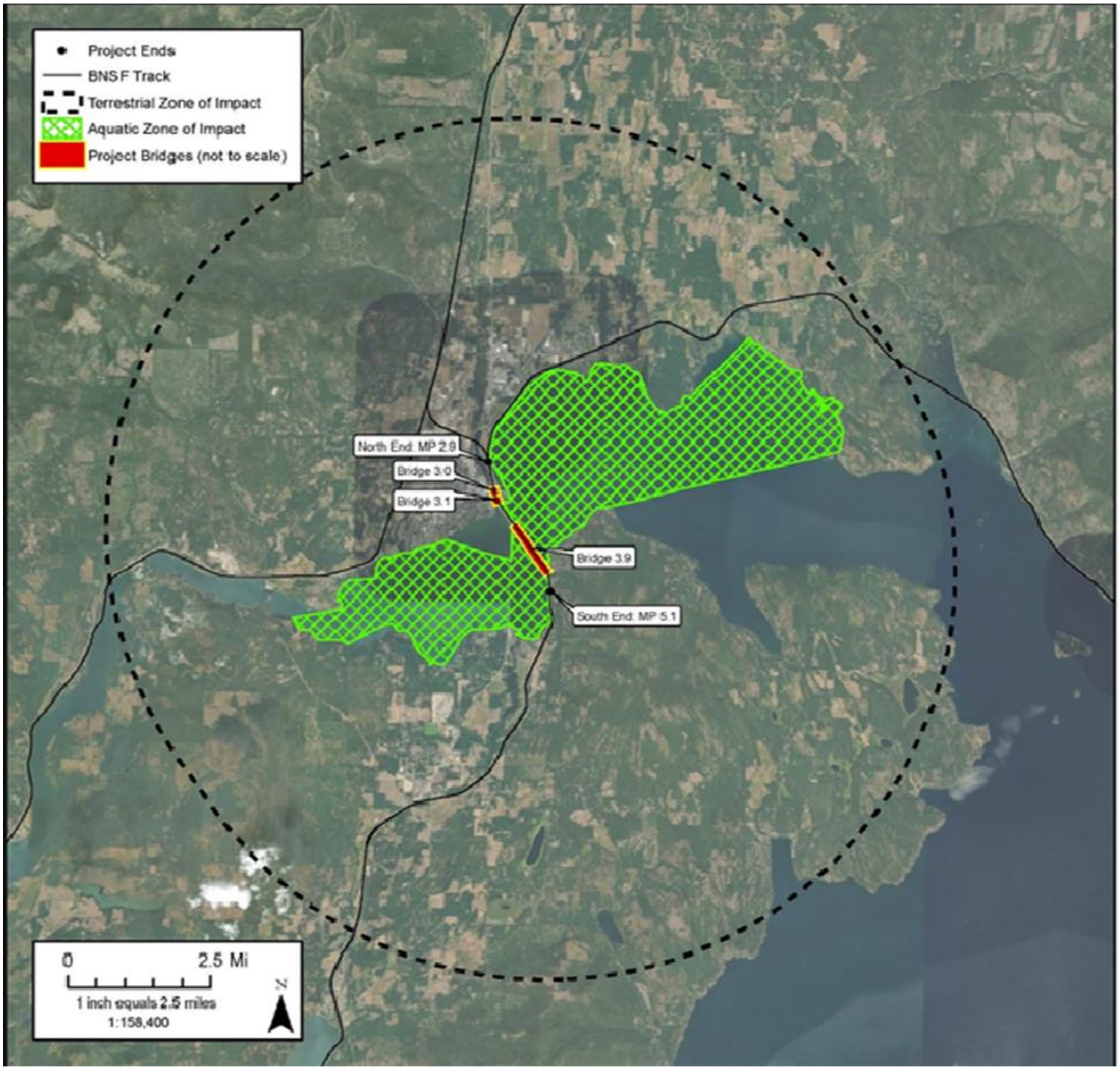

Figure 2. Action Area Map

2.1.8 Proposed Action

The Project construction to build the 2.2-mile-long second main line track west of the existing BNSF main line consists of the following general elements:

- Constructing a new main line track west of the existing BNSF main line track.
- Constructing a new bridge over Bridge Street (Bridge 3.0) adjacent to (west of) the existing rail bridge).
- Constructing a new bridge over Sand Creek (Bridge 3.1) adjacent to (west of) the existing rail bridge.

- Constructing a new bridge over LPO (Bridge. 3.9) adjacent to (west of) the existing rail bridge.
- Upgrading tracks, switches, and signals.
- Building and removing temporary construction bridges over LPO and Sand Creek.
- Improving temporary construction material and equipment work staging areas.
- Filling 0.88 acre of permanent and 0.38 acre of temporary nearshore areas below the jurisdictional OHWM elevation of 2,062.50 feet, associated with bridge abutments and the south switch.
- Filling 0.28 acre of wetland in one location between the rail grade and the multiuse public pathway, south of Bridge 3.1.

Following are the key elements of the construction process, listed in the proposed chronological order:

1. Mobilize and Improve Access Roads/Staging Areas

a. Access roads and staging areas in the existing BNSF ROW will be improved to accommodate Project-specific construction needs. The Project north end access is via Bridge Street, east of First Avenue in Sandpoint, and north onto Railroad Avenue towards the Amtrak Depot. A BNSF-owned maintenance area is just north of the depot. The south end access to the Project is via Bottle Bay Road, off of US 95, south of the Long Bridge, to Glen Eden Road, a private road with restricted public crossing of the BNSF ROW.

b. Project access and staging improvements may include reconditioning the existing rock surfaces, improving entry/exit locations for safety (e.g., line of sight clearing), and implementing Project-specific environmental protection measures such as placing rock at construction entrances/exits to avoid off-site sediment tracking and establishing easily accessible emergency containment/cleanup materials for vehicles, equipment, and staged petroleum fluids.

c. Mobilization of equipment and delivery of Project materials to staging areas will be an ongoing process during construction.

2. Identify Work Limits

a. Work limits (cut/fill) as per plan and regulatory permits or conditions will be staked and flagged prior to the start of earth-disturbing activities. These areas will be reviewed on-site with the contractor to verify equipment operations and earth-disturbing/fill activities are compliant and within the limits.

b. Stakes and flagging will be replaced or refreshed by the Project environmental compliance lead as needed throughout construction.

3. Implement Environmental Best Management Practices (BMPs)

a. When work limits are marked, the contractor will implement temporary environmental protection BMPs, such as installing sediment fencing and filter rolls along the grading/fill work limits adjacent to nearshore and wetland fills.

b. Clearing and grubbing of existing vegetation will be the minimum required to construct the Project. Grubbed materials will be removed to upland areas within the BNSF ROW or removed to off-site, upland locations in accordance with BNSF environmental requirements for material movement out of the BNSF ROW.

4. Vegetation Removal

a. Riparian vegetation removal in the nearshore and wetland fill areas will be the minimum needed. Vegetation will be cleared and grubbed using backhoes, bull dozers, or machinery appropriate for the specific location. Equipment access will be from adjacent upland areas. Cleared/grubbed materials will be loaded into haul trucks for removal to upland locations within the BNSF ROW or off-site, when those locations have been approved by BNSF and the Project environmental compliance lead.

b. Upland vegetation removal will be the minimum necessary for placement of structural rock fill, as per the Project plan and specifications. Large trees will be cut with chainsaws into manageable pieces for removal, via work trucks, to upland locations within the BNSF ROW prior to removal to approved off-site locations. Smaller-sized shrubs and grasses/weed cover will be grubbed and cleared using bulldozers, backhoes, graders, or other similar earth-moving equipment. Clearing/grading depths will be specified in the design, generally to native rock or rocky soil suitable for railroad grade construction. Grubbed stumps or rootwads will be taken to upland staging areas within the BNSF ROW, via haul trucks, for stockpiling prior to removal to off-site upland locations approved by BNSF and the Project environmental compliance lead.

5. Nearshore and Wetland Fills

a. Only clean, structural rock fill will be used, as required for construction of railroad grades. Fill material will be sourced from existing local commercial quarries approved for use in main line railroad construction.

b. Fill will be placed according to plan and in compliance with regulatory permits. Fill will be brought to the Project via haul/dump trucks with grading/compaction of the fill completed by bulldozers, graders, and roller/compactors. Fill sequencing will be according to plan and in accordance to main line railroad construction standards.

c. Fill work in nearshore and wetland areas will be done during LPO drawdown or low water conditions when no water is present in the fill locations. Fill in adjacent upland locations will be done when the nearshore/wetland fill is completed and compacted in accordance to railroad standards.

d. BMPs to prevent sedimentation from the fill into adjacent regulatory areas will be implemented prior to fill placement. These will be identified in the Project Stormwater SWPPP and WQMPP. BMPs such as sediment filter fencing, sediment filter rolls, rock filter berms, vegetation filter berms, or other perimeter protection measures will contain fill materials within the staked/flagged/marked work limits. These temporary BMPs will be kept in place until high water, summer pool lake levels are reached to contain potential “first flush” sedimentation from the newly placed rock materials. Prior to the regulated lake levels covering the BMPs and after “first flush” sediment settling, these temporary BMPs will be removed so they do not become a navigation hazard.

6. Upland Work Adjacent to Nearshore/Wetland Fills

a. Grading and compacting for the new rail grade development will be done after nearshore/wetland fill actions are complete during lake water-level drawdown. Clean, structural rock fill will be used in accordance to railroad construction standards. Fill material will be sourced from existing local commercial quarries approved for use in main line railroad construction.

b. Fill will be placed in locations/work limits according to plan and in compliance with regulatory permits. Fill will be brought to the work sites via haul/dump trucks and grading/compaction will be done by bulldozers, graders, and roller/compactors in a sequence according to standard practices for main line railroad construction.

c. Best management practices to prevent sedimentation to jurisdictional areas adjacent to upland fill locations will be implemented before fill work starts. The BMPs will be maintained throughout the Project until complete. When possible, as rail grade development is completed, final restoration/stabilization BMPs will be implemented—such as final seeding/mulching and/or rock cover. If upland areas are unworked for more than fourteen days during the summer/fall (i.e., dry season) or seven days during the winter/spring (i.e., wet season) temporary seed/mulch cover will be implemented.

d. Best management practices to avoid impacts via construction-related stormwater runoff will be implemented and maintained during work activities.

7. Construct Temporary Work Bridge 3.1 (Sand Creek)

a. A temporary timber deck work bridge will be constructed immediately adjacent to and west of the new Sand Creek bridge location. The Sand Creek temporary work bridge will measure approximately 510 feet long and 32 feet wide with eleven 48-foot-long spans. The temporary work bridge will be supported by 10 piers partially or fully below the OHWM. Eight piers will consist of 4, 24-inch-diameter, open-ended steel pipe piles, and two piers will consist of 8, 24-inch-diameter, open-ended steel pipe piles. In total, 30 to 40 piles will be below the OHWM to account for minor adjustments in span support needs and site conditions. The temporary work bridge will support large cranes that will be working to construct the new, permanent bridge over Sand Creek.

b. Generally, the work bridge will be used to gain access from the south side of Sand Creek, from an existing maintenance road and work pad west of the existing BNSF tracks. North side access will be developed off of Bridge Street, but will likely be used as a backup. The expected primary access point will presumably be from the south. Construction of the work bridge will likely start from the south side of Sand Creek, progressing north. The ends of the work bridge will consist of a temporary bulkhead at the water's edge that is filled to the existing grade or higher, as necessary. This will require permanent fill at the south end and temporary fill along the north end. Construction of the work bridge will be done in "leapfrog" fashion. The crane will advance a pile-driving template for every span. Once the template is in place, the support piles will be driven in the proper location. Four support piles are typical and have been assumed for this Project. Project-specific geotechnical data presumes that after a few days in place, the piles will have adequate strength for heavy loading. After the support piles are in place, the bracing will be installed and pier caps will be secured on top of the piles. Next, the beam groups will be placed from the temporary bulkhead to the first bent (cross-ways structural element to create the trestle) and secured to the foundations. Finally, the timber deck will be placed out to the first pier, and a safety handrail will be installed. At this time, the crane will be able to move out to the end of the work bridge and the entire process will be repeated for subsequent spans.

c. The work bridge will be constructed as noted and extended to the north end of the new bridge. The proposed work bridge deck construction system will be fully contained. Plastic sheeting will be installed between the deck timbers and the plywood to seal the deck. The bull rail (sides of the work bridge) will have foam rope under them and be tightened down to provide another level of sealed containment.

d. Once the work bridge reaches the north end, the production pile driving for the new, second bridge will commence and work from north to south. The temporary work bridge piles will be vibrated to resistance, and one pile per pier will be proofed with an impact hammer at an estimated 20 to 50 strikes for a short duration. Impact and vibratory pile driving will occur during daylight working hours. Assuming that two temporary work bridge piles can be driven per day, pile driving is expected to occur for about a month for the Sand Creek temporary work bridge, dependent on weather or other interruptions.

e. With the pile-driving activity, short, temporary retaining walls will be constructed at each pier, along the upland side (east) embankment so that the existing track stability is not adversely affected. Once enough piles are placed and their capacity is confirmed, the precast pile caps will be installed. After caps are placed, the precast concrete or steel beams, steel walkway, and handrail will be erected.

f. The temporary Sand Creek work bridge marked and lighted navigation channel will be limited to the period when no navigational access up Sand Creek is available, from approximately October 15 to April 15, depending on the fall LPO lake level drawdown and spring fill. The Albeni Falls Dam is approximately 25 miles downstream from the Project, on the Pend Oreille River, and regulates the ordinary high water and ordinary low water levels of LPO. The temporary work bridge over the marked and lighted navigation channel for Sand Creek will be removed between April 15 and October 15. As a result, the temporary work bridge will not impact navigation for marine traffic in Sand Creek as it will not be an obstruction when navigational access up Sand Creek is available.

