United States Department of the Interior

FISH AND WILDLIFE SERVICE

Washington Fish and Wildlife Office
Eastern Washington Field Office
11103 East Montgomery Drive
Spokane Valley, Washington 99206

In Reply Refer To:
01EWFW00-2017-F-1145

DEC 2 2 2017

Mark Robertson
Lower Snake River Compensation Plan Office
U.S. Fish and Wildlife Service
1387 S. Vinnell Way, Suite 343
Boise, Idaho 83709

Dear Mr. Robertson:

Subject: Walla Walla and Touchet River Summer Steelhead Programs

This letter transmits the U. S. Fish and Wildlife Service's Biological Opinion on the proposed funding of Walla Walla and Touchet River Summer Steelhead Programs located in southeast Washington, and their effects on bull trout (*Salvelinus confluentus*) and critical habitat for the bull trout. Formal consultation on the proposed action was conducted in accordance with section 7 of the Endangered Species of 1973, as amended (16 U.S.C. 1531 *et seq.*) (Act). Your July 11, 2017, request for formal consultation was received via email on the same date.

The enclosed Biological Opinion is based on information provided in the June 12, 2017, Biological Assessment, telephone conversations, field investigations, and other sources of information cited in the Biological Opinion. A complete record of this consultation is on file at the Eastern Washington Field Office in Spokane, Washington.

If you have any questions regarding the enclosed Biological Opinion, our response to your concurrence request(s), or our shared responsibilities under the Act, please contact Erin Kuttel at 509-893-8029.

Sincerely,

Michelle Eames for

Eric V. Rickerson, State Supervisor
Washington Fish and Wildlife Office

Enclosure(s)

cc:
WDFW, Dayton, WA (J. Bumgarner)
CTUIR, Pendleton, OR (B. Zimmerman)

Endangered Species Act - Section 7 Consultation

BIOLOGICAL OPINION

U.S. Fish and Wildlife Service Reference:
01EWFW00-2017-F-1145

Walla Walla and Touchet River Summer Steelhead Programs

Federal Action Agency:

US Fish and Wildlife Service, Lower Snake River Compensation Plan Office

Consultation Conducted By:

U.S. Fish and Wildlife Service
Washington Fish and Wildlife Office
Spokane, Washington

for Michelle Eames

Eric V. Rickerson, State Supervisor
Washington Fish and Wildlife Office

12-22-17

Date

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ACRONYMS AND ABBREVIATIONS

Act	Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*)
AFS	American Fisheries Society
BA	Biological Assessment
BCW	bacterial cold water
BKD	Bacterial Kidney Disease
BPA	Bonneville Power Administration
cfs	cubic feet per second
CHU	Critical Habitat Unit
CHRU	Columbia Headwaters Recovery Unit
CTUIR	Confederated Tribes of the Umatilla Indian Reservation
CWA	Clean Water Act
DAP	Dayton Acclimation Pond
DAT	Dayton Adult Trap
DPS	Distinct Population Segment
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FCRPS	Federal Columbia River Power System
FDA	Federal Drug Administration
FMO	Foraging, Migration and Overwintering
IGDO	inter-gravel dissolved oxygen
IHNV	Infectious Pancreatic Necrosis Virus
IHOT	Integrated Hatchery Operations Team
km	kilometer
LFH	Lyons Ferry Hatchery
LPO	Lake Pend Oreille
LSRCP	Lower Snake River Compensation Program
MHHW	mean higher high-water
MLLW	mean low low-water
mi	mile
M&E	monitoring and evaluation
NE	Northeast
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
O&M	operation and maintenance
OHWM	Ordinary High Water Mark
OIE	Office International des Epizooties/World Organization for Animal Health
Opinion	Biological Opinion
PBF	physical or biological features
PCE	Primary Constituent Element
PIT	Passive Integrated Transponder
PNFHPC	Pacific Northwest Fish Health Protection Committee
PVC	Polyvinyl Chloride
RKM	river kilometer

RM&E	research monitoring and evaluation
RU	Recovery Unit
RUIP	Recovery Unit Implementation Plan
SE	Southeast
Service	U.S. Fish and Wildlife Service
SMA	Shoreline Management Area
SR	spawning and rearing
TMDL	Total Maximum Daily Load
TSS	Total suspended solids
USFWS	U.S. Fish and Wildlife Service
WDFW	Washington Department of Fish and Wildlife

INTRODUCTION

This document represents the U. S. Fish and Wildlife Service's (Service) Biological Opinion (Opinion) based on our review of the continued funding and operation of summer steelhead hatchery programs in southeast Washington, and their effects on bull trout (*Salvelinus confluentus*), in accordance with section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*) (Act). The Biological Assessment (dated June 12, 2017) and request for formal consultation were received via email on July 11, 2017.

This Opinion is based on information provided in the June 12, 2017, Biological Assessment, telephone conversations, field investigations, and other sources of information as detailed below. A complete record of the consultation is on file at the Eastern Washington Field Office in Spokane, Washington.

CONSULTATION HISTORY

The following is a summary of important events associated with this consultation:

- The Biological Assessment was received on July 11, 2017.
- Formal consultation was initiated on July 11, 2017.
- A site visit was conducted on July 24, 2017.
- The Service completed consultation on the NE Oregon/SE Washington Hatchery Programs for Chinook, Steelhead and Rainbow Trout (0lEOFW00-2015-F-0154) in August 2016. The program has elements directly tied to elements of this action.

BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

A federal action means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by federal agencies in the United States or upon the high seas (50 CFR 402.02).

The Lower Snake River Compensation Program (LSRCP) is proposing to continue funding and authorization of the operation of hatchery facilities and Maintenance and Evaluation (M&E) related to two steelhead programs in Southeast Washington. A complete summary of the program facilities, locations, and activities are in Table 1, including facilities located in the Touchet River, Cottonwood Creek, and Snake River drainages. Activities described at the Lyons Ferry Hatchery (LFH) and Cottonwood Adult Trap have been previously described in the NE Oregon/SE Washington Biological Assessment (BA) and Biological Opinion (NOAA et al. 2014 and USFWS 2016a, respectively, hereby incorporated by reference), and will not be discussed in depth in this document. All facilities described in detail in this Opinion are operated by the Washington Department of Fish and Wildlife (WDFW).

Table 1. Proposed Action Facility, Activities, and Location Summary.

Facility	RKM	Waterbody	BT Habitat Type	BT Habitat Unit	Fish Health/ Disease	Adult Collection	Juvenile Release	Water Diversion	Water Effluent	O&M
LFH	95.0	Snake River	FMO	Mainstem Snake River	X				X	X
DAP	84.8	Touchet River	FMO	Touchet River	X		X	X	X	X
DAT	85.6	Touchet River	FMO	Touchet River	X	X		X	X	X
Cottonwood Adult Trap	0.2	Cottonwood Creek	FMO	Grande Ronde	X	X		X	X	X
Walla Walla River [1]	48.0	Walla Walla River	FMO	Walla Walla River	X		X			

LFH: Lyons Ferry Hatchery, DAP: Dayton Acclimation Pond, DAT: Dayton Adult Trap, FMO: Foraging, Migrating, & Overwintering; RKM: River Kilometer.

1 Releases of steelhead in the Walla Walla River were ceased following the 2017 release, with adult returns expected in 2018 and 2019.

General Program Activity Categories

Adult Collection

Broodstock collection (the collection of returning adult steelhead for spawning in the hatcheries) can be accomplished in several ways, but in most hatchery operations it occurs by trapping. The hatchery programs in the Action Area (Touchet River) use a low rise concrete dam with an associated fish ladder/trap. Hanging PVC (Polyvinyl chloride) pickets are placed over a portion of the dam to encourage fish to use the fish ladder, but this is not a 100% impediment. Fish that don't bypass the dam freely, travel through the fish ladder and are retained in the trap box. Evaluation staff regularly checks the trap box to capture steelhead broodstock and release non-target fish. Broodstock collection for the Wallowa stock releases in the Walla Walla and Touchet Rivers occurs at the Cottonwood Adult Trap satellite facility in the Grande Ronde basin.

Water Diversions

Water supply is the most important aspect of fish hatchery operations. Water supplies for most hatchery facilities come from either surface water diversions, ground water sources (wells and springs), or a combination of both. Ground water is extracted using onsite wells. Surface water intakes, which draw from stream and river sources, typically have diversion structures associated with them to efficiently withdraw the required water volume to operate the hatchery facility. Juvenile acclimation facilities only need water for part of the year, while hatchery spawning and rearing facilities require water year round. Surface water diversions are made via permanent fixed or temporary mobile pumps, depending on the facility and the nature of the water needs. Water intakes are screened to reduce impingement and entrainment.

Effluent

Hatchery operations discharge waste water from normal operations. This water is typically discharged (returned) into the stream it was first withdrawn from and is typically returned downstream of the facility and withdrawal diversion point. Groundwater extracted in support of hatchery operations is also returned to surface waters adjacent to hatchery facilities. The effluent water has typically been used throughout the facility, for all aspects of hatchery operations, including: adult broodstock trapping and holding, egg incubation, juvenile rearing, fish health treatments, and pond cleaning. The Federal Clean Water Act (CWA) regulates discharges of dredged or fill material into waters of the United States. The purpose of the CWA is to restore the physical, biological, and chemical integrity of the waters of the United States using two basic mechanisms: (1) direct regulation of discharges pursuant to permits issued under the National Pollution Discharge Elimination System (NPDES) and Section 404 (discharge of dredge or fill materials); and (2) the Title III water quality program. The State of Washington is responsible for issuing and reporting on NPDES permits. The threshold applied for fish hatchery operations under the CWA is that any facility that rears 20,000 pounds of fish or more and discharges effluent into navigable waters must obtain a permit.

Routine Facility Operation and Maintenance

Normal and preventative maintenance of hatchery facility structures and equipment is necessary for proper functionality. Normal maintenance activities include: pond cleaning, pump maintenance, debris removal from intake and outfall structures, building maintenance, and grounds maintenance. Hatchery maintenance that occurs directly in watered structures, such as pond maintenance, pump maintenance and removal of minor amounts of debris from intake or outfall structures, weirs, and traps occur on a regular basis to ensure proper facility operation.

Non-Routine (Semi-Routine) Facility Operation and Maintenance

Non-routine maintenance and semi-routine maintenance activities occur on an irregular basis and include instream work. Non-routine activities include irregular in-stream work, such as bank reinforcements, bridge repair, or weir maintenance. Semi-routine maintenance includes such things as intake cleaning/dredging activities that occur regularly (up to annually) in the action area; the scale is similar for the actions but the frequency is unpredictable. Major new in-river hatchery structures, such as new hatchery outfall structures or weirs, are not included in the proposed action and will require a separate consultation, if needed in the future.

Acclimation and Release

Acclimation is conducted at the Dayton Acclimation Pond (DAP). During operations, the site requires regular, daily human presence for the entire acclimation period. Acclimation typically occurs over a period of 2 to 3 months. Smolts are released through volitional release practices so that the fish migrate quickly seaward, limiting the duration of smolt presence at and downstream of the release site.

Monitoring and Evaluation

Numerous M&E programs occur within the action area under a variety of funding sources to evaluate hatchery origin steelhead. The M&E work described in this subsection is in support of multiple Washington hatchery programs and in many cases has been reviewed under previous consultations.

In-Hatchery M&E

The in-hatchery M&E is primarily focused on the performance of the fish in the hatchery facilities, from growth-rate and mortality rates at the various life stages, to marking and tagging rates and retention estimates. While all of the aspects of in-hatchery M&E are vital to the continued operation and success of the program, in-hatchery activities occur specifically to species cultured within hatchery facilities only.

Off-Station M&E

The off-station M&E activities associated with the programs take place throughout the action area. Activities are focused in two major areas of concern: adult spawner and juvenile production estimates for summer steelhead. These M&E projects have been in place since the 1980s and are formalized and funded through the LSRCP and other sources (BPA and State of Washington). Current project operators, timelines, locations, and funding sources are summarized in Table 2. All activities are further described in the text below.

Table 2. Current and/or past M&E Projects Associated with the Steelhead Hatchery Programs.

Project Name	Operator	Annual timeframe of Activities	Locations of Activities	Funded by
Steelhead spawning ground surveys	WDFW	March - May	Touchet River (multiple locations)	LSRCP
Steelhead Adult Trapping	WDFW	January - October	Touchet River (DAT)	LSRCP
Steelhead Electrofishing Surveys	WDFW	July-August	Touchet River (RM 40 upstream)	LSRCP, BPA
Smolt trapping	WDFW	October - July	Touchet River (Harvey Shaw Rd, RM 32)	WDFW, BPA, and LSRCP

Spawner Surveys

Ground-based (by foot) surveys of summer steelhead spawning grounds in the Touchet River Basin take place from March to May. Reaches are walked (waded) and examined for new redd deposition in survey areas. Additionally, carcasses of steelhead are sampled for marks, tags, breeding effort and sometimes tissue sampled.

Sample Survey (Electrofishing, snorkeling, seining, etc.)

LSRCP funded Electrofishing surveys have been terminated in recent years in the Touchet River because of concerns about the degree of bias in the steelhead estimates that result. However, these surveys may be initiated again (under BPA funding) if methods to reduce bias are found or a specific need for the juvenile data is described. Electrofishing surveys may occur from July through August, and are conducted to monitor distribution and abundance of natural-origin steelhead.

Smolt Trapping

A rotary screw trap has been used at several locations (Gallinat et al. 2016) to trap out-migrating steelhead (natural and hatchery-origin). Juvenile trapping enables WDFW to determine critical habitat, abundance, migration patterns, survival, and alternate life history strategies for steelhead. Some of the natural- and hatchery-origin steelhead captured are measured, weighed and released. All captured steelhead receive a Passive Integrated Transponder (PIT) tag and also have scales collected. Most fish are counted and released immediately back to the stream to continue their migration.

Non-Broodstock Adult Trapping

Beyond broodstock needs for the Touchet River endemic steelhead program, WDFW continues to trap natural origin adult steelhead at the Dayton Adult Trap (DAT) for population status monitoring. The trap is operated from January – October each year to evaluate adult steelhead spawner escapement, demographics and hatchery/natural composition. Other species of interest are also trapped and counted (i.e. whitefish, spring Chinook, suckers, bull trout, etc.). The trap is checked daily for fish and cleaned of debris.

Program Descriptions and Activities

Walla Walla Basin Summer Steelhead Program (Wallowa Stock)

The Walla Walla and Touchet rivers summer steelhead programs involve the LFH; adult broodstock trapping at Cottonwood Creek in the Grande Ronde; and smolt releases in the Touchet River (at the DAP). Smolt releases into the Walla Walla River were discontinued in the spring of 2017. The Touchet Summer Steelhead Wallowa stock program is a segregated program for harvest mitigation purposes under the LSRCP. Broodstock are trapped at the Cottonwood Creek Adult Trap from March through April with the gametes transported to LFH for incubation and rearing. Juvenile steelhead are then transported to the DAP in February with a volitional release into the Touchet River during the month of April. The current smolt release goal for the Touchet (Wallowa stock) program is 100,000 smolts.

LFH was constructed in 1984 and serves as the incubation and rearing facility for this program. Actions that occur annually at LFH during operation of the steelhead program include water pumping from wells, incubation, juvenile rearing, fish health and disease management, effluent, M&E, and facility maintenance. The Cottonwood Adult Trap was constructed in 1992 and serves as the adult broodstock source for WDFW Wallowa stock program. Actions that occur annually at the Cottonwood Facility during operation of the steelhead program include water diversion and facility maintenance. Operation, water supply, discharge, and maintenance activities occurring at LFH and the Cottonwood facilities were analyzed in the NE Oregon/SE Washington Biological Assessment (NOAA et al 2014) and Biological Opinion (USFWS 2016a).

The DAP was constructed in 1985 and currently serves as the acclimation and juvenile release facility for both Touchet River summer steelhead programs. Actions that occur annually at the DAP during operation of the steelhead program include water diversion, acclimation and juvenile release, fish health and disease management, effluent, and facility maintenance.

The water supply for DAP is from the Touchet River. Surface water intake at the facility meets current National Marine Fisheries Service (NMFS) screening criteria (NOAA 2011). Discharge from DAP complies with all NPDES standards where it enters the Touchet River (Dayton). Routine maintenance occurs at DAP on an annual basis. All fish are examined annually by WDFW fish health specialists and certified for release as required under the Pacific Northwest Fish Health Protection Committee (PNFHPC) (1989) guidelines.

Touchet Summer Steelhead Program (Touchet Stock)

The Touchet River endemic stock summer steelhead program involves one fish hatchery (LFH), adult trapping at the DAT in the Touchet River, and smolt releases from DAP. The Touchet River Summer Steelhead Program is an integrated program for conservation purposes at this time, but may be expanded for harvest mitigation in the future. Broodstock for this program are trapped at the DAT from January through April, with adults transported to LFH for holding, followed by spawning, incubation and rearing. Smolts are then transported to the DAP in late March/early April. Smolts are volitionally released from the DAP during the month of April. The current smolt release goal for the program is 50,000, but may be expanded to 150,000 in the future depending on management decisions.

Descriptions of LFH and DAP, and their water supply and effluent are provided above. Broodstock collection occurs at the DAT (Figure 1). The DAT consists of a low concrete dam (sloped towards the fish/ladder side to maintain flow by the intake), a fish ladder/trap, and a water intake for the DAP. A draft assessment of the exclusion barrier and fishway indicates that modifications may be warranted to meet passage criteria (NOAA 2011); a strategy is in place to determine modification needs based on species and program risks via coordination with NMFS, WDFW, and other interested parties. If the effects of this action are greater than considered in this Opinion, it would be consulted on at a later date. The trap appears to meet all criteria. Routine maintenance may require removal of gravel or fine sediment that accumulates in the acclimation pond diversion or within the fish ladder over the course of time. It is expected one routine maintenance cleaning annually will be necessary. However, in some rare instances or in high water years, up to two may be required. All removal of gravel/sediment will be by hand or hydraulic (pump) actions and occur within the defined in-water work window. Prior approval from WDFW Habitat Division will occur before any sediment is disturbed.

Actions that occur annually at the DAP and DAT during operation of the Touchet River endemic stock steelhead program include adult trapping, water diversion, acclimation and juvenile release, fish health and disease management, effluent, and facility maintenance. All fish are examined annually by WDFW fish health specialists and certified for release as required under the PNFHPC (1989) guidelines.

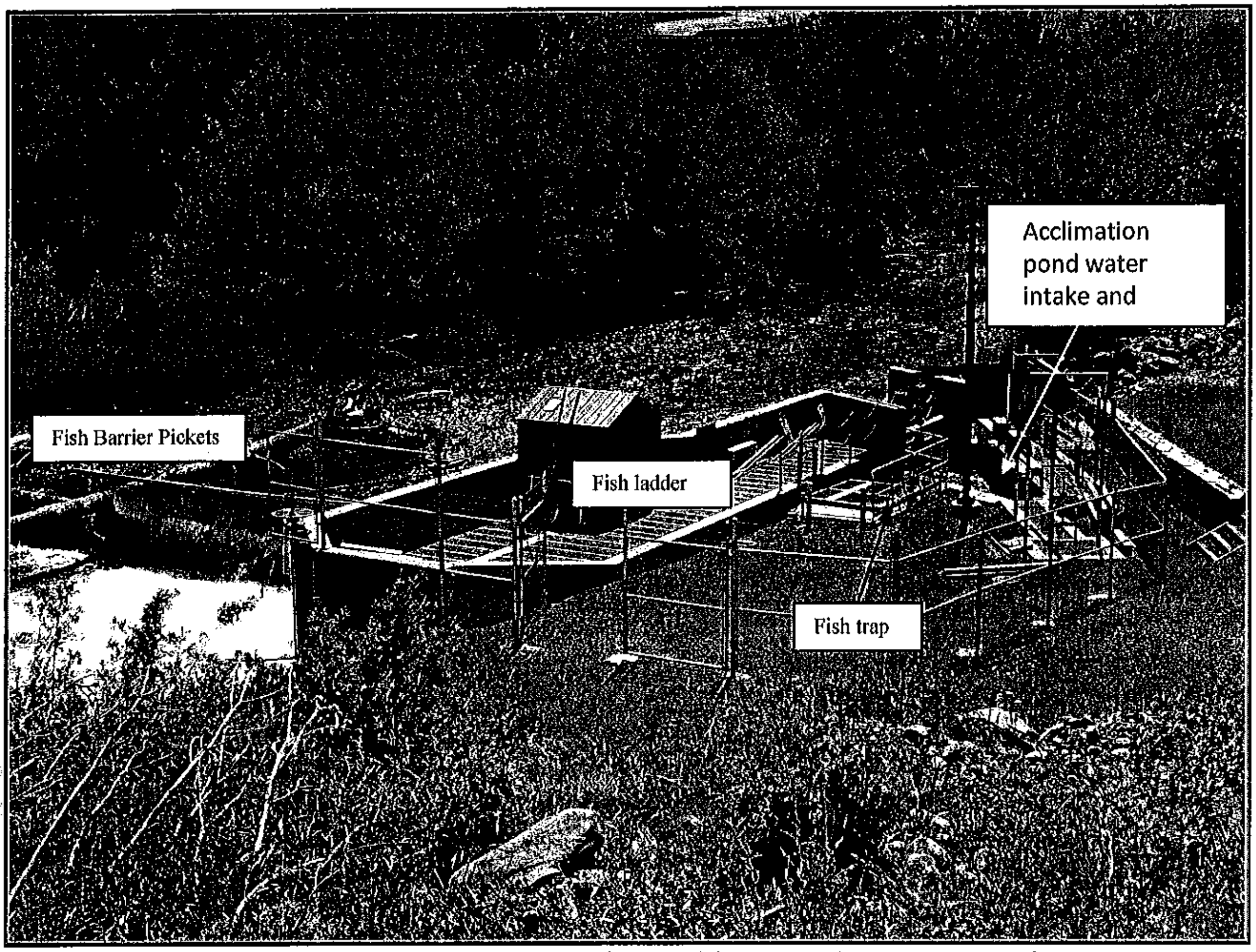

Figure 1. View of DAT and the water diversion facility for DAP, Touchet River.

Conservation Measures

Conservation measures minimize effects and/or benefit or promote the recovery of listed species and are included by the federal agency. These actions will be taken by the program operators as an integral part of the proposed action.

Adult Collection

Measures applied to minimize potential effects during broodstock collection activities include:

- Operate programs in accordance with the policies and procedures developed by the Integrated Hatchery Operations Team (IHOT) for Columbia Basin anadromous salmonid hatcheries.
- Direct and coordinate all programs adult collection activities through annual planning meetings between the Confederated Tribes of the Umatilla Indian Reservation (CTUIR), WDFW, and LSRCP that results in the development of an Annual Operating Plan and coordinated with the Service as needed.
- Operate all traps in accordance with their design standards to minimize risk to all fish in general and non-target species in particular.
- Check the adult traps at least daily and more often during peak steelhead returns. Remove fish quickly from the trap and return all non-target fish to the stream

immediately with minimal handling.

- Ensure that the fish ladders receive sufficient flow in all seasons to attract and effectively pass fish of all life stages.

Water Diversion

Measures applied to minimize potential effects of water withdrawals include:

- Operate facilities within their water right with respect to maximum withdrawal from surface and/or ground water sources.
- Site, design, and operate all withdrawal structures to prevent barriers to fish passage.
- LSRCP will catalog and prioritize those intakes and traps that do not meet Anadromous Salmonid Passage Facility Design (NOAA 2011) for upgrades as funding becomes available.

Effluent

General measures applied to minimize potential effects of hatchery effluent include (WDFW and LSRCP 2017):

- Operate all hatchery facilities under an applicable CWA NPDES permit, which includes periodic water quality sampling for compliance.
- Ensure that proper feeding volume and application to reduce non-utilized feed.
- Perform all hatchery maintenance on "watered" or "in-water" facilities to minimize potential effects to hatchery effluent (i.e., sediment disturbance, water temperature, and chemical composition.).

Specific measures applied to minimize disease risk from effluent (WDFW and LSRCP 2017):

- Operate programs in accordance with the policies and procedures developed by the IHOT for Columbia Basin anadromous salmonid hatcheries.
- Follow the disease control measures outlined in the PNFHPC Model Comprehensive Fish Health Protection Program, IHOT, and Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State.
- Test pre-release and broodstock to ensure that released fish are not diseased. Conduct testing in accordance to protocols in the American Fisheries Society (AFS) Fish Health Section Blue Book and OIE standards.
- Administer therapeutic drugs and chemicals to fish and eggs reared at program facilities only when necessary to effectively prevent, control, or treat disease conditions.
- Administer all treatments according to label directions in compliance with the Food and Drug Administration (FDA) and the Environmental Protection Agency (EPA) regulations for the use of aquatic animal drugs and chemicals. EPA and FDA consider the environmental effects acceptable when the therapeutic compounds are used according to the label.
- Notify program fish health staff at least six weeks prior to a release or transfer of fish from the hatchery. Collect tissue samples on 60 fish of the stock being transferred or released. The pathogens screened for include: infectious hematopoietic necrosis virus (IHNV); infectious pancreatic necrosis virus; viral hemorrhagic septicemia virus; *R. salmoninarum*; *Aeromonas salmonicida*; *Yersinia ruckeri*; and under certain circumstances other pathogens such as *Myxobolus cerebralis* and *Ceratomyxa shasta*.

Facility Operation and Maintenance
None beyond those identified for effluent and/or non-routine operation and maintenance.