8. Construct Temporary Work Bridge 3.9 (LPO)

a. A temporary timber deck work bridge will be constructed immediately adjacent to and west of the new LPO bridge location. The LPO temporary work bridge will measure approximately 4,800 feet long and 32 feet wide, with 101 approximately 48-foot-long spans and one 24-foot-long span at the north end. Additionally, eight 64-foot-wide staging set-outs will be installed at approximately 500-foot intervals along the bridge for safety and material staging and to provide continuous through-access for the length of the temporary work bridge.

b. The temporary work bridge will support large cranes that will be working to construct the new, permanent bridge over LPO. The temporary work bridge will maintain a 42-foot horizontal and 15-foot vertical clearance at the location of the marked navigation channel under the exiting bridge.

c. Construction of the work bridge will likely start from both the north and south ends of the Project over LPO. The end of the work bridge will consist of a temporary bulkhead at the lake's edge. This work requires both temporary and permanent fill to the existing grade or higher, as necessary. Construction of the work bridge will be done in "leapfrog" fashion. The crane will advance a pile-driving template for every span. Once the template is in place, the support piles will be driven in the proper location. Four support piles are typical and have been assumed for this Project. Project-specific geotechnical data, presumes that after a few days in place, the piles will have adequate strength for heavy loading. After the support piles are in place, the bracing will be installed and the pier cap secured on top of the piles. Next the beam groups will be placed from the abutment to the first bent and secured to the foundations. Finally, the timber deck will be placed out to the first pier and the handrail will be installed. Once these items are complete, the crane will move out to the end of the work bridge and the entire process will be repeated for subsequent spans. If the process is started from each bank at the same time, it is conceivable that the two bridge segments will be joined near the middle of the Project corridor over LPO.

d. There will be a time lag for when the work bridge has been extended out far enough from the bank and the piles have gained enough strength to support additional equipment and material for construction of the new, second bridge. Once this occurs, the production phase will begin. A work bridge deck system that will potentially be used will be fully contained. Plastic sheeting will be installed between the deck timbers and the plywood to seal the deck. The bull rail (sides of work bridge) will have foam rope under them and tightened down to provide another level of sealed containment. The temporary bridge piles will be vibrated to resistance, and one pile per pier will be proofed with an impact hammer at an estimated 20 to 50 strikes for a short duration. The work bridge will require 700, 24-inch-diameter steel pipe piles, with six hundred of the piles being installed in water. Impact and vibratory pile driving will occur during daylight working hours. Assuming that two temporary bridge piles can be driven per day, pile driving is expected to occur for an estimated one calendar year for the LPO temporary work bridge, dependent on weather or other interruptions. The vertical clearance of the LPO temporary work bridge will gradually rise from the abutments. Spans 1 through 16 at the north end of the bridge will have less than 10 feet of vertical clearance, with the maximum vertical clearance (low chord) gradually rising from 10 to 15 feet for Spans 17 through 67. Spans 68 through 71 will provide 15 feet of vertical clearance, with the low chord gradually lowering back down from 15 feet to 10 feet at the south end for Spans 72 through 101. The LPO temporary work bridge will be constructed first and will remain in place until the new, second bridge is placed into service. The temporary work bridge went through many design iterations to identify the least impacts to navigation while providing a safe working platform for the large, heavy equipment required to construct the new LPO railroad bridge. The majority of the work bridge will retain an equivalent vertical and horizontal clearance as the existing railroad bridge during construction. All marine traffic that now passes below the existing bridge will be able to pass under the temporary work bridge throughout construction. Signage, lighting, and other notices will be in place to direct marine traffic on LPO away from restrictive spans to the safe, non-restrictive boating passage spans.

9. Construct New, Second Bridge 3.1 (Sand Creek)

a. The new, second bridge over Sand Creek will be constructed approximately 35 feet west of the existing rail bridge in existing BNSF ROW and will measure approximately 505 feet long by 21 feet wide. The new bridge will be supported by 11 piers, each consisting of open-ended, 24-inch-diameter steel pipe piles. Two piers within the OHWM of the creek channel will consist of eight piles each; seven piers (one partially or wholly within the OHWM and six fully upland) will consist of six piles each; and two piers upland of the OHWM will consist of three piles each. A total of 64 piles will be placed, with 22 below the OHWM. Piles within the main channel of Sand Creek will be driven during low-water conditions/winter pool elevation. Two of the bridge bents will be fully within the Sand Creek navigational channel. The new bridge navigational horizontal clearance is 74 feet; the existing bridge has an approximately 45-foot-wide horizontal clearance. Vertical clearance of the new bridge will match the vertical clearance of the existing bridge, which is 17 feet above the 2,062.5-foot OHWM elevation. The new Sand Creek bridge piles will be vibrated to resistance into the creek bed and finished with an impact hammer with an average of 1,200 strikes per pile. Pile driving will occur during daylight working hours. Assuming that up to two piles could be driven per day, pile driving will occur for about 1 month, dependent on weather-related, or other, interruptions. Generally, a new rail bridge consists of four primary elements, working from the bottom up: installing piles, installing pier caps, pre-cast beams and deck, and installing the pile bracing. The first element is pile installation, which consists of vibrating to resistance, impact-hammer driving to load specifications, and proofing/testing to verify that loadbearing criteria has been met. A pile template will be installed at each new pier location. The pile template will likely have four temporary piles with a steel frame installed on top to correctly position the new permanent piling. Due to the long lengths of new pile required, the piles will be delivered to the work site by trucks to the Project staging areas and then to the pile placement locations as needed via the temporary work bridge. The sections will be welded as they are driven to form one long pile. The first section is driven before the second section is held in place and welded to the first. The third section is then welded to the pile and driving of that pile is completed. Each pier will have six piles. The pile bracing may be installed any time after the piles are complete, but this will likely occur during LPO drawdown or low water periods.

b. Once the pile capacity has been verified through impact testing, the top of the piles will be cut off at the proper elevation and the precast pile cap can be installed. This is done by lifting the cap from the work bridge and setting it onto the piles before welding the bottom of the cap to the top of the piles.

c. When at least two pier caps have been installed, erection of the precast concrete beams and bridge deck may begin. Depending on length, there are four or five beams per span, which will be connected to each other with steel diaphragms that bolt to the beam. The beams will rest on bearings that are anchored into the pier caps. Ballast and track will be placed directly on the deck structure.

d. These four bridge construction elements will generally follow each other in a linear fashion for the construction of the new, permanent Bridge 3.1 over Sand Creek.

10. Construct New, Second Bridge 3.9 (LPO)

a. The new, second bridge over LPO will be constructed approximately 50 feet west of the existing rail bridge in existing BNSF ROW and measure approximately 4,874 feet long by 18 feet wide. The new bridge will have 49 spans: forty-two 104-foot long, six 75-foot-11-inch long, and one 47-foot-10-inch long.

b. Each pier bent will consist of 6, open-ended, 36-inch-diameter steel pipe piles for a total of 288 piles below the regulated summer pool elevation of 2,062.5 feet that makes up the jurisdictional OHWM of the lake. The new piers will align approximately with every other pier of the existing bridge.

c. The new, permanent LPO bridge will have 10 spans at, and adjacent to, the designated navigation spans on the existing bridge that will closely match those longer-span horizontal clearances. The low chord of the new bridge will be 15 feet above the regulated summer pool elevation of 2,062.5 feet. These 15-foot clearances will consist of six 75-foot-11-inch spans, four of which will align with the existing rail bridge's 77-foot spans that are equal to or greater than 15-foot vertical clearance. The new bridge will not reduce the horizontal or vertical clearance over the marked navigation channel under the existing bridge.

d. Generally, a new rail bridge consists of five primary elements, working from the bottom up: installing piles, installing pier caps, setting beams, casting the concrete deck, and installing the pile bracing. The first element is pile installation, which consists of vibrating to resistance, impact-hammer driving to load specifications, and proofing/testing to verify that load-bearing criteria has been met. A pile template will be installed at each new pier location. The pile template will likely have four temporary piles with a steel frame installed on top to correctly position the new permanent piling. Due to the long lengths of new pile required, the piles will be delivered to the work site by trucks to the Project staging areas and then to the pile placement locations as needed via the temporary work bridge. The sections will be welded as they are driven to form one long pile. The first section is driven before the second section is held in place and welded to the first. The third section is then welded to the pile and driving of that pile is completed. Each pier will have six piles. The pile bracing can be installed any time after the piles are complete, but this will likely occur during LPO drawdown or low water periods.

e. Once the pile capacity has been verified through impact testing, the top of the piles will be cut off at the proper elevation and the precast pile cap can be installed. This is done by lifting the cap from the work bridge and setting it onto the piles before welding the bottom of the cap to the top of the piles.

f. When at least two pier caps have been installed, erection of the precast concrete beams can begin. Depending on length, there are four or five beams per span that will be connected to each other with steel diaphragms that bolt to the beam. The beams will rest on bearings that are anchored into the pier caps.

g. Next the bridge deck construction will commence. The deck is nominally 13 feet wide by 76 or 104 feet long and 8 inches thick. Concrete formwork will be installed between and outside the beams. Then reinforcing bar will be tied in place on the formwork. Once all elements are checked for conformance with the design plans, the concrete will be placed with the use of a concrete pump, supplied by concrete trucks, from the temporary work bridge. A second concrete placement activity, via a concrete pump system/concrete truck support, will potentially be required for each span to construct the curbs on the outside of each deck. Once these items are complete, the temporary formwork will be removed. Finally, the steel handrail will be installed on the outside face of each curb.

h. The five-bridge construction elements will generally follow each other in a linear fashion. Because Bridge 3.9 is so long, it is likely that pile driving will occur at the same time the concrete deck is being installed, i.e., all five primary bridge elements may occur at the same time.

i. The new, permanent LPO bridge, will require vibrating 288 piles to resistance into the lake bed and finishing with an impact hammer with an average of 1,600 strikes per pile. All piles will be installed in water. Pile driving will occur during daylight working hours. Assuming that up to two piles will be driven per day, pile driving will take place over 6 consecutive months, dependent on weather-related or other interruptions. Air bubble curtains will be used during impact pile driving to attenuate in-water SPLs (when water is more than 2 feet deep; WSDOT 2018), and a turbidity curtain will surround the area where bubble curtains are utilized

11. Remove Temporary Work Bridge 3.1 (Sand Creek)

a. Once all the new bridge construction elements have been completed, and the track has been installed, the contractor will begin removing the work bridge. For one span at a time, the deck is removed, then the beams, then the pile cap, and finally the piles. This process is repeated until complete. A crane will be used as the main piece of equipment during this disassembly process.

b. The temporary work bridge components, deck sections first, will be stockpiled in upland staging areas for eventual removal from the site. The temporary work bridge piles will be removed using a vibratory extraction methodology further described in the Minimization Measures section.

12. Remove Temporary Work Bridge 3.9 (LPO)

a. As with the temporary bridge over Sand Creek, the LPO temporary work bridge will be removed in sections when the new bridge construction is complete.

b. Generally, this process will be the same as described for the Sand Creek Bridge 3.1 work bridge. Once all the new, permanent bridge construction elements have been completed, and the new main line track has been installed, the contractor will begin removing the work bridge.

13. Remove Temporary Nearshore Fills

a. Temporary nearshore fills will be removed once temporary work bridge removal is complete and work space from adjacent upland areas is allowed. Backhoes with “thumb”’ attachments on the hoe portion or excavators will be used to remove the temporary fill material. This work will be done during LPO drawdown or low water conditions.

14. Demobilize and Stabilize/Restore Disturbed Areas

a. Concurrent with the disassembly of the temporary work bridges, final grading and track construction could be occurring in upland areas within the Project limits.

b. Site restoration will include final grading and removal of temporary nearshore fills in areas adjacent to Sand Creek or LPO. These areas will be seeded and mulched with native riparian grass species and, where there is sufficient soil, native riparian trees and shrubs will be planted. Sediment control BMPs will be implemented around these areas until vegetation becomes established.

c. When open soil areas are determined to be stable by the environmental compliance lead, temporary construction materials and BMPs such as fencing, signage, and erosion control products will be removed.

d. Final inspection Project punch-list environmental items will also be addressed at this time prior to the contractor demobilization off of the Project site. Construction supplies and equipment will be removed from the staging areas and the contractor will demobilize off BNSF property. Staging areas will be restored to BNSF standards.

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 range-wide 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 or 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 cold-water 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; PRBO 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 kilometers (km) (155 miles (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

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

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; Goetz et al. 2004, p. 105; 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).

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).

2.3.1.6 Status and Distribution

While all six of the bull trout recovery units are 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, this Opinion will only discuss the Upper Columbia Headwaters Recovery Unit as pertinent to this consultation. 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).

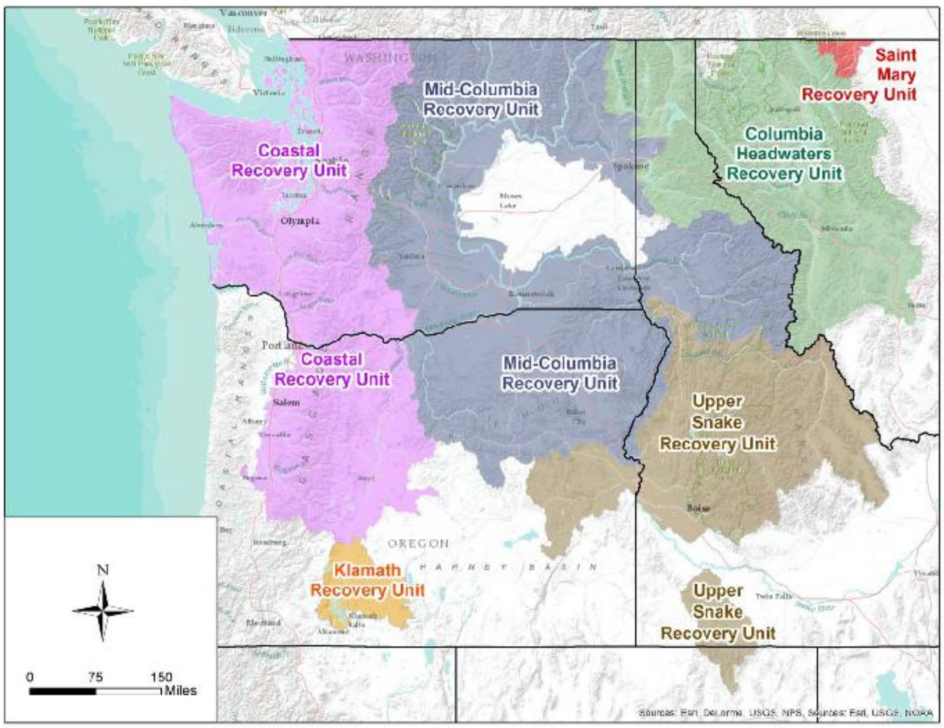

Figure 3. Map showing the location of the six bull trout Recovery Units.

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.