Non-Routine (Semi-Routine) Facility Operation and Maintenance
Measures applied to minimize potential effects of non-routine hatchery facility maintenance:

- Catalog and prioritize those structures that do not meet Anadromous Salmonid Passage Facility Design (NOAA 2011) for upgrades as funding becomes available.
- Complete all work during the allowable freshwater work times established for each location, unless otherwise approved in writing by the appropriate state agency (WDFW), NMFS, and/or the Service.
- Prepare and implement a pollution and erosion control plan to prevent pollution related to Operation and Maintenance (O&M) activities. The plan will be made available for inspection on request by the Bonneville Power Administration (BPA), NMFS, and/or the Service. Pollution and erosion control plan will address equipment and materials storage sites, fueling operations, staging areas, cement mortars and bonding agents, hazardous materials, spill containment and notification, and debris management.
- Select equipment that will have the least adverse effects on the environment (e.g., minimally-sized rubber tires, etc.) when heavy equipment must be used.
- Have the proper approved oils/lubricants when working below the Ordinary High Water Mark (OHWM).
- Operate all equipment above the OHWM or in the dry whenever possible to reduce impacts.
- Make absorbent material available on site to collect any lubricants in case of a pressurized line failure. Dispose of all used materials in the proper manner.
- Stage and fuel all equipment in appropriate areas above the OHWM.
- Cease operations if, at any time, fish are observed in distress as a result of the action activities.
- Clean all equipment to ensure it is free of vegetation, external oil, grease, dirt, and mud before equipment is brought to the site and prior to removal from the project area.
- Involve local habitat entities with the maintenance actions and notify local habitat entities prior and following the activities completion.
- Ensure that all work meets state and federal fish passage requirements.
- Minimize impacts to riparian vegetation at the work sites and upon completion of the work. Grade and replant disturbed areas to match the landscape and existing vegetation at the site.
- Install silt barriers at the site during work to prevent/reduce sediment from entering the river.
- Dispose of all discharge water created by O&M tasks (e.g. debris removal operations, vehicle wash water) at an adjacent upland location. No discharge water will be allowed to return to the adjacent waterbodies unless specifically approved by NMFS or the Service.
- Obtain all appropriate state and Federal permits before work is initiated.
- Clean all materials used prior to placement below the OHWM.
- Install straw bales and/or geo-textile filtration traps to outlet channel when dredging to catch any sediment exiting the subject waterbody.
- Filter pumped water through straw bale sediment traps to remove any sediment prior to re-entering state waterbodies.

Acclimation and Release

Measures applied to minimize potential competition/predation effects during juvenile release activities include:

- Operate programs in accordance with the policies and procedures developed by the IHOT for Columbia Basin anadromous salmonid hatcheries.
- Release hatchery smolts that are physiologically ready to migrate. Hatchery fish released as smolts emigrate seaward soon after liberation, minimizing the potential for competition with juvenile naturally produced fish in freshwater (Steward and Bjornn 1990; California HSRG 2012).
- Operate hatcheries such that hatchery fish are reared to sufficient size that smoltification occurs in nearly the entire population.
- Release all hatchery fish as actively migrating smolts through volitional release practices so that the fish migrate quickly seaward, limiting the duration of interaction with any co-occurring natural-origin fish downstream of the release site.

Monitoring and Evaluation

Measures applied to minimize potential effects of M&E include:

- Conduct all in-river spawner surveys in known target species spawning reaches.
- Conduct surveys to minimize disturbance of live fish spawning activities and non-target species behavior.
- Follow standard fish handling and anesthetization procedures to minimize the effects on all fish handled for M&E activities.
- Follow fish trapping, trap maintenance, fish handling, fish anesthesia, and fish marking protocols explicitly and train all staff in their use and application before working under field conditions.
- Do not use non-target species for smolt trap efficiency tests.
- Minimize stress and mortality associated with smolt studies by:

    - Check traps and live boxes regularly throughout the day and night to ensure that traps are maintained and that no mortalities occur. Check smolt trap cones and debris drums regularly to ensure that traps are not causing fish impingement or descaling and that fine debris is removed from the traps. Monitor water temperatures and stream discharge regularly to ensure safe capture and handling of all fish.

Action Area

The action area is defined 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). In delineating the action area, we evaluated the farthest reaching physical, chemical, and biotic effects of the action on the environment.

The action area includes all areas where Walla Walla and Touchet river steelhead program activities will occur and is distinguishable from existing total numbers of steelhead in a watershed. Therefore, the action area includes the Walla Walla River Basin, Cottonwood Creek (Grande Ronde River Basin), and mainstem Snake and Columbia Rivers from Hells Canyon

Dam downstream to McNary Dam. It is recognized that fish released from the programs will also inhabit other portions of the Columbia River basin and the Pacific Ocean. Considering the small proportion of fish from the proposed programs in the total numbers of fish in the Columbia River basin and the ocean, it is not possible to meaningfully measure, detect, or evaluate the effects of those juvenile interactions due to the low likelihood or magnitude of such interactions in locations outside the action area (NMFS 2012). Thus, these areas are not included in the action area.

ANALYTICAL FRAMEWORK FOR THE JEOPARDY AND ADVERSE MODIFICATION DETERMINATIONS

Jeopardy Determination

The following analysis relies on the following four components: (1) the *Status of the Species*, which evaluates the rangewide condition of the listed species addressed, the factors responsible for that condition, and the species' survival and recovery needs; (2) the *Environmental Baseline*, which evaluates the condition of the species in the action area, the factors responsible for that condition, and the relationship of the action area to the survival and recovery of the 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 or interdependent activities on the species; and (4) *Cumulative Effects*, which evaluates the effects of future, non-federal activities in the action area on the species.

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 species' current status, taking into account any 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 listed species in the wild.

The jeopardy analysis in this Opinion emphasizes the rangewide survival and recovery needs of the listed species and the role of the action area in providing for those needs. It is within this context that we evaluate the significance of the proposed Federal action, taken together with cumulative effects, for purposes of making the jeopardy determination.

Adverse Modification Determination

Section 7(a)(2) of the Act requires that Federal agencies insure 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). 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."

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 (81 FR 7414) 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. However, the shift in terminology does not change the approach used in conducting a ''destruction or adverse modification'' analysis, which is the same regardless of whether the original designation identified PCEs, PBFs or essential features. For those reasons, in this biological opinion, references to PCEs or essential features should be viewed as synonymous with PBFs. All of these terms characterize the key components of critical habitat that provide for the conservation of the listed species.

Our analysis for destruction or adverse modification of critical habitat relies on the following four components: (1) the Status of Critical Habitat, which evaluates the range-wide condition of designated critical habitat for the bull trout in terms of essential features, PCEs, or PBFs, depending on which of these terms was relied upon in the designation, the factors responsible for that condition, and the intended recovery function of the critical habitat overall; (2) the Environmental Baseline, which evaluates the condition of the critical habitat in the action area, the factors responsible for that condition, and the recovery role of the critical habitat in the action area; (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 essential features, PCEs, or PBFs and how those effects are likely to influence the recovery role of affected critical habitat units; and (4) Cumulative Effects, which evaluates the effects of future, non-Federal activities in the action area on the essential features, PCEs, or PBFs and how those effects are likely to influence the recovery role of affected critical habitat units.

For purposes of making the destruction or adverse modification finding, the effects of the proposed Federal action, together with any cumulative effects, are evaluated to determine if the critical habitat rangewide would remain functional (or retain the current ability for the PBFs to be functionally re-established in areas of currently unsuitable but capable habitat) to serve its intended conservation/recovery role for the (species).

STATUS OF THE SPECIES: BULL TROUT

The bull trout was listed as a threatened species in the coterminous United States in 1999 (64 FR 58910 [Nov. 1, 1999]). Throughout its range, the bull trout is threatened by the combined effects of habitat degradation, fragmentation, and alteration (associated with dewatering, road construction and maintenance, mining, grazing, the blockage of migratory corridors by dams or other diversion structures, and poor water quality), incidental angler harvest, entrainment, and introduced non-native species.

Since the listing of bull trout, there has been very little change in the general distribution of bull trout in the coterminous United States, and we are not aware of any known, occupied bull trout core areas that have been extirpated (U.S. Fish and Wildlife Service 2015a). Although still relatively widely distributed across its historic range, the bull trout occurs in low numbers in many areas. Overall bull trout abundance is "stable" range-wide (U.S. Fish and Wildlife Service 2015a). However, 81 core areas have 1,000 or fewer adults, with 24 core areas not having surveys conducted to determine adult abundance (USFWS 2008) (USFWS 2015c, p. 2). In addition, 23 core areas have declining populations, with 66 core areas having insufficient information (USFWS 2008) (USFWS 2015a, p. 2). These values reflect the condition of bull trout habitat. The decline of bull trout is primarily due to habitat degradation and fragmentation, blockage of migratory corridors, poor water quality, past fisheries management practices, impoundments, dams, water diversions, and the introduction of nonnative species (63 FR 31647 [June 10, 1998]; 64 FR 17112 [April 8, 1999]).

The 2015 recovery plan for bull trout identifies six recovery units within the listed range of the species (USFWS 2015a). Each of the six recovery units are further organized into multiple bull trout core areas, which are mapped as non-overlapping watershed-based polygons, and each core area includes one or more local populations. Within the coterminous United States we recognize 109 currently occupied bull trout core areas, which comprise 600 or more local populations (USFWS 2015a). Core areas are functionally similar to bull trout metapopulations, in that bull trout within a core area are much more likely to interact, both spatially and temporally, than are bull trout from separate core areas.

The Service also identified a number of marine or mainstem riverine habitat areas outside of bull trout core areas that provide foraging, migration, and overwintering (FMO) habitat that may be shared by bull trout originating from multiple core areas. These shared FMO areas support the viability of bull trout populations by contributing to successful overwintering survival and dispersal among core areas (USFWS 2015a).

For a detailed account of bull trout biology, life history, threats, demography, and conservation needs, refer to Appendix A: Status of the Species: Bull Trout.

STATUS OF CRITICAL HABITAT: BULL TROUT

The final critical habitat designation for the coterminous United States population of the bull trout was effective on November 17, 2010 (75 FR 63898 [October 18, 2010]). The primary function of individual Critical Habitat Units 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); 2) provide for persistence of strong local populations, in part, by providing habitat conditions that encourage movement of migratory fish (Rieman and McIntyre 1993; The Montana Bull Trout Scientific Group (MBTSG) 1998); 3) are large enough to incorporate genetic and phenotypic diversity, but small enough to ensure connectivity between populations (Hard 1995; Healey and Prince 1995; Rieman and McIntyre 1993; MBTSG 1998); and 4) are distributed throughout the historic range of the species to preserve both genetic and phenotypic adaptations (Hard 1995; Rieman and McIntyre 1993; Rieman and Allendorf 2001; MBTSG 1998).

Physical and Biological Features for Bull Trout

Within the designated critical habitat areas, the PBFs for bull trout are those habitat components that are essential for the primary biological needs of foraging, reproducing, rearing of young, dispersal, genetic exchange, or sheltering. Based on our current knowledge of the life history, biology, and ecology of this species and the characteristics of the habitat necessary to sustain its essential life-history functions, we have determined that the PBFs, as described within USFWS 2010, are essential for the conservation of bull trout. The PBFs are defined as follows.

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 °C to 15 °C, 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 departure 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 non-native 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.

The condition of bull trout critical habitat varies from poor to good across the species' range. There is widespread agreement in the scientific literature that many factors related to human activities have impacted bull trout and their designated critical 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; Rieman and McIntyre 1993); 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; MBTSG 1998); 3) the introduction and spread of nonnative fish species, particularly brook trout (*Salvelinus fontinalis*) and lake trout (*S. namaycush*), 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; Rieman et al. 2006); 4) degradation of mainstem river FMO habitat, and the degradation and loss of marine nearshore foraging and migration habitat, due to urban and residential development in the Puget Sound and Olympic Peninsula geographic regions where anadromous bull trout occur; and 5) degradation of FMO habitat resulting from reduced prey base, roads, agriculture, development, and dams.

For a detailed account of the status of designated bull trout critical habitat, refer to Appendix B: Status of Designated Critical Habitat: Bull Trout.

ENVIRONMENTAL BASELINE: BULL TROUT AND DESIGNATED BULL TROUT CRITICAL HABITAT

Regulations implementing the Act (50 CFR 402.02) define the environmental baseline as the past and present impacts of all Federal, State, or private actions and other human activities in the action area. Also included in the environmental baseline are the anticipated impacts of all proposed federal projects in the action area that have undergone section 7 consultation, and the impacts of state and private actions which are contemporaneous with the consultation in progress.

Current Condition of the Bull Trout in the Action Area

The action area encompasses hundreds of miles of FMO habitat in the lower Snake and Columbia Rivers. In addition, the action area encompasses swaths of the Grande Ronde River basin and the entirety of the Walla Walla River basin. Activities in the Walla Walla River basin, including the Touchet River, will occur in both spawning and rearing and FMO habitats for bull trout. Several bull trout populations from the tributaries throughout the Snake and Columbia Rivers, including the Umatilla, Walla Walla, Touchet, Tucannon, Asotin, Clearwater, Grande Ronde, Imnaha, and Salmon Rivers, may interact with steelhead or hatchery operation activities as a result of the proposed programs.

While there are no barriers to movement of bull trout from core areas in the Clearwater, Salmon, and Asotin basins, the likely number of individuals present in the action area is very small. Data indicates that few to no bull trout from these basins enter the Snake River (Barrows *et al* 2016) and interactions with direct hatchery operations or releases are not likely to occur. Bull trout from populations in the Umatilla and Tucannon populations may interact with hatchery releases as they enter the mainstem Snake and Columbia Rivers. The Service anticipates that these interactions would occur between adult and subadult bull trout and juvenile steelhead smolts. The short duration of smolt retention in the mainstem rivers and the beneficial food source for foraging bull trout likely results in unmeasurable and/or positive impacts to bull trout populations in the Umatilla and Tucannon Rivers. Therefore, lengthy discussion of status of bull trout populations in the Umatilla, Walla Walla, Touchet, Tucannon, Asotin, Clearwater, Grande Ronde, Imnaha, and Salmon Rivers are not included in this document. The status of bull trout within the mainstem Snake and Columbia Rivers and each of the core areas identified within the action area (Grande Ronde, Touchet and Walla Walla) are addressed separately, below.

The dams and reservoirs within the action area are all part of the Federal Columbia River Power System (FCRPS), which is comprised of a series of multi-purpose, hydroelectric facilities constructed on the lower Snake and Columbia Rivers and operated by the Corps and Bureau of Reclamation. All of the dams on the lower Snake River are operated by the Corps as run-of-the-river facilities primarily for navigation, hydropower production, and flood control. Under current operations, the pool elevations of the reservoirs within the action area have a maximum potential fluctuation of about five feet. The reservoir shorelines throughout the action area are often steep and characterized by cliffs and talus substrate, while much of the remaining shoreline areas are lined with riprap to protect adjacent structures. Relatively little riparian vegetation remains along the shorelines within the action area and the remaining riparian areas are highly fragmented.

In addition to construction of the dams themselves, numerous other human activities (e.g., construction of ports, docks, roads, railways, landscaping, and agriculture) have contributed to altering or displacing shoreline riparian and in-stream habitats in the action area. These activities have further reduced the quantity and quality of nearshore habitat by eliminating native riparian vegetation, disrupting natural hydrological cycles, and disconnecting the river mainstems from their historic floodplains. In addition, many native plant species that evolved under the riverine ecosystem are not well suited to the largely static, slackwater conditions that are currently present within the action area, and many shoreline areas now support vegetation assemblages that include vigorous stands of non-native, invasive plant species. These altered habitats often provide inadequate protection and refugia for various animal species within the action area.

Touchet River Core Area

The Touchet River is located in southeastern Washington and is a tributary to the Walla Walla River, which empties into the Columbia River near Wallula Gap (Figure 2). Both fluvial and resident bull trout life-history forms occur in the Touchet River Core Area. Bull trout movements and migration information in the Touchet River has been gathered in recent years with the addition of PIT tag arrays in the basin. Based on the limited data to date, downstream (post-spawn) and upstream (pre-spawn) migrations following similar migration patterns and timing as other local populations (i.e. Tucannon River bull trout in a neighboring watershed). Bull trout appear to begin their upstream migration from February through July, and continue on to the spawning areas in the upper reaches of the Touchet River and tributaries in July and August. Spawning begins in late August/early September and continues through October.

The Touchet River from its confluence with the Walla Walla River upstream 78.9 km (49.0 mi) to the confluence with Coppei Creek is FMO habitat and provides connectivity to FMO habitat in the Walla Walla and Columbia Rivers. The Touchet River from its confluence with Coppei Creek upstream 21.2 km (13.2 mi) to the North Fork/South Fork confluence currently provides important foraging and overwintering habitat for fluvial bull trout that spawn upstream and serves as a migratory corridor to the lower Walla Walla River and Columbia River. Adult and sub-adult bull trout have been captured annually at the steelhead adult trap in Dayton. Trap counts were 20 or more bull trout per year through 2008, with 110 captured in the new fish trap in 2009. Fluvial bull trout are presumed to overwinter downstream of Dayton, but their abundance, distribution and use patterns in this reach have not been determined. Glen Mendel (WDFW) reported that a PIT tag from a Touchet River bull trout was identified in the Columbia River in 2009. Data is limited on bull trout use of the lower Touchet River. In 2008, a fish ladder was installed at Hofer Dam, which is expected to greatly improve conditions for upstream fish movement from the lower Walla Walla River up into the Touchet River.

Historically bull trout were thought to be widely distributed in the Touchet River watershed (Mendel et al. 2003). Currently, local populations in the Touchet River core area occur in the North Fork, Wolf Fork, and in the Burnt Fork of the South Fork Touchet River (Kassler and Mendel 2007; Mendel et al. 2014). Recent telemetry and PIT tag data indicate migratory bull trout in the Touchet River core area remain within the overall Walla Walla River basin, foraging and overwintering in the lower Touchet drainage or mainstem Walla Walla River, and rarely migrate further downstream into the Columbia River (Schaller et al. 2014). Kassler and Mendel (2007) determined that more than 50 percent of migratory bull trout in the Touchet River core area originate from the Wolf Fork population.

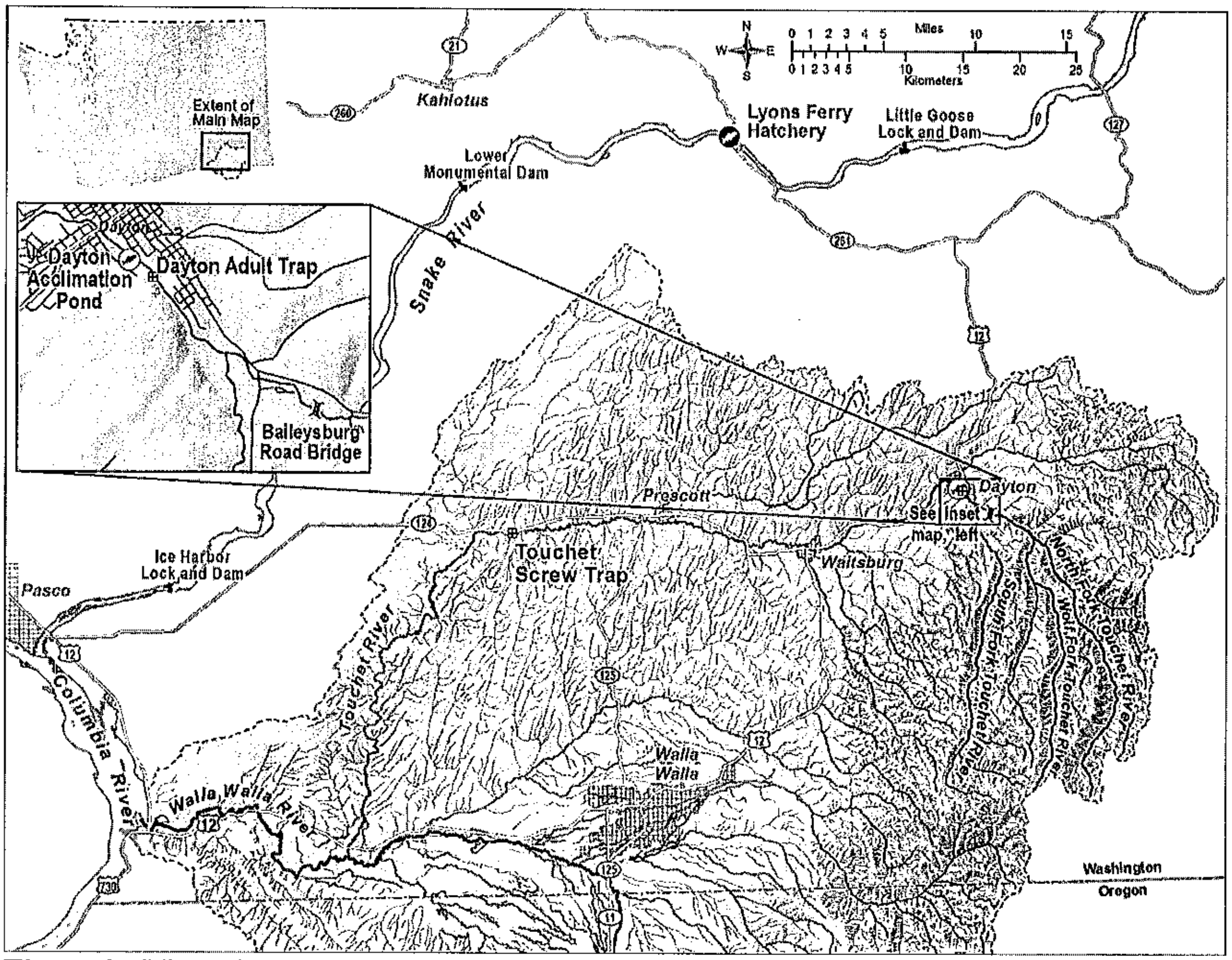

Figure 2. Map of the Touchet River Basin, LFH, DAP, and DAT. Source: WDFW GIS Staff 2017.

Bull trout redd surveys have been occurring in portions of the Touchet River core area since 1994 in the North Fork and since 1990 in the Wolf Fork. In more recent years, surveys have been conducted in consistently established reaches. Limited spawning occurs outside these two main areas in Spangler and Lewis Creeks. Genetics from individuals from each tributary were not distinguishable from either North Fork or Wolf Fork individuals (Kassler and Mendel 2007). Redd counts in the North Fork and Wolf Fork between 1999 and 2013 suggest that these two local populations are stable (Mendel et al. 2014). However, redd count data for the Burnt Fork of the South Fork Touchet is more limited. Bull trout redds were first observed in 2000, but not detected in 2003 and 2004 (Mendel et al. 2004; Mendel et al. 2007; Mahoney et al. 2009; Fitzgerald pers. comm. 2015). Since 2005, access to complete surveys in the Burnt Fork has been restricted across private property (Mendel et al. 2014; A. Fitzgerald, pers. comm. 2015), and have not been conducted consistently. The population trend in this core area appears to be stable, but is cyclical in nature (Figure 3).

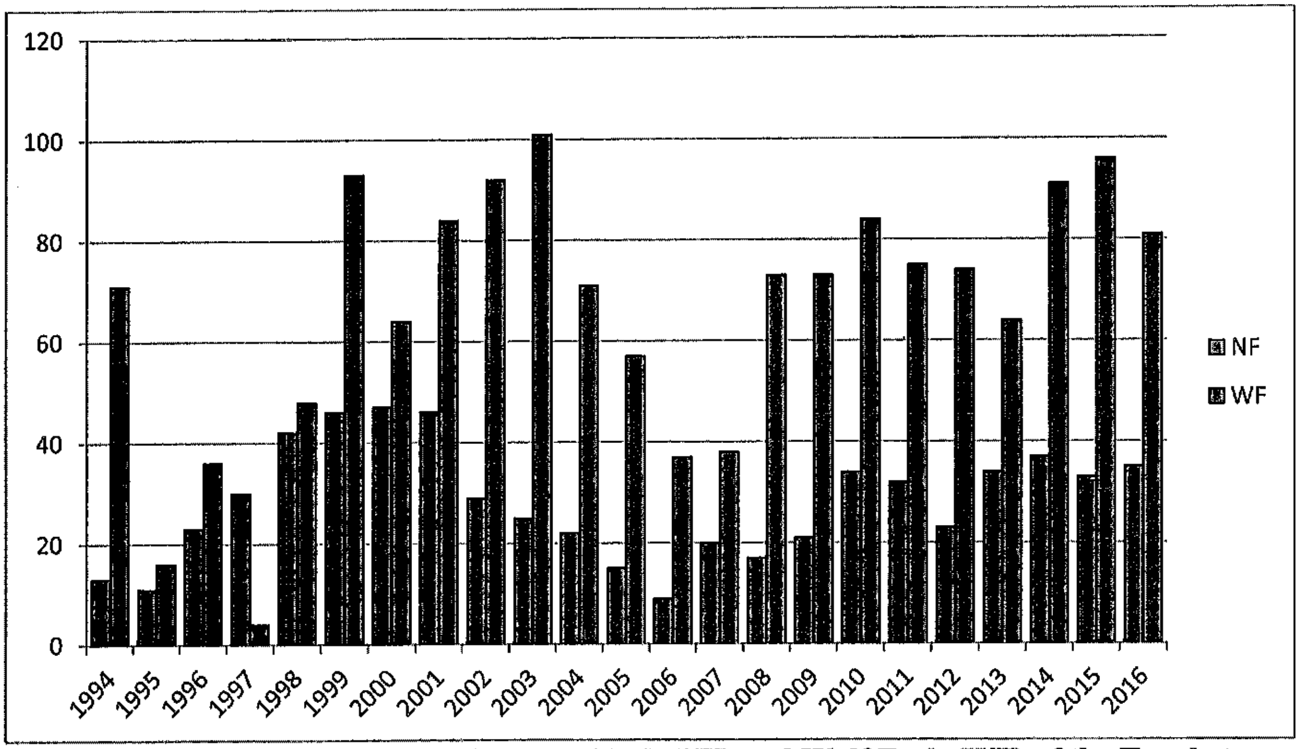

Figure 3. Bull trout redd counts in North Fork (NF) and Wolf Fork (WF) of the Touchet River.