For more information on conservation actions see section 2.3.1.7 below.

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.).

The 2015 RP (USFWS 2015a, entire) integrates 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).

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 Service's Summary of Bull Trout Conservation Successes and Actions since 1999 (Available at: http://www.fws.gov/pacific/ecoservices/endangered/recovery/documents/Service_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[1].

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).

Table 2. 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 miles) 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

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

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 , 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 or 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).

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. 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

2.4.1 Terrestrial Setting

While Project actions are limited to the BNSF ROW in upland areas, the terrestrial setting includes the action area which extends to a modeled 7.5 miles. Uplands in the action area are a patchwork of urban, urban fringe, and rural development, managed forest lands and minor amounts of undisturbed areas. The immediate Project area is primarily developed and consists of railroad tracks, gravel and paved parking areas, highway/roadways, and LPO. The cities of Sandpoint, Kootenai, Dover, and Sagle all occur within 7.5 miles of the Project. Aside from potential elevated noise levels, little disturbance would occur in terrestrial areas; therefore, they are not described in detail in the section.

2.4.2 Lake Pend Oreille

LPO is a natural, temperate, oligotrophic lake. It is the largest natural lake in Idaho and the fifth deepest lake in the United States, with a mean depth of 538 feet, a maximum depth of 1,152 feet at its southern end, and a surface area of 94,720 acres. It is fed by over 20 streams originating in the Selkirk Mountains to the northwest, the Cabinet Mountains to the northeast, and the Coeur d'Alene Mountains to the east, which comprise most of the largely undeveloped, steep, rocky terrain LPO's shoreline and littoral zone. The remaining littoral zone at the lake's northern end and bays consists of gradual or moderately sloping bottom, surrounded by flat to gently sloping upland and floodplain with residential and commercial development within the cities of Sandpoint, Ponderay, and Kootenai; the cities of Hope and Clark Fork (farther east); and within the unincorporated areas of Sagle (south of Sandpoint; McCubbins et al. 2016, p. 1270).

The Clark Fork River, originating in western Montana, is the largest tributary into the lake providing 92 percent of LPO's inflow at the river's mouth near the city of Clark Fork, northeast of Sandpoint. Three hydroelectric dams were constructed from 1913 to 1959 (Cabinet Gorge, Noxon, and Thompson Falls Dams), creating a series of impoundments on the lower Clark Fork River.

The Pend Oreille River is LPO's only surface water outlet west of Sandpoint near the city of Dover. The river flows approximately 27 miles from LPO in Idaho into eastern Washington, then north into Canada where it joins the Upper Columbia River. The Pend Oreille River is impounded by the Albeni Falls hydroelectric dam, constructed in 1955 near the Idaho-Washington border, which regulates the lake's surface elevation/pool at 2,062.5 feet from approximately mid-June through September, and at 2,051 to 2,056 feet from October through May. The Project area is in the shallowest portion of LPO where waters are likely the warmest.

A wide diversity of fish species are present in LPO. The native fish present are westslope cutthroat trout (*Oncorhynchus clarki lewisi*), bull trout (*Salvelinus confluentus*), mountain whitefish (*Prosopium williamsoni*), pygmy whitefish (*Prosopium coulterii*), slimy sculpin (*Cottus cognates*), peamouth (*Mylocheilus caurinus*), northern pikeminnow (*Pschocheilus oregonensis*), redside shiner (*Richardsonius balteatus*), longnose sucker (*Catostomus catostomus*) and largescale sucker (*Catostomus macrocheilus*).

Non-native sport fish that have been stocked or found their way into the lake over the years include kokanee (*Oncorhynchus nerka* – a land-locked form of sockeye salmon), rainbow trout (*Oncorhynchus mykiss*), Gerrard-strain rainbow trout (Kamloops), lake whitefish (*Coregonus clupeaformis*), lake trout (*Salvelinus namaycush*), smallmouth bass (*Micropterus dolomieu*), and several other species present in low quantity including northern pike (*Esox lucius*), brown trout (*Salmo trutta*), largemouth bass (*Micropterus salmoides*), yellow perch (*Perca flavescens*), and walleye (*Sander vitreus*) (McCubbins et al. 2016, pp 1270-1271).

2.4.3 Sand Creek

The Sand Creek watershed, a tributary to LPO, covers 38 square miles or 24,209 acres, and includes Jack Creek, Little Sand Creek, Swede Creek, and Schweitzer Creek northeast of Sandpoint. Sand Creek generally flows from north to south for approximately 16 miles and discharges into LPO within the City of Sandpoint, where it is subject to the regulated levels of LPO. Although it is known locally known as Sand Creek and is considered to be Sand Creek by the IDL (Fuson 2017, *in litt*), federal agencies and the IDEQ consider the lower portion of Sand Creek, from LPO upstream to State Highway 200, as an inlet of LPO (Williams 2018, *in litt*; IDEQ 2018).

The average gradient of Sand Creek is one percent and the primary channel substrate is sand. Land use consists of forestry, agriculture, and permanent grasslands with small areas of shrub land and barren land. The primary land use is agriculture/rural. Land ownership is mostly private, with the remainder of the watershed held by the City of Sandpoint, Bureau of Land Management, Idaho State, and the United States Forest Service (IDEQ 2017b).

The upper portion of the creek is surrounded by sparse residential development within the unincorporated areas of Bonner County, except for the Schweitzer Mountain Ski Resort, a large residential and commercial development located in the upper reaches of Schweitzer Creek. The lower, approximate four-mile portion of Sand Creek is surrounded by residential and commercial development within the cities of Sandpoint and Ponderay.

2.4.4 Bull Trout

2.4.4.1 Status of the Bull Trout in the Action Area

The Lake Pend Oreille Core Area is one of the largest, most complex, and best-documented bull trout core areas in the upper Columbia River watershed. The Core Area includes the Pend Oreille River in northeastern Washington, a nearly 95,000-acres lake in Idaho (Lake Pend Oreille), and the Lower Clark Fork River in western Montana. Bull trout face a variety of threats across their range; however the biggest threats to bull trout status and distribution within the Lake Pend Oreille core area are believed to be from the following (USFWS 2015a, p. 15-18):

1. Introduced species/fisheries management;
2. Forest management practices and forest roads;
3. Fish passage issues (artificial barriers to migration), connectivity, and entrainment; and,
4. Residential development and urbanization.

In 1925, the U.S. Fish Commission stocked 100,000 lake trout (*S. namaycush*) into Lake Pend Oreille and its tributaries (Pratt and Huston 1993, p. 75). Additionally, lake trout may also have migrated downstream of Flathead Lake, where they were introduced 20 years earlier (USFWS 2002c, p. 91). Lake trout compete with native bull trout for food resources and are listed as one of the biggest threats to bull trout populations in the Lake Pend Oreille core area and in Lake Pend Oreille (Lake Pend Oreille Bull Trout Watershed Advisory Group [LPOBTWAG] 1999, p. B-4; USFWS 2008, p. 16). Findings from Donald and Alger (1993, p. 245) and Fredenberg (2002, p. 151) suggest that bull trout will not persist in the presence of lake trout. For example, Priest Lake experienced dramatic declines in bull trout numbers as corresponding lake trout numbers increased (Mauser 1986, p. 26).

Efforts to reduce competition for food resources, which benefit lake conditions for bull trout in Lake Pend Oreille, are ongoing through predator removal programs. Considerable effort has been put into controlling the lake trout population in Lake Pend Oreille through angler incentive programs, and trap and gill netting projects. This program continues and is believed to be highly effective at reducing lake trout numbers. A more detailed description of the lake trout removal program can be found in Section 2.6.1.2 of this Opinion.

To monitor bull trout population trends, an extensive redd count monitoring program in Lake Pend Oreille core area has been devised by the Idaho Department of Fish and Game and has been in place since 1983 (USFWS 2008, p. 2). Table 3 documents the results of annual redd surveys in the Lake Pend Oreille core area (Ryan and Jakubowski 2011, p. 16, Bouwens pers. comm. 2017). Based on 2010 surveys of the Lake Pend Oreille drainage, the adult bull trout spawning population consisted of at least an estimated 2,093 fish (compared to 2,771 in 2009) (Hardy pers. comm. 2011). Survey results from 2009 also identified more than six local populations with greater than 100 individuals in each, estimated adult escapement (number of adults returning to spawn based on the number of redds observed during annual surveys) of 2,500 or more individuals, and increasing relative abundance measured as the trend in adult escapement. Recovery objectives (USFWS 2002d) were met for five years between 2002 and 2006, but estimated adult escapement was less than 2,500 in 2007, 2008 and 2010 and represented below average counts in several highly influential tributary spawning populations including Trestle Creek, Granite Creek, and Gold Creek (Hardy et al. 2010, p. 17; Hardy pers. comm. 2011). Despite this, regression analysis depicting trends in bull trout redds from 1983 to 2017, demonstrates that redd abundance varies annually throughout the core area (Hardy et al. 2010, p. 14, 41; Hardy pers. comm. 2011). Although the fundamental trend for bull trout redd counts from 1983 to 2017 appears positive, bull trout like other fish species demonstrate population fluctuations (as assessed by redd counts) due to a variety of factors.

Bull trout in the interconnected Lake Pend Oreille watershed appear to be entirely adfluvial (Panhandle Bull Trout Advisory Team [PBTTAT] 1998, p.8). Adult bull trout make spawning migrations into the larger tributaries beginning in April (PBTTAT 1998, p. 9), with juvenile outmigration occurring as early as March and lasting until June. Fall migrations (September-October) follow a similar pattern of movement with adults moving further upstream to spawn (then returning to Lake Pend Oreille to overwinter) and juveniles moving downstream into Lake Pend Oreille (Downs et al. 2006, p. 193-194). Adult and subadult bull trout are likely to transit through the action area year-round, including moving through the area for foraging, or in the course of migrating to spawning and rearing (SR) tributaries (Dupont et al. 2007, p. 1269).

Some bull trout migrations in LPO have been shown to be very extensive (USFWS 2002d, p. 15). For example, research conducted by Dupont and Horner (2002, p. 125) suggested that migratory bull trout spawning in the Middle Fork East River and Uleda Creeks, tributaries to the East River downstream of Priest Lake, may exhibit an unusual life history strategy. These fish have been documented to migrate downstream out of Lake Pend Oreille into the Pend Oreille River, before ascending the East River drainage for spawning. It was previously believed that bull trout in this drainage were part of the Priest Lake core area (USFWS 2008, p. 3). This life history was believed to also occur in tributaries downstream of Albeni Falls prior to construction of the dam.

There is no documented presence of bull trout in Sand Creek, and there is minimal data on bull trout use of LPO within the Project action area (Sitarii 2017, *in litt*); USFWS 2017b). Subadult bull trout emigrate into LPO from tributaries in two pulses, one in spring associated with snowmelt runoff and increasing water temperatures and a second in fall as stream temperatures drop and fall rains begin (Downs et al. 2006). A fall-only subadult bull trout emigration occurs from the downstream East River to the Pend Oreille River to LPO, presumably to allow bull trout to avoid swimming upstream into the lake against the current during spring high flows (USFWS 2015b).

Fish passage barriers also influence bull trout distribution throughout the core area. Log crossings, beaver dams, large alluvial deposits and culverts are recognized as fish passage barriers across the area. To improve fish passage, many of these barriers (i.e., culverts, log crossings, etc.) have been removed or replaced. While the aforementioned barriers influence fish passage on a local scale, large hydroelectric dams have had the greatest influence on bull trout distribution throughout the core area. Beginning in 1913, with the construction of Thompson Falls Dam on a set of natural falls in the Clark Fork River, dams in the basin (Cabinet Gorge in 1952, Albeni Falls in 1955, Box Canyon in 1956, and Noxon Rapids in 1959) have permanently interrupted established bull trout migration routes, eliminating access from portions of the tributary system to the productive waters of Lake Pend Oreille and Flathead Lake (USFWS 2015a, p. 15). Three dams on the lower Clark Fork River have significantly reduced the amount of spawning and rearing habitat available to Lake Pend Oreille bull trout. Other effects of these dams to bull trout habitat include changes in water quality (temperature, sediment, and nutrients) and quantity, lake drawdowns, a reduction in shoreline food sources, and direct losses of fish into water conveyance systems (turbines, spillways, or water delivery systems) (USFWS 2015a, p. 34).

Within the action area, the Pend Oreille River has been significantly altered by residential development along the shoreline. Bank armoring and recreational docks have limited complexity and large wood recruitment, modified natural hydraulic processes, and removed vegetation that provide shade and forage. These actions have furthered limited the potential for bull trout use of the river, and the persistence of the species in the action area.

Table 3. Bull trout redd counts from tributaries of Lake Pend Oreille, Clark Fork River, and Pend Oreille River, Idaho.