Between 2001 and 2015, a total of 1,109 bull trout have been PIT tagged within the Touchet River, either at the DAT or from the rotary screw traps. Of those, only one has been observed outside the Touchet River basin. This fish went into Mill Creek, near the city of Walla Walla. Based on this, it appears that limited exchange of fish between the Touchet and Walla Walla populations is occurring.

The lower 24.0 km (14.9 mi) of the North Fork is utilized by bull trout for foraging and overwintering, and it provides connectivity to the South Fork and the mainstem Touchet River. The upper North Fork Touchet River from Spangler Creek upstream 8.1 km (5.0 mi) to its headwaters provides spawning and rearing habitat. Bull trout spawn in the North Fork Touchet River from Bluewood Creek downstream to Spangler Creek. From 1984 through 2001, over 40 redds per year were found in this area (Mendel et al. 2007, pg 78). Rearing of adults, sub-adults, and age 1+ juveniles occurs in the North Fork from Spangler Creek down to the Wolf Fork confluence. WDFW found bull trout in 59 of 104 sites surveyed from 1998 to 2006, with multiple age classes detected at many of the sites (Mendel et al. 2007). *Lewis Creek* from its confluence with the North Fork Touchet River upstream 8.0 km (4.9 mi) is utilized as rearing habitat, but a few redds have been documented in the past. WDFW found bull trout in 16 of 47 sites electrofished from 1998 to 2006 and multiple age classes were observed (Mendel et al. 2007). *Spangler Creek* from its confluence with the North Fork Touchet River upstream 6.6 km (4.1 mi) provides spawning and rearing habitat (Mendel et al. 2007, pg 78). Some bull trout spawning has been documented in Spangler Creek and bull trout were detected at 11 of 17 sites electrofished by WDFW from 1998 to 2006 (Mendel et al. 2007).

Corral Creek from its confluence with the North Fork Touchet River upstream 0.5 km (0.31 mi) provides spawning and rearing habitat (Mendel et al. 2007, pg 78). Young of year bull trout were found in lower Corral Creek during WDFW electrofishing surveys in 2005.

The Wolf Fork Touchet River includes 12.4 km (7.7 mi) of FMO habitat and 13.5 km (8.4 mi) of spawning and rearing habitat. The Wolf Fork Touchet River supports the largest local population in the Touchet River Basin. The lower Wolf Fork Touchet River, downstream of Whitney Creek, is utilized by bull trout for foraging and overwintering and provides connectivity to the North Fork and mainstem Touchet River. The current known spawning distribution in the Wolf Fork Touchet River is from Whitney Creek 2.4 km (1.5 mi) upstream of the Forest Service boundary (about 8.8 km / 5.5 mi). From 1994 to 2002, an average of 63 redds per year were found in this area, with a high of 93 redds in 1999 (Mendel et al. 2003). Fifty seven redds were found in 2005 (Mendel, Trump, and Gembala 2006, pg 52), 37 redds were found in 2006, and 38 redds were found in 2007 (Mendel et al. 2007). WDFW detected bull trout at 56 of 82 electrofishing sites sampled from 1998 to 2006, with multiple age classes observed in upper reach areas (Mendel et al. 2007). Green Fly Canyon from its confluence with Wolf Fork upstream 0.33 km (0.2 mi) provides spawning and rearing habitat (Mendel et al. 2007). Lower Green Fly Creek has multiple age classes of bull trout based on one-pass electrofishing by WDFW (Mendel et al. 2007).

The South Fork Touchet River from the confluence with the Walla Walla River upstream 25.8 km (16.0 mi) is FMO habitat and 4.4 km (2.7 mi) of spawning and rearing habitat in the upper reaches. The South Fork Touchet River supports a small local population with spawning occurring in Burnt Fork. WDFW detected bull trout at 3 of 67 sites electrofished on the South Fork from 1998 to 2006 (Mendel et al. 2007). The South Fork Touchet River and Griffin Fork are utilized by fluvial bull trout for foraging and overwintering. A bull trout local population was identified in the Burnt Fork of the South Fork Touchet River in 2000, as evidenced by the presence of three age classes and four redds (Mendel et al. 2007). The CTUIR purchased a large ranch on the South Fork Touchet River (now called the Rainwater Wildlife Area) in 1998, and have taken steps to improve in-stream habitat and acquire additional lands. This area serves as a wildlife mitigation area and is managed for fish and wildlife resources. Griffin Fork from its confluence with the South Fork Touchet River upstream 0.7 km (0.4 mi) provides FMO habitat. Bull trout have been documented in Griffin Fork by CTUIR personnel, although no redds have been found in this tributary (Mendel et al. 2007, pg 55). Burnt Fork from its confluence with the South Fork Touchet River upstream 4.4 km (2.7 mi) provides spawning and rearing habitat. Sixteen redds were found in the Burnt Fork in 2001, but only two redds were detected in 2002 (Mendel et al. 2003). Two redds were observed in Burnt Fork in 2005 (Mendel, Trump, and Gembala 2006, pg 56), and in 2008 six live bull trout were observed in the South Fork Touchet River just below Burnt Fork.

The primary threats identified in the 2015 Recovery Plan for the Touchet River Core Area include Upland/Riparian Land Management, Instream Impacts, Water Quality, Connectivity Impairments, and Nonnative Fishes (USFWS 2015b, p. C13). The identified threats likely contribute to depressed conditions of the local populations of bull trout within the Touchet River watershed (USFWS 2008a, pp. 63-65; USFWS 2015b, pp. C13). Elevated water temperatures from factors such as damaged riparian vegetation, increased sedimentation, and decreased water flows have reduced habitat quality for bull trout in the Touchet River drainage (Mendel et al.

2003). Introduced brown trout and rainbow trout that used to be stocked in the basin (stocking ceased in 1998 following Endangered Species Act (ESA) listing of steelhead) likely competed with native bull trout for food and habitat. Predatory species such as non-native Walleye and smallmouth bass in the lower reaches of the Touchet and mainstem Walla Walla River pose a predatory risk to juveniles and sub-adults in the basin. There are a few partial or seasonal barriers to movement in the core area that limit connectivity between local populations. Flood control levees have confined the river and reduced channel complexity and wood recruitment. Recent climate change modeling indicates that the Touchet River drainage is at high risk for reduced instream flows, elevated water temperatures, and reduced habitat suitability into the future and existing habitat threats will likely be exacerbated (Schaller et al. 2014).

Walla Walla River Core Area

Major tributaries to the Walla Walla River include the Touchet River, Mill Creek, and the South Fork of the Walla Walla River (South Fork). Two other smaller tributaries (North Fork Walla Walla River (North Fork) and Yellowhawk Creek) are also within the Walla Walla River basin. While the Touchet River is a main tributary to the Walla Walla River, it is identified as its own core area due to unique characteristics of bull trout populations there. The Walla Walla core area contains three local populations in the upper Mill Creek, Low Creek, and the South Fork Walla Walla River. Migratory bull trout have been detected moving into the Columbia River (USFWS 2008b, pp. 44, 63), however, only very few have ever been known to return to the Walla Walla core area or to move upstream to the mouth of the Snake River (Anglin et al. 2012, p. 2; Barrows et al. 2016).

The Walla Walla River core area still supports both resident and migratory forms of bull trout and is considered a stronghold population within the broader region (USFWS 2010, p. 410). During the early 2000s, the bull trout population in this core area was considered fairly large with total annual redd counts exceeding 300. However, steep declines were noted in the mid to late 2000s (USFWS 2008b, pp. 45-46; Mahoney et al. 2012, p. iii). Further, these apparent declines were mainly due to a loss of migratory bull trout. The available information indicates that adequate winter flows in the upper Walla Walla River watershed are the main factor in maintaining migratory bull trout in this core area, yet the reliability of these flows may be threatened by recent management actions (USFWS 2008b, p. 50). In the South Fork Walla Walla redd counts peaked in 2001 at over 400 and have steadily declined to just above 100 in 2012. Although the total number of bull trout, including juveniles, appears to be stable, the number of large adults is declining (Schaller et al. 2014) as are total adults, as reflected in the redd counts. Likewise, adult abundance in Mill Creek declined 63 percent during 2006 to2010 with even greater declines in sub-adult survival (Howell & Sankovich 2012).

The quality of habitat for most bull trout life stages, strategies and actions is generally better in headwater reaches and degrades incrementally downstream from the Umatilla National Forest boundary as the severity and often cumulative anthropogenic modifications and other influences become more prevalent (Schaller et al. 2014). While the resident component of the population only experiences headwater conditions, migratory bull trout may be exposed to a spectrum of anthropogenic channel modifications, riparian habitat degradation, varying levels of streamflow depletion and regulations, and other influences throughout the basin and in the mainstem Columbia River. In the middle and lower Walla Walla River, as flows decrease and are largely diverted for agricultural purposes and water temperatures elevate, habitat conditions become progressively less favorable for most bull trout uses. The greatest threats within the Walla Walla River core area include dewatering/low flows that result in significant barriers; water quality impairment from multiple sources (e.g., agricultural practices, urban development), and passage barriers to migration (USFWS 2008b; USFWS 2015a). Improving habitat conditions to restore connectivity (including removing low flow barriers) among local populations is critical to maintaining redundancy and supporting resiliency of bull trout in the Walla Walla River core area (Schaller et al. 2014).

Several threats likely contribute to the depressed conditions of the local populations of bull trout within the Walla Walla River watershed (USFWS 2008b; USFWS 2015a, pp. C12). These include construction of small recreational and irrigation dams, mining, road construction and maintenance, local fires, urban development, channelization, irrigation, and flood control measures. In various reaches throughout the watershed, these impacts have led to increased water temperatures and sedimentation levels, inadequate seasonal flows, reduced habitat complexity due to a lack of large woody debris and deep pools, and an increase in non-native predatory or competitive fish species.

Grande Ronde River

Baseline conditions and status of bull trout in the Grande Ronde basin, including Cottonwood Creek, are described in detail in the Opinion for hatchery operations in NE Oregon and SE Washington (USFWS 2016a, pp. 41-43).

Snake River and Columbia River

Baseline conditions at LFH and status of bull trout in the Snake River are described in detail in the Opinion for hatchery operations in NE Oregon and SE Washington (USFWS 2016a, pp. 47-53).

Summary

Bull trout spawning/rearing and FMO habitats and behaviors occur throughout the action area. Actions related to broodstock collection, juvenile release, hatchery operations, and monitoring all occur within the Touchet River where spawning and rearing bull trout populations occur. Activities also occur within FMO for bull trout in the Snake, Columbia, Grande Ronde, Walla Walla, and Touchet rivers. In addition, activities in the Columbia and Snake Rivers occur in shared FMO habitat, where individuals from populations outside of the action may utilize for forage and overwintering. However, in most cases these interactions are not likely to negatively impact bull trout from those populations (i.e. Umatilla, Tucannon, Asotin, Clearwater, and Salmon). The available information indicates that a relatively small number of bull trout may occur in the Snake and Columbia Rivers during the proposed activities. Within the Touchet and Walla Walla Rivers; however, it is expected that bull trout could be present during any and all activities related to the proposed action. Activities in the Grande Ronde, specifically Cottonwood Creek, and the Snake River were previously discussed in the NE Oregon/SE Washington Hatchery Programs Biological Opinion (USFWS 2016a, pp. 2-20). A variety of past, ongoing, and planned landscape-scale management activities have impacted the status and health of bull trout population in the action area.

Current Condition of Critical Habitat for Bull Trout in the Action Area

Designated critical habitat for bull trout includes: free flowing reaches of the Mainstem Upper Columbia River Critical Habitat Unit (CHU) and Mainstem Snake River CHU and their reservoirs to the ordinary high water elevations and normal operating pool elevations, respectively. The action area also includes critical habitat designated throughout the Walla Walla River basin, Touchet River, and Grande Ronde River. Detailed discussion of the Grande Ronde basin critical habitat is included in the NE Oregon/SE Washington Hatchery Operation Opinion (USFWS 2016a, pp. 56-61). Critical habitat is not designated in Cottonwood Creek within the Grande Ronde River basin. The current conditions of the PBFs that comprise bull trout critical habitat within the action area are described below.

1. *Springs, seeps, groundwater sources, and subsurface water connectivity (hyporheic flows) that contribute to water quality and quantity and provide thermal refugia.*

   In each of the CHUs within the action area, the element of seeps, springs, groundwater sources, and subsurface flows varies. In the Mainstem Upper Columbia River CHU and Mainstem Snake River CHU, where habitat is primarily reservoirs above several dams, this element has minimal presence and is not likely a significantly influence on available bull trout habitats. Reservoirs in the Snake and Columbia Rivers are highly stratified with cold waters at depth providing similar benefits of this PBF.

   In tributaries (i.e. Touchet and Walla Walla), however, depending on locations of various activities, elements of this PBF may highly influence habitats for bull trout. Seeps, springs, groundwater sources, and subsurface flows are observed throughout each of the Touchet, Walla Walla and Grande Ronde River basins.

   Therefore, this PBF is considered to have a meaningful presence and is functioning at risk in the action area.

2. *Migration habitats with minimal physical, biological, or water quality impediments between spawning, rearing, over-wintering, and freshwater and marine foraging habitats, including but not limited to permanent, partial, intermittent, or seasonal barriers.*

   Throughout the action area, impediments to passage pose threats to bull trout. Numerous dams throughout the Snake and Columbia Rivers, as well as in the Walla Walla and Touchet rivers have impacted the free movement of bull trout. Most of the facilities have some form of passage structure, via fish ladders or traps, to minimize impediments to free-flowing upstream passage throughout the action area. However, these facilities were designed for salmon passage primarily and are often shut down during periods when bull trout need passage. As well, most facilities provide minimal downstream passage options for bull trout through turbines, surface collector, spillways, or navigation channels. The operation of dams on the mainstems disrupts bull trout migration by impeding upstream and downstream movements. The dams also create partial or seasonal barriers as a result of water temperature issues, mechanical impingement, and elevated dissolved gas levels. Water quality issues in the Grande Ronde and Walla Walla basins from high stream temperatures and sediment; low flows; and high nutrients, bacteria, and chemicals impede bull trout passage. Low flows caused by irrigation withdrawals from June 1 through October 1 in the Touchet River and a lack of functioning riparian zones may create thermal barriers to migrating bull trout thus reducing connectivity during certain periods of the year within the action area (Kuttel, 2001).

Within the action area, the current function of this PBF is functioning at risk.

3. *An abundant food base, including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish.*

   The entire action area currently supports an abundant food base for all life stages of bull trout. Potential forage fish for bull trout, such as juvenile salmon, steelhead, and whitefish (family Salmonidae), sculpins (family Cottidae), suckers (family Catostomidae), lamprey (family Petromyzontidae) and minnows (family Cyprinidae), are present throughout.

   Therefore, this PBF is functioning at risk in the action area.

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.*

   The reservoir environments and flow regimes that are currently present in the lower Snake and Columbia Rivers within the action area are significantly altered from the historic riverine conditions that existed. Generally, the reservoirs have relatively stable channels and streambanks and in some portions, especially in the vicinity of the dams and urban areas, the shorelines have been extensively armored with riprap. In addition, floodplain encroachment by industrial, commercial, and private development over large portions of the action area have further degraded the historic habitat characteristics (e.g., riparian areas, off-channel habitats, water temperatures) of the original riverine environments. Consequently, the conditions and processes (e.g., seasonal flow patterns, channel complexity, large wood recruitment, litter fall) that supported historic riverine environments within the action area have been replaced with more simplified, adfluvial habitats. Tributaries offer more complexity, especially in the headwater reaches. However, many have been channelized with armoring, levee construction, and residential encroachment.

   Therefore, this PBF is functioning at risk in the action area.

5. *Water temperatures ranging from 36 °F 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 (e.g., provided by riparian habitat), streamflow, and local groundwater influence.*

   The timing, frequency, magnitude, and duration of water temperature and flow regimes in the lower Snake and Columbia Rivers have been significantly altered by human activities, such as hydropower production and irrigated agriculture, since at least the mid-1900s. As a result, water temperatures in the lower Snake and Columbia Rivers, including the action area, often exceed 68° F during the summer (USFWS 2010, p. 36). Because of dam release flows of impounded water during the winter, water temperatures in the action area are also typically warmer during the winter compared to many tributary reaches and historic mainstem river conditions.

Therefore, this PBF is functioning at risk in the action area.

6. *In spawning and rearing areas, substrate of sufficient amount, size, and composition to ensure success of egg and embryo over-winter 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 amount of fine sediment suitable to bull trout will likely vary from system to system.*

Available historical data suggests that the mainstems of the Columbia and Snake Rivers did not support spawning or early rearing of bull trout. Therefore, elements of this PBF are not present in the mainstem portions of the action area. However, bull trout spawning and rearing does occur within portions of the Grande Ronde, Touchet, and Walla Walla Rivers in the action area.

7. *A natural hydrograph, including peak, high, low, and base flows, within historic and seasonal ranges or, if flows are controlled, minimal flow departure from a natural hydrograph.*

Most of the action area has some level of modification to the natural hydrograph as a result of dam, irrigation diversion, hatchery weirs, and flood protection levees. The operation of dams and weirs throughout the Snake and Columbia River watersheds has significantly altered the natural river hydrograph by decreasing spring and summer flows and increasing fall and winter flows from historic river conditions. Flows in the lower Touchet River are regulated by Hofer Dam, concrete weirs, agricultural diversions, and other anthropogenic modifications that change flow and natural hydrologic functions. Low flows occasionally occur during the summer months from Hofer Dam downstream to the mouth of the Touchet (Mendel *et al.* 1999). The Touchet River's flow increases in mid- to late-October as irrigation reduces and fall precipitation increases. In the Grande Ronde basin, dependent on level and location of past land management activities (roads, harvest, irrigation withdrawals, mining, etc.), the baseline condition of this PBF varies from good to poor, but is generally in fair condition.

8. *Sufficient water quality and quantity such that normal reproduction, growth, and survival are not inhibited.*

Water quality varies greatly within the action area, but major consistencies surround the influence of agriculture and temperature. The water quality of the lower Snake River is described as excellent (Class A) (Washington Administrative Code [WAC] Chapter 173-201A-030). However, historic flow and temperature regimes within the action area have been significantly altered since construction of the dams. Water quality and quantity in the action area are influenced by water control structures up and down stream of the action area. As well, diversions, Hofer Dam, and poor shading further increase temperatures throughout the watershed inhibiting survival and limiting behaviors of bull trout. Within the action area, temperatures, water quality, and water quantity are influenced by riparian development, agricultural practices, and irrigation. In summer months, low flow conditions and temperatures may limit use of the action area by bull trout.

Oregon Department of Environmental Quality has identified many stream segments within the Grande Ronde subbasin as water quality limited. Oregon's 1998 303 (d) List of Water Quality Limited Waterbodies identifies nine parameters of concern in the Upper Grande Ronde River subbasin: algae, bacteria, dissolved oxygen, flow modification, habitat modification, nutrients, PH, sedimentation, and temperatures. All of these concerns exist within the Grande Ronde River valley portion of the subbasin. Three of these nine concerns – temperature, sediment, and habitat modification – are widespread throughout the rest of the subbasin outside of the Grande Ronde River Valley (USFWS 2004a, b).

Within the action area, the current function of this PBF is functioning at risk.

9. *Sufficiently low levels of occurrence of non-native predatory (e.g., lake trout [Salvelinus namaycush], walleye [Stizostideon vitreum], northern pike [Esox lucius], smallmouth bass [Micropterus dolomieu]), interbreeding (e.g., brook trout [Salvelinus fontinalis]), or competing (e.g., brown trout [Salmo trutta]) species that, if present, are adequately temporally and spatially isolated from bull trout.*

Various non-native predatory fish species that are known to prey on juvenile and sub-adult salmonids are present throughout the action area. As well, some level of competitive and interbreeding species such as hatchery rainbow, brook trout, and brown trout are present in some of the action area watersheds, or in small isolated areas. There are non-native (rainbow trout), competitive (brown trout) and non-native walleye and small mouth bass in the lower reaches of the Touchet and mainstem Walla Walla River which pose a predatory risk to species present in the action area.

Within the action area, the current function of this PBF is functioning at risk.

Conservation Role of in the Action Area

Bull trout spawning/rearing and FMO habitats and behaviors occur throughout the action area. In addition, activities in the Columbia and Snake Rivers occur in shared FMO habitat, where individuals from populations outside of the action may utilize for forage and overwintering. FMO habitat is important to bull trout of the Mid-Columbia Recovery Unit for maintaining diversity of life history forms and for providing access to productive foraging areas. Many bull trout of the Touchet River core area are fluvial or resident, and therefore rely on middle portions of the basin for migrating, overwintering, extended rearing and growth to maturity (USFWS 2015c). The primary threats identified for the Touchet River core area in the 2015 Recovery Plan include Upland/Riparian Land Management, Instream Impacts, Water Quality, Connectivity Impairments, and Nonnative Fishes (USFWS 2015c, p. C-12). Similar threats exist for the Walla Walla River core area.

The CHUs within the action area are essential to the recovery of bull trout because they contain PBFs that comprise suitable spawning, rearing, foraging, migration, and over-wintering habitats and provide connectivity between multiple core areas in tributaries throughout the broader region (USFWS 2010, pp. 527 and 583).

Consultations and Conservation Efforts in the Action Area

The Service has undertaken numerous section 7 consultations pursuant to the Act within the action area in coordination with various Federal agencies. To date, none of the Federal actions that have underdone consultation were determined to jeopardize the continued existence of bull trout in the Columbia River Interim Recovery Unit or to adversely modify designated critical habitat for bull trout. Many of these federal actions included measures to help avoid or minimize potential impacts to bull trout and bull trout critical habitat. Most of these past consultation efforts also included conservation recommendations from the Service that the Federal action agencies could take to benefit bull trout and other Federal species of concern in the action area. The following discussions address several of these consultation efforts with specific bearing on this current Opinion.

In 2000, the Service consulted with the Corps and other Federal agencies on the operations of the FCRPS, which evaluated potential effects to bull trout from dam operations on the lower Snake and Columbia Rivers (USFWS 2000). In connection with the FCRPS, operations at the dams are reviewed on a regular basis and the Corps also routinely consults with the Service and National Oceanic and Atmospheric Administration (NOAA) on operational changes and other agency initiatives that affect threatened and endangered salmonids, along with other listed species Some of the general effects addressed by the FCRPS and other associated consultations in the broader region include the following: 1) fish passage barriers and entrainment; 2) modifications of stream flows and water temperature regimes; 3) dewatering of shallow water zones; 4) reduced productivity in the reservoirs; 5) gas supersaturation of waters in dam outflows; 6) management of native riparian habitats; 7) water level fluctuations associated with power peaking operations; and 8) control of non-native, invasive species.

The Service has consulted with the EPA regarding their issuance of permits associated with the NPDES. The NPDES seeks to control water pollution levels by regulating point sources that discharge pollutants into waters of the United States. In 2004, the Service issued a Biological Opinion to EPA regarding a permit issued to the Potlatch Corporation (now Clearwater Paper Corporation) within the action area. The Potlatch NPDES Permit Biological Opinion was renewed in 2011. Of greatest concern during this consultation was the potential bioaccumulation of organic compounds in the bull trout and bald eagle (*Haliaeetus leucocephalus*) resulting from the mill's discharge of industrial return waters into the Clearwater River at Lewiston, Idaho (USFWS 2004c, p. 36). The EPA has also issued NPDES permits to various municipalities in the broader region of the action area, including one to the City of Lewiston for its wastewater facility discharges into the Clearwater River. The treatment facility provides secondary treatment and disinfection of domestic and industrial wastes prior to discharging them into the river. Issuance of many NPDES permits has not undergone consultation with the Service. Nevertheless, all of the permits issued by EPA established discharge limits to protect downstream water quality.

In 2003, the Service consulted with EPA regarding proposed limits for total maximum daily loads (TMDL) of dissolved gas and dioxins in the lower Snake River (USFWS 2004c, pp. 34-35). Corps actions taken during Phase I of efforts to manage these TMDL were expected to have a positive effect on listed species under the Service's jurisdiction during voluntary spill periods. The Service anticipated further ESA consultation with the Corps prior to implementation of actions undertaken in association with any future phase(s) to specifically manage these TMDL.

Multiple aspects of bull trout recovery efforts are incorporated into (and funded through) the BPA's Fish and Wildlife Program. This program included subbasin planning efforts for the Tucannon River, Asotin Creek, Grande Ronde River, and Imnaha River. Subbasin plans for these watersheds were completed in 2004. The Service has consulted on numerous restoration projects in the Tucannon River, Asotin Creek, Grande Ronde River and Imnaha River Watersheds that result in improvements to habitat structure, complexity, and water quality for bull trout in recent years.

In 2004, the Service consulted with BPA on the Northeast Oregon Hatchery Program, Grande Ronde-Imnaha spring Chinook hatchery project in Wallowa and Union counties, Oregon (USFWS 2004d). In 2006, BPA sent the Service a supplement to the 2004 BA on the Northeast Oregon Hatchery Program, Grande Ronde-Imnaha spring Chinook hatchery project and the Service responded with a letter confirming that the modifications did not change effects determination for the original consultation (USFWS 2006).

The Service consulted with NMFS, LSRCP, and BPA on the operation and maintenance of Chinook, steelhead, and rainbow trout hatchery programs in Northeast Oregon and Southeast Washington in 2016 (USFWS 2016a). The consultation assessed the impacts of several facilities and activities in the region similar or tied to those in this consultation; including broodstock collection, water withdrawals, effluent, and maintenance operations of the Lyons Ferry Hatchery and the Cottonwood Creek facilities. Analyses of activities related to these sites indicated that their operations would not result in take of bull trout, would not jeopardize bull trout, and would not destroy or adversely modify critical habitat (USFWS 2016a, pp. 68-71, 101).

Climate Change

Consistent with Service policy, our analyses under the ESA include consideration of ongoing and projected changes in climate. The term "climate" refers to the mean and variability of different types of weather conditions over time, with 30 years being a typical period for such measurements, although shorter or longer periods also may be used (IPCC 2014a, pp. 119-120). The term "climate change" thus refers to a change in the mean or variability of one or more measures of climate (e.g., temperature or precipitation) that persists for an extended period, typically decades or longer, whether the change is due to natural variability, human activity, or both (IPCC 2014a, p. 119). Various types of changes in climate can have direct or indirect effects on species and critical habitats. These effects may be positive, neutral, or negative, and they may change over time. The nature of the effect depends on the species' life history, the magnitude and speed of climate change, and other relevant considerations, such as the effects of interactions of climate with other variables (e.g., habitat fragmentation) (IPCC 2014b, pp. 64, 67-69, 94, 299). In our analyses, we use our expert judgment to weigh relevant information, including uncertainty, in our consideration of various aspects of climate change and its effects on species and their critical habitats. We focus in particular on how climate change affects the capability of species to successfully complete their life cycles, and the capability of critical habitats to support that outcome.

The potential effects of climate change on bull trout were estimated by manipulating the elevational limits of fish distributions over a range bounding the predicted effects of warming over the next 50 plus years (Rieman *et al.* 2007). Results of these modeling efforts indicate that bull trout populations in some subbasins, particularly in the southern and central portions of the Mid-Columbia Recovery Unit (including the major tributaries neighboring the action area) are already at high risk of extirpation under the base model conditions. The predicted effects of climate change would not only be expected to increase water temperatures, but could also intensify dewatering events in important habitats for bull trout due strictly to changed weather patterns or from effects of ongoing forestry and agricultural practices. While portions of the upper-most watersheds may be somewhat insulated from climate change (e.g., minimal management activities in designated wilderness areas), the core area populations would likely become increasingly fragmented and their migratory life histories could be lost. Increased water temperatures and dewatering events would also further limit the ability of bull trout throughout the broader region to re-found previously occupied habitat, seek refuge during catastrophic events, or reach seasonal use habitats for foraging, migrating, or over-wintering. Some studies indicate that climate induced effects may alter the rate of hybridization impacts (Muhlfeld *et al.* 2014, p. 3). Many of the core areas in the action area are experiencing impacts of hybridization, further intensifying the long term effects of climate change.

Bull trout are already exposed to unsuitable water temperatures during much of the summer within the action area and many of the neighboring tributary reaches. These core populations would likely be further impacted by climate change if there are no cold water refuges remaining for them in the lower tributary reaches and mainstems of the river systems.

EFFECTS OF THE ACTION: BULL TROUT AND DESIGNATED BULL TROUT CRITICAL HABITAT

The effects of the action refers to the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline (50 CFR 402.02). Indirect effects are those that are caused by the proposed action and are later in time, but still are reasonably certain to occur.

In this section, we examine the response of bull trout to the various stressors and determine the effects these may have on individual bull trout, the core population, and the Recovery Unit. First, we examine the exposure to which bull trout will be subject. Then we assess which actions will result in only insignificant and/or discountable effects, as well as those components that may be beneficial to bull trout. Lastly, we consider both the direct and indirect effects of actions which will result in adverse effects to bull trout and/or critical habitat. Our analysis focuses on impacts from individual facilities. In most cases, the operation of individual facilities, not the specific propagation program, results in effects to bull trout or designated critical habitat.

Exposure Analysis

The actions of the LSRCP Touchet River steelhead programs occur within or adjacent to rivers that contain bull trout and within critical habitat that has been identified for bull trout in the Columbia River DPS, Touchet River and Walla Walla core areas. Other Core Areas (i.e. Grande Ronde) and shared FMO in the Snake River affected by the action were previously considered in the NE Oregon/SE Washington Hatchery Programs Opinion (USFWS 2016a, pp. 67-97). As discussed in that Opinion, bull trout and critical habitat may experience effects from disturbance, water quality and quantity impacts, broodstock collection, and juvenile releases. Therefore, detailed effects analyses for the Grande Ronde populations of bull trout are incorporated here by reference.

The facilities, release sites, and M&E actions for these programs are dispersed throughout SE Washington, but mostly contained within the Touchet River. Bull trout in the Touchet River will be exposed to activities at the adult trap, near the acclimation pond, during capture within the rotary screw trap, during spawning ground surveys, and where released steelhead overwinter and/or migrate to the ocean. The effects to bull trout in spawning/rearing habitat are minor since facilities are all located below primary bull trout spawning/rearing habitat in the action area. The only action occurring in bull trout spawning/rearing areas is steelhead spawning ground surveys during the spring months, with expected encounters with bull trout. The effects to FMO habitats will be generally localized near facility locations and extend out into FMO habitat during release of steelhead, and during trapping of adult steelhead in the Touchet River. M&E activities generally are located in FMO habitat but may overlap with spawning/rearing habitat in some areas (upper Touchet only for steelhead spawning ground surveys).

Disturbance of bull trout may occur from hatchery operation activities (adult trapping, acclimation and release of juveniles within Touchet River basin), M&E (smolt trapping, electrofishing (suspended), and spawning ground surveys), water withdrawals, discharge of effluent, and routine and non-routine maintenance actions that occur. The LSRCP Touchet River steelhead programs are not targeting bull trout for any activity, however, there is potential to adversely affect bull trout during the course of implementing the hatchery programs and their associated M&E activities.

Effects to Bull Trout in the Grande Ronde River

Effects on bull trout within the mainstem Grande Ronde River (shared FMO habitat) from activities at the Cottonwood satellite facility were fully analyzed in the NE Oregon/SE Washington Hatchery Programs Opinion (USFWS 2016a, pp. 67-97). Please refer to that assessment for a detailed description of effects. Impacts to bull trout from this action are the same as those discussed in the previous Opinion. No bull trout are known to occupy Cottonwood Cr., no bull trout have been captured at the facility from 1999-2017, and no critical habitat has been designated in the creek.

Effects to Bull Trout in the Mainstem Snake River

Effects on bull trout within the mainstem Snake River (shared FMO habitat) from activities at LFH were fully analyzed in the NE Oregon/SE Washington Hatchery Programs Opinion (USFWS 2016a, pp. 67-97). Please refer to that assessment for a detailed description of effects. Impacts to bull trout from this action are the same as those discussed in the previous Opinion. No bull trout have been captured at the facility between 1999 and 2017, the likelihood of bull trout presence is low due to the lack of suitable habitat conditions in this impounded section of the Snake River, and critical habitat is limited to FMO uses.

Effects to Bull Trout in the Touchet and Walla Walla Rivers

Effects to bull trout associated with the Walla Walla River core area resulting from program implementation and associated M&E are expected to be mostly beneficial. The Walla Walla River component of the program (summer steelhead releases) has been discontinued, there are no program facilities in the Walla Walla River, and returning fish from past releases (including the final program release in the spring of 2017) will not be monitored, thus no negative effects on bull trout are expected. Returning fish and any impacts from subsequent natural spawning events will be non-measureable over existing conditions for bull trout from a competition perspective. Positive effects are expected, at least in the short term, as a result of marine derived nutrients in steelhead entering the system. The following sections summarize effects to bull trout in the Touchet River.

Adult Collection

There is one trap location associated with the steelhead hatchery program in the Touchet River Core Area. The adult trap is located in the city of Dayton, and forms a partial barrier to upstream bull trout migration during the trapping season (Figure 1). The DAT consists of a concrete ladder associated with the hatchery water intake. An enlarged section of the ladder is designed to operate as a trap. When steelhead are sampled from the trap, they can be released into the ladder and allowed to migrate upstream, or removed and hauled to LFH for broodstock. Adult summer steelhead for the broodstock programs are trapped January through May (Table 3), but trapping for all species occurs from January through October each year (Table 3).

The DAT is located at RKM 86.5 (Figure 1). The weir/trap is located within the Touchet River population FMO habitat, below the spawning/rearing habitat. Bull trout captures at the DAT from 1999 through 2016 totaled 1,253 (range 20 – 162 per year) for an average of approximately 70 bull trout trapped per year, with 8 total mortality (0.64% for all years), or less than 1 mortality/year (Table 4). Six of the eight mortalities occurred between 1999 and 2007 prior to completion of a new fish ladder/adult trap (WDFW and LSRCP 2017, pp. 35-38). During that time, 450 bull trout were captured, so the mortality rate was 1.3%. The previous adult trap was limited in flexibility or operation under different stream flow and/or debris conditions, and would sometimes kill or injure bull trout. Since the new fish ladder/adult trap was completed in 2008, there have only been two bull trout mortalities (2 of 803 fish: 0.25% mortality), one of which occurred during the first year of new trap operations. The trap was then modified to reduce risk/injury (WDFW and LSRCP 2017, pp. 35-38). Since 2009, there has only been 1 mortality of 768 captured bull trout (0.13% mortality), with no mortalities since 2011 (WDFW and LSRCP 2017, pp. 35-38).

Table 3. Bull Trout Life Stages and Activities for the Touchet River summer steelhead programs.

Life Stage/Activity	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Activities and Bull trout Presence in FMO												
Steelhead Adult Collections												
Steelhead Water Diversion												
Steelhead Effluent												
Facility Maintenance												
Steelhead Fish Health/Disease												
Steelhead Smolt Trapping												
Adult Fluvial Migration												
Juvenile/Subadult Migration												
Activities and Bull trout Presence in Spawning/Rearing												
Steelhead Acclimation/Release												
Steelhead Spawning Surveys												
Steelhead Electrofishing (suspended)												
Adult Spawning												
Adult/Subadult Rearing												
Egg Incubation thru Fry Emergence												
Juvenile Rearing												

Red = hatchery program activities, Grey = bull trout presence.

Table 4. Number of bull trout captured, mortalities and in-year recaptures at the DAT, 1999-2016 (WDFW and LSRCP 2017 pp 37)

Year	Number Captured	Mortalities	In-Year Recaptures
1999	20	2	0
2000	31	0	9
2001	43	0	0
2002	22	1	0
2003	60	1	15
2004	87	0	17
2005	60	0	11
2006	84	2	22
2007	43	0	11
2008	35	1	1
2009	116	0	6
2010	143	1	19
2011	162	0	29
2012	70	0	9
2013	60	0	3
2014	81	0	41
2015	74	0	33
2016	62	0	2
Totals	***1,253***	***8***	***228***
Percent		***0.64%***	***18.20%***

Steelhead trapping periods in the Touchet River overlap with adult fluvial migration into the upper Touchet River and tributaries. Bull trout spawning/rearing habitat areas (North Fork, Wolf Fork, etc.) are all located above the DAT. Bull trout have been observed by WDFW snorkelers holding in the DAT pool during the summer months, where apparently some cold-water seeps may be adequate for holding. In addition, recaptures are observed nearly every year at the trap site, indicating that the area around the trap is suitable for holding during a portion of the migration period (Table 4). Over all the years, approximately 20% of the bull trout fallback after being released upstream, but re-ascend later. Occasionally, large bull trout have been captured which contain a steelhead PIT tag from the endemic stock group (i.e. the steelhead was eaten) suggesting the pool at the trap may provide forage resources for migrating bull trout (WDFW and LSRCP 2017 pp 35-38). Run timing of bull trout has varied from year to year, and is influenced by stream flow and temperature. In addition, the weir/dam hanging panels are generally removed around the middle of May each year to allow unrestricted passage over the dam (WDFW and LSRCP 2017 pp 35-38). Outside of adult collection timeframes, free passage through the fishway is possible in both the upstream and downstream directions. Although ladder flows do not meet NMFS's current compliance criterion, flow is maintained in the fishway irrespective of usage of the intake for the acclimation pond, and passage issues for bull trout have not been observed (see below).

Trapping at DAT results in capture and handling of up to 162 bull trout annually during operations. As threats to bull trout are addressed in the basin and bull trout populations improve, it is expected that as many as 200 bull trout may be handled annually at the DAT during operations. Since methods of handling are not completely free of risk, the Service expects as many as two bull trout each year may be injured or die as a result of these activities at the DAT.

Water Diversion

The water diversion intake structure for DAP is located at the DAT. Surface water is diverted from the Touchet River and piped into the acclimation facility (~1/4 mile downstream), and then returned to the Touchet River after a single use through the pond. The DAP is operated from February through April, with a maximum water withdrawal of 6.0 cfs. Percent water diverted from the Touchet River during the facility operations ranges from approximately 0.3% to 5.5% of the total stream flow as measured at Bolles Bridge (about 15 miles downstream of the intake structure)(Table 5).

Table 5. Mean Monthly Water Diversion Use at the DAP in the Touchet Rivera .

Month	Max Intake (CFS)	Min River (CFS)	Mean River (CFS)	Max River (CFS)	Max % Diverted	Mean % Diverted	Min % Diverted
February	6.0	114	419	1,550	5.3%	1.4%	0.4%
March	6.0	125	599	2,240	4.8%	1.0%	0.3%
April	6.0	110	334	689	5.5%	1.8%	0.9%

a. Flow for Touchet River measured below the facility at Bolles Bridge, about 15 miles below the intake, 2014-2016.

Hatchery surface water diversion screens were identified as a factor for decline in the draft 2002 Bull Trout Recovery Plan, less so in the 2015 Recovery Plan. The DAP intake screens now meet current NOAA Fisheries screening guidelines. The screens were brought into compliance when the fish ladder/adult trap/intake was rebuilt in the 2007/2008. Water diversion for DAP is located below spawning/rearing habitat for bull trout, the diversion has a properly screened intake, diverts less than 5.5% of river into the facility during any month of operation, is maintained on an annual basis, and allows upstream passage of bull trout through the diverted reach all year. Passage is provided by the fishway, which is operational the whole year, irrespective of diversion timeframes associated with the acclimation pond intake. The hatchery reduces flows in the diverted section (approximately 0.25 miles) for bull trout. Reduced flow may lead to elevated water temperatures in the diversion reach and result in short term or seasonal reductions in passage and habitat availability. Withdrawals are less than 10 percent of the total water volume and meet NOAA screening criteria. Bull trout potentially present during water withdrawals are not anticipated to experience effects noticeable above background conditions. The timing of withdrawals in spring between February and April will also limit potential exposure to elevated temperatures and movement delays. Therefore, while migrating bull trout may be present between the intake and outflows during water withdrawals, the impacts to bull trout are anticipated to be insignificant or immeasurable over background conditions.

Effluent/Fish Health

Average monthly discharge from DAP is 6.0 cfs. Total discharge volume to river flow ranges from 0.3% to 5.5% (Table 5). The low volume of discharge and low percent of discharge to river volume at the outflow should minimize potential impacts to the area immediately below the outflow. Effluent (discharges of organics) from DAP, which is located below spawning/rearing habitat, meets federal and state water quality standards (NPDES), makes up less than 5.5% (maximum) of the total river volume below the outfall during any month of operation, but does increase organic loading (fecal material and undigested fish food) into the river below the outfall. Effluent discharge has the potential to change or impact forage base, water quality parameters, and fish health at or near the discharge site.

Fish health monitoring and testing will be conducted in accordance with IHOT, PNFHPC, AFS, and OIE protocols and standards to limit the introduction of disease from hatchery fish to natural bull trout populations. Little scientific literature regarding bull trout disease susceptibility is available. Bull trout are relatively resistant to Bacterial Kidney Disease (BKD). Hatchery salmon sometimes have BKD cases, though occurrences have been greatly reduced in recent years. Hatchery summer steelhead sometimes have Bacterial Cold Water (BCW) disease (fairly common on an annual basis), and are also susceptible to the IHNV (less common now due to disinfection practices that have been instituted). There is evidence that bull trout are sensitive to IHNV, but little is known about their susceptibility to BCW. The IHNV is widely distributed in Pacific Northwest waters and wild fishes. The hatchery programs control or prevent the spread of the IHNV through the use of egg disinfection and careful management of water supplies for young fish. Bull trout are susceptible to whirling disease, but USFWS Region 1 hatcheries have had no detected cases of whirling disease in salmon; therefore, transmission would be unlikely.

While the potential for disease transmission to bull trout exists, releases of juveniles from both steelhead programs in the Touchet River occur below primary spawning/rearing habitat and current fish health management practices are expected to reduce the potential for new or increased transmission to bull trout beyond normal rates occurring within the Touchet River populations. Fish health and disease management at DAP comply with state, federal, and PNFHPC standards and protocols designed to manage disease within the culture system and to ensure protection of the natural fish populations. However, because the full extent of horizontal pathogen and disease transmittal is unknown, adverse effects to bull trout are expected.

Flows, velocities, and other factors at the discharge site influence the distance in which effluent may affect habitat. With the implementation of NPDES permit requirements and conservation measures, it is expected that the effects of effluent will not extend more than 100 feet from the discharge site. Therefore, due to known presence of migrating bull trout, exposure to effluent is anticipated, but given implemented conservation measures, small distance impacted, and location below known spawning and rearing areas, and ability of migrating bull trout to move away from the effluent, the effects are expected to not be measureable over background conditions and will be insignificant to adult bull trout in the area.

Facility operations and maintenance

Facility operations and routine maintenance at DAT/DAP include rearing of juvenile steelhead, adult steelhead trapping, off-station M&E, and routine maintenance activities that occur above the OHWM. Operations and maintenance activities include Conservation Measures to reduce the potential to affect bull trout in the Touchet River, and therefore are not expected to significantly impact normal behaviors of or habitat of bull trout. However, maintenance activities implemented below the OHWM have the potential to impact bull trout or their habitat.

Routine maintenance activities that occur below the OHWM (with a frequency of up to twice annually) have the potential to cause short-term adverse effects to bull trout individuals. These actions occur below the OHWM where bull trout may be residing and the specific timing of such activities is unpredictable. Examples of maintenance include instream work such as clearing gravel blockages from water intakes, outfalls, or traps after larger flow events, replacement of failed equipment, or weir or ladder maintenance. These instream activities are likely to cause short-term adverse habitat effects associated with increases in sediment, turbidity, and stream bank erosion. Potential indirect effects to bull trout include behavioral changes resulting from elevated turbidity (Sigler *et al.* 1984; Berg and Northcote 1985; Whitman *et al.* 1982; and Gregory and Levings 1998) during instream work. Water turbidity, resulting from elevated levels of total suspended solids (TSS) has been reported to cause physiological stress, reduce growth, and adversely affect survival. Of key importance in considering the detrimental effects of TSS on fish are the frequency and the duration of the exposure, not just the TSS concentration. Chronic exposure can cause physiological stress responses that can increase maintenance energy and reduce feeding and growth (Redding *et al.* 1987; Lloyd 1987; Servizi and Martens 1991). The elevated TSS levels resulting from this project should be limited primarily to the period of semi-routine maintenance activities that increase turbidity and thus should be short-term in nature. Increased sedimentation can lead to increased embeddedness of spawning substrates; however, spawning/rearing areas are not present near the DAT or DAP facilities. The proposed timing of instream work during low flow periods should help minimize sediment transport and impacts to bull trout and their habitat.

Non-Routine Maintenance activities are actions that occur below the OHWM and do not ordinarily occur on an annual basis such as bank armoring or new structure construction. These non-routine actions may result in impacts to bull trout within the Touchet River via disturbance from in- or near-water activities, or decreases in water quality due to increases in suspended sediment. Therefore, these activities are likely to significantly affect bull trout in the Touchet River core area and will require a separate consultation in the future.

The DAT and Water Intake structure occasionally requires minor maintenance inside the structure (usually following high flow events) to remove small rock/gravel that accumulate in front of the intake screens, or in the fish ladder. Any material (small rock/gravel) is removed by hand and returned to the Touchet River below the structure. Bank stabilization structures (riprap) are located above and below the structure for protection of the facility.

The DAP is located within the city of Dayton, at the WDFW Snake River Lab Monitoring and Research Office (Figure 4). This pond is a man-made concrete structure with a volume of 348,000 ft^3, and is supplied with a maximum of six cfs (ft^3/sec) Touchet River water. It is an off channel impoundment adjacent to the Touchet River. The only area of concern below the OHW area is at the lake discharge location back into the Touchet River. The estimated maximum amount of sediment material to be removed from the bottom of the pond is 600 cubic yards. The pond is drained prior to any maintenance. Dam boards are installed at the outlet structure to eliminate excessive sediment from re-entering state waters. Sediment material in the lake is piled up with the use of a bulldozer, pushed towards the lake edges, excavated, and removed off site.

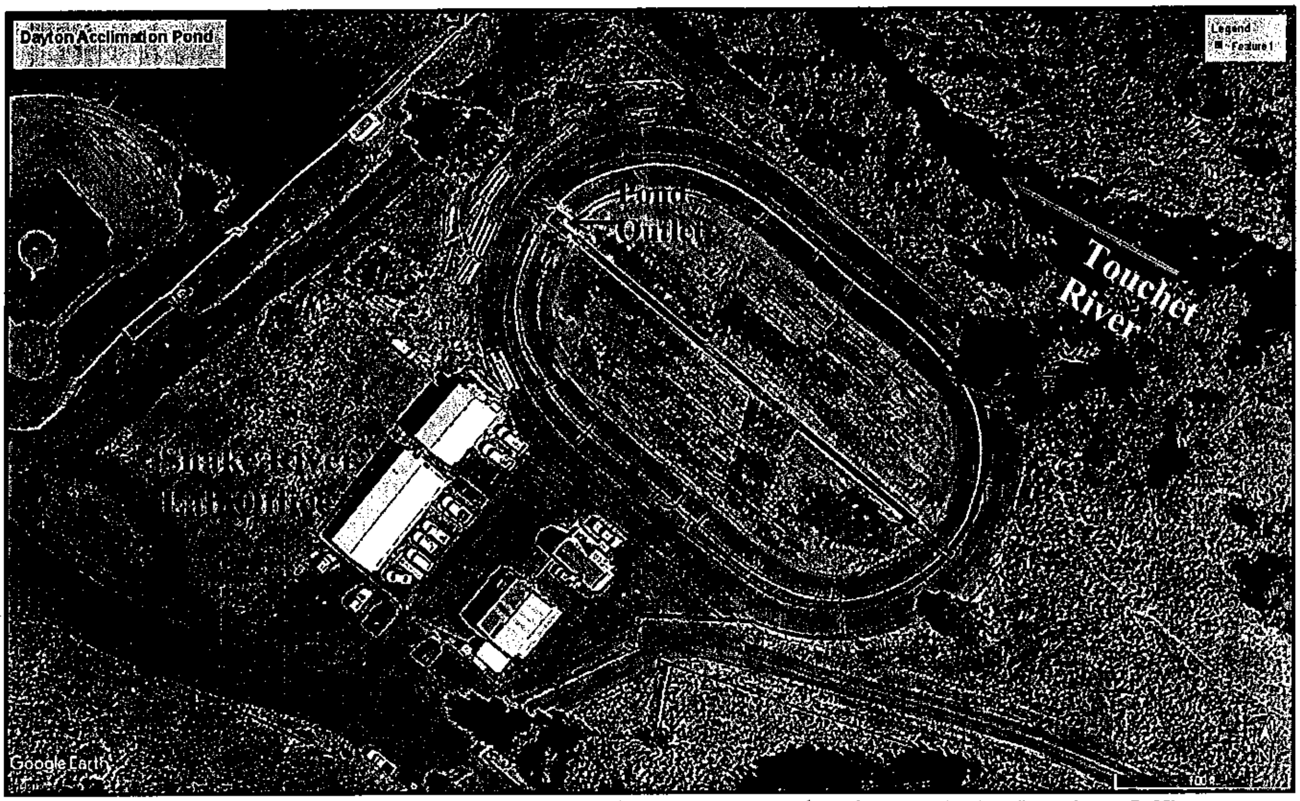

Figure 4. View of DAP and WDFW Snake River Lab Monitoring and Evaluation Office. The outlet to the river is just out of view in the top of the photo.

There is also the potential for fuel or other contaminant spills associated with use of motorized equipment in or near the stream during any maintenance activities. Operation of back-hoes, excavators, and other motorized equipment requires the use of fuel, lubricants, and other substances which, if spilled into the channel of a waterbody or into the adjacent riparian zone, can injure or kill aquatic organisms. Petroleum-based contaminants (such as fuel, oil, and some hydraulic fluids) contain polycyclic aromatic hydrocarbons, which can be acutely toxic to salmonids at high levels of exposure and can also cause mortality and have acute and chronic sub-lethal effects on aquatic organisms (Neff 1985). Instream work, if conducted with motorized equipment, will elevate the risk for chemical contamination of the aquatic environment within the action area. However, given the proposed conservation measures which should reduce the risk of a contaminant spill, and the localized and short-duration of the activities, the probability of direct injury or mortality from chemical contamination is low.

Because routine and non-routine maintenance activities will be conducted during times when bull trout may be present and would result in temporary disturbance, modifications to substrate, elevated in-water noise, disruption of forage species, and other impacts typical of in-water work, it is expected that adverse effects to normal behaviors are expected. Short-term adverse effects to bull trout near the facilities during semi-routine maintenance could occur. In a worst-case scenario, the Service assumes that as many as 50 individuals (adults and sub-adults) could be in an area during maintenance activities. All 50 could experience some level of short-term behavioral impacts such as avoidance, delayed movement, disruption of foraging, or handling during salvage. Of that number, it is expected few effects will result in injury or mortality. Therefore, the Service expects up to one bull trout adult or sub-adult may be injured or killed per in-water routine or non-routine maintenance event.

Acclimation and Release

The production goal for Touchet River summer steelhead is 100,000 Wallowa stock individuals and 50,000 Touchet Stock individuals. Both groups are transferred from LFH to DAP during the spring (Wallowa stock in February, Touchet Stock in late March/early April). Volitional release for both groups occurs during the month of April. Existing release protocols for steelhead are designed to promote rapid emigration from release sites downstream to the ocean and release sites occur downstream of spawning/rearing habitat for bull trout in the Touchet River. Release of Wallowa or Touchet stock steelhead may negatively impact bull trout in the Touchet River via residualization (staying in river) and temporary competitive interactions (including predation of bull trout juveniles). Beneficial effects are also expected due to the increased availability of steelhead for bull trout prey and increased primary productivity from marine derived nutrients deposited within the basin resulting from increased adult steelhead abundance. Juvenile hatchery and natural origin steelhead may compete for food and space with naturally rearing bull trout of the same size. WDFW has observed larger sized bull trout preying on recently released smolts in the Touchet River in the past (based on PIT Tags). While some interaction through competition or predation may harm some bull trout individuals, these impacts are not expected to be measurable over natural river conditions. In many situations, the release of smolts may provide additional food resources. Therefore, the effects from this activity would be insignificant, or beneficial to the bull trout.