STREAM (*Index)	Avg 1983-2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Clark Fork R.	7	0	3	2	0	1	0	0	--	--	--			
Lightning Cr.	10	22	9	3	10	11[b]	0	20	1	1	4	11	--	3
East Fork Cr. *	51	50	51	34	38	85	26	64	11[b]	26	22	17	19	80
Savage Cr.	8	7	25	0[b]	8	5	6	1	--[b]	5	6	5	1	19
Char Cr.	11	15	20	1	5[e]	1[e]	4[e]	9[e]	0[b,e]	4[e]	2	0	0	0
Porcupine Cr.	9	14	8	8	8	15	11	13	2[b]	4	15	0	14	10
Wellington Cr.	9	6	29	9	10	4[b]	7	6	5	5	11	8	3	5
Rattle Cr.	22	34	21	2	24	62[b]	43	65	59	8	63	5	5	20
Johnson Cr. *	19	45	28	32	40	47	57	54	54	50	21	5	5	10
Twin Cr.	9	7	11	0	4	0	0	1	--	--	--	--	--	--
Morris Cr.	2	3	16	0	6	6	9	0	0[b]	3	14	0	3	32
Strong Cr.	1	--	--	--	7	6	2	11	3	47	17	0	10	4
Trestle Cr. [a] *	251	174	395	145	183	279	188	178	187	133	159	117	91	75
Pack R.	23	53	44	16	11	4	0	1	7	6	1	35	5	57
Grouse Cr. *	37	77	55	38	31	51	27	116	69	12	54	48	--	32
Granite Cr.	43	132	166	104	52	106[c]	75[c]	129[c]	68	217	115	66	48	96
Sullivan Springs Cr.	15	15	28	17	7[c]	2[c]	9[c]	11[c]	4	11	4	0	4	14
North Gold Cr. *	30	34	30	28	17	28[c]	28[c]	6[c]	3[b]	28	25	41	22	54
Gold Cr. *	120	200	235	179	73	107[c]	130[c]	56[c]	110[c]	106[c]	88	69	71	169
W. Gold Cr.	NA	--	4	0	7	5	4	0	8	29	10	3	0	3
M.F. East R.	13	48	71	34	36	25	22	28	28	25	51	51	50	23
Uleda Cr.	4	4	7	2	7[b]	16	6	9	24	14	26	11	2	1
N.F. East R.	1	0	0	--	0	--	0	--	--	--	--	--	--	--
Caribou Creek	NA	--	--	--	--	--	--	37	6	47	9	57	4	51
Hellroaring	NA	--	--	--	--	--	--	--	3	--	--	2	2	24
Total 6 index streams	507	580	794	456	382	597	456	474	434	355	369	297	208	420
Total of all streams	694	940	1256	654	584	866	654	815	652	781	717	551	359	782

[a] Additional approx. 0.5 km reach immediately upstream of index reach on Trestle Creek added in 2001
[b] Impaired observation conditions (ice, high water, etc.)
[c] Abundant early spawning kokanee made identification of bull trout redds in lower reaches difficult
[d] Partial Count
[e] Barrier excluded bull trout from accessing typical spawning habitat

2.4.4.2 Factors Affecting the Bull Trout in the Action Area

Specific threats identified in the LPO-B core area and its tributaries, extending from Cabinet Gorge Dam on the Clark Fork River downstream to LPO to Albeni Falls Dam on the Pend Oreille River include (USFWS 2010a):

- Historic fragmentation of the lower Clark Fork River due to three privately-owned mainstem hydroelectric dams (Cabinet Gorge, Noxon Rapids, and Thompson Falls) that seriously compromised access and productivity of this bull trout habitat for nearly a century;
- Overfishing of bull trout and the presence of voracious non-native species, specifically lake trout (mackinaw) that prey on juvenile bull trout and consume kokanee, a primary food source for bull trout, as identified by the IDFG; and
- Legacy impacts from upland/riparian land management practices threaten habitat through increases in sedimentation, riparian and instream degradation, loss of large woody debris, and pool reduction in FMO habitat and in some SR tributaries.

Ongoing and planned near-term fish passage efforts at Cabinet Gorge and Albeni Falls dams (fishways and trap and transport programs) will improve the longer-term prognosis for bull trout connectivity, and are expected to provide a critical linkage to recovering bull trout in the entire Lower Clark Fork Geographic Region in the future. Continuing efforts to suppress non-native fish (specifically lake trout), which is funded under the Avista Corporation Clark Fork Settlement Agreement (CFSA), would remain an important component of the recovery effort (USFWS 2010a).

In addition, Lake Pend Oreille and Sand Creek within the Project action area are listed for water quality impairments by IDEQ (2007) and have established loading targets, or total maximum daily loads (TMDLs). These include Sand Creek TMDLs for temperature and sediment approved by USEPA in 2007, and a LPO nearshore TMDL for total phosphorus approved by USEPA in 2002. Lake Pend Oreille and Sand Creek within the Project action area are also currently listed as impaired by mercury and development of a TMDL is currently underway. Pend Oreille River (including the outlet arm of LPO within the Project action area) is currently in need of TMDLs for temperature and dissolved gas supersaturation impairments (IDEQ 2017a, Appendix K, p. 12).

2.4.5 Bull Trout Critical Habitat

2.4.5.1 Status of Bull Trout Critical Habitat in the Action Area

In accordance with section 3(5)(A)(i) of the ESA and regulations at 50 CFR 424.12(b), in determining which areas occupied at the time of listing to propose critical habitat, the Service considered the physical or biological features essential to the conservation of the species and that may require special management considerations or protection, and were discussed earlier in this document. The PBFs listed earlier in the document, and apply to the action area are as follows:

1. The Project action area (Sand Creek and LPO) has ample water sources year-round. Water levels are controlled by the Albeni Falls Dam on the Pend Oreille River at the Idaho/Washington border, approximately 25 miles downstream from the Project. Levels fluctuate from an elevation of 2,051 feet at winter pool to 2,062 feet at summer pool.

2. Shoreline armoring, marinas, and bridges are present within Sand Creek and LPO. Migration between spawning, and rearing habitat in tributaries, and overwintering and foraging habitat in LPO, has been impeded by upstream dams on the lower Clark Fork River (Cabinet Gorge, Noxon Rapids) and by the downstream Albeni Falls Dam on the Pend Oreille River.

3. An abundant food base is present in LPO with IDFG estimating kokanee abundance at 21 million in 2015, a primary bull trout food source. However, predation of kokanee by lake trout is an issue in LPO, and significantly impacted the kokanee population before IDFG initiated an ongoing lake trout suppression effort in 2006. IDFG is also currently researching feasibility of a walleye suppression effort in LPO.

4. The Project area includes Sand Creek and LPO. Large wood, pools and undercut banks are not present within the Project area. Though LPO levels are artificially managed, there are a variety of depths and gradients present in the action area.

5. A 2005 temperature monitoring study (Annear et al. 2006) reported temperatures ranging from 2 to 22°C at depths ranging from 0.16 to 15.24 meters between February and November in LPO near Contest Point (approximately 1.5 miles upstream/east of the existing Bridge 3.9), and reported temperatures ranging from 7 to 25°C at depths ranging from 0.61 to 7.62 meters between April and November at the US 95 bridge over LPO (approximately 0.5-mile downstream/west of the existing Bridge 3.9). The study also noted that thermal stratification occurs in LPO in the middle of summer (August).

6. Not applicable; the Project is not within bull trout SR habitat.

7. Sand Creek and LPO have seasonal changes in water levels that can depart from a natural hydrograph. Water levels are controlled by the Albeni Falls Dam on the Pend Oreille River at the Idaho/Washington border, approximately 25 miles downstream of the Project. Levels fluctuate from an elevation of 2,051 feet at winter pool to 2,062 feet at summer full pool.

8. Water quality impairments exist in the action area for sediment, temperature, and nearshore phosphorus. These issues have established TMDLs: Sand Creek temperature and sediment in 2007, and a LPO nearshore TMDL for total phosphorus in 2002. LPO and Sand Creek within the Project action area are also currently listed as impaired by mercury. Additionally, the Pend Oreille River (including the outlet arm of LPO within the Project action area) have impairments for temperature and dissolved gas supersaturation that are a medium TMDL in 2019 (IDEQ 2017a, Appendix K, p. 12).

9. Per IDFG (2017a, *in litt*) data, predatory species are present within the LPO including walleye, smallmouth bass, northern pike, and lake trout. These invasive species present a threat to bull trout through predation or competition. IDFG is conducting an ongoing lake trout suppression effort that has been underway since 2006 and is also currently researching feasibility of a walleye suppression effort.

2.4.5.2 Factors Affecting Bull Trout Critical Habitat in the Action Area

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 (ISAB) 2007, p. iv).

2.5 Effects of the Proposed Action

Effects of the action consider 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. An interrelated activity is an activity that is part of the proposed action and depends on the proposed action for its justification. An interdependent activity is an activity that has no independent utility apart from the action under consultation.

2.5.1 Direct Effects of the Proposed Action on Bull Trout

Direct effects are 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 would result from, the proposed action and occur later in time (USFWS 2015i). Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area. The proposed action may result in direct effects to bull trout from temporary pile driving associated with the construction permanent and temporary bridges.

2.5.1.1 Elevated Underwater Sound Levels

The Project would construct both a temporary and permanent bridges over Sand Creek and LPO, which would require vibratory and impact pile driving of both 36-inch-diameter steel piles and 24-inch-diameter steel piles. The project includes both vibratory and impact pile driving.

High levels of underwater sound can injure or kill fish and cause alterations in behavior (Turnpenny et al. 1994, entire; Turnpenny and Nedwell 1994, pp 11-13; Popper 2003, p. 29; Hastings and Popper 2005, entire; NMFS 2007, entire). Death from barotrauma can be instantaneous or delayed up to several days after exposure. Even in the absence of mortality, elevated noise levels can cause sublethal injuries. Fish suffering damage to hearing organs may suffer equilibrium problems, and may have a reduced ability to detect predators and prey (Hastings et al. 1996, pp. 1762-1763). Hastings (2007, p. 5) determined that a sound exposure level (SEL) as low as 183 dB (re: 1 µPa2-sec) was sufficient to injure the non-auditory tissues of juvenile spot (*Leiostomus xanthurus*) and pinfish (*Lagodon rhomboides*) with an estimated mass of 0.5 grams.

Adverse effects on survival and fitness can occur even in the absence of overt injury. Exposure to elevated noise levels can cause a temporary shift in hearing sensitivity (referred to as a temporary threshold shift), decreasing sensory capability for periods lasting from hours to days (Turnpenny et al. 1994, entire; Hastings et al. 1996, p. 1759). Popper et al. (2005, p. 3959) found temporary threshold shifts in hearing sensitivity after exposure to cumulative SELs as low as 184 dB. Temporary threshold shifts reduce the survival, growth, and reproduction of the affected fish by increasing the risk of predation and reducing foraging or spawning success.

Cumulative SEL is a measure of the risk of injury from exposure to multiple pile strikes. The Equal Energy Hypothesis, described by NMFS (2007, entire), is used as a basis for calculating cumulative SEL. The number of pile strikes is estimated per continuous work period. This approach assumes that there would be a break of at least 12 hours between work periods. NMFS uses the practical spreading model to calculate transmission loss. The NMFS uses an agreed-upon interim criteria to minimize potential impacts to fishes (Fisheries Hydroacoustic Working Group 2008, entire).

The interim criteria include peak SPL and SEL injury threshold limits of:

- Peak SPL: levels at or above 206 dB from a single hammer strike likely results in the onset of physical injury; and
- SEL: cumulative levels at or above 187 dB for fish sizes of 2 grams or greater, or 183 dB for fish smaller than 2 grams.

Bull trout smaller than 2 grams are not present within the LPO since spawning and rearing do not occur within the vicinity of the Project. Pile driving SPLs in excess of 150 dB RMS are expected to cause temporary changes in bull trout behavior such as a startle response, disruption of feeding, or impairment of predator detection.

The action area is not optimal habitat for use by bull trout throughout the year, or specific times of day. A limited study was conducted where 2 of 6 radio tagged adult bull trout were found to overwinter near the BNSF railroad bridge beginning in November, but remained in the area only until May upon which returned to their spawning and rearing tributary (Dupont, et al, 2007, p. 2269, 1272). During the winter, daylight hours are shorter, and there will be less construction activity. Project planning anticipates “minimal or no production over a 2-3 month period each winter” which allows for greater habitat availability during this timeframe.

The habitat in the action area is also sub-optimal since it is relatively shallow (10-25 feet deep) compared to other areas of the lake. Studies have shown that bull trout display little activity during the day, and tend to occupy deeper water at the time pile driving would occur, with peak bull trout activity typically occurring at night (McPhail and Baxter 1996, p. 14; Muhlfeld, et al 2003, p. 163). This being the case, few, if any, bull trout are expected to occupy these shallow water areas during periods of daylight. Since pile driving will only occur during daylight hours, and there is a break of 12 hours or more, bull trout migration and foraging through the action area is available nightly. Spawning tributaries are outside of the action area, and will not affect bull trout staging at the mouth of tributaries, or upstream migration for spawning.

The shallow depths in the action area also allow for warmer water that tends to limit bull trout distribution when greater than 15 degrees Celsius. A temperature study in the area noted that water temperatures at depths found in the action area are above 15 degrees Celsius from late June through September, which would discourage bull trout use of this habitat during this period (Annear, 2006, p. 14) when more optimal temperatures are found in deeper adjacent habitat.

2.5.1.1.1 Vibratory Pile Driving

All piles will require vibratory pile driving for installation and all temporary piles will be removed slowly with a vibratory pile driver at a rate of 4 piles per day. Vibratory pile driving will occur year round during temporary and permanent bridge installation and temporary bridge removal. Vibratory pile drivers produce SPLs 10 to 20 dB below that of impact pile drivers. However, vibratory pile driving will occur for much longer durations than impact pile driving. Vibratory pile driving is not likely to result in fish injury but is likely to impact behavior by resulting in an avoidance of the project area. Distance at which 150 dB RMS is expected to be exceeded (behavioral effects) is 464 meters (2.98 miles). Vibratory pile driving will occur off and on year round between May of 2019 and November 2022.

2.5.1.1.2 Impact Pile Driving

Piles 36 inches in diameter are the widest pile proposed, and will be installed with vibratory pile-driving equipment and an impact hammer will be used for finishing. Approximately four 36-inch-diameter piles will be driven per day with up to 1,600 strikes per pile. The impact hammer can produce spikes of sound reaching levels than can harm or kill fish or cause behavioral effects. Impact hammers produce more intense pressure waves, and while the initial strikes may elicit a startle response in fish, the response wanes and fish may remain within the range of potentially harmful sound. Additionally, impact hammers produce short spikes of sound lasting less than a few seconds with energy outside of the infrasound range, which may not elicit an avoidance response in fishes. Therefore, fish may be exposed to harmful pressures for longer periods of time (USFWS 2015b).

Impact pile driving associated with 24-inch-diameter piles at both temporary work bridges is anticipated to require a total of 144 hours of impact pile driving with an injury area (cumulative SEL dB to fish ≥ 2 grams) of 61 meters and a disturbance area of 3.4 miles (Appendix A). Temporary bridge construction will occur over a year-long period and affect both migration and non-migration periods.

Impact pile driving a 36-inch-diameter piles associated with permanent Bridge 3.9 is anticipated to require 432 hours of pile driving, with two pile drivers going at once, at each end of the bridge. This action will result in an injury area (cumulative SEL dB to fish ≥ 2 grams) of 0.62 miles and a disturbance area of 2.88 miles (Appendix A). Permanent bridge construction will occur over a 2-year-long period and affect both migration and non-migration periods.

Impact pile driving of 24-inch-diameter pile associated with Bridge 3.1 is anticipated to require 44 hours of pile driving over a 1- to 5-month period. This action will result in an injury area (cumulative SEL dB to fish ≥ 2 grams) of 0.28 miles and a disturbance area of 2.88 miles (Appendix A). Permanent bridge construction may affect both migration and non-migration periods.