Monitoring and Evaluation

WDFW annually conducts spawning ground surveys in steelhead spawning habitat from March through May in the upper Touchet River (North, South, Wolf and Robinson forks). Surveys are conducted in index sections (subsets of the total stream), and generally represent only about 25% of the total stream length. Surveyors walk the stream sections to enumerate steelhead redds and sample carcasses if possible. Steelhead spawning ground surveys may result in disturbance of migratory or rearing bull trout in the area, however the effects to bull trout are expected to be of short duration and are limited to disturbance. Since steelhead spawning grounds are downstream of bull trout spawning areas, impacts to bull trout redds and juveniles are not anticipated. Disturbance of foraging adults and subadults could be expected, and feeding and sheltering may be impaired. The exact number of individuals impacted is difficult to quantify; however, the Service does not expect the number of individuals impacted to be greater than that impacted by electrofishing surveys in previous years. For the time period of 2000 through 2005, WDFW captured/observed a total of 199 (range 5 – 87 per year) bull trout during surveys (average of 33 per year), with 2 reported mortalities for the entire time period (1.0%), or less than 1 mortality per year. No mortalities of bull trout would be expected from spawning ground surveys without electrofishing.

Electrofishing surveys have been terminated in recent years in the Touchet River because of concerns about the degree of bias in the steelhead estimates that result. However, these surveys may be initiated again if methods to reduce bias are found or a specific need for the juvenile data is described. Electrofishing surveys may occur from July through August, and are usually conducted to monitor distribution and abundance of natural-origin steelhead. Electrofishing protocols currently in place reduce exposure, capture time, and handling of bull trout, however, based on past efforts, adverse effects to bull trout are expected if electrofish activities resume. Based on previous discussion, we believe up to 90 bull trout may be handled per year during electrofishing, and a small number may be injured or killed.

A rotary screw trap has been used at several locations (Gallinat et al. 2016) to trap out-migrating steelhead (natural and hatchery-origin) in the Touchet River since the 2007/08 migration year. Juvenile trapping enables WDFW to determine critical habitat, abundance, migration patterns, survival, and alternate life history strategies for steelhead within the basin. During juvenile trapping operations on the Touchet River, bull trout are sometimes trapped, handled/sampled and released. During the seven year trapping period from 2007/08 through 2013/14, when the trap was located at either Dayton, or in Waitsburg, the trap captured 469 bull trout (range 30-98 per year) with zero reported mortality (0.0%). In 2015, the smolt trap was moved to the lower Touchet River near Harvey Shaw Road in an attempt to capture the entire possible range of steelhead migration. Since that time (2015 and 2016 trapping), only two bull trout have been captured, with zero mortalities. The lower bull trout captures indicates that the trap was moved below the typical downstream redistribution point of bull trout following spawning, or their typical over-wintering locations. Protocols employed at the traps minimize trap time, handling, and stress on bull trout prior to release back into the Touchet River. Currently, steelhead emigrant trapping results in capture and handling (0.00% mortality documented) of <1 bull trout captured annually during operations.

Given the above information, combined steelhead monitoring and evaluation activities in the Touchet River may impact up to 200 adult and/or subadult bull trout each year. This number is based on less than 10 bull trout captured during smolt trapping, approximately 100 bull trout disturbed during spawning ground surveys, and up to 90 bull trout handled during electrofishing surveys. Over time as populations fluctuate, this number may be slightly higher or lower in a given year. Therefore, it is anticipated that in any 5-year period, no more than 1,000 adult and subadult bull trout may be disturbed, captured or handled during steelhead monitoring and evaluation activities. Mortality of bull trout as a result of these activities is expected to be very small. No more than 10 bull trout will be killed over a 5 year period during or as a result of steelhead monitoring and evaluation activities.

Effects to Critical Habitat

Effects to Critical Habitat in Grande Ronde River

Effects on bull trout critical habitat within the mainstem Grande Ronde River (shared FMO habitat) from activities at the Cottonwood satellite facility were fully analyzed in the NE Oregon/SE Washington Hatchery Programs Opinion (USFWS 2016a pp 94). Please refer to that assessment for a detailed description of effects. Impacts to critical habitat from this action are the same as those discussed in the previous Opinion. No bull trout are known to occupy Cottonwood Cr., no bull trout have been captured at that facility from 1999 to 2017 and no critical habitat is designated in the creek.

Effects to Critical Habitat in Mainstem Snake River

Effects on bull trout critical habitat from steelhead hatchery programs within the mainstem Snake River (shared FMO habitat) from activities at LFH were fully analyzed in the NE Oregon/SE Washington Hatchery Programs Opinion (USFWS 2016 pp 94). Impacts to critical habitat from this action are the same as those discussed in the previous Opinion. No bull trout have been captured at the facility between 1999 and 2017, the likelihood of bull trout presence is low due to the lack of suitable habitat conditions in this impounded section of the Snake River, and critical habitat is limited to FMO uses.

Effects to Critical Habitat in Touchet and Walla Walla Rivers

Effects to bull trout associated with the Walla Walla River core area resulting from program implementation and associated Research Monitoring and Evaluation (RM&E) are expected to be mostly beneficial. The Walla Walla River component of the program has been discontinued, there are no program facilities in the Walla Walla River, and returning fish from past releases (including the final program release in the spring of 2017) will not be monitored, thus no negative effects to critical habitat are expected. Returning fish and any impacts from subsequent natural spawning events will be non-measureable over existing conditions for bull trout from a competition perspective. Positive effects are expected, at least in the short term, as a result of marine derived nutrients entering the system through returning steelhead. The following sections summarize effects to bull trout in the Touchet River.

Adult Collections

Adult collections at DAT for steelhead have the potential to significantly affect PBF 2 (migration habitat) for bull trout. Operation of the DAT to collect steelhead from January through July results in many of the bull trout migrating up the Touchet River past the site entering the adult trap where they are handled/sampled and passed upstream above DAT. This operation time frame overlaps with the bull trout fluvial migration period (mid-April through July) in the Touchet River. Migration is delayed during operational months as bull trout are handled and processed through the trap. During non-operational periods, bull trout may pass upstream with limited or no delay. Bull trout have been observed by WDFW snorkelers holding in the DAT pool during the summer months, where cold-water seeps can be found to provide refugia. In addition, recaptures are observed nearly every year at the trap site, indicating that the area around the trap is suitable for holding during a portion of the migration period. Protocols in place at the adult collection facility are expected to maintain current criteria to minimize potential impacts (limited holding time and stress) to bull trout and allow continued passage above the existing adult trap/water diversion.

Adult collections at DAT for steelhead are not expected to affect the remaining PBFs (1, 3, 4, 5, 6, 7, 8, 9) identified for bull trout.

Water Diversions

Water diversion for the DAT and DAP may impact PBFs 2 (migration habitat), 7 (flows), and 8 (water quality and quantity), although the percentage of water diverted (0.3%-5.5%) is not large relative to the flows in the river. Both facilities are located below spawning/rearing habitat for bull trout and the small percentage of river flows diverted is expected to have a minor effect to water quantity and quality for bull trout. Water diversions are screened to meet the latest NOAA/USFWS screening criteria and divert a small portion of the Touchet River in a reach of approximately 0.25 miles. The timing of withdrawals in spring between February and April will also limit potential exposure to elevated temperatures and movement delays. Given the insignificant percentage of water diverted (<10% of the total flow) and the short-term impacts, these affects are not expected to reduce the function of critical habitat over the long term.

Water diversions at DAP and DAT are not expected to affect the remaining PBFs (1, 3, 4, 5, 6, 9) identified for bull trout.

Effluent

Discharge of effluent into the Touchet River below DAP into the Touchet River may affect PBF 8 (water quality and quantity) in the Touchet River. Discharge of organic pollutants at DAP comply with federal and state water quality standards and guidelines (NPDES Standards). Average discharge during operations from DAP is 6.0 cfs (0.3-5.5% of stream flow). The facilities will continue to follow NPDES and IHOT criteria, monitor effluent, and make any modifications required to meet standards if modified to meet ESA concerns to listed species. It is unlikely that discharges will significantly impair the function of critical habitat within these areas, while NPDES regulations are in place.

There is little evidence to suggest that diseases are routinely transmitted from hatchery to natural fish. Fish health monitoring and disease management procedures diminish the likelihood that natural populations would be affected by hatchery-origin fish diseases. Established disease management policies and protocols including the IHOT policies, PNFHPC fish health model program, and state, federal, and Tribal policies are expected to reduce potential effects to bull trout. Existing protocols employed to minimize potential effects to bull trout during fish health management and facility locations below spawning/rearing habitat are expected to minimize impacts. However, because the full extent of horizontal pathogen and disease transmittal is unknown, adverse effects to bull trout critical habitat are expected.

Effluent from DAP is not expected to affect the remaining PBFs (1, 2, 3, 4, 5, 6, 7, 9) identified for bull trout.

Facility Operation and Maintenance

Routine operation and maintenance above the OHWM at the facilities (DAP or DAT) will be conducted implementing Conservation Measures to reduce potential impacts to bull trout critical habitat in the Touchet River. Due to work above the OHWM and protocols used to minimize potential effects to bull trout during routine operation and maintenance, these activities are expected to result in insignificant effects on PBFs (1, 2, 3, 4, 5, 6, 7, 8, 9) identified for bull trout.

Non-routine and semi-routine maintenance actions occur below the OHWM and in the short-term are likely to adversely affect PBF 2, (minimal barriers to migration), PBF 3 (Prey base), PBF 4 (complex river channels), PBF 6 (minimal fine sediment in spawning/recovery areas), and PBF 8 (water quality and quantity). To minimize adverse effects to critical habitat, these types of actions will occur infrequently; will occur in areas that have previously been modified when the facilities were constructed; will be conducted during the established instream work windows; and will employ the appropriate Conservation Measures.

Non-routine maintenance actions at the DAT and/or the water intake structure for DAP are not expected to affect the remaining PBFs (1, 5, 7, and 9) identified for bull trout.

Acclimation and Release

Release of steelhead in the Touchet River is expected to benefit forage base (PBF 3) of designated critical habitat by increasing the availability of prey in all action area watersheds. Additional beneficial effects (PBF 3, food base) include increased primary productivity from marine derived nutrients deposited within the basin due to increased adult Steelhead abundance.

Existing release protocols, designed to promote rapid emigration from release sites downstream to the ocean should reduce any potential negative impacts to PBFs 2(migration), 3(food base), and 9(non-native species). This activity would not affect PBF's 1, 4, 5, 6, 7, and 8.

Monitoring and Evaluation

Spawning ground surveys in the Touchet River, operation of an outmigrant trap, and summer sampling programs (including the currently suspended electrofishing efforts) may affect bull trout critical habitat in the Touchet River. Impacts to migration habitats (PBF 2) and spawning areas (PBF 6) occur during spawning ground surveys. Bull trout migrations may be temporarily blocked during operation of smolt traps and spawning substrates temporarily disturbed or crushed during spawning ground surveys. These impacts are anticipated to be short-term during surveys and not permanently modify or degrade critical habitat for bull trout. Protocols employed during M&E are designed to; minimize trap time, handling, and disturbance within critical habitat. In addition, surveys conducted within the Touchet River are typically downstream of spawning areas for bull trout, further limiting significant impacts to spawning grounds (PBF 6) of critical habitat.

M&E activities for spring/summer steelhead are not expected to affect the remaining PBFs (1, 3, 4, 5, 6, 7, 8, 9) identified for bull trout.

CUMULATIVE EFFECTS: BULL TROUT AND DESIGNATED BULL TROUT CRITICAL HABITAT

Cumulative effects 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.

Current on-going, non-Federal actions are expected to continue to affect bull trout in the action area at similar levels of intensity. Ongoing activities anticipated to continue into the future include timber harvest, livestock grazing, agricultural production, and residential development. Water withdrawals for agricultural use will also continue. Tribal treaty and sport fishing in the Walla Walla/Touchet River basins will continue in the future in accordance with their applicable fishery management plans. Many State, Tribal, and local governmental actions are likely to be in the form of legislation, administrative rules, or policy initiatives. Many non-governmental or private actions may include changes in land and water use patterns, including ownership and management intensity, any of which could affect listed species or their habitat. Even actions that are already authorized are often subject to subsequent political, legislative, and fiscal uncertainties.

State and local governments are likely to be faced with pressures from future population growth and other demographic factors. Growth in local businesses could increase demands for buildable land, infrastructure, water, electricity, and waste disposal. Such population trends will place greater overall and localized demands on the resources within the action area that could affect water quality directly and indirectly, and increase the need for transportation and communication infrastructure. The effects of private actions are the most uncertain. Private landowners may convert their lands from current uses, or they may intensify, discontinue, or otherwise alter those uses in the future.

Potential impacts to the aquatic environments within the broader region that may contribute specifically to cumulative effects, especially within the neighboring major tributaries, include water flow fluctuations, degraded water quality, migration barriers, habitat degradation, resource competition, and introduction of non-native invasive species. Because the action area primarily encompasses aquatic environments, water quality and availability are primary concerns when evaluating potential effects to listed species. Agricultural practices associated with irrigation also have the potential to adversely affect aquatic environments. Water withdrawals and runoff of irrigation water containing residual constituents of pesticides and fertilizers can contribute excessive nutrients, elevated levels of chemicals, and substantial amounts of sediment to natural waterways further degrading the water quality and quantity within the river systems throughout the broader region. Likewise, urban and rural land uses for residential, commercial, industrial, and recreational activities, such as boating and golf courses, often require water withdrawals and can further contribute pollutants and sediments to surface waters. Elevated levels of contaminants in the waterways can adversely affect aquatic species through direct lethal or sub-lethal toxicity, through indirect effects on their food supply, or through interactions with other compounds present in the water.

Ongoing actions that contribute to beneficial effects on fisheries resources include those actions aimed at protecting, enhancing or restoring aquatic and riparian habitat in the basins. Activities carried out by State, tribal, and local governments under the various salmonid recovery planning efforts will continue in the future throughout the listed species' range, including the action area. In Washington, the Salmon Recovery Funding Board will continue to provide grants to local organizations in watersheds to restore and protect salmon/steelhead habitat and the state's salmon recovery plans will continue to provide a recovery framework for various fish populations in the action area. Such future tribal, state, and local government actions adhering to the plans will likely to be implemented through legislation, administrative rules, policy initiatives, or permitting. Government and private actions may include changes in land and water uses, including ownership and intensity, and habitat improvements any of which could impact listed species or their habitat. Watershed assessments and other educational programs may further reduce the adverse effects associated with land uses in the action area by continuing to raise public awareness about the potentially detrimental effects of agriculture, residential development, and recreation on salmonid habitats and by presenting ways in which a growing human population and healthy fish populations can co-exist.

There are a number of other State and private interest approaches that have generally helped to address potential impacts to bull trout from urban development within the broader region encompassing the action area. These approaches include initiatives under Critical Areas Ordinances and measures associated with the State's Shoreline Management Act (SMA). All cities and counties in Washington are required to adopt Critical Areas Ordinances under the State's Growth Management Act. Among other concerns, the ordinances address important fish and wildlife habitats, including wetlands, rivers, streams, lakes, and marine shorelines. No regulated activity can be undertaken in a critical area or protection zone without a Critical Areas Permit, which are designed to give additional protections to fish and aquatic habitats over existing conditions. The SMA seeks to prevent harm to identified resources due to haphazard development of State shorelines. The responsibilities of local governments under the SMA, with support and oversight provided by the Washington Department of Ecology, include: 1) administering a shoreline permit system for proposed substantial development; 2) conducting and compiling a shoreline inventory; and 3) developing a Shoreline Master Program for regulating the State's shorelines.

Considering the available information, cumulative effects within the action area that could potentially impact bull trout or critical habitat for bull trout are likely to increase in the future.

INTEGRATION AND SYNTHESIS OF EFFECTS: BULL TROUT AND DESIGNATED BULL TROUT CRITICAL HABITAT

The action area provides FMO and spawning/rearing habitat for bull trout from multiple local populations and core areas throughout the Mid-Columbia Recovery Unit. The habitat is important for maintaining diversity of life history and for providing access to productive foraging and spawning areas. Some of the proposed action occurs in the Grande Ronde and Snake River watersheds, and were considered in NE Oregon/SE Washington Hatchery Opinion (USFWS 2016a). The effects in this action are the same as those in the previous action, therefore the majority of the discussion in this opinion focuses on the effects to bull trout in the Touchet and Walla Walla River basins. Many bull trout of the Touchet River core area are fluvial or resident, and therefore rely on middle portions of the basin for migrating, overwintering, extended rearing and growth to maturity (USFWS 2015b, pp. 308-309).

The proposed action continues operation and maintenance of steelhead hatchery programs throughout the Touchet and Walla Walla River basins. Structural elements will be operated and maintained that reduce free flowing passage of bull trout and include handling of bull trout resulting in direct effects. Since methods of handling are never free from risk, mortality of some bull trout is expected. During trapping at and operation of the DAT, as many as 200 bull trout from the Touchet River may be handled each year, with a small proportion of those resulting in death. In addition, habitat impacts from reduced flows, effluent from the acclimation pond, maintenance activities, and steelhead monitoring and evaluation studies will result in significant impacts to bull trout behaviors in the Touchet and Walla Walla River basins. Most activities will result in few to no physical injuries or mortality to individuals.

In addition, maintenance activities at the hatchery facilities will result in changes to water quality that further may temporarily impact bull trout individuals. With implementation of the proposed conservation measures, the Service expects that only low numbers of subadult and adult bull trout will be exposed to turbidity from short-term maintenance activities, and those effects would be short-term.

The Service expects that the proposed action will have no measurable effect on the relative sizes of the fluvial and resident individuals contributing to the core area's local populations. The action will result in migration delays, and have a minor effect on distribution at the scale of the local populations in the Touchet River core area. However, no measureable impacts to the Walla Walla Core Area bull trout populations are expected from activities occurring within that basin. The anticipated direct and indirect effects of the action, combined with the effects of interrelated and interdependent actions, and the cumulative effects 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 reproduction, numbers, or distribution at the scale of the Touchet River core area or the Mid-Columbia Recovery Unit. As stated in the NE Oregon/SE Washington Hatchery Opinion, activities with the Grande Ronde and Snake River basins are the same as considered in this action, and are also not expected to appreciably reduce the ability for bull trout recovery (USFWS 2016a, p. 99). Totaled together impacts in the Grande Ronde, Snake River, Touchet, and Walla Walla Basins will not alter the status of bull trout at the scale of the coterminous range.

Activities associated with the proposed action, are expected to minimize the extent and duration of habitat effects, such that it is unlikely that the function or conservation role of the critical habitat will be adversely affected in the long-term by the proposed activity. PBF 3 will have a beneficial effect from project activities (release of steelhead and chinook prey base). PBF 1 and 9 will be affected by project activities but these effects will be insignificant. PBFs 2, 4, 5, 6, 7, and 8 will be adversely affected in the short-term. Any adverse impacts to PBFs 2, 4, 5, 6, 7, and 8 will not permanently alter or destroy the quality or function of bull trout critical habitat in the action 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 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 Touchet River core area, Mid-Columbia Management Unit, and coterminous range.

CONCLUSION: BULL TROUT OR DESIGNATED BULL TROUT CRITICAL HABITAT

After reviewing the current status of bull trout and bull trout critical habitat, the environmental baseline for the action area, the effects of the proposed action and the cumulative effects, it is the Service's Biological Opinion that the action, as proposed, is not likely to jeopardize the continued existence of the bull trout, and is not likely to destroy or adversely modify designated critical habitat.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special 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* is defined by the Service as an act which actually kills or injures wildlife. Such an act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavior patterns, including breeding, feeding, or sheltering (50 CFR 17.3). *Harass* is defined by the Service as an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering (50 CFR 17.3). Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by the LSRCP so that they become binding conditions of any grant or permit issued to the WDFW, as appropriate, for the exemption in section 7(o)(2) to apply. The LSRCP has a continuing duty to regulate the activity covered by this Incidental Take Statement. If the LSRCP 1) fails to assume and implement the terms and conditions or 2) fails to require the WDFW to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the LSRCP or WDFW must report the progress of the action and its impact on the species to the Service as specified in this Incidental Take Statement [50 CFR 402.14(i)(3)].

AMOUNT OR EXTENT OF TAKE

The Service anticipates bull trout will be taken as a result of this proposed action. The incidental take is expected to be in the form of harm, harass, or kill.

The following incidental take is anticipated due to the proposed action:

1. Incidental take of bull trout in the form of ***harm*** (physical injury or mortality) and ***harassment*** (significant disruption of normal behaviors that creates a likelihood of injury) resulting from handling during operation of the adult trap.
    - Two adult and/or subadult bull trout will be harmed as a result of trap operation, fish handling, tagging (if necessary) and release operations conducted annually.
    - Two hundred adult and/or subadult bull trout will be harassed as a result of trap operation, fish handling, tagging (if necessary) and release operations conducted annually.
2. Incidental take of bull trout in the form of ***harm*** (physical injury or mortality) and ***harassment*** (significant disruption of normal behaviors that creates a likelihood of injury) resulting from maintenance activities in and around the DAT and DAP (including from salvage and handling).
    - One adult and/or subadult bull trout will be harmed as a result of maintenance activities conducted up to twice annually.
    - Fifty adult and/or subadult bull trout will be harassed as a result of maintenance activities conducted up to twice annually.
3. Incidental take of bull trout in the form of ***harm*** (physical injury or mortality) and ***harassment*** (significant disruption of normal behaviors, captured, or handled that creates a likelihood of injury) resulting from annual monitoring and evaluation activities, including on average: steelhead spawning ground surveys (100 bull trout); smolt trapping (10) bull trout; and potential future electrofishing activities (90 bull trout per year).
    - In any 5-year period, no more than 1,000 adult and subadult bull trout may be harassed during steelhead monitoring and evaluation activities in the Touchet River.
    - No more than 10 bull trout will be harmed over a 5 year period during or as a result of steelhead monitoring and evaluation activities in the Touchet River.

The Service expects that incidental take of bull trout will be difficult to detect or quantify for the following reasons: 1) the low likelihood of finding dead or injured adults or sub-adults; 2) delayed mortality; and, 3) losses may be masked by seasonal fluctuations in numbers.

EFFECT OF THE TAKE

In the accompanying Opinion, the Service determined that this level of anticipated take is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat.

REASONABLE AND PRUDENT MEASURES

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize impacts of incidental take of bull trout:

1. Minimize the impacts to bull trout from adult/brood-stock collection.

2. Minimize the potential for incidental take from construction activities in or near the river during semi-routine maintenance.

3. Minimize the potential for incidental take from in-water disturbance of bull trout during monitoring and evaluation activities.

4. Report incidental take of bull trout through annual reporting of project activities.

TERMS AND CONDITIONS

In order to be exempt from the prohibitions of section 9 of the Act, the LSRCP must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

1. The following terms and conditions are necessary for the implementation of Reasonable and Prudent Measures (RPM) 1:
   a. Captured bull trout shall be released as soon as possible and time spent in the trap box or other holding facility shall not exceed 48 hours at any time.
   b. LSRCP and/or WDFW shall notify the Eastern Washington Field Office as soon as possible when they find evidence, or are told about evidence, of bull trout mortality or passage difficulties at the DAT.
2. The following terms and conditions are necessary for the implementation of RPM 2:
   a. All work within the active channel will be completed within the WDFW approved in-water work window. Any adjustments to the in-water work period will first be approved by, and coordinated with the Service, and WDFW.
3. The following terms and conditions are necessary for the implementation of RPM 3:
   a. Purposeful take of bull trout which are actively spawning or are near bull trout spawning sites is prohibited. Incidental take of spawning bull trout or redds shall be reduced by minimizing RM&E activities in known spawning habitat and in critical habitat designated for spawning/rearing uses during critical time frames. Redd sites (both "pit" and "mound") shall not be physically disturbed during instream activities. Because some bull trout redds may be small and difficult to see, take precautions to avoid stepping in areas that may be potential redd locations for bull trout (i.e. small gravel deposits behind boulders; under overhanging vegetation; near woody debris or logs; or areas of hydraulic influence such as confluences of tributaries, springs, seeps, pool tail crests, or edges of pools).

b. For RM&E electrofishing activities, the following measures must be adhered to:

   i. Electrofishing methods shall use the minimum voltage, pulse width, and rate settings necessary to immobilize fish. Water conductivity shall be measured in the field before electrofishing to determine appropriate settings. Electrofishing equipment and methods shall comply with the electrofishing guidelines outlined by the NMFS (NMFS 2000) or current equivalent.

   ii. If electrofishing is utilized to capture salmonids in bull trout habitat, conduct fish capture when stream temperatures are at or below 15 degrees C (59 degrees F), to the extent practicable. Recommend work be conducted early and late in the day when water temperatures are cooler to minimize stress to bull trout and other salmonids.

   iii. Electrofishing activities shall be minimized where larger, fluvial bull trout might be captured and in spawning areas where redds are present.

   iv. Fish capture and removal operations must be conducted by a qualified biologist and all staff participating in the operation have the necessary knowledge, skills, and abilities to ensure safe handling of fish. Fish capture and removal operations shall take all appropriate steps to minimize the amount and duration of handling. The operations shall maintain captured fish in water to the maximum extent possible during seining/netting, handling, and transfer for release, to prevent and minimize stress.

   v. Water quality conditions must be adequate in the buckets or tanks used to hold and transport captured fish. The operations shall use aerators to provide for the circulation of clean, cold, well-oxygenated water, and/or shall stage fish capture, temporary holding, and release, to minimize the risks associated with prolonged holding.

4. The following term and condition is necessary for the implementation of RPM 4:
   a. Annual reports submitted by LSRCP in coordination with the program operators, due March 1 of each year, shall be provided to the Service's Eastern Washington Field Office (Spokane, WA). The report shall briefly summarize bull trout collections at the facilities, and bull trout sampled during monitoring and evaluation activities, monitoring results, and any modifications or improvements that have been implemented to avoid or minimize impacts to bull trout.

The Service believes that no more than the extent of take described above bull trout will occur as a result of the proposed action. The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. If, during the course of the action, this level of incidental take is exceeded, such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. The Federal

agency must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the reasonable and prudent measures.
The Service is to be notified within three working days upon locating a dead, injured or sick endangered or threatened species specimen. Initial notification must be made to the nearest U.S. Fish and Wildlife Service Law Enforcement Office. Notification must include the date, time, precise location of the injured animal or carcass, and any other pertinent information. Care should be taken in handling sick or injured specimens to preserve biological materials in the best possible state for later analysis of cause of death, if that occurs. In conjunction with the care of sick or injured endangered or threatened species or preservation of biological materials from a dead animal, the finder has the responsibility to ensure that evidence associated with the specimen is not unnecessarily disturbed. Contact the U.S. Fish and Wildlife Service Law Enforcement Office at (425) 883-8122, or the Service's Washington Fish and Wildlife Office at (360) 753-9440.

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 plans, or to develop information.

The Service has not identified any conservation recommendations for the action agency associated with this project.

REINITIATION NOTICE

This concludes formal consultation on the actions outlined in the request for formal consultation. 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 retained (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 not considered in this Opinion; or 4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

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APPENDIX A

Status of the Species: Bull Trout

Taxonomy

The bull trout (*Salvelinus confluentus*) is a native char found in the coastal and intermountain west of North America. Dolly Varden (*Salvelinus malma)* and bull trout were previously considered a single species and were thought to have coastal and interior forms. However, Cavender (1978, entire) described morphometric, meristic and osteological characteristics of the two forms, and provided evidence of specific distinctions between the two. Despite an overlap in the geographic range of bull trout and Dolly Varden in the Puget Sound area and along the British Columbia coast, there is little evidence of introgression (Haas and McPhail 1991, p. 2191). The Columbia River Basin is considered the region of origin for the bull trout. From the Columbia, dispersal to other drainage systems was accomplished by marine migration and headwater stream capture. Behnke (2002, p. 297) postulated dispersion to drainages east of the continental divide may have occurred through the North and South Saskatchewan Rivers (Hudson Bay drainage) and the Yukon River system. Marine dispersal may have occurred from Puget Sound north to the Fraser, Skeena and Taku Rivers of British Columbia.

Species Description

Bull trout have unusually large heads and mouths for salmonids. Their body colors can vary tremendously depending on their environment, but are often brownish green with lighter (often ranging from pale yellow to crimson) colored spots running along their dorsa and flanks, with spots being absent on the dorsal fin, and light colored to white under bellies. They have white leading edges on their fins, as do other species of char. Bull trout have been measured as large as 103 centimeters (41 inches) in length, with weights as high as 14.5 kilograms (32 pounds) (Fishbase 2015, p. 1). Bull trout may be migratory, moving throughout large river systems, lakes, and even the ocean in coastal populations, or they may be resident, remaining in the same stream their entire lives (Rieman and McIntyre 1993, p. 2; Brenkman and Corbett 2005, p. 1077). Migratory bull trout are typically larger than resident bull trout (USFWS 1998, p. 31668).

Legal Status

The coterminous United States population of the bull trout was listed as threatened on November 1, 1999 (USFWS 1999, entire). The threatened bull trout generally 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. 4; Brewin and Brewin 1997, pp. 209-216; Cavender 1978, pp. 165-166; Leary and Allendorf 1997, pp. 715-720).

Throughout its range, the bull trout are 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, 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, p. 58910). 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 (Battin et al. 2007, entire; Rieman et al. 2007, entire; Porter and Nelitz. 2009, pages 4-8). Poaching and incidental mortality of bull trout during other targeted fisheries are additional threats.

Life History

The iteroparous reproductive strategy of bull trout has important repercussions for the management of this species. Bull trout require passage both upstream and downstream, not only for repeat spawning but also for foraging. Most fish ladders, however, were designed specifically for anadromous semelparous salmonids (fishes that spawn once and then die, and require only one-way passage upstream). Therefore, even dams or other barriers with fish passage facilities may be a factor in isolating bull trout populations if they do not provide a downstream passage route. Additionally, in some core areas, bull trout that migrate to marine waters must pass both upstream and downstream through areas with net fisheries at river mouths. This can increase the likelihood of mortality to bull trout during these spawning and foraging migrations.

Growth varies depending upon life-history strategy. Resident adults range from 6 to 12 inches total length, and migratory adults commonly reach 24 inches or more (Goetz 1989, p. 30; Pratt 1985, pp. 28-34). The largest verified bull trout is a 32-pound specimen caught in Lake Pend Oreille, Idaho, in 1949 (Simpson and Wallace 1982, p. 95).

Bull trout typically spawn from August through November during periods of increasing flows and decreasing water temperatures. Preferred spawning habitat consists of low-gradient stream reaches with loose, clean gravel (Fraley and Shepard 1989, p. 141). Redds are often constructed in stream reaches fed by springs or near other sources of cold groundwater (Goetz 1989, pp. 15-16; Pratt 1992, pp. 6-7; Rieman and McIntyre 1996, p. 133). Depending on water temperature, incubation is normally 100 to 145 days (Pratt 1992, p. 1). After hatching, fry remain in the substrate, and time from egg deposition to emergence may surpass 200 days. Fry normally emerge from early April through May, depending on water temperatures and increasing stream flows (Pratt 1992, p. 1; Ratliff and Howell 1992, p. 10).

Early life stages of fish, specifically the developing embryo, require the highest inter-gravel dissolved oxygen (IGDO) levels, and are the most sensitive life stage to reduced oxygen levels. The oxygen demand of embryos depends on temperature and on stage of development, with the greatest IGDO required just prior to hatching.

A literature review conducted by the Washington Department of Ecology (WDOE 2002, p. 9) indicates that adverse effects of lower oxygen concentrations on embryo survival are magnified as temperatures increase above optimal (for incubation). Normal oxygen levels seen in rivers used by bull trout during spawning ranged from 8 to 12 mg/L (in the gravel), with corresponding instream levels of 10 to 11.5 mg/L (Stewart et al. 2007, p. 10). In addition, IGDO concentrations, water velocities in the water column, and especially the intergravel flow rate, are interrelated variables that affect the survival of incubating embryos (ODEQ 1995, Ch 2 pp.

23-24). Due to a long incubation period of 220+ days, bull trout are particularly sensitive to adequate IGDO levels. An IGDO level below 8 mg/L is likely to result in mortality of eggs, embryos, and fry.

Population Dymanics

Population Structure

Bull trout exhibit both resident and migratory life history strategies. Both resident and migratory forms may be found together, and either form may produce offspring exhibiting either resident or migratory behavior (Rieman and McIntyre 1993, p. 2). Resident bull trout complete their entire life cycle in the tributary (or nearby) streams in which they spawn and rear. The resident form tends to be smaller than the migratory form at maturity and also produces fewer eggs (Goetz 1989, p. 15). Migratory bull trout spawn in tributary streams where juvenile fish rear 1 to 4 years before migrating to either a lake (adfluvial form), river (fluvial form) (Fraley and Shepard 1989, p. 138; Goetz 1989, p. 24), or saltwater (anadromous form) to rear as subadults and to live as adults (Brenkman and Corbett 2005, entire; McPhail and Baxter 1996, p. i; WDFW et al. 1997, p. 16). Bull trout normally reach sexual maturity in 4 to 7 years and may live longer than 12 years. They are iteroparous (they spawn more than once in a lifetime). Repeat- and alternate-year spawning has been reported, although repeat-spawning frequency and post-spawning mortality are not well documented (Fraley and Shepard 1989, p. 135; Leathe and Graham 1982, p. 95; Pratt 1992, p. 8; Rieman and McIntyre 1996, p. 133).

Bull trout are naturally migratory, which allows them to capitalize on temporally abundant food resources and larger downstream habitats. Resident forms may develop where barriers (either natural or manmade) occur or where foraging, migrating, or overwintering habitats for migratory fish are minimized (Brenkman and Corbett 2005, pp. 1075-1076; Goetz et al. 2004, p. 105). 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). Parts of this river system have retained habitat conditions that allow free movement between spawning and rearing areas and the mainstem Snake River. Such multiple life history strategies help to maintain the stability and persistence of bull trout populations to environmental changes. Benefits to migratory bull trout include greater growth in the more productive waters of larger streams, lakes, and marine waters; greater fecundity resulting in increased reproductive potential; and dispersing the population across space and time so that spawning streams may be recolonized should local populations suffer a catastrophic loss (Frissell 1999, pp. 861-863; MBTSG 1998, p. 13; Rieman and McIntyre 1993, pp. 2-3). In the absence of the migratory bull trout life form, isolated populations cannot be replenished when disturbances make local habitats temporarily unsuitable. Therefore, the range of the species is diminished, and the potential for a greater reproductive contribution from larger size fish with higher fecundity is lost (Rieman and McIntyre 1993, p. 2).

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

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

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

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

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

More recently, the Service identified additional genetic units within the coastal and interior lineages (Ardren et al. 2011, p. 18). Based on a recommendation in the Service's 5-year review of the species' status (USFWS 2008a, p. 45), the Service reanalyzed the 27 recovery units identified in the draft bull trout recovery plan (USFWS 2002a, p. 48) by utilizing, in part, information from previous genetic studies and new information from additional analysis (Ardren et al. 2011, entire). In this examination, the Service applied relevant factors from the joint Service and National Marine Fisheries Service Distinct Population Segment (DPS) policy (USFWS 1996, entire) and subsequently identified six draft recovery units that contain assemblages of core areas that retain genetic and ecological integrity across the range of bull trout in the coterminous United States. These six draft recovery units were used to inform designation of critical habitat for bull trout by providing a context for deciding what habitats are essential for recovery (USFWS 2010, p. 63898). The six draft recovery units identified for bull trout in the coterminous United States include: Coastal, Klamath, Mid-Columbia, Columbia Headwaters, Saint Mary, and Upper Snake. These six draft recovery units were also identified in the Service's revised recovery plan (USFWS 2015, p. vii) and designated as final recovery units.

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; Burkey 1995, entire).

Metapopulation concepts of conservation biology theory have been suggested relative to the distribution and characteristics of bull trout, although empirical evidence is relatively scant (Rieman and McIntyre 1993, p. 15; Dunham and Rieman 1999, entire; Rieman and Dunham 2000, entire). A metapopulation is an interacting network of local populations with varying frequencies of migration and gene flow among them (Meffe and Carroll 1994, pp. 189-190). For inland bull trout, metapopulation theory is likely most applicable at the watershed scale where habitat consists of discrete patches or collections of habitat capable of supporting local populations; local populations are for the most part independent and represent discrete reproductive units; and long-term, low-rate dispersal patterns among component populations influences the persistence of at least some of the local populations (Rieman and Dunham 2000, entire). Ideally, multiple local populations distributed throughout a watershed provide a mechanism for spreading risk because the simultaneous loss of all local populations is unlikely. However, habitat alteration, primarily through the construction of impoundments, dams, and water diversions has fragmented habitats, eliminated migratory corridors, and in many cases isolated bull trout in the headwaters of tributaries (Rieman and Clayton 1997, pp. 10-12; Dunham and Rieman 1999, p. 645; Spruell et al. 1999, pp. 118-120; Rieman and Dunham 2000, p. 55).

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

Habitat Characteristics

Bull trout have more specific habitat requirements than most other salmonids (Rieman and McIntyre 1993, p. 4). Habitat components that influence bull trout distribution and abundance include water temperature, cover, channel form and stability, valley form, spawning and rearing substrate, and migratory corridors (Fraley and Shepard 1989, entire; Goetz 1989, pp. 23, 25; Hoelscher and Bjornn 1989, pp. 19, 25; Howell and Buchanan 1992, pp. 30, 32; Pratt 1992, entire; Rich 1996, p. 17; Rieman and McIntyre 1993, pp. 4-6; Rieman and McIntyre 1995, entire; Sedell and Everest 1991, entire; Watson and Hillman 1997, entire). Watson and Hillman (1997, pp. 247-250) concluded that watersheds must have specific physical characteristics to provide the habitat requirements necessary for bull trout to successfully spawn and rear and that these specific characteristics are not necessarily present throughout these watersheds. Because bull trout exhibit a patchy distribution, even in pristine habitats (Rieman and McIntyre 1993, pp. 4-6), bull trout should not be expected to simultaneously occupy all available habitats.

Migratory corridors link seasonal habitats for all bull trout life histories. The ability to migrate is important to the persistence of bull trout (Rieman and McIntyre 1993, p. 2). Migrations facilitate gene flow among local populations when individuals from different local populations interbreed or stray to nonnatal streams. Local populations that are extirpated by catastrophic events may also become reestablished by bull trout migrants. However, it is important to note that the genetic structuring of bull trout indicates there is limited gene flow among bull trout populations, which may encourage local adaptation within individual populations, and that reestablishment of extirpated populations may take a long time (Rieman and McIntyre 1993, p. 2; Spruell et al. 1999, entire). Migration also allows bull trout to access more abundant or larger prey, which facilitates growth and reproduction. Additional benefits of migration and its relationship to foraging are discussed below under "Diet."

Cold water temperatures play an important role in determining bull trout habitat quality, as these fish are primarily found in colder streams, and spawning habitats are generally characterized by temperatures that drop below 9 °C in the fall (Fraley and Shepard 1989, p. 137; Pratt 1992, p. 5; Rieman and McIntyre 1993, p. 2).

Thermal requirements for bull trout appear to differ at different life stages. Spawning areas are often associated with cold-water springs, groundwater infiltration, and the coldest streams in a given watershed (Pratt 1992, pp 7-8; Rieman and McIntyre 1993, p. 7). Optimum incubation temperatures for bull trout eggs range from 2 °C to 6 °C whereas optimum water temperatures for rearing range from about 6 °C to 10 °C (Buchanan and Gregory 1997, p. 4; Goetz 1989, p. 22). In Granite Creek, Idaho, Bonneau and Scarnecchia (1996, entire) observed that juvenile bull trout selected the coldest water available in a plunge pool, 8 °C to 9 °C, within a temperature gradient of 8 °C to 15 °C. In a landscape study relating bull trout distribution to maximum water temperatures, Dunham et al. (2003, p. 900) found that the probability of juvenile bull trout occurrence does not become high (i.e., greater than 0.75) until maximum temperatures decline to 11 °C to 12 °C.

Although bull trout are found primarily in cold streams, occasionally these fish are found in larger, warmer river systems throughout the Columbia River basin (Buchanan and Gregory 1997, p. 2; Fraley and Shepard 1989, pp. 133, 135; Rieman and McIntyre 1993, pp. 3-4; Rieman and

McIntyre 1995, p. 287). Availability and proximity of cold water patches and food productivity can influence bull trout ability to survive in warmer rivers (Myrick 2002, pp. 6 and 13).

All life history stages of bull trout are associated with complex forms of cover, including large woody debris, undercut banks, boulders, and pools (Fraley and Shepard 1989, p. 137; Goetz 1989, p. 19; Hoelscher and Bjornn 1989, p. 38; Pratt 1992, entire; Rich 1996, pp. 4-5; Sedell and Everest 1991, entire; Sexauer and James 1997, entire; Thomas 1992, pp. 4-6; Watson and Hillman 1997, p. 238). Maintaining bull trout habitat requires natural stability of stream channels and maintenance of natural flow patterns (Rieman and McIntyre 1993, pp. 5-6). Juvenile and adult bull trout frequently inhabit side channels, stream margins, and pools with suitable cover (Sexauer and James 1997, p. 364). These areas are sensitive to activities that directly or indirectly affect stream channel stability and alter natural flow patterns. For example, altered stream flow in the fall may disrupt bull trout during the spawning period, and channel instability may decrease survival of eggs and young juveniles in the gravel from winter through spring (Fraley and Shepard 1989, p. 141; Pratt 1992, p. 6; Pratt and Huston 1993, p. 70). Pratt (1992, p. 6) indicated that increases in fine sediment reduce egg survival and emergence.

Diet

Bull trout are opportunistic feeders, with food habits primarily a function of size and life-history strategy. Fish growth depends on the quantity and quality of food that is eaten, and as fish grow their foraging strategy changes as their food changes, in quantity, size, or other characteristics (Quinn 2005, pp. 195-200). Resident and juvenile migratory bull trout prey on terrestrial and aquatic insects, macrozooplankton, and small fish (Boag 1987, p. 58; Donald and Alger 1993, pp. 242-243; Goetz 1989, pp. 33-34). Subadult and adult migratory bull trout feed on various fish species (Donald and Alger 1993, pp. 241-243; Fraley and Shepard 1989, pp. 135, 138; Leathe and Graham 1982, pp. 13, 50-56). Bull trout of all sizes other than fry have been found to eat fish half their length (Beauchamp and VanTassell 2001, p. 204). In nearshore marine areas of western Washington, bull trout feed on Pacific herring (*Clupea pallasi*), Pacific sand lance (*Ammodytes hexapterus*), and surf smelt (*Hypomesus pretiosus*) (Goetz et al. 2004, p. 105; WDFW et al. 1997, p. 23).

Bull trout migration and life history strategies are closely related to their feeding and foraging strategies. Migration allows bull trout to access optimal foraging areas and exploit a wider variety of prey resources. For example, in the Skagit River system, anadromous bull trout make migrations as long as 121 miles between marine foraging areas in Puget Sound and headwater spawning grounds, foraging on salmon eggs and juvenile salmon along their migration route (WDFW et al. 1997, p. 25). Anadromous bull trout also use marine waters as migration corridors to reach seasonal habitats in non-natal watersheds to forage and possibly overwinter (Brenkman and Corbett 2005, pp. 1078-1079; Goetz et al. 2004, entire).

Status and Distribution

Distribution and Demography

The historical range of bull trout includes major river basins in the Pacific Northwest at about 41 to 60 degrees North latitude, from the southern limits in the McCloud River in northern

California and the Jarbidge River in Nevada to the headwaters of the Yukon River in the Northwest Territories, Canada (Cavender 1978, pp. 165-166; Bond 1992, p. 2). To the west, the bull trout's range includes Puget Sound, various coastal rivers of British Columbia, Canada, and southeast Alaska (Bond 1992, p. 2). Bull trout occur in portions of the Columbia River and tributaries within the basin, including its headwaters in Montana and Canada. Bull trout also occur in the Klamath River basin of south-central Oregon. East of the Continental Divide, bull trout are found in the headwaters of the Saskatchewan River in Alberta and Montana and in the MacKenzie River system in Alberta and British Columbia, Canada (Cavender 1978, pp. 165-166; Brewin et al. 1997, entire).

Each of the following recovery units (below) is necessary to maintain the bull trout's distribution, as well as its genetic and phenotypic diversity, all of which are important to ensure the species' resilience to changing environmental conditions. No new local populations have been identified and no local populations have been lost since listing.

Coastal Recovery Unit

The Coastal Recovery Unit is located within western Oregon and Washington. Major geographic regions include the Olympic Peninsula, Puget Sound, and Lower Columbia River basins. The Olympic Peninsula and Puget Sound geographic regions also include their associated marine waters (Puget Sound, Hood Canal, Strait of Juan de Fuca, and Pacific Coast), which are critical in supporting the anadromous[1] life history form, unique to the Coastal Recovery Unit. The Coastal Recovery Unit is also the only unit that overlaps with the distribution of Dolly Varden (*Salvelinus malma*) (Ardren *et al.* 2011), another native char species that looks very similar to the bull trout (Haas and McPhail 1991). The two species have likely had some level of historic introgression in this part of their range (Redenbach and Taylor 2002). The Lower Columbia River major geographic region includes the lower mainstem Columbia River, an important migratory waterway essential for providing habitat and population connectivity within this region. In the Coastal Recovery Unit, there are 21 existing bull trout core areas which have been designated, including the recently reintroduced Clackamas River population, and 4 core areas have been identified that could be re-established. Core areas within the recovery unit are distributed among these three major geographic regions (Puget Sound also includes one core area that is actually part of the lower Fraser River system in British Columbia, Canada) (USFWS 2015a, p. A-1).

The current demographic status of bull trout in the Coastal Recovery Unit is variable across the unit. Populations in the Puget Sound region generally tend to have better demographic status, followed by the Olympic Peninsula, and finally the Lower Columbia River region. However, population strongholds do exist across the three regions. The Lower Skagit River and Upper Skagit River core areas in the Puget Sound region likely contain two of the most abundant bull trout populations with some of the most intact habitat within this recovery unit. The Lower Deschutes River core area in the Lower Columbia River region also contains a very abundant

1 Anadromous: Life history pattern of spawning and rearing in fresh water and migrating to salt water areas to mature.

bull trout population and has been used as a donor stock for re-establishing the Clackamas River population (USFWS 2015a, p. A-6).

Puget Sound Region

In the Puget Sound region, bull trout populations are concentrated along the eastern side of Puget Sound with most core areas concentrated in central and northern Puget Sound.

Although the Chilliwack River core area is considered part of this region, it is technically connected to the Fraser River system and is transboundary with British Columbia making its distribution unique within the region. Most core areas support a mix of anadromous and fluvial life history forms, with at least two core areas containing a natural adfluvial life history (Chilliwack River core area [Chilliwack Lake] and Chester Morse Lake core area). Overall demographic status of core areas generally improves as you move from south Puget Sound to north Puget Sound. Although comprehensive trend data are lacking, the current condition of core areas within this region are likely stable overall, although some at depressed abundances. Two core areas (Puyallup River and Stillaguamish River) contain local populations at either very low abundances (Upper Puyallup and Mowich Rivers) or that have likely become locally extirpated (Upper Deer Creek, South Fork Canyon Creek, and Greenwater River). Connectivity among and within core areas of this region is generally intact. Most core areas in this region still have significant amounts of headwater habitat within protected and relatively pristine areas (e.g., North Cascades National Park, Mount Rainier National Park, Skagit Valley Provincial Park, Manning Provincial Park, and various wilderness or recreation areas) (USFWS 2015a, p. A-7).

Olympic Peninsula Region

In the Olympic Peninsula region, distribution of core areas is somewhat disjunct, with only one located on the west side of Hood Canal on the eastern side of the peninsula, two along the Strait of Juan de Fuca on the northern side of the peninsula, and three along the Pacific Coast on the western side of the peninsula. Most core areas support a mix of anadromous and fluvial life history forms, with at least one core area also supporting a natural adfluvial life history (Quinault River core area [Quinault Lake]). Demographic status of core areas is poorest in Hood Canal and Strait of Juan de Fuca, while core areas along the Pacific Coast of Washington likely have the best demographic status in this region. The connectivity between core areas in these disjunct regions is believed to be naturally low due to the geographic distance between them.

Internal connectivity is currently poor within the Skokomish River core area (Hood Canal) and is being restored in the Elwha River core area (Strait of Juan de Fuca). Most core areas in this region still have their headwater habitats within relatively protected areas (Olympic National Park and wilderness areas) (USFWS 2015a, p. A-7).

Lower Columbia River Region

In the Lower Columbia River region, the majority of core areas are distributed along the Cascade Crest on the Oregon side of the Columbia River. Only two of the seven core areas in this region are in Washington. Most core areas in the region historically supported a fluvial life history form, but many are now adfluvial due to reservoir construction. However, there is at least one core area supporting a natural adfluvial life history (Odell Lake) and one supporting a natural, isolated, resident life history (Klickitat River [West Fork Klickitat]). Status is highly variable across this region, with one relative stronghold (Lower Deschutes core area) existing on the Oregon side of the Columbia River. The Lower Columbia River region also contains three watersheds (North Santiam River, Upper Deschutes River, and White Salmon River) that could potentially become re-established core areas within the Coastal Recovery Unit. Although the South Santiam River has been identified as a historic core area, there remains uncertainty as to whether or not historical observations of bull trout represented a self-sustaining population. Current habitat conditions in the South Santiam River are thought to be unable to support bull trout spawning and rearing. Adult abundances within the majority of core areas in this region are relatively low, generally 300 or fewer individuals.

Most core populations in this region are not only isolated from one another due to dams or natural barriers, but they are internally fragmented as a result of manmade barriers. Local populations are often disconnected from one another or from potential foraging habitat. In the Coastal Recovery Unit, adult abundance may be lowest in the Hood River and Odell Lake core areas, which each contain fewer than 100 adults. Bull trout were reintroduced in the Middle Fork Willamette River in 1990 above Hills Creek Reservoir. Successful reproduction was first documented in 2006, and has occurred each year since (USFWS 2015a, p. A-8). Natural reproducing populations of bull trout are present in the McKenzie River basin (USFWS 2008d, pp. 65-67). Bull trout were more recently reintroduced into the Clackamas River basin in the summer of 2011 after an extensive feasibility analysis (Shively et al. 2007, Hudson et al. 2015). Bull trout from the Lower Deschutes core area are being utilized for this reintroduction effort (USFWS 2015a, p. A-8).

Klamath Recovery Unit

Bull trout in the Klamath Recovery Unit have been isolated from other bull trout populations for the past 10,000 years and are recognized as evolutionarily and genetically distinct (Minckley et al. 1986; Leary et al. 1993; Whitesel et al. 2004; USFWS 2008a; Ardren et al. 2011). As such, there is no opportunity for bull trout in another recovery unit to naturally re- colonize the Klamath Recovery Unit if it were to become extirpated. The Klamath Recovery Unit lies at the southern edge of the species range and occurs in an arid portion of the range of bull trout.