Impact pile driving will occur for approximately 620 hours over a two-year period considering two impact pile drivers may be working at either ends of Bridge 3.9. Considering there are 24 hours in a day, and 365 days in a year, this results in impact pile driving 3.5 percent of the time over a two-year span. All pile driving will occur during daylight hours.

For aquatic species, risk of injury or mortality resulting from noise is related to the effects of rapid pressure changes, especially on gas-filled spaces in the fish's body (such as swim bladder, lungs, sinus cavities, etc.). Generally, in-water or near-water pile driving is the issue of concern. Noise generated by impact pile driving is impulsive—consisting of a broad range of frequencies over a short duration. Different aquatic species exhibit different hearing ranges, and threshold distances and noise levels have been established to be used as a basis for effect determinations.

Peak dB describes the instantaneous peak SPL and is used to evaluate potential injury to fish, and RMS dB describes the pressure level during the impulse and is used to describe disturbance-related effects (i.e., harassment) to fish. SEL is used as an indication of the energy dose (WSDOT 2018).

There are several factors that can reduce the extent of underwater noise transmission, including water depth, sediment type, bottom topography, current, underwater structures, sinuosity (in rivers or streams), type and diameter of piles, and use of attenuation devices such as air bubble curtains (WSDOT 2018). Calculated results for Bridge 3.9 show a cumulative SEL of 218 dB and the following distances at which various thresholds of accumulated SEL are expected to be exceeded for bull trout:

- Distance at which 206 dB PEAK is expected to be exceeded (onset of physical injury) = 12 meters (37 feet)
- Distance at which 187 dB accumulated SEL is expected to be exceeded (onset of physical injury to fish 2g or greater) = 1000 meters (0.62 mile)
- Distance at which 150 dB RMS is expected to be exceeded (behavioral effects) = 4,642 meters (2.88 miles)

Potential behavioral effects to bull trout could therefore extend northeast to LPO's Kootenai Bay, and southwest nearly to the start of the Pend Oreille River near the City of Dover at the lake's outlet arm (Figure 4). Calculated results for Bridge 3.1 show a cumulative SEL of 212 dB and the following distances within which various thresholds of accumulated SEL are projected to be exceeded for bull trout:

- Distance in which 206 dB PEAK is expected to be exceeded (onset of physical injury) = 7 meters (23 feet)
- Distance within which 187 dB accumulated SEL is expected to be exceeded (onset of physical injury to fish 2g or greater) = 451 meters (0.28 mile)
- Distance within which 150 dB RMS is expected to be exceeded (behavioral effects) = 5,412 meters (3.36 miles)

For Bridge 3.9, the NOAA Pile Driving Calculator (Appendix A) shows that injury to subadult and adult bull trout could occur within approximately 0.62 miles of the pile driving, and behavioral effects could occur within approximately 2.88 miles. For Bridge 3.1, the calculator shows that injury to subadult and adult bull trout could extend approximately 0.28 miles from the bridge into LPO, and behavioral effects could extend over a mile southeast across LPO to the lake shoreline near Contest Point and overlap the behavioral effects range of Bridge 3.9. These noise-related effects to bull trout within the action area are expected to be adverse.

Bull trout typically remain in colder and deeper waters during daylight hours. The action area contains the shallowest portion of LPO, with depths of only 10 to 25 feet in the vicinity of the bridges. Much deeper water is located adjacent the action area and in other parts of LPO. Due to increased activity occurring in the immediate area of Project construction and the use of dispersion strikes, bull trout could be expected to move away from the area at, or prior to, initiation of impact pile driving. The operational pause of up to 12 hours or more (overnight) between work periods, is believed to be sufficient time for recovery from exposure to high noise levels (USFWS 2015i, entire). Additionally, Project actions are proposed in the shallowest, and likely the warmest portion, of the lake; therefore, species presence is anticipated to be fewer relative to other areas of the Lake. Further, bull trout are known to be most active at night and thus less likely to be in the action area when pile driving occurs. Lastly, air bubble curtains would be used to attenuate sound impacts when installing temporary and permanent bridge piles to reduce SPLs by 3 dB thereby somewhat reducing the lateral extent of effects.

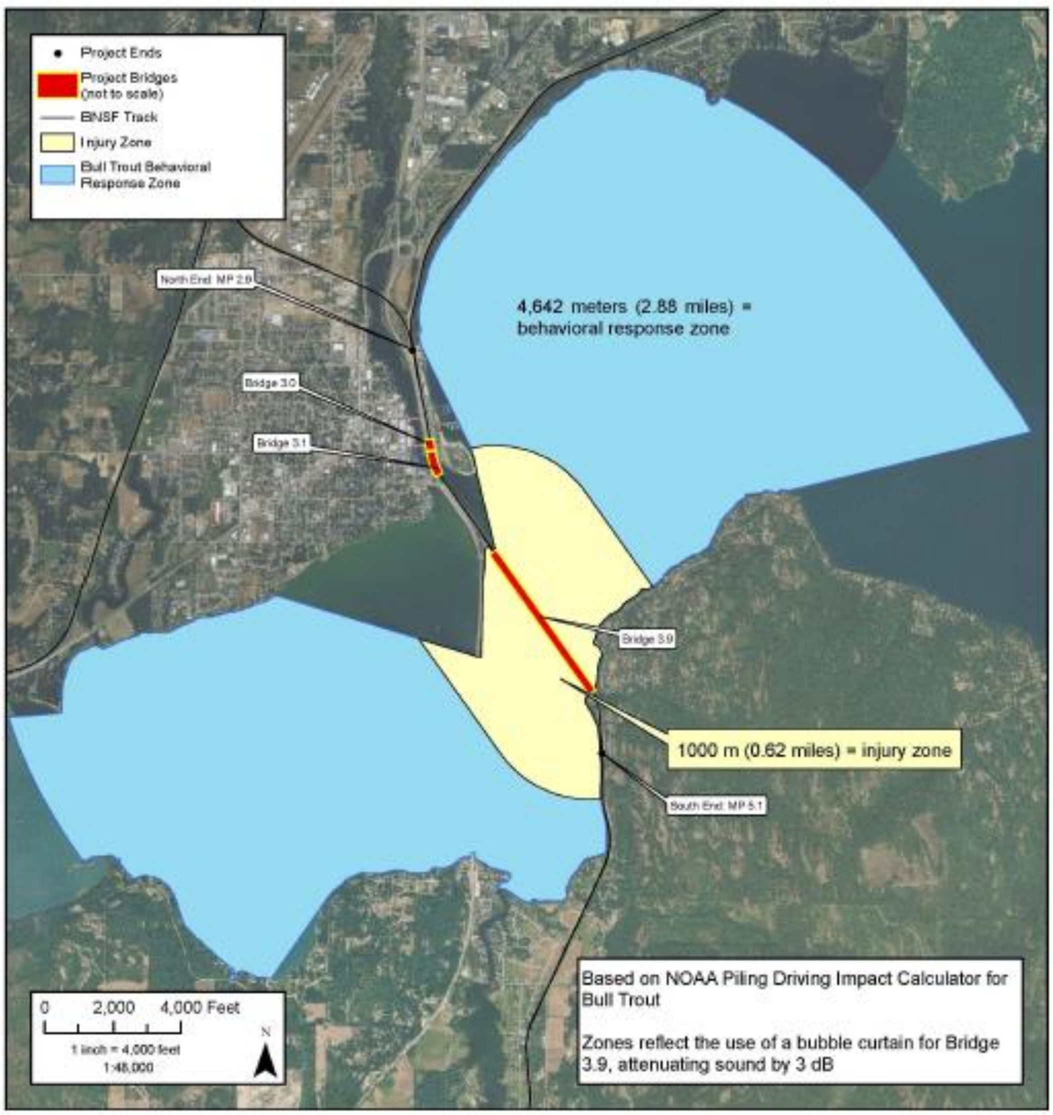

Figure 4. Bull Trout Threshold Distances

2.5.1.2 Sedimentation/Turbidity

Activities included in the proposed action may result in suspended sediment above background levels as a result of excavation or fill placement below or adjacent to the OHWM/MHHW, runoff from areas with disturbed riparian vegetation, placement of rip-rap, and pile driving and removal. BNSF would employ BMPs and minimization measures to minimize the production of suspended sediment.

Increases in turbidity from the proposed action would largely be temporary and localized in nature. Sediment input from disturbed riparian areas would occur until the sites are stabilized or new vegetation grows. Placement of nearshore fill is proposed during low/no water conditions to reduce sedimentation and turbidity impacts. However, when water levels increase during the high water season, loose sediments from newly placed nearshore fills can temporarily increase turbidity in a localized area. Sediments resuspended from pile driving would continue for a short period after driving is completed, and would occur only in a small area surrounding the pile being driven or removed. When possible turbidity curtains would be utilized.

Salmonids typically avoid areas with higher suspended sediment, which can mean that they displace themselves from their preferred habitats in order to seek areas with less suspended sediment. Fish unable to avoid suspended sediment can experience adverse effects. The severity of effect of suspended sediment increases as a function of the sediment concentration and exposure time (Newcombe and Jensen 1996; Bash et al. 2001, pp 7-8). Suspended sediments can cause sublethal effects such as elevated blood sugars and cough rates (Servizi and Martens 1991, p. 495), physiological stress, and reduced growth rates. Sigler et al. (1984, p. 150) found that a reduction in growth occurred in steelhead and coho salmon when turbidity was as little as 25 NTUs.

Elevated turbidity levels can reduce the ability of salmonids to detect prey, cause gill damage (Sigler et al. 1984, p 50; Lloyd et al. 1987, p. 23; Bash et al. 2001, p. 7), and cause juvenile steelhead to leave rearing areas (Sigler et al. 1984, p. 149). Decreases in reactive distance reactive distance were also reported and a reduced percentage of prey captured (Sweka and Hartman 2001, p. 141; Bash et al. 2001, pp. 21-23; Klein 2003, pp. 1, 21). At 0 NTUs, 100 percent of the prey items were consumed; at 10 NTUs, fish frequently were unable to capture prey species; at 60 NTUs, only 35 percent of the prey items were captured. At 20 to 60 NTUs, significant delay in the response of fish to prey was observed (Bash et al. 2001, p. 22). Loss of visual capability and capture of prey leads to depressed growth and reproductive capability. Additionally, short-term pulses of suspended sediment influence territorial, gill-flaring, and feeding behavior of salmon under laboratory conditions (Berg and Northcote 1985, p. 1410). Adult and larger juvenile salmonids appear to be little affected by high concentrations of suspended sediments that occur during storm and snowmelt runoff episodes (Bjornn and Reiser 1991, p. 119). However, research indicates that chronic exposure can cause physiological stress responses that can increase maintenance energy and reduce feeding and growth (Lloyd et al. 1987, p. 23; Servizi and Martens 1991, p. 497).

While pile driving itself typically generates localized sediment displacement, the use of air bubble curtains can mobilize a higher level of sediment and increase localized areas of turbidity within the action area temporarily. Removal of piles for the temporary work bridges also could result in localized turbidity increases. The level of turbidity within several meters of construction is likely to exceed natural background levels. Turbidity can cause stress responses in bull trout, such as gill flaring, coughing, avoidance, and an increase in blood sugar levels. However, moderate levels of turbidity can also reduce vulnerability to predators due to a camouflaging effect (USFWS 2015i, entire).

Turbidity impacts will be reduced by utilizing turbidity curtains during impact driving of the piles for temporary and permanent bridges while bubble curtains are in use in water greater than 2 ft. in depth, and where appropriate when bubble curtains are not being used (Sugarman 2019, *in litt*). They will also be used when removing piles for the temporary work bridge over LPO, and where possible for the temporary work bridge over Sand Creek. Turbidity curtains are expected to limit the extent and magnitude of sediment transport. Additionally, the potential of bull trout remaining in the construction area will be low due to the activity and noise avoidance. Therefore, the effects to bull trout from temporary increases in turbidity are expected to be insignificant.

2.5.1.3 Contaminant Mobilization

Potential contaminants in lakebed sediments could include mercury (LPO and Sand Creek are listed as mercury-impaired), and arsenic, cadmium, copper, lead, and zinc primarily from legacy discharges from mining and smelting in the headwaters of Montana's Clark Fork River. The Clark Fork River contributes approximately 92 percent of the annual inflow to the lake and most of the annual suspended sediment load.

Concentrations of Clark Fork River bed-sediment metals decrease exponentially with distance downstream away from mining (Axtmann and Luoma 1991, p. 79). No sediment studies were conducted in the Project vicinity; however, a study done for the Clark Fork Delta restoration project (approximately 16 miles upstream of the Project) detected metal concentrations (cadmium, copper, mercury and zinc) exceeding the USEPA's Sediment Evaluation Framework (SEF) Interim Freshwater SL1 Concentrations (concentrations below this level are not expected to adversely affect benthic communities) in 13 of 103 samples collected at 10 of 33 sampling locations; 8 of the 13 contaminated samples were at depths between 1.5 and 2.5 feet (GeoEngineers 2014, entire).

Construction of permanent and temporary work bridges creates the potential risk of construction materials or construction equipment fluids (fuel, oil, hydraulic fluid, antifreeze, etc.) entering open waters. Exposure to high levels of petroleum-based products can cause toxicity to bull trout and chronic lethal and sublethal effects to a wide range of aquatic organisms. Spills of wet concrete into water can potentially result in temporary localized increases in pH levels. The risk to aquatic life depends on the type of contaminant, the time of year, the amount of material spilled or leaked, and the effectiveness of containment materials (USFWS 2015i, entire).

Implementation of BMPs/minimization measures such as containment systems installed under the construction and permanent bridges to capture potential falling construction materials or debris, spill prevention planning and staging, proper storage and handling of fluids, and equipment monitoring and maintenance, are all proposed to be implemented to reduce potential impacts to water quality and bull trout.

As discussed under Sedimentation/Turbidity above, pile removal has the ability to increase turbidity. If contaminated sediments are present within the pile driving area, there is a potential for resuspension of these particles. The use of turbidity curtains is proposed and will help contain suspended sediments to a localized area. If a fish is within the vicinity of pile removal activities during sediment resuspension, there is a potential for exposure.

Depending on the type of metal and its concentration when remobilized in the water column, potential effects to bull trout can range from coughing and neurotoxicity to adverse growth and behavior impacts. Potential effects to bull trout critical habitat include effects to water quality and an adequate prey base, since metals bioaccumulate in adult piscivorous fish such as bull trout. However, these effects are primarily associated with chronic exposure and/or very high levels of acute exposure (USFWS 2015j, entire).