Bull trout were once widespread within the Klamath River basin (Gilbert 1897; Dambacher et al. 1992; Ziller 1992; USFWS 2002b), but habitat degradation and fragmentation, past and present land use practices, agricultural water diversions, and past fisheries management practices have greatly reduced their distribution. Bull trout abundance also has been severely reduced, and the remaining populations are highly fragmented and vulnerable to natural or manmade factors that place them at a high risk of extirpation (USFWS 2002b). The presence of nonnative brook trout (*Salvelinus fontinalis*), which compete and hybridize with bull trout, is a particular threat to bull trout persistence throughout the Klamath Recovery Unit (USFWS 2015b, pp. B-3-4).

Upper Klamath Lake Core Area

The Upper Klamath Lake core area comprises two bull trout local populations (Sun Creek and Threemile Creek). These local populations likely face an increased risk of extirpation because they are isolated and not interconnected with each other. Extirpation of other local populations in the Upper Klamath Lake core area has occurred in recent times (1970s). Populations in this core area are genetically distinct from those in the other two core areas in the Klamath Recovery Unit (USFWS 2008b), and in comparison, genetic variation within this core area is lowest. The two local populations have been isolated by habitat fragmentation and have experienced population bottlenecks. As such, currently unoccupied habitat is needed to restore connectivity between the two local populations and to establish additional populations. This unoccupied habitat includes canals, which now provide the only means of connectivity as migratory corridors. Providing full volitional connectivity for bull trout, however, also introduces the risk of invasion by brook trout, which are abundant in this core area.

Bull trout in the Upper Klamath Lake core area formerly occupied Annie Creek, Sevenmile Creek, Cherry Creek, and Fort Creek, but are now extirpated from these locations. The last remaining local populations, Sun Creek and Threemile Creek, have received focused attention. Brook trout have been removed from bull trout occupied reaches, and these reaches have been intentionally isolated to prevent brook trout reinvasion. As such, over the past few generations these populations have become stable and have increased in distribution and abundance. In 1996, the Threemile Creek population had approximately 50 fish that occupied a 1.4-km (0.9-mile) reach (USFWS 2002b). In 2012, a mark-resight population estimate was completed in Threemile Creek, which indicated an abundance of 577 (95 percent confidence interval = 475 to 679) age-1+ fish (ODFW 2012). In addition, the length of the distribution of bull trout in Threemile Creek had increased to 2.7 km (1.7 miles) by 2012 (USFWS unpublished data). Between 1989 and 2010, bull trout abundance in Sun Creek increased approximately tenfold (from approximately 133 to 1,606 age-1+ fish) and distribution increased from approximately 1.9 km (1.2 miles) to 11.2 km (7.0 miles) (Buktenica et al. 2013) (USFWS 2015b, p. B-5).

Sycan River Core Area

The Sycan River core area is comprised of one local population, Long Creek. Long Creek likely faces greater risk of extirpation because it is the only remaining local population due to extirpation of all other historic local populations. Bull trout previously occupied Calahan Creek, Coyote Creek, and the Sycan River, but are now extirpated from these locations (Light et al. 1996). This core area's local population is genetically distinct from those in the other two core areas (USFWS 2008b). This core area also is essential for recovery because bull trout in this core area exhibit both resident2 and fluvial life histories, which are important for representing diverse life history expression in the Klamath Recovery Unit. Migratory bull trout are able to grow larger than their resident counterparts, resulting in greater fecundity and higher reproductive potential

2 Resident: Life history pattern of residing in tributary streams for the fish's entire life without migrating.

(Rieman and McIntyre 1993). Migratory life history forms also have been shown to be important for population persistence and resilience (Dunham et al. 2008).

The last remaining population (Long Creek) has received focused attention in an effort to ensure it is not also extirpated. In 2006, two weirs were removed from Long Creek, which increased the amount of occupied FMO habitat by 3.2 km (2.0 miles). Bull trout currently occupy approximately 3.5 km (2.2 miles) of spawning/rearing habitat, including a portion of an unnamed tributary to upper Long Creek, and seasonally use 25.9 km (16.1 miles) of FMO habitat. Brook trout also inhabit Long Creek and have been the focus of periodic removal efforts. No recent statistically rigorous population estimate has been completed for Long Creek; however, the 2002 Draft Bull Trout Recovery Plan reported a population estimate of 842 individuals (USFWS 2002b). Currently unoccupied habitat is needed to establish additional local populations, although brook trout are widespread in this core area and their management will need to be considered in future recovery efforts. In 2014, the Klamath Falls Fish and Wildlife Office of the Service established an agreement with the U.S. Geological Survey to undertake a structured decision making process to assist with recovery planning of bull trout populations in the Sycan River core area (USFWS 2015b, p. B-6).

Upper Sprague River Core Area

The Upper Sprague River core area comprises five bull trout local populations, placing the core area at an intermediate risk of extinction. The five local populations include Boulder Creek, Dixon Creek, Deming Creek, Leonard Creek, and Brownsworth Creek. These local populations may face a higher risk of extirpation because not all are interconnected. Bull trout local populations in this core area are genetically distinct from those in the other two Klamath Recovery Unit core areas (USFWS 2008b). Migratory bull trout have occasionally been observed in the North Fork Sprague River (USFWS 2002b). Therefore, this core area also is essential for recovery in that bull trout here exhibit a resident life history and likely a fluvial life history, which are important for conserving diverse life history expression in the Klamath Recovery Unit as discussed above for the Sycan River core area.

The Upper Sprague River core area population of bull trout has experienced a decline from historic levels, although less is known about historic occupancy in this core area. Bull trout are reported to have historically occupied the South Fork Sprague River, but are now extirpated from this location (Buchanan et al. 1997). The remaining five populations have received focused attention. Although brown trout (*Salmo trutta*) co-occur with bull trout and exist in adjacent habitats, brook trout do not overlap with existing bull trout populations. Efforts have been made to increase connectivity of existing bull trout populations by replacing culverts that create barriers. Thus, over the past few generations, these populations have likely been stable and increased in distribution. Population abundance has been estimated recently for Boulder Creek (372 + 62 percent; Hartill and Jacobs 2007), Dixon Creek (20 + 60 percent; Hartill and Jacobs 2007), Deming Creek (1,316 + 342; Moore 2006), and Leonard Creek (363 + 37 percent; Hartill and Jacobs 2007). No statistically rigorous population estimate has been completed for the Brownsworth Creek local population; however, the 2002 Draft Bull

Trout Recovery Plan reported a population estimate of 964 individuals (USFWS 2002b). Additional local populations need to be established in currently unoccupied habitat within the Upper Sprague River core area, although brook trout are widespread in this core area and will need to be considered in future recovery efforts (USFWS 2015b, p. B-7).

Mid-Columbia Recovery Unit

The Mid-Columbia Recovery Unit (RU) comprises 24 bull trout core areas, as well as 2 historically occupied core areas and 1 research needs area. The Mid-Columbia RU is recognized as an area where bull trout have co-evolved with salmon, steelhead, lamprey, and other fish populations. Reduced fish numbers due to historic overfishing and land management changes have caused changes in nutrient abundance for resident migratory fish like the bull trout. The recovery unit is located within eastern Washington, eastern Oregon, and portions of central Idaho. Major drainages include the Methow River, Wenatchee River, Yakima River, John Day River, Umatilla River, Walla Walla River, Grande Ronde River, Imnaha River, Clearwater River, and smaller drainages along the Snake River and Columbia River (USFWS 2015c, p. C-1).

The Mid-Columbia RU can be divided into four geographic regions the Lower Mid-Columbia, which includes all core areas that flow into the Columbia River below its confluence with the 1) Snake River; 2) the Upper Mid-Columbia, which includes all core areas that flow into the Columbia River above its confluence with the Snake River; 3) the Lower Snake, which includes all core areas that flow into the Snake River between its confluence with the Columbia River and Hells Canyon Dam; and 4) the Mid-Snake, which includes all core areas in the Mid-Columbia RU that flow into the Snake River above Hells Canyon Dam. These geographic regions are composed of neighboring core areas that share similar bull trout genetic, geographic (hydrographic), and/or habitat characteristics. Conserving bull trout in geographic regions allows for the maintenance of broad representation of genetic diversity, provides neighboring core areas with potential source populations in the event of local extirpations, and provides a broad array of options among neighboring core areas to contribute recovery under uncertain environmental change USFWS 2015c, pp. C-1-2).

The current demographic status of bull trout in the Mid-Columbia Recovery Unit is highly variable at both the RU and geographic region scale. Some core areas, such as the Umatilla, Asotin, and Powder Rivers, contain populations so depressed they are likely suffering from the deleterious effects of small population size. Conversely, strongholds do exist within the recovery unit, predominantly in the Lower Snake geographic area. Populations in the Imnaha, Little Minam, Clearwater, and Wenaha Rivers are likely some of the most abundant. These populations are all completely or partially within the bounds of protected wilderness areas and have some of the most intact habitat in the recovery unit. Status in some core areas is relatively unknown, but all indications in these core areas suggest population trends are declining, particularly in the core areas of the John Day Basin (USFWS 2015c, p. C-5).

<u>*Lower Mid-Columbia Region*</u>

In the Lower Mid-Columbia Region, core areas are distributed along the western portion of the Blue Mountains in Oregon and Washington. Only one of the six core areas is located completely in Washington. Demographic status is highly variable throughout the region. Status is the poorest in the Umatilla and Middle Fork John Day Core Areas. However, the Walla Walla River core area contains nearly pristine habitats in the headwater spawning areas and supports the most abundant populations in the region. Most core areas support both a resident and fluvial life history; however, recent evidence suggests a significant decline in the resident and fluvial life history in the Umatilla River and John Day core areas respectively. Connectivity between the core areas of the Lower Mid-Columbia Region is unlikely given conditions in the connecting FMO habitats. Connection between the Umatilla, Walla Walla and Touchet core areas is uncommon but has been documented, and connectivity is possible between core areas in the John Day Basin. Connectivity between the John Day core areas and Umatilla/Walla Walla/Touchet core areas is unlikely (USFWS 2015c, pp. C-5-6).

Upper Mid-Columbia Region

In the Upper Mid-Columbia Region, core areas are distributed along the eastern side of the Cascade Mountains in Central Washington. This area contains four core areas (Yakima, Wenatchee, Entiat, and Methow), the Lake Chelan historic core area, and the Chelan River, Okanogan River, and Columbia River FMO areas. The core area populations are generally considered migratory, though they currently express both migratory (fluvial and adfluvial) and resident forms. Residents are located both above and below natural barriers (*i.e.*, Early Winters Creek above a natural falls; and Ahtanum in the Yakima likely due to long lack of connectivity from irrigation withdrawal). In terms of uniqueness and connectivity, the genetics baseline, radio-telemetry, and PIT tag studies identified unique local populations in all core areas. Movement patterns within the core areas; between the lower river, lakes, and other core areas; and between the Chelan, Okanogan, and Columbia River FMO occurs regularly for some of the Wenatchee, Entiat, and Methow core area populations. This type of connectivity has been displayed by one or more fish, typically in non-spawning movements within FMO. More recently, connectivity has been observed between the Entiat and Yakima core areas by a juvenile bull trout tagged in the Entiat moving in to the Yakima at Prosser Dam and returning at an adult size back to the Entiat. Genetics baselines identify unique populations in all four core areas (USFWS 2015c, p. C-6).

The demographic status is variable in the Upper-Mid Columbia region and ranges from good to very poor. The Service's 2008 5-year Review and Conservation Status Assessment described the Methow and Yakima Rivers at risk, with a rapidly declining trend. The Entiat River was listed at risk with a stable trend, and the Wenatchee River as having a potential risk, and with a stable trend. Currently, the Entiat River is considered to be declining rapidly due to much reduced redd counts. The Wenatchee River is able to exhibit all freshwater life histories with connectivity to Lake Wenatchee, the Wenatchee River and all its local populations, and to the Columbia River and/or other core areas in the region. In the Yakima core area some populations exhibit life history forms different from what they were historically. Migration between local populations and to and from spawning habitat is generally prevented or impeded by headwater storage dams on irrigation reservoirs, connectivity between tributaries and reservoirs, and within lower portions of spawning and rearing habitat and the mainstem Yakima River due to changed flow patterns, low instream flows, high water temperatures, and other habitat impediments. Currently, the connectivity in the Yakima Core area is truncated to the degree that not all populations are able to contribute gene flow to a functional metapopulation (USFWS 2015c, pp. C-6-7)

Lower Snake Region

Demographic status is variable within the Lower Snake Region. Although trend data are lacking, several core areas in the Grande Ronde Basin and the Imnaha core area are thought to be stable. The upper Grande Ronde Core Area is the exception where population abundance is considered depressed. Wenaha, Little Minam, and Imnaha Rivers are strongholds (as mentioned above), as are most core areas in the Clearwater River basin. Most core areas contain populations that express both a resident and fluvial life history strategy. There is potential that some bull trout in the upper Wallowa River are adfluvial. There is potential for connectivity between core areas in the Grande Ronde basin, however conditions in FMO are limiting (USFWS 2015c, p. C-7).

Middle Snake Region

In the Middle Snake Region, core areas are distributed along both sides of the Snake River above Hells Canyon Dam. The Powder River and Pine Creek basins are in Oregon and Indian Creek and Wildhorse Creek are on the Idaho side of the Snake River. Demographic status of the core areas is poorest in the Powder River Core Area where populations are highly fragmented and severely depressed. The East Pine Creek population in the Pine-Indian-Wildhorse Creeks core area is likely the most abundant within the region. Populations in both core areas primarily express a resident life history strategy; however, some evidence suggests a migratory life history still exists in the Pine-Indian-Wildhorse Creeks core area. Connectivity is severely impaired in the Middle Snake Region. Dams, diversions and temperature barriers prevent movement among populations and between core areas. Brownlee Dam isolates bull trout in Wildhorse Creek from other populations (USFWS 2015c, p. C-7).

Columbia Headwaters Recovery Unit

The Columbia Headwaters Recovery Unit (CHRU) includes western Montana, northern Idaho, and the northeastern corner of Washington. Major drainages include the Clark Fork River basin and its Flathead River contribution, the Kootenai River basin, and the Coeur d'Alene Lake basin. In this implementation plan for the CHRU we have slightly reorganized the structure from the 2002 Draft Recovery Plan, based on latest available science and fish passage improvements that have rejoined previously fragmented habitats. We now identify 35 bull trout core areas (compared to 47 in 2002) for this recovery unit. Fifteen of the 35 are referred to as "complex" core areas as they represent large interconnected habitats, each containing multiple spawning streams considered to host separate and largely genetically identifiable local populations. The 15 complex core areas contain the majority of individual bull trout and the bulk of the designated critical habitat (USFWS 2010).

However, somewhat unique to this recovery unit is the additional presence of 20 smaller core areas, each represented by a single local population. These "simple" core areas are found in remote glaciated headwater basins, often in Glacier National Park or federally-designated wilderness areas, but occasionally also in headwater valley bottoms. Many simple core areas are upstream of waterfalls or other natural barriers to fish migration. In these simple core areas bull trout have apparently persisted for thousands of years despite small populations and isolated existence. As such, simple core areas meet the criteria for core area designation and continue to be valued for their uniqueness, despite limitations of size and scope. Collectively, the 20 simple core areas contain less than 3 percent of the total bull trout core area habitat in the CHRU, but represent significant genetic and life history diversity (Meeuwig et al. 2010). Throughout this recovery unit implementation plan, we often separate our analyses to distinguish between complex and simple core areas, both in respect to threats as well as recovery actions (USFWS 2015d, pp. D-1-2).

In order to effectively manage the recovery unit implementation plan (RUIP) structure in this large and diverse landscape, the core areas have been separated into the following five natural geographic assemblages.

Upper Clark Fork Geographic Region

Starting at the Clark Fork River headwaters, the *Upper Clark Fork Geographic Region* comprises seven complex core areas, each of which occupies one or more major watersheds contributing to the Clark Fork basin (*i.e.*, Upper Clark Fork River, Rock Creek, Blackfoot River, Clearwater River and Lakes, Bitterroot River, West Fork Bitterroot River, and Middle Clark Fork River core areas) (USFWS 2015d, p. D-2).

Lower Clark Fork Geographic Region

The seven headwater core areas flow into the *Lower Clark Fork Geographic Region*, which comprises two complex core areas, Lake Pend Oreille and Priest Lake. Because of the systematic and jurisdictional complexity (three States and a Tribal entity) and the current degree of migratory fragmentation caused by five mainstem dams, the threats and recovery actions in the Lake Pend Oreille (LPO) core area are very complex and are described in three parts. LPO-A is upstream of Cabinet Gorge Dam, almost entirely in Montana, and includes the mainstem Clark Fork River upstream to the confluence of the Flathead River as well as the portions of the lower Flathead River (*e.g.*, Jocko River) on the Flathead Indian Reservation. LPO-B is the Pend Oreille lake basin proper and its tributaries, extending between Albeni Falls Dam downstream from the outlet of Lake Pend Oreille and Cabinet Gorge Dam just upstream of the lake; almost entirely in Idaho. LPO-C is the lower basin (*i.e.*, lower Pend Oreille River), downstream of Albeni Falls Dam to Boundary Dam (1 mile upstream from the Canadian border) and bisected by Box Canyon Dam; including portions of Idaho, eastern Washington, and the Kalispel Reservation (USFWS 2015d, p. D-2).

Historically, and for current purposes of bull trout recovery, migratory connectivity among these separate fragments into a single entity remains a primary objective.

Flathead Geographic Region

The *Flathead Geographic Region* includes a major portion of northwestern Montana upstream of Kerr Dam on the outlet of Flathead Lake. The complex core area of Flathead Lake is the hub of this area, but other complex core areas isolated by dams are Hungry Horse Reservoir (formerly South Fork Flathead River) and Swan Lake. Within the glaciated basins of the Flathead River headwaters are 19 simple core areas, many of which lie in Glacier National Park or the Bob Marshall and Great Bear Wilderness areas and some of which are isolated by natural barriers or other features (USFWS 2015d, p. D-2).

Kootenai Geographic Region

To the northwest of the Flathead, in an entirely separate watershed, lies the *Kootenai Geographic Region*. The Kootenai is a uniquely patterned river system that originates in southeastern British Columbia, Canada. It dips, in a horseshoe configuration, into northwest Montana and north Idaho before turning north again to re-enter British Columbia and eventually join the Columbia River headwaters in British Columbia. The *Kootenai Geographic Region* contains two complex core areas (Lake Koocanusa and the Kootenai River) bisected since the 1970's by Libby Dam, and also a single naturally isolated simple core area (Bull Lake). Bull trout in both of the complex core areas retain strong migratory connections to populations in British Columbia (USFWS 2015d, p. D-3).

Coeur d'Alene Geographic Region

Finally, the *Coeur d'Alene Geographic Region* consists of a single, large complex core area centered on Coeur d'Alene Lake. It is grouped into the CHRU for purposes of physical and ecological similarity (adfluvial bull trout life history and nonanadromous linkage) rather than due to watershed connectivity with the rest of the CHRU, as it flows into the mid-Columbia River far downstream of the Clark Fork and Kootenai systems (USFWS 2015d, p. D-3).

Upper Snake Recovery Unit

The Upper Snake Recovery Unit includes portions of central Idaho, northern Nevada, and eastern Oregon. Major drainages include the Salmon River, Malheur River, Jarbidge River, Little Lost River, Boise River, Payette River, and the Weiser River. The Upper Snake Recovery Unit contains 22 bull trout core areas within 7 geographic regions or major watersheds: Salmon River (10 core areas, 123 local populations), Boise River (2 core areas, 29 local populations), Payette River (5 core areas, 25 local populations), Little Lost River (1 core area, 10 local populations), Malheur River (2 core areas, 8 local populations), Jarbidge River (1 core area, 6 local populations), and Weiser River (1 core area, 5 local populations). The Upper Snake Recovery Unit includes a total of 206 local populations, with almost 60 percent being present in the Salmon River watershed (USFWS 2015e, p. E-1).

Three major bull trout life history expressions are present in the Upper Snake Recovery Unit, adfluvial3, fluvial4, and resident populations. Large areas of intact habitat exist primarily in the Salmon drainage, as this is the only drainage in the Upper Snake Recovery Unit that still flows directly into the Snake River; most other drainages no longer have direct connectivity due to irrigation uses or instream barriers. Bull trout in the Salmon basin share a genetic past with bull trout elsewhere in the Upper Snake Recovery Unit. Historically, the Upper Snake Recovery Unit is believed to have largely supported the fluvial life history form; however, many core areas are now isolated or have become fragmented watersheds, resulting in replacement of the fluvial life history with resident or adfluvial forms. The Weiser River, Squaw Creek, Pahsimeroi River, and North Fork Payette River core areas contain only resident populations of bull trout (USFWS 2015e, pp. E-1-2).

Salmon River

The Salmon River basin represents one of the few basins that are still free-flowing down to the Snake River. The core areas in the Salmon River basin do not have any major dams and a large extent (approximately 89 percent) is federally managed, with large portions of the Middle Fork Salmon River and Middle Fork Salmon River - Chamberlain core areas occurring within the Frank Church River of No Return Wilderness. Most core areas in the Salmon River basin contain large populations with many occupied stream segments. The Salmon River basin contains 10 of the 22 core areas in the Upper Snake Recovery Unit and contains the majority of the occupied habitat. Over 70 percent of occupied habitat in the Upper Snake Recovery Unit occurs in the Salmon River basin as well as 123 of the 206 local populations. Connectivity between core areas in the Salmon River basin is intact; therefore it is possible for fish in the mainstem Salmon to migrate to almost any Salmon River core area or even the Snake River.

Connectivity within Salmon River basin core areas is mostly intact except for the Pahsimeroi River and portions of the Lemhi River. The Upper Salmon River, Lake Creek, and Opal Lake core areas contain adfluvial populations of bull trout, while most of the remaining core areas contain fluvial populations; only the Pahsimeroi contains strictly resident populations. Most core areas appear to have increasing or stable trends but trends are not known in the Pahsimeroi, Lake Creek, or Opal Lake core areas. The Idaho Department of Fish and Game reported trend data from 7 of the 10 core areas. This trend data indicated that populations were stable or increasing in the Upper Salmon River, Lemhi River, Middle Salmon River-Chamberlain, Little Lost River, and the South Fork Salmon River (IDFG 2005, 2008). Trends were stable or decreasing in the Little-Lower Salmon River, Middle Fork Salmon River, and the Middle Salmon River-Panther (IDFG 2005, 2008).

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3 Adfluvial: Life history pattern of spawning and rearing in tributary streams and migrating to lakes or reservoirs to mature.

4 Fluvial: Life history pattern of spawning and rearing in tributary streams and migrating to larger rivers to mature.

Boise River

In the Boise River basin, two large dams are impassable barriers to upstream fish movement: Anderson Ranch Dam on the South Fork Boise River, and Arrowrock Dam on the mainstem Boise River. Fish in Anderson Ranch Reservoir have access to the South Fork Boise River upstream of the dam. Fish in Arrowrock Reservoir have access to the North Fork Boise River, Middle Fork Boise River, and lower South Fork Boise River. The Boise River basin contains 2 of the 22 core areas in the Upper Snake Recovery Unit. The core areas in the Boise River basin account for roughly 12 percent of occupied habitat in the Upper Snake Recovery Unit and contain 29 of the 206 local populations. Approximately 90 percent of both Arrowrock and Anderson Ranch core areas are federally owned; most lands are managed by the U.S. Forest Service, with some portions occurring in designated wilderness areas. Both the Arrowrock core area and the Anderson Ranch core area are isolated from other core areas. Both core areas contain fluvial bull trout that exhibit adfluvial characteristics and numerous resident populations. The Idaho Department of Fish and Game in 2014 determined that the Anderson Ranch core area had an increasing trend while trends in the Arrowrock core area is unknown (USFWS 2015e).

Payette River

The Payette River basin contains three major dams that are impassable barriers to fish: Deadwood Dam on the Deadwood River, Cascade Dam on the North Fork Payette River, and Black Canyon Reservoir on the Payette River. Only the Upper South Fork Payette River and the Middle Fork Payette River still have connectivity, the remaining core areas are isolated from each other due to dams. Both fluvial and adfluvial life history expression are still present in the Payette River basin but only resident populations are present in the Squaw Creek and North Fork Payette River core areas. The Payette River basin contains 5 of the 22 core areas and 25 of the 206 local populations in the recovery unit. Less than 9 percent of occupied habitat in the recovery unit is in this basin. Approximately 60 percent of the lands in the core areas are federally owned and the majority is managed by the U.S. Forest Service. Trend data are lacking and the current condition of the various core areas is unknown, but there is concern due to the current isolation of three (North Fork Payette River, Squaw Creek, Deadwood River) of the five core areas; the presence of only resident local populations in two (North Fork Payette River, Squaw Creek) of the five core areas; and the relatively low numbers present in the North Fork core area (USFWS 2015e, p. E-8).

Jarbidge River

The Jarbidge River core area contains two major fish barriers along the Bruneau River: the Buckaroo diversion and C. J. Strike Reservoir. Bull trout are not known to migrate down to the Snake River. There is one core area in the basin, with populations in the Jarbidge River; this watershed does not contain any barriers. Approximately 89 percent of the Jarbidge core area is federally owned. Most lands are managed by either the Forest Service or Bureau of Land Management. A large portion of the core area is within the Bruneau-Jarbidge Wilderness area. A tracking study has documented bull trout population connectivity among many of the local populations, in particular between West Fork Jarbidge River and Pine Creek. Movement between the East and West Fork Jarbidge River has also been documented; therefore, both resident and fluvial populations are present. The core area contains six local populations and 3 percent of the occupied habitat in the recovery unit. Trend data are lacking within this core area (USFWS 2015e, p. E-9).