BMPs that will be utilized to contain and control potential remobilization of contaminated sediments during pile removal include slowly vibrating the piles out of the lakebed and using turbidity curtains around each pile or bent being removed; curtains will be anchored to the lakebed for total water column seal and tied off to withstand maximum current conditions. Should turbidity occur, it will be of short duration and contained within the turbidity curtain until sediments have settled. Therefore, effects to bull trout from temporary remobilization of contaminated sediments are expected to be insignificant.

2.5.1.4 Nearshore Fill Placement

The Project action will consist of a filling 0.88 acre of permanent nearshore area and 0.38 acre of temporary nearshore area below the jurisdictional ordinary high water mark elevation of 2,062.5 feet, associated with bridge abutments and the south switch. Fills result in both temporary and permanent habitat loss.

The LPO water level is slowly brought up about 5 feet in the month of April through a release from the upstream dam, 4 feet in the month of May and, 2 to 2.5 feet by mid-June. Sometimes USACE engages their “flexible winter operations” which could fluctuate the lake level 1-5 feet multiple times during the winter (Jacobs 2018b, entire). When water levels increase during the high water season, loose sediments from newly placed nearshore fills can temporarily increase turbidity in a localized area. However, due to the small size of the fill area relative to LPO, effects to bull trout from nearshore fill placement are expected to be insignificant.

2.5.1.5 Riparian Vegetation Removal

Shoreline development at both ends of Bridge 3.9 has reduced shoreline vegetation and LWD recruitment, displaced willow habitat, and altered wave and scour patterns adjacent to new shoreline structures. Removal of riparian vegetation can increase water temperature and reduce the supply of terrestrial insects. Removal of riparian trees also reduces the potential for LWD recruitment that contributes to production of invertebrate prey for bull trout (USFWS 2015i, entire).

Removal of existing shoreline vegetation will be limited to the minimum necessary for construction of the Project.

During construction and prior to post-construction revegetation, there will temporarily be a loss of vegetation within the project construction and staging areas. However, due to the small area where riparian vegetation will be removed relative to the total amount of shoreline and riparian vegetation currently remaining in LPO, effects to bull trout from this activity are expected to be insignificant.

2.5.2 Indirect Effects on Bull Trout

Indirect effects are those impacts that are caused by the action and occur later in time (after the action is completed) but are still reasonably certain to occur. There may be permanent indirect effects to bull trout due to the potential for increased predation associated with the increased shading and additional pier hiding habitat from Bridge 3.9 after construction. Non-pollution generating stormwater would flow through the bridge as it does on the existing bridge. Water captured in the deck tubs would run off through scuppers or along the bents. The water would remain within the same subbasin and therefore would not result in a hydrologic affect.

2.5.2.1 Long-Term Habitat Loss or Alteration

LPO provides FMO habitat for bull trout. The Project will construct a new railroad bridge over LPO that will require driving 288 permanent 36-inch-diameter steel piles and up to 700 temporary 24-inch-diameter piles into the lakebed. This will result in a permanent loss of 2,036 square feet of benthic habitat, and a temporary loss of 2,200 square feet of benthic habitat (the area where the piles are installed). The Project action will also consist of a filling 0.88 acre of permanent nearshore area and 0.38 acre of temporary nearshore area below the jurisdictional ordinary high water mark elevation of 2,062.5 feet, associated with bridge abutments and the south switch. Given the footprint of the Project where permanent benthic habitat will be lost relative to the total benthic habitat available in LPO, the effects to benthic habitat are expected to be discountable.

2.5.2.2 Predator/Prey Relationships

Bridge 3.9 over LPO will result in additional shading (low level) and additional pier hiding habitat (moderate). Both have the potential to create rearing and ambush habitat for native and non-native fish species that prey on subadult bull trout. Smallmouth bass and largemouth bass are two predator fish in the action area that have a strong affinity to habitat structures including bridges and pilings (USFWS 2015i, entire).

Based on the presence of bull trout and predators in the action area, and the additional shading and structure created by the new Bridge 3.9, there is a potential for increased predation of subadult bull trout. Bull trout in the action area are migratory and use the area for foraging and overwintering. However, due to the small size of Bridge 3.9 relative to LPO, effects to bull trout from increased predator habitat are expected to be insignificant.

2.5.3 Effects of Interrelated or Interdependent Actions

Per 50 CFR 402.33(a)(2)(iii), interrelated or interdependent actions should be assessed and considered when providing a determination. Interrelated or interdependent actions associated with the Project include staging areas which require temporary nearshore fills and temporary clearing and grading which require removal of riparian vegetation. These actions and impacts are fully reviewed in the direct and indirect analysis of effect sections.

2.5.4 Direct and Indirect Effects of the Proposed Action on Bull Trout Critical Habitat

This section provides an analysis of the Project's effects on each PBF detailed earlier in this document.

The Project will not impact water levels or subsurface water connectivity as no actions are proposed that will substantially reduce water levels or interrupt water connectivity. Placement of temporary and permanent nearshore fills will result in insignificant impacts to PBF 1.

While the new, permanent Bridge 3.9 over LPO will have new in-water piers, these will not be partial or complete fish barriers to bull trout migration in the Project action area. There will be fewer piers supporting the new Bridge 3.9 compared to the existing bridge, and the new bridge piers will align approximately with every other pier of the existing bridge. Spacing between piers for the new bridge ranges from approximately 65 feet to 93 feet. However, pile driving during bull trout migratory periods in the spring and fall may affect bull trout migration in LPO. While most bull trout migrations are nocturnal and occur within the first few hours of darkness, there may be isolated instances of bull trout attempting to migrate during daylight transition times (early morning/early evening hours) when construction work could be starting or ending. Sound pressure impacts above behavior disturbance are unavoidable. Since the project will impact behavior within a migratory zone for an extended duration of 620 hours over a 2-year period; the project will significantly affect the ability of the action area to serve as a migratory corridor for bull trout.

The Project may impact predator/prey relationships at the Bridge 3.9 permanent bridge and temporary work bridge due to the presence of more underwater structures that provide ambush habitat for native and non-native fish species that prey on sub-adult bull trout. Temporary turbidity during construction, and/or placement of nearshore fills, could impact access to macroinvertebrates in a localized area. Limited vegetation removal will not substantially change the availability of riparian organisms due to the existing low-quality nearshore habitat in the Project area; therefore, the project will have insignificant impacts on PBF 3.

Kokanee, a preferred prey species, are high in number in LPO (IDFG estimated kokanee abundance to be 21 million in 2015) and any declines in the population due to Project implementation will be temporary.

The Project will not change substrates or the presence of side channels. The Project will not change the depths, velocities or channels of the Sand Creek inlet or LPO. Sand Creek gradient will not be modified. The Project will not change water temperatures or the amount of thermal refugia currently available in LPO. Therefore, the placement of piles and fill within the Sand Creek inlet within LPO will result in insignificant impacts to PBF 4.

The new Bridge 3.9 and the temporary work bridge were designed to match the elevation of the existing bridge and are at sufficient elevations to allow penetration of sunlight during most of the day and are not expected to affect existing surface water temperatures. LPO stratifies in the summer and bull trout will be expected to occupy the deeper, colder waters below the thermocline during the daytime. Therefore, there will be no expected change in the amount of available thermal refugia in the action area. Additionally, a relatively small amount of riparian vegetation will need to be removed in areas needed for construction of bridge abutments and at the south switch. The limited amount of riparian vegetation removal will not substantially impact water temperatures and, therefore, will have an insignificant impact to PBF 5. There will be no effect on PBF 6 since spawning and rearing habitat do not occur within the project vicinity or action area.

Due to the small size of the fill areas relative to LPO, the effects to the hydrology of the action area from implementation of the Project are expected to be insignificant.

The Project does not include any elements that would impact the quantity of water in LPO. The Project may impact water quality associated with PBF 8, due to sedimentation during nearshore fill placements and temporary fill removals, and during bridge pile installations and temporary work bridge pile removals. Pile removal in LPO could also potentially remobilize contaminated sediments. The areas of temporary increases in suspended sediments are insignificant when compared to the size of LPO and the available critical habitat.

The Project will not contribute to water quality impairments for temperature or dissolved gases in the action area. Existing temperature and dissolved gas impairments are in the Pend Oreille River, approximately 2.7 miles west/downstream of Bridge 3.9. Removal of temporary piles for Bridges 3.1 and 3.9 work bridges may result in short-term, spatially-limited sedimentation/turbidity in Sand Creek and LPO, and could also remobilize contaminated sediments if present. Sand Creek and LPO are both listed as impaired by mercury, which may be present in bottom sediments. The use of turbidity curtains during in-water pile removal, and during the use of bubble curtains, will limit the extent and duration of sedimentation and potential remobilization of contaminants. Therefore, effects to water quality from Project implementation are expected to be insignificant.

The Project will not introduce new predatory, inbreeding or competitive species. However, Bridge 3.9 new permanent and temporary work bridges may provide additional ambush habitat for native and non-native fish species that prey on subadult bull trout. New underwater pier structures for the new bridge in LPO may alter predator/prey relationships due to the presence of more structures that provide ambush habitat for native and non-native fish species that prey on sub-adult bull trout. These altered relationships will occur year-round since sub-adult bull trout are present in the lake year-round and do not migrate to/from SR tributaries until they are sexually mature. However, due to the small size of predator habitat resulting from Project implementation relative to LPO, effects to PBF 9 in the action area are expected to be insignificant.

2.5.5 Effects of Interrelated or Interdependent Actions

Per 50 CFR 402.33(a)(2)(iii), interrelated or interdependent actions should be assessed and considered when providing a determination. Interrelated or interdependent actions associated with the project include staging areas which require temporary nearshore fills and temporary clearing and grading which require removal of riparian vegetation. These actions and impacts are fully reviewed in the direct and indirect analysis of effect sections.

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.

Though the information and activities presented below do not directly occur within the Project action area, they are provided to assist Service with preparation of the Biological Opinion and to help in tracking the environmental conditions throughout a general area. These actions are assumed to continue at this level of effort for the foreseeable future.

2.6.1 Non-Native Fish Suppression

Avista CFSA has provided funding to IDFG for suppression of lake trout via the LPO Trap and Gill Net Program and the LPO Angler Incentive Program since 2006. The goals of these programs are to reduce predator abundance and increase kokanee numbers. These programs have removed more than 216,000 lake trout from 2006 through 2017 (Avista 2017, p. 5).

Annual CFSA Implementation Reports to the Federal Energy Regulatory Commission (FERC) document the number of lake trout removed from LPO and has resulted in a positive response in bull trout and kokanee abundance for both programs, but also there is an amount of bull trout take and mortalities associated with the Trap and Gill Net Program (Avista 2016, pp. 69-70; Avista 2017, pp. 76-77). As a result of the lake trout suppression efforts, 1,612 bull trout were taken with 549 of them moralities in 2016 with similar numbers reported in 2017.

Avista is also providing research CFSA funding to IDFG for a walleye suppression feasibility study. In 2017, walleye were tagged and released, and the first year of a three-year removal plan started in 2018. As a result of this investigation, 15 bull trout were taken with 11 mortalities reported in 2018.

2.6.2 Fish Passage Projects

The project noted below is anticipated to benefit bull trout. At this time, there are no other known state, tribal or private actions that are certain to occur in the action area, other than additional private docks may be constructed along the LPO and Pend Oreille River shorelines within the action area. These docks are not anticipated to alter any measurable amount of shoreline within the Project action area. Overall, non-associated projects are not anticipated to result in overall negative impacts to bull trout.

- Avista Cabinet Gorge Dam Fish Passage Facility (Clark Fork River):
  - Would construct a new facility to transport native migratory salmonids, with a focus on upstream transport of bull trout to tributaries in Montana to restore connectivity in the LPO bull trout core recovery area.
  - Construction to begin in fall 2018.
  - Current trap and haul passage of bull trout at Cabinet Gorge Dam passed 903 bull trout (4 mortalities) in 2016–2017.
- Albeni Falls Dam Fish Passage Facility (Pend Oreille River):
  - Would construct a new facility to allow upstream passage of bull trout over Albeni Falls Dam to restore connectivity in the LPO bull trout core recovery area
  - U.S. Army Corps of Engineers is currently seeking appropriations and funding for construction of the facility.

2.7 Conclusion on Bull Trout

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. This determination is based on the following:

- The action area is designated as FMO habitat, but is not high quality due to its shallow depth, and elevated water temperatures during warmer times of the year. Bull trout rearing and spawning habitats are not present in the action area, and therefore the proposed action will have no effect on bull trout rearing or spawning habitat, or these essential behaviors.
- The proposed action incorporates both permanent design elements and conservation measures which will reduce effects to habitat and avoid and minimize impacts during construction. The action's temporary adverse effects are limited in both physical extent and duration allowing access to FMO habitat in the action area at times they are most likely to use it.
- Due to the relatively small area that will experience effects to water quality, as well as implementation of conservation measures, we expect that few subadult and adult bull trout or their prey base will be exposed to these impacts or experience measurable adverse effects from reduced water quality. In the long term, we do not expect that the proposed action will worsen surface water or sediment quality trajectories at the scale of the action area or Lake Pend Oreille watershed.
- With full implementation of the proposed conservation measures (e.g., not pile driving at night, when bull trout are most active), we expect that low numbers of subadult and adult bull trout will be adversely affected by construction activities. Exposure to construction activities may kill or injure a limited number of bull trout, may result in sub lethal physiological stress with potential consequences for individual growth and/or long term survival, and will disrupt normal bull trout behaviors (feeding, moving, and sheltering). However, we expect that the vast majority of temporary, construction-related bull trout exposures will be sub-lethal, and many are likely to elicit only mild behavioral responses (e.g., avoidance of the immediate work area). Because these subadult and adult bull trout may originate from any of the more than 20 local populations in the core area, we expect that any resulting temporary or long term effects to bull trout numbers (abundance) or reproduction (productivity) will not be measurable at the scale of the local populations or core area.
- The proposed action may result in temporary adverse effects to the bull trout prey base. Construction activities will create conditions which benefit nonnative fish predators and could, at least hypothetically, lead to increased predator numbers or density in the short term. Kokanee, a preferred prey species, are high in number in LPO (IDFG estimated kokanee abundance to be 21 million in 2015) and declines will be temporary, not measureable, and the project will likely have insignificant or discountable adverse effects to the bull trout prey base in the long term.
- The proposed action will have limited short-term, and no measurable long term effects on bull trout distribution at the scale of the local populations or the core area.
- The anticipated direct and indirect effects of the action, combined with the effects of interrelated and interdependent actions, and the cumulative effects associated with future State, tribal, local, and private actions will not appreciably reduce the likelihood of survival and recovery of the species. The anticipated direct and indirect

effects of the action (permanent and temporary) will not measurably reduce bull trout numbers, reproduction, or distribution at the scale of the core area or Columbia Headwaters recovery unit. The anticipated direct and indirect effects of the action will not alter the status of bull trout at the scale of the Columbia Headwaters recovery unit recovery unit or coterminous range.

2.8 Conclusion on Bull Trout Critical Habitat

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. The action area provides seven out of the nine PBFs for designated bull trout critical habitat.

- The action area is designated as FMO habitat, but is not high quality due to its shallow depth, and elevated water temperatures during warmer times of the year. Bull trout rearing and spawning habitats are not present in the action area, and therefore the proposed action will have no effect on bull trout rearing or spawning habitat, or these essential behaviors.
- The proposed action incorporates both permanent design elements and conservation measures which will reduce effects to critical habitat and avoid and minimize impacts during construction. The action's temporary, construction-related adverse effects are limited in both physical extent and duration.
- The action will result in temporary, intermittent, adverse effects to function of the foraging, migratory corridor (PBF 2) during daylight hours in the vicinity of the action area, for approximately three years (2019 through 2022).
- The proposed action will result in temporary adverse effects to the bull trout prey base (PBF 3). Construction activities will create conditions which benefit nonnative fish predators and could, at least hypothetically, lead to increased predator numbers or density in the short term. Kokanee, a preferred prey species, are high in number in LPO (IDFG estimated kokanee abundance to be 21 million in 2015) and any declines will be temporary, and the project will likely have insignificant or discountable adverse effects to the bull trout prey base in the long term.
- We expect that relatively few subadult and adult bull trout or their prey base will be exposed to water quality impacts or experience measurable adverse effects with the full implementation of the proposed conservation measures. In the long term, we do not expect that the proposed action will worsen surface water or sediment quality trajectories at the scale of the action area or the Lake Pend Oreille watershed.
- The action will result in temporary adverse effects that impair free movement and/or temporarily displace bull trout from refugia or preferred habitats due to hydroacoustic effects during daylight hours. However, in the long term, we do not expect that the proposed action will worsen surface water or sediment quality trajectories at the scale of the action area or Lake Pend Oreille watershed. Furthermore, we do not expect that the project's long term effects will cause or contribute to a measurable, incremental decline in the bull trout prey base.
- The action will result in limited, temporary adverse effects to lake and shoreline

aquatic habitats and processes (PBF 4). Construction activities will increase the amount of artificial, over-water and in-water structure for a term of approximately three years (2019 through 2022). However, the action also includes design measures and mitigation components which we expect will reduce permanent or long term impacts to aquatic habitats, and maintain or restore important habitat functions over time. The action's adverse effects to lake and shoreline habitats (e.g., surface water quality resulting from sediment, in-water and over-water structures) are limited in physical extent, will not further degrade current function, prevent future establishment of full, proper function, or preclude bull trout from foraging, migrating, and overwintering in the action area.

- The action will result in temporary adverse effects to PBF 9. Construction activities will create conditions which benefit nonnative fish predators and could, at least hypothetically, lead to increased predator numbers or density in the short term. Kokanee, a preferred prey species, are high in number in LPO (IDFG estimated kokanee abundance to be 21 million in 2015) and declines will be temporary, not measureable, and the project will likely have insignificant or discountable adverse effects to the bull trout prey base in the long term.
- Within the action area, bull trout critical habitat will retain its current ability to establish functioning PBFs. The anticipated direct and indirect effects of the action, combined with the effects of interrelated and interdependent actions, and the cumulative effects associated with future State, tribal, local, and private actions will not prevent the PBFs of critical habitat from being maintained, and will not degrade the current ability to establish functioning PBFs at the scale of the action area. Critical habitat within the action area will continue to serve the intended conservation role for the species at the scale of the core area, and the Columbia Headwaters recovery unit, and coterminous range.

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.

2.9 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.

2.9.1 Form and Amount or Extent of Take Anticipated

We anticipate that take in the form of harm (injury or mortality) and harassment (disruption of normal behaviors) of subadult and adult bull trout from the Lake Pend Oreille core areas will result from the proposed action.

Regulation 50 CFR 402.14 (i)(1)(i) authorizes the use of surrogates when amount or extent of anticipated incidental take will be difficult to detect or quantify. Therefore the Service is using distance elevated sound pressure levels travel, and the calculated area of impact as a surrogate in place of a numerical value for the following reasons: 1) the low likelihood of finding dead or injured adults, or subadults; 2) delayed mortality; and, 3) the relationship between habitat conditions and the distribution and abundance of individuals is imprecise such that a specific number of affected individuals cannot be practically obtained. Due to the sub-optimal habitat conditions in the action area, e.g. shallow water, water temperatures in excess of 15 degrees Celsius in June through September, water disturbance from construction activities, in concert with conservation and mitigation measures, and adjacent preferential habitat, the number of bull trout affected is likely to be very low. However, we anticipate that all bull trout that experience these elevated noise levels will be harmed (injury or mortality) or harassed (disruption of normal behaviors) as described below:

1. Incidental take of bull trout in the form of harassment resulting from degraded surface water quality and exposure to elevated turbidity and sedimentation during construction. Water quality will be degraded intermittently while construction activities are being completed in the action area below the OHWM of Lake Pend Oreille, to include the LPO inlet identified as Sand Creek. Take will result when levels of turbidity reach or exceed 25 NTU above background at any time.

2. Incidental take of bull trout as described in table 4, resulting from the direct effects of elevated sound pressure levels in the action area.

Table 4. Incidental take of bull trout from elevated sound pressure levels on Lake Pend Oreille, Idaho

Action	Form of Incidental Take	Stressor	Duration and period	Distance	Area (acres)	Percent of available bull trout FMO habitat on LPO
Construction of Temporary Work Bridge 3.1	Harm	Direct effect of exposure to elevated underwater SPLs resulting from impact pile driving and proofing of approximately 10, 24-inch steel piles below the OHWM of LPO inlet identified as Sand Creek in 2019 and possibly another 10, 24-inch steel piles in 2020. If the temporary bridge is removed for navigation and reinstalled in 2020, the additional take for the same area and duration will apply.	Approximately 30 hours between 2019 and 2020	0.04 mi (64 m)	2.9	0.003

Action	Form of Incidental Take	Stressor	Duration and period	Distance	Area (acres)	Percent of available bull trout FMO habitat on LPO
Construction of Permanent Bridge 3.1	Harm	Direct effect of exposure to elevated underwater SPLs resulting from impact pile driving and proofing of approximately 22, 24-inch steel piles below the OHWM of LPO inlet identified as Sand Creek	Approximately 44 hours between 2019 and 2020	0.28 mi. (451 m)	19	0.02
Construction of Temporary Work Bridge 3.9	Harm	Direct effect of exposure to elevated underwater SPLs resulting from impact pile driving and proofing of approximately 76, 24-inch steel piles below the OHWM of LPO	Approximately 288 hours between 2019 and 2020	0.04 mi. (64 m)	2.9	0.003
Construction of Permanent Bridge 3.9	Harm	Direct effect of exposure to elevated underwater SPLs resulting from impact pile driving and proofing of approximately 288, 36-inch steel piles below the OHWM of LPO	Approximately 864 hours between 2020 and 2022	0.62 mi. (998 m)	830	0.88
Construction of Temporary Work Bridge 3.1	Harassment	Direct effect of exposure to elevated underwater SPLs resulting from impact pile driving and proofing of approximately 10, 24-inch steel piles below the OHWM of LPO inlet identified as Sand Creek in 2019 and possibly another 10, 24-inch steel piles in 2020. If the temporary bridge is removed for navigation and reinstalled in 2020, the additional take for the same area and duration will apply.	Approximately 30 hours between 2019 and 2020	3.4 mi (5,472 m)	310	0.33
Construction of Permanent Bridge 3.1	Harassment	Direct effect of exposure to elevated underwater SPLs resulting from impact pile driving and proofing of approximately 22, 24-inch steel piles below the OHWM of LPO inlet identified as Sand Creek between 2019 and 2020	Approximately 44 hours between 2019 and 2020	3.36 mi. (5,407 m)	310	0.3
Construction of Temporary Work Bridge 3.9	Harassment	Direct effect of exposure to elevated underwater SPLs resulting from impact pile driving and proofing of approximately 76, 24-inch steel piles below the OHWM of Lake Pend Oreille	Approximately 288 hours between 2019 and 2020	3.4 mi. (5,412 m)	7,230	7.6
Construction of Permanent Bridge 3.9	Harassment	Direct effect of exposure to elevated underwater SPLs resulting from impact pile driving and proofing of approximately 288, 36-inch steel piles below the OHWM of LPO	Approximately 864 hours between 2020 and 2022	2.88 mi. (4,635 m)	6,650	7.02
Construction of All Bridges	Harassment	Direct exposure of elevated underwater SPLs resulting from installation and removal of piles using a vibratory hammer	Approximately 2 years during the project	0.29 mi (464 m)	351	0.37

2.9.2 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.

2.9.3 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.

1. Minimize and monitor incidental take caused by elevated turbidity and sedimentation during construction.

2. Minimize and monitor incidental take caused by elevated underwater SPLs from impact driving and proofing of steel piles, and proper function and attenuation provided by bubble curtains with limited hydroacoustic monitoring.

3. Minimize migration and foraging affects caused by elevated underwater SPLs from pile driving and impact proofing of steel piles by limiting these activities to daylight hours only, not to exceed a 12-hour period.

2.9.4 Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the Act, the USCG must ensure compliance with the following terms and conditions, which implement the RPMs described above. These terms and conditions are non-discretionary.

The following terms and conditions are required for the implementation of RPM 1:

- Measure turbidity to ensure levels do not exceed 25 NTUs above background level at 325 ft. (100 m) from the sediment generating activity.
  - Monitoring shall be conducted to establish background turbidity levels away from the influence of sediment-generating activities, and compared to turbidity levels at least twice daily during sediment-generating activities. In the event of a visually appreciable change in background turbidity (plume), an additional sample shall be taken.
  - If, in cooperation with other permit authorities, the USCG develops a functionally equivalent monitoring strategy (e.g., intensive monitoring, by project area or activity, followed by validation and routine monitoring), they may submit this plan to the Service for review and approval in lieu of the above monitoring requirements. The strategy must be submitted to the Service a minimum of 60 days prior to construction. In order to be approved for use in lieu of the above requirements, the plan must meet each of the same objectives
- The USCG shall ensure a monitoring report is submitted to the Idaho Fish and Wildlife Office in Spokane, Washington, by September 30 following each year of the project. The report shall include, at a minimum, the following: (a) dates, times, and locations of construction activities, (b) monitoring results, sample times, locations, and measured turbidities (in NTUs), (c) summary of construction activities and measured turbidities associated with those activities, and (d) summary of corrective actions taken to reduce turbidity.
- The USCG shall also ensure the Service is copied on any water or sediment quality monitoring data or reports submitted to the Idaho Department of Environmental Quality in satisfaction of related permits.

The following terms and conditions are required for the implementation of RPM 2:

- The USCG shall ensure a vibratory pile hammer is used to the fullest extent practicable when installing steel piles below the OHWM.
- The USCG shall ensure in-water sound generation and attenuation is monitored while installing steel piles with an impact pile hammer.
- The USCG will ensure that hydroacoustic equipment used for monitoring is tested and calibrated prior to data collection.
- The USCG shall ensure a performance test of the sound attenuation device is conducted prior to any impact pile driving or proofing. The performance test shall confirm calculated pressures and flow rates at each manifold ring.
- The USCG shall ensure that a qualified individual is present during all impact pile driving and proofing operations to observe and report any indications of dead, injured, or distressed fish. The USCG shall ensure that the Service is contacted within 24 hours if any dead, injured, or distressed fish are observed.
- The USCG shall ensure routine monitoring is conducted and document the effectiveness of the noise attenuation device with hydroacoustic monitoring for permanent bridges in the action area for peak, SEL, and RMS at a distance of 10 m:
  - A minimum of five steel pilings installed during the initial pile driving activity for each bridge in the critical habitat area
  - A minimum of five additional steel piling installed at the mid-point of the piling installation; and,
  - A minimum of five additional steel piling installed near completion of the piling installation schedule.
  - If, in cooperation with other permit authorities, the USCG develops a functionally equivalent monitoring strategy (e.g., intensive monitoring, by project area or activity, followed by validation and routine monitoring), they may submit this plan to the Service for review and approval in lieu of the above monitoring requirements. The strategy must be submitted to the Service a minimum of 60 days prior to construction. In order to be approved for use in lieu of the above requirements, the plan must meet each of the same objectives
- If the pile strike count for four consecutive piles exceeds by 50 percent or more the maximum single pile strike count observed when performing routine monitoring in that area, this shall be indicative of changed pile driving characteristics. The USCG shall ensure pile driving ceases and is not restarted except with implementation of contingency hydroacoustic monitoring.
- In each instance of changed pile driving characteristics, contingency hydroacoustic monitoring will document effectiveness of the noise attenuation device and resulting peak sound levels for the next three steel piles.
- Factors to consider in identifying the piles to be monitored include, but are not limited to bathymetry of the project site, total number of piles to be impact driven and proofed, depth of water, and distance from shore. This monitoring shall document recorded SPLs, and single strike and cumulative SELs, and the distance from the pile at mid-water depth.
- The USCG shall ensure the Service is contacted within 24 hours if the hydroacoustic monitoring indicates that the sound levels will exceed the levels estimated in the Biological Opinion.

- The USCG shall also ensure the Service is contacted within 24 hours if they determine that unattenuated pile strikes are necessary to determine baseline sound levels or evaluate effectiveness of the noise attenuation device. The USCG shall consult with the Service regarding modifications to the proposed action in an effort to reduce the sound levels below the limits of take and continue hydroacoustic monitoring.
- USCG shall ensure peak, SEL, and RMS sound pressure levels are measured in water that is at least 8 meters deep near the mouth of Trestle Creek when construction of permanent Bridge 3.9 commences to determine if RMS level exceeds the behavioral threshold of 150 dB. If the RMS exceeds this threshold, the USCG will coordinate with the Service to determine if it will impede immigration and emigration from critical spawning and rearing habitat. If the RMS level does not exceed this threshold, no further monitoring of this site is necessary for the duration of the Project.
- The USCG shall ensure a monitoring report is submitted to the Idaho Fish and Wildlife Office in Spokane, Washington (Attn: Field Office Supervisor), by September 30th each year of the project, and at the completion of the project. The report shall include the following information:
  - Size and type of piles driven and proofed;
  - The type of sound attenuation devise used;
  - The impact hammer force used to drive and proof piles;
  - A description of the monitoring equipment;
  - The distance between hydrophone and pile;
  - The depth of the hydrophone;
  - The distance from the pile to the wetted perimeter;
  - The depth of water;
  - The depth into the substrate the pile was driven and proofed;
  - The physical characteristics of the bottom substrate into which the piles were driven and proofed; and
  - The results of the hydroacoustic monitoring, including the frequency spectrum, SPLs, and single-strike and cumulative SEL. The report must also include the ranges and means for peak, RMS, and SELs.

The following term and condition is required for the implementation of RPM 3:

- The USCG will restrict pile driving and impact proofing activities from sunrise to sunset in the action area.

2.9.5 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)]. In addition, any accidental spills of equipment, creation of a sediment plume that extends beyond 100 meters, or chemicals that could have an adverse effect to bull trout will be reported to the Service within 24 hours of the incident.

2.10 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.

2.10.1 Invasive Species Prevention

Zebra mussels (*Dreissena polymorpha*), cheatgrass (*Bromus tectorum*), and other invasive species (IS) hold the potential to harm listed species and critical habitat given their ability to quickly colonize and drastically modify entire ecosystems. Human activity is the primary means of IS movement into new landscapes and watersheds, and therefore effective prevention measures can reduce the risk of biological invasions substantially. Executive Order 13112, reaffirmed by Executive Order 13751 directs all federal departments and agencies to take steps to prevent the introduction and spread of invasive species, which are defined as a non-native species “whose introduction does or is likely to cause economic or environmental harm or harm to human health.”

Note: the following best management practices supplement any applicable laws and regulations for invasive species control, including state watercraft inspection requirements.

2.10.2 Use local, low-risk sources of materials

- Locally-sourced materials typically do not present invasive species risks that are not already found within the project area. Plants, seeds, and bulbs necessary for habitat restoration or other purposes should be from sources certified as weed-free or otherwise evaluated to ensure that they are not harboring invasive species. Nurseries providing materials should be using best management practices to validate that plants are labeled correctly and are not infested by disease or pests.
- Soil, rocks, gravel, mulch, and other fill material for habitat restoration, road construction, or other purposes should be from sources that have been inspected (and treated, as warranted) for the presence of invasive species prior to transport.
- Water transported for fire management, vegetation irrigation, or other purposes should come from potable sources and/or water bodies not known to harbor invasive species.
- Logs, branches, dimensional lumber, and other woody material for habitat restoration or other purposes should be locally sourced to the extent practical, inspected, and treated (as appropriate to intended use) to minimize infestation by invasive species, including wood-boring insects.

2.10.3 Reduce Exposure

- Field work within sites with existing invasive species should be planned to avoid routes of transit through areas of heavy invasive species density, and to work in invaded portions and/or downstream areas last to avoid introduction into uninvaded portions.

- Activity should be timed when feasible to avoid exposure to reproductive stages of invasive species (e.g., seasons when seed production is prevalent).
- Vehicles should be parked on pavement, gravel, or other sites that are away from vegetation; or in designated parking areas that help contain the spread of invasive species.

2.10.4 Inspect and Decontaminate Vehicles, Gear, Materials and Equipment

- Prior to arrival at a new field site, all vehicles, equipment, gear, and materials imported from outside of the watershed should be thoroughly cleaned to remove all visible plants and animals (even if they appear dead), mud, and other material. Where possible, particularly for water-based equipment, a hot water pressure washer should be used to apply constant exposure at a minimum of 140°F (60°C) and minimal pressure of 90 pounds/square inch (PSI) for a minimum of 15 seconds on hard/nonporous surfaces. Alternatively, or as extra protection, a brush with a combination of soft and stiff bristles should be used to remove unwanted material, paying special attention to crevices and other surface features (e.g., carpeting, Velcro, felt soles) more likely to accumulate debris or harbor invasive species.
- Upon arrival at a new field site, all vehicles, equipment, gear, and materials should be staged initially in a dedicated containment area, and thoroughly inspected for hitchhiking organisms such as seeds, plant fragments, snails, etc. Concealed recesses and other inconspicuous locations where water or organisms can escape initial observation require heightened scrutiny; a mirror and flashlight can help inspection in these hard-to-reach areas. Where inspection at the field site reveals that prior off-site cleaning procedures have failed to remove unwanted material, the associated item should be cleaned on land and within containment prior to deployment.
- Prior to entering a new water body, equipment should be thoroughly dry (ideally for a minimum of 5 days), and any standing water (including inside internal compartments, tubing, bilges and bladders) should be drained completely on land.

2.10.5 Monitor site and respond quickly to invasive species introductions

- The site should be monitored regularly (with particular attention to vehicle and equipment staging and storage areas) for incipient populations of non-native plant and animals likely to establish if prevention measures are not fully effective. Eradication measures should be implemented quickly for any detected invasions by executing standard control treatments for the species and/or soliciting assistance from local invasive species managers.

2.10.6 Additional References:

1. Technical Memorandum No. 86-68220-07-05: Inspection and Cleaning Manual for Equipment and Vehicles to Prevent the Spread of Invasive Species (2012 Edition)

2. Preventing Invasive Species: Cleaning Watercraft and Equipment, NOAA.

3. Uniform Minimum Protocols and Standards for Watercraft Inspection and Decontamination Programs for Dreissenid Mussels in the Western United States (UMPS III). Pacific States Marine Fisheries Commission, Portland, OR. (2016 Edition)

4. Invasive Species of Idaho, Idaho State Department of Agriculture.

2.11 Reinitiation Notice

This concludes formal consultation on the proposed Burlington Northern Santa Fe Sandpoint Junction Connector 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.

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4. APPENDICES

4.1 Appendix A

Project Title	BNSF SPJ - LPO Temporary Work Bridge 3.1
Pile information (size, type, number, pile strikes, etc.)	Impact Proof 10 24-inch-diameter steel piles (1 pile per pier) after vibratory to refusal; maximum 60 strikes/pile; 2-3 hours each install; 4 piles/day (2 simultaneously). Attenuated 3dB with bubble curtains.

Fill in green cells: estimated sound levels and distances at which they were measured, estimated number of pile strikes per day, and transmision loss constant.

	Acoustic Metric			
	Peak	SEL	RMS	Effective Quiet
Measured single strike level (dB)	**204**	**175**	**191**	**150**
Distance (m)	**10**	**10**	**10**	

Estimated number of strikes	**240**

Cumulative SEL at measured distance
199

	Distance (m) to threshold			
	Onset of Physical Injury			Behavior
	Peak dB	Cumulative SEL dB**		RMS dB
		Fish ≥ 2 g	Fish < 2 g	
Transmission loss constant (15 if unknown)	206	187	183	150
15	**7**	**61**	**113**	**5412**

** This calculation assumes that single strike SELs < 150 dB do not accumulate to cause injury (Effective Quiet)

Notes (source for estimates, etc.)

(This model was last updated January 26, 2009)

5,412 meters = 3.36 miles; 61 meters = 0.04 mile; 7 meters = 0.004 mile (2.1 feet)

Mitigated (levels for simultaneous driving of two piles at a time), measured 10 m from the pile, 24-inch steel pipe pile; per WSDOT BA Preparation Advanced Training Manual Version 4-2018, Table 7-12.

Number of strikes needed/24" pile for construction equipment load requirements - per BNSF

Project Title	BNSF Sandpoint Junction Connector, Sand Ck Br. 3.1
Pile information (size, type, number, pile strikes, etc.)	64 24-inch-diameter steel pipe piles, 22 below OHWM. Maximum 1,200 strikes/pile, 1-2 hours each install; 4 piles/day (2 simultaneously). Install during winter pool/low-water conditions. Attenuated -3 dB for bubble curtains

Fill in green cells: estimated sound levels and distances at which they were measured, estimated number of pile strikes per day, and transmision loss constant.

	Acoustic Metric			
	Peak	SEL	RMS	Effective Quiet
Measured single strike level (dB)	**204**	**175**	**191**	**150**
Distance (m)	**10**	**10**	**10**	

Estimated number of strikes	**4,800**

Cumulative SEL at measured distance
212

	Distance (m) to threshold			
	Onset of Physical Injury			Behavior
	Peak	Cumulative SEL dB**		RMS
	dB	Fish ≥ 2 g	Fish < 2 g	dB
Transmission loss constant (15 if unknown)	206	187	183	150
15	**7**	**451**	**464**	**5412**

** This calculation assumes that single strike SELs < 150 dB do not accumulate to cause injury (Effective Quiet)

Notes (source for estimates, etc.)

(This model was last updated January 25, 2009)

7 meters = 23 feet; 284 meters= 0.28 miles; 464 meters = 0.29 miles; 5,412 meters = 3.36 miles
LPO main waterbody is 0.25 mile downstream of Bridge 3.1; Sand Creek considered to be an inlet of LPO so within BT CH.

Per sound pressure levels attenuated -3 dB by using bubble curtain in water depths 2 feet or greater; for single strikes, measured 10 m from the pile, 24-inch steel pipe pile; per WSDOT BA Preparation Advanced Training Manual Version 4-2017, Table 7-12.

Dominant frequencies generated in pile driving are between 50 & 1000 Hz, so most of the energy is not propagated in water depths of 1.5 feet or less.

Underwater noise propagation is limited by sinusoity of a system (where river bends noise is unlikely to propagate; line-of-sight rule is used to determine the extent of noise propagation in river systems.)

Project Title	BNSF SPJ - LPO Temporary Work Bridge 3.9
Pile information (size, type, number, pile strikes, etc.)	Impact Proof 76 24-inch-diameter steel piles (1 pile per pier) after vibratory to refusal; maximum 60 strikes/pile; 2-3 hours each install; 4 piles/day (2 simultaneously). Attenuated 3dB with bubble curtains.

Fill in green cells: estimated sound levels and distances at which they were measured, estimated number of pile strikes per day, and transmision loss constant.

	Acoustic Metric			
	Peak	SEL	RMS	Effective Quiet
Measured single strike level (dB)	**204**	**175**	**191**	**150**
Distance (m)	**10**	**10**	**10**	

Estimated number of strikes	**240**

Cumulative SEL at measured distance
199

	Distance (m) to threshold			
	Onset of Physical Injury			Behavior
	Peak	Cumulative SEL dB**		RMS
	dB	Fish ≥ 2 g	Fish < 2 g	dB
Transmission loss constant (15 if unknown)	206	187	183	150
15	**7**	**61**	**113**	**5412**

** This calculation assumes that single strike SELs < 150 dB do not accumulate to cause injury (Effective Quiet)

Notes (source for estimates, etc.)

(This model was last updated January 26, 2009)

5,412 meters = 3.36 miles; 61 meters = 0.04 mile; 7 meters = 0.004 mile (2.1 feet)

Mitigated (levels for simultaneous driving of two piles at a time), measured 10 m from the pile, 24-inch steel pipe pile; per WSDOT BA Preparation Advanced Training Manual Version 4-2018, Table 7-12.

Number of strikes needed/24" pile for construction equipment load requirements - per BNSF

Project Title	BNSF Sandpoint Junction Connector, LPO Bridge 3.9
Pile information (size, type, number, pile strikes, etc.)	288 36-inch-diameter steel piles; maximum 1600 strikes/pile; 2-3 hours each install; 4 piles/day (2 simultaneously) Attenuated by 3 dB for bubble curtains

Fill in green cells: estimated sound levels and distances at which they were measured, estimated number of pile strikes per day, and transmision loss constant.

	Acoustic Metric			
	Peak	SEL	RMS	Effective Quiet
Measured single strike level (dB)	**207**	**180**	**190**	**150**
Distance (m)	**10**	**10**	**10**	

Estimated number of strikes	**6,400**

Cumulative SEL at measured distance
218

	Distance (m) to threshold			
	Onset of Physical Injury			Behavior
	Peak	Cumulative SEL dB**		RMS
	dB	Fish ≥ 2 g	Fish < 2 g	dB
Transmission loss constant (15 if unknown)	206	187	183	150
15	**12**	**1000**	**1000**	**4642**

** This calculation assumes that single strike SELs < 150 dB do not accumulate to cause injury (Effective Quiet)

Notes (source for estimates, etc.)

(This model was last updated January 26, 2009)

4,642 meters = 2.88 miles; 1,000 meters =0 .62 mile; 12 meters = 0.007 mile (37 feet)

Attenuated (-3 dB for bubble curtains, levels for simultaneous driving of two piles at a time), measured 10 m from the pile, 36-inch steel pipe pile; per WSDOT BA Preparation Advanced Training Manual Version 4-2017, Table 7-12.

Number of strikes needed/36" pile for rail load requirements - per BNSF

Project Title	BNSF SPJ - Vibratory driving behavioral impact distance
Pile information (size, type, number, pile strikes, etc.)	Vibratory driving of 36-inch steel piles assumed at 175dBrms (WSDOT).

Fill in green cells: estimated sound levels and distances at which they were measured, estimated number of pile strikes per day, and transmision loss constant.

	Acoustic Metric			
	Peak	SEL	RMS	Effective Quiet
Measured single strike level (dB)			**175**	**150**
Distance (m)			**10**	

Estimated number of strikes	

Cumulative SEL at measured distance
#NUM!

	Distance (m) to threshold			
	Onset of Physical Injury			Behavior
	Peak	Cumulative SEL dB**		RMS
	dB	Fish ≥ 2 g	Fish < 2 g	dB
Transmission loss constant (15 if unknown)	206	187	183	150
15	**0**	**#NUM!**	**#NUM!**	**464**

** This calculation assumes that single strike SELs < 150 dB do not accumulate to cause injury (Effective Quiet)

Notes (source for estimates, etc.)

(This model was last updated January 26, 2009)

464 meters = 0.29 mile.