Little Lost River

The Little Lost River basin is unique in that the watershed is within a naturally occurring hydrologic sink and has no connectivity with other drainages. A small fluvial population of bull trout may still exist, but it appears that most populations are predominantly resident populations. There is one core area in the Little Lost basin, and approximately 89 percent of it is federally owned by either the U.S. Forest Service or Bureau of Land Management. The core area contains 10 local populations and less than 3 percent of the occupied habitat in the recovery unit. The current trend condition of this core area is likely stable, with most bull trout residing in Upper Sawmill Canyon (IDFG 2014).

Malheur River

The Malheur River basin contains major dams that are impassable to fish. The largest are Warm Springs Dam, impounding Warm Springs Reservoir on the mainstem Malheur River, and Agency Valley Dam, impounding Beulah Reservoir on the North Fork Malheur River. The dams result in two core areas that are isolated from each other and from other core areas. Local populations in the two core areas are limited to habitat in the upper watersheds. The Malheur River basin contains 2 of the 22 core areas and 8 of the 206 local populations in the recovery unit. Fluvial and resident populations are present in both core areas while adfluvial populations are present in the North Fork Malheur River. This basin contains less than 3 percent of the occupied habitat in the recovery unit, and approximately 60 percent of lands in the two core areas are federally owned. Trend data indicates that populations are declining in both core areas (USFWS 2015e, p. E-9).

Weiser River

The Weiser River basin contains local populations that are limited to habitat in the upper watersheds. The Weiser River basin contains only a single core area that consists of 5 of the 206 local populations in the recovery unit. Local populations occur in only three stream complexes in the upper watershed: 1) Upper Hornet Creek, 2) East Fork Weiser River, and 3) Upper Little Weiser River. These local populations include only resident life histories. This basin contains less than 2 percent of the occupied habitat in the recovery unit, and approximately 44 percent of lands are federally owned. Trend data from the Idaho Department of Fish and Game indicate that the populations in the Weiser core area are increasing (IDFG 2014) but it is considered vulnerable because local populations are isolated and likely do not express migratory life histories (USFWS 2015e, p.E-10).

St. Mary Recovery Unit

The Saint Mary Recovery Unit is located in northwest Montana east of the Continental Divide and includes the U.S. portions of the Saint Mary River basin, from its headwaters to the international boundary with Canada at the 49th parallel. The watershed and the bull trout population are linked to downstream aquatic resources in southern Alberta, Canada; the U.S. portion includes headwater spawning and rearing (SR) habitat in the tributaries and a portion of the FMO habitat in the mainstem of the Saint Mary River and Saint Mary lakes (Mogen and Kaeding 2001).

The Saint Mary Recovery Unit comprises four core areas; only one (Saint Mary River) is a complex core area with five described local bull trout populations (Divide, Boulder, Kennedy, Otatso, and Lee Creeks). Roughly half of the linear extent of available FMO habitat in the mainstem Saint Mary system (between Saint Mary Falls at the upstream end and the downstream Canadian border) is comprised of Saint Mary and Lower Saint Mary Lakes, with the remainder in the Saint Mary River. The other three core areas (Slide Lakes, Cracker Lake, and Red Eagle Lake) are simple core areas. Slide Lakes and Cracker Lake occur upstream of seasonal or permanent barriers and are comprised of genetically isolated single local bull trout populations, wholly within Glacier National Park, Montana. In the case of Red Eagle Lake, physical isolation does not occur, but consistent with other lakes in the adjacent Columbia Headwaters Recovery Unit, there is likely some degree of spatial separation from downstream Saint Mary Lake. As noted, the extent of isolation has been identified as a research need (USFWS 2015f, p. F-1).

Bull trout in the Saint Mary River complex core area are documented to exhibit primarily the migratory fluvial life history form (Mogen and Kaeding 2005a, 2005b), but there is doubtless some occupancy (though less well documented) of Saint Mary Lakes, suggesting a partly adfluvial adaptation. Since lake trout and northern pike are both native to the Saint Mary River system (headwaters of the South Saskatchewan River drainage draining to Hudson Bay), the conventional wisdom is that these large piscivores historically outcompeted bull trout in the lacustrine environment (Donald and Alger 1993, Martinez et al. 2009), resulting in a primarily fluvial niche and existence for bull trout in this system. This is an untested hypothesis and additional research into this aspect is needed (USFWS 2015f, p. F-3).

Bull trout populations in the simple core areas of the three headwater lake systems (Slide, Cracker, and Red Eagle Lakes) are, by definition, adfluvial; there are also resident life history components in portions of the Saint Mary River system such as Lower Otatso Creek (Mogen and Kaeding 2005a), further exemplifying the overall life history diversity typical of bull trout. Mogen and Kaeding (2001) reported that bull trout continue to inhabit nearly all suitable habitats accessible to them in the Saint Mary River basin in the United States. The possible exception is portions of Divide Creek, which appears to be intermittently occupied despite a lack of permanent migratory barriers, possibly due to low population size and erratic year class production (USFWS 2015f, p. F-3).

It should be noted that bull trout are found in minor portions of two additional U.S. watersheds (Belly and Waterton rivers) that were once included in the original draft recovery plan (USFWS 2002) but are no longer considered core areas in the final recovery plan (USFWS 2015) and are not addressed in that document. In Alberta, Canada, the Saint Mary River bull trout population is considered at "high risk," while the Belly River is rated as "at risk" (ACA 2009). In the Belly River drainage, which enters the South Saskatchewan system downstream of the Saint Mary River in Alberta, some bull trout spawning is known to occur on either side of the international boundary. These waters are in the drainage immediately west of the Saint Mary River headwaters. However, the U.S. range of this population constitutes only a minor headwater migratory SR segment of an otherwise wholly Canadian population, extending less than 1 mile (0.6 km) into backcountry waters of Glacier National Park. The Belly River population is otherwise totally dependent on management within Canadian jurisdiction, with no natural migratory connection to the Saint Mary (USFWS 2015f, p. F-3).

Current status of bull trout in the Saint Mary River core area (U.S.) is considered strong (Mogen 2013). Migratory bull trout redd counts are conducted annually in the two major SR streams, Boulder and Kennedy creeks. Boulder Creek redd counts have ranged from 33 to 66 in the past decade, with the last 4 counts all 53 or higher. Kennedy Creek redd counts are less robust, ranging from 5 to 25 over the last decade, with a 2014 count of 20 (USFWS 2015f, p. F-3).

Generally, the demographic status of the Saint Mary River core area is believed to be good, with the exception of the Divide Creek local population. In this local population, there is evidence that a combination of ongoing habitat manipulation (Smillie and Ellerbroek 1991, F-5 NPS 1992) resulting in occasional historical passage issues, combined with low and erratic recruitment (DeHaan et al. 2011) has caused concern for the continuing existence of the local population.

While less is known about the demographic status of the three simple cores where redd counts are not conducted, all three appear to be self-sustaining and fluctuating within known historical population demographic bounds. Of the three simple core areas, demographic status in Slide Lakes and Cracker Lake appear to be functioning appropriately, but the demographic status in Red Eagle Lake is less well documented and believed to be less robust (USFWS 2015f, p. F-3).

Reasons for Listing

Bull trout distribution, abundance, and habitat quality have declined rangewide (Bond 1992, pp. 2-3; Schill 1992, p. 42; Thomas 1992, entire; Ziller 1992, entire; Rieman and McIntyre 1993, p. 1; Newton and Pribyl 1994, pp. 4-5; McPhail and Baxter 1996, p. 1). Several local extirpations have been documented, beginning in the 1950s (Rode 1990, pp. 26-32; Ratliff and Howell 1992, entire; Donald and Alger 1993, entire; Goetz 1994, p. 1; Newton and Pribyl 1994, pp. 8-9; Light et al. 1996, pp. 6-7; Buchanan et al. 1997, p. 15; WDFW 1998, pp. 2-3). Bull trout were extirpated from the southernmost portion of their historic range, the McCloud River in California, around 1975 (Rode 1990, p. 32). Bull trout have been functionally extirpated (i.e., few individuals may occur there but do not constitute a viable population) in the Coeur d'Alene River basin in Idaho and in the Lake Chelan and Okanogan River basins in Washington (USFWS 1998, pp. 31651-31652).

These declines result from the combined effects of habitat degradation and fragmentation, the blockage of migratory corridors; poor water quality, angler harvest and poaching, entrainment (process by which aquatic organisms are pulled through a diversion or other device) into diversion channels and dams, and introduced nonnative species. Specific land and water management activities that depress bull trout populations and degrade habitat include the effects of dams and other diversion structures, forest management practices, livestock grazing, agriculture, agricultural diversions, road construction and maintenance, mining, and urban and rural development (Beschta et al. 1987, entire; Chamberlain et al. 1991, entire; Furniss et al. 1991, entire; Meehan 1991, entire; Nehlsen et al. 1991, entire; Sedell and Everest 1991, entire; Craig and Wissmar 1993pp, 18-19; Henjum et al. 1994, pp. 5-6; McIntosh et al. 1994, entire; Wissmar et al. 1994, entire; MBTSG 1995a, p. 1; MBTSG 1995b. pp. i-ii; MBTSG 1995c, pp. i-ii; MBTSG 1995d, p. 22; MBTSG 1995e, p. i; MBTSG 1996a, p. i-ii; MBTSG 1996b, p. i; MBTSG 1996c, p. i; MBTSG 1996d, p. i; MBTSG 1996e, p. i; MBTSG 1996f, p. 11; Light et al. 1996, pp. 6-7; USDA and USDI 1995, p. 2).

Emerging Threats

Climate Change

Climate change was not addressed as a known threat when bull trout was listed. The 2015 bull trout recovery plan and RUIPs summarize the threat of climate change and acknowledges that some extant bull trout core area habitats will likely change (and may be lost) over time due to anthropogenic climate change effects, and use of best available information will ensure future conservation efforts that offer the greatest long-term benefit to sustain bull trout and their required coldwater habitats (USFWS 2015, p. vii, and pp. 17-20, USFWS 2015a-f).

Global climate change and the related warming of global climate have been well documented (IPCC 2007, entire; ISAB 2007, entire; Combes 2003, entire). Evidence of global climate change/warming includes widespread increases in average air and ocean temperatures and accelerated melting of glaciers, and rising sea level. Given the increasing certainty that climate change is occurring and is accelerating (IPCC 2007, p. 253; Battin et al. 2007, p. 6720), we can no longer assume that climate conditions in the future will resemble those in the past.

Patterns consistent with changes in climate have already been observed in the range of many species and in a wide range of environmental trends (ISAB 2007, entire; Hari et al. 2006, entire; Rieman et al. 2007, entire). In the northern hemisphere, the duration of ice cover over lakes and rivers has decreased by almost 20 days since the mid-1800's (Magnuson et al. 2000, p. 1743). The range of many species has shifted poleward and elevationally upward. For cold-water associated salmonids in mountainous regions, where their upper distribution is often limited by impassable barriers, an upward thermal shift in suitable habitat can result in a reduction in range, which in turn can lead to a population decline (Hari et al. 2006, entire).

In the Pacific Northwest, most models project warmer air temperatures and increases in winter precipitation and decreases in summer precipitation. Warmer temperatures will lead to more precipitation falling as rain rather than snow. As the seasonal amount of snow pack diminishes, the timing and volume of stream flow are likely to change and peak river flows are likely to increase in affected areas. Higher air temperatures are also likely to increase water temperatures (ISAB 2007, pp. 15-17). For example, stream gauge data from western Washington over the past 5 to 25 years indicate a marked increasing trend in water temperatures in most major rivers.

Climate change has the potential to profoundly alter the aquatic ecosystems upon which the bull trout depends via alterations in water yield, peak flows, and stream temperature, and an increase in the frequency and magnitude of catastrophic wildfires in adjacent terrestrial habitats (Bisson et al. 2003, pp 216-217).

All life stages of the bull trout rely on cold water. Increasing air temperatures are likely to impact the availability of suitable cold water habitat. For example, ground water temperature is generally correlated with mean annual air temperature, and has been shown to strongly influence the distribution of other chars. Ground water temperature is linked to bull trout selection of spawning sites, and has been shown to influence the survival of embryos and early juvenile rearing of bull trout (Baxter 1997, p. 82). Increases in air temperature are likely to be reflected in increases in both surface and groundwater temperatures.

Climate change is likely to affect the frequency and magnitude of fires, especially in warmer drier areas such as are found on the eastside of the Cascade Mountains. Bisson et al. (2003, pp. 216-217) note that the forest that naturally occurred in a particular area may or may not be the forest that will be responding to the fire regimes of an altered climate. In several studies related to the effect of large fires on bull trout populations, bull trout appear to have adapted to past fire disturbances through mechanisms such as dispersal and plasticity. However, as stated earlier, the future may well be different than the past and extreme fire events may have a dramatic effect on bull trout and other aquatic species, especially in the context of continued habitat loss, simplification and fragmentation of aquatic systems, and the introduction and expansion of exotic species (Bisson et al. 2003, pp. 218-219).

Migratory bull trout can be found in lakes, large rivers and marine waters. Effects of climate change on lakes are likely to impact migratory adfluvial bull trout that seasonally rely upon lakes for their greater availability of prey and access to tributaries. Climate-warming impacts to lakes will likely lead to longer periods of thermal stratification and coldwater fish such as adfluvial bull trout will be restricted to these bottom layers for greater periods of time. Deeper thermoclines resulting from climate change may further reduce the area of suitable temperatures in the bottom layers and intensify competition for food (Shuter and Meisner 1992. p. 11).

Bull trout require very cold water for spawning and incubation. Suitable spawning habitat is often found in accessible higher elevation tributaries and headwaters of rivers. However, impacts on hydrology associated with climate change are related to shifts in timing, magnitude and distribution of peak flows that are also likely to be most pronounced in these high elevation stream basins (Battin et al. 2007, p. 6720). The increased magnitude of winter peak flows in high elevation areas is likely to impact the location, timing, and success of spawning and incubation for the bull trout and Pacific salmon species. Although lower elevation river reaches are not expected to experience as severe an impact from alterations in stream hydrology, they are unlikely to provide suitably cold temperatures for bull trout spawning, incubation and juvenile rearing.

As climate change progresses and stream temperatures warm, thermal refugia will be critical to the persistence of many bull trout populations. Thermal refugia are important for providing bull trout with patches of suitable habitat during migration through or to make feeding forays into areas with greater than optimal temperatures.

There is still a great deal of uncertainty associated with predictions relative to the timing, location, and magnitude of future climate change. It is also likely that the intensity of effects will vary by region (ISAB 2007, p 7) although the scale of that variation may exceed that of States. For example, several studies indicate that climate change has the potential to impact ecosystems in nearly all streams throughout the State of Washington (ISAB 2007, p. 13; Battin et al. 2007, p. 6722; Rieman et al. 2007, pp. 1558-1561). In streams and rivers with temperatures approaching or at the upper limit of allowable water temperatures, there is little if any likelihood that bull trout will be able to adapt to or avoid the effects of climate change/warming. There is little doubt that climate change is and will be an important factor affecting bull trout distribution. As its distribution contracts, patch size decreases and connectivity is truncated, bull trout populations that may be currently connected may face increasing isolation, which could accelerate the rate of local extinction beyond that resulting from changes in stream temperature alone (Rieman et al. 2007, pp. 1559-1560). Due to variations in land form and geographic location across the range of the bull trout, it appears that some populations face higher risks than others. Bull trout in areas with currently degraded water temperatures and/or at the southern edge of its range may already be at risk of adverse impacts from current as well as future climate change.

The ability to assign the effects of gradual global climate change to bull trout or to a specific location on the ground is beyond our technical capabilities at this time.

Conservation

<u>Conservation Needs</u>

The 2015 recovery plan 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 stable1 in six recovery units; 2) effectively manage and ameliorate the primary threats in each of six recovery units 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 2015, p. v.).

Information presented in prior draft recovery plans published in 2002 and 2004 (USFWS 2002a, 2004) have served to identify recovery actions across the range of the species and to provide a framework for implementing numerous recovery actions by our partner agencies, local working groups, and others with an interest in bull trout conservation.

The 2015 recovery plan (USFWS 2015) integrates new information collected since the 1999 listing regarding bull trout life history, distribution, demographics, conservation successes, etc., and integrates and updates previous bull trout recovery planning efforts across the range of the single DPS listed under the Act.

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 2015, p. 45-46).

To implement the recovery strategy, the 2015 recovery plan establishes categories of recovery actions for each of the six Recovery Units (USFWS 2015, p. 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 biologically-based recover units: 1) Coastal Recovery Unit; 2) Klamath Recovery Unit; 3) Mid-Columbia Recovery Unit; 4) Upper Snake Recovery Unit; 5) Columbia Headwaters Recovery Unit; and 6) Saint Mary Recovery Unit (USFWS 2015, 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 2015, p. 33).

Each of the six recovery units contain multiple bull trout core areas, 116 total, which are non-overlapping watershed-based polygons, and each core area includes one or more local populations. Currently there are 109 occupied core areas, which comprise 611 local populations (USFWS 2015, p. 3). There are also six core areas where bull trout historically occurred but are now extirpated, and one research needs area where bull trout were known to occur historically, but their current presence and use of the area are uncertain (USFWS 2015, p. 3). Core areas can be further described as complex or simple (USFWS 2015, p. 3-4). Complex core areas contain multiple local bull trout populations, are found in large watersheds, have multiple life history forms, and have migratory connectivity between spawning and rearing habitat and FMO habitats. Simple core areas are those that contain one bull trout local population. Simple core areas are small in scope, isolated from other core areas by natural barriers, and may contain unique genetic or life history adaptations.

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

Recovery Units and Local Populations

The final recovery plan (USFWS 2015) designates six bull trout recovery units as described above. These units replace the 5 interim recovery units previously identified (USFWS 1999). The Service will address the conservation of these final recovery units in our section 7(a)(2) analysis for proposed Federal actions. The recovery plan (USFWS 2015), identified threats and factors affecting the bull trout within these units. A detailed description of recovery implementation for each recovery unit is provided in separate recovery unit implementation plans (RUIPs)(USFWS 2015a-f), which identify conservation actions and recommendations needed for each core area, forage/ migration/ overwinter areas, historical core areas, and research needs areas. Each of the following recovery units (below) is necessary to maintain the bull trout's distribution, as well as its genetic and phenotypic diversity, all of which are important to ensure the species' resilience to changing environmental conditions.

Coastal Recovery Unit

The coastal recovery unit implementation plan describes the threats to bull trout and the site-specific management actions necessary for recovery of the species within the unit (USFWS 2015a). The Coastal Recovery Unit is located within western Oregon and Washington. The Coastal Recovery Unit is divided into three regions: Puget Sound, Olympic Peninsula, and the Lower Columbia River Regions. This recovery unit contains 20 core areas comprising 84 local populations and a single potential local population in the historic Clackamas River core area where bull trout had been extirpated and were reintroduced in 2011, and identified four historically occupied core areas that could be re-established (USFWS 2015, pg. 47; USFWS 2015a, p. A-2). Core areas within Puget Sound and the Olympic Peninsula currently support the only anadromous local populations of bull trout. This recovery unit also contains ten shared FMO habitats which are outside core areas and allows for the continued natural population dynamics in which the core areas have evolved (USFWS 2015a, p. A-5). There are four core areas within the Coastal Recovery Unit that have been identified as current population strongholds: Lower Skagit, Upper Skagit, Quinault River, and Lower Deschutes River (USFWS 2015, p.79). These are the most stable and abundant bull trout populations in the recovery unit. The current condition of the bull trout in this recovery unit is attributed to the adverse effects of climate change, loss of functioning estuarine and nearshore marine habitats, development and related impacts (e.g., flood control, floodplain disconnection, bank armoring, channel straightening, loss of instream habitat complexity), agriculture (e.g., diking, water control structures, draining of wetlands, channelization, and the removal of riparian vegetation, livestock grazing), fish passage (e.g., dams, culverts, instream flows) residential development, urbanization, forest management practices (e.g., timber harvest and associated road building activities), connectivity impairment, mining, and the introduction of non-native species. Conservation measures or recovery actions implemented include relicensing of major hydropower facilities that have provided upstream and downstream fish passage or complete removal of dams, land acquisition to conserve bull trout habitat, floodplain restoration, culvert removal, riparian revegetation, levee setbacks, road removal, and projects to protect and restore important nearshore marine habitats.

Klamath Recovery Unit

The Klamath recovery unit implementation plan describes the threats to bull trout and the site-specific management actions necessary for recovery of the species within the unit (USFWS 2015b). The Klamath Recovery Unit is located in southern Oregon and northwestern California. The Klamath Recovery Unit is the most significantly imperiled recovery unit, having experienced considerable extirpation and geographic contraction of local populations and declining demographic condition, and natural re-colonization is constrained by dispersal barriers and presence of nonnative brook trout (USFWS 2015, p. 39). This recovery unit currently contains three core areas and eight local populations (USFWS 2015, p. 47; USFWS 2015b, p. B-1). Nine historic local populations of bull trout have become extirpated (USFWS 2015b, p. B-1). All three core areas have been isolated from other bull trout populations for the past 10,000 years (USFWS 2015b, p. B-3. The current condition of the bull trout in this recovery unit is attributed to the adverse effects of climate change, habitat degradation and fragmentation, past and present land use practices, agricultural water diversions, nonnative species, and past fisheries management practices. Conservation measures or recovery actions implemented include removal of nonnative fish (e.g., brook trout, brown trout, and hybrids), acquiring water rights for instream flows, replacing diversion structures, installing fish screens, constructing bypass channels, installing riparian fencing, culver replacement, and habitat restoration.

Mid-Columbia Recovery Unit

The Mid-Columbia recovery unit implementation plan describes the threats to bull trout and the site-specific management actions necessary for recovery of the species within the unit (USFWS 2015c). The Mid-Columbia Recovery Unit is located within eastern Washington, eastern Oregon, and portions of central Idaho. The Mid-Columbia Recovery Unit is divided into four geographic regions: Lower Mid-Columbia, Upper Mid-Columbia, Lower Snake, and Mid-Snake Geographic Regions. This recovery unit contains 24 occupied core areas comprising 142 local populations, two historically occupied core areas, one research needs area, and seven FMO habitats (USFWS 2015, pg. 47; USFWS 2015c, p. C-1–4). The current condition of the bull trout in this recovery unit is attributed to the adverse effects of climate change, agricultural practices (e.g. irrigation, water withdrawals, livestock grazing), fish passage (e.g. dams, culverts), nonnative species, forest management practices, and mining. Conservation measures or recovery actions implemented include road removal, channel restoration, mine reclamation, improved grazing management, removal of fish barriers, and instream flow requirements.

Columbia Headwaters Recovery Unit

The Columbia headwaters recovery unit implementation plan describes the threats to bull trout and the site-specific management actions necessary for recovery of the species within the unit (USFWS 2015d, entire). The Columbia Headwaters Recovery Unit is located in western Montana, northern Idaho, and the northeastern corner of Washington. The Columbia Headwaters Recovery Unit is divided into five geographic regions: Upper Clark Fork, Lower Clark Fork, Flathead, Kootenai, and Coeur d'Alene Geographic Regions (USFWS 2015d, pp. D-2 – D-4). This recovery unit 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 2015d, p. D-1). Fish passage improvements within the recovery unit have reconnected some previously fragmented habitats (USFWS 2015d, p. D-1), while others remain fragmented. Unlike the other recovery units in Washington, Idaho and Oregon, the Columbia Headwaters Recovery Unit does not have any anadromous fish overlap. Therefore, bull trout within the Columbia Headwaters Recovery Unit do not benefit from the recovery actions for salmon (USFWS 2015d, p. D-41). The current condition of the bull trout in this recovery unit 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. Conservation measures or recovery actions implemented include habitat improvement, fish passage, and removal of nonnative species.

Upper Snake Recovery Unit

The Upper Snake recovery unit implementation plan 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 Upper Snake Recovery Unit is located in central Idaho, northern Nevada, and eastern Oregon. The Upper Snake Recovery Unit is divided into seven geographic regions: Salmon River, Boise River, Payette River, Little Lost River, Malheur River, Jarbidge River, and Weiser River. This recovery unit contains 22 core areas and 207 local populations (USFWS 2015, p. 47), with almost 60 percent being present in the Salmon River Region. The current condition of the bull trout in this recovery unit is attributed to the adverse effects of climate change, dams, mining, forest management practices, nonnative species, and agriculture (e.g., water diversions, grazing). Conservation measures or recovery actions implemented include instream habitat restoration, instream flow requirements, screening of irrigation diversions, and riparian restoration.

St. Mary Recovery Unit

The St. Mary recovery unit implementation plan describes the threats to bull trout and the site-specific management actions necessary for recovery of the species within the unit (USFWS 2015f). The Saint Mary Recovery Unit is located in Montana but is heavily linked to downstream resources in southern Alberta, Canada. Most of the Saskatchewan River watershed which the St. Mary flows into is located in Canada. The United States portion includes headwater spawning and rearing habitat and the upper reaches of FMO habitat. This recovery unit contains four core areas, and seven local populations (USFWS 2015f, p. F-1) in the U.S. Headwaters. The current condition of the bull trout in this recovery unit is attributed primarily to the outdated design and operations of the Saint Mary Diversion operated by the Bureau of Reclamation (e.g., entrainment, fish passage, instream flows), and, to a lesser extent habitat impacts from development and nonnative species.

Tribal Conservation Activities

Many Tribes throughout the range of the bull trout are participating on bull trout conservation working groups or recovery teams in their geographic areas of interest. Some tribes are also implementing projects which focus on bull trout or that address anadromous fish but benefit bull trout (e.g., habitat surveys, passage at dams and diversions, habitat improvement, and movement studies).

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APPENDIX B

Status of the Species: Bull Trout Critical Habitat

Past designations of critical habitat have used the terms "primary constituent elements" (PCEs), "physical and biological features" (PBFs) or "essential features" to characterize the key components of critical habitat that provide for the conservation of the listed species. The new critical habitat regulations (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.

Current Legal Status of the Critical Habitat

Current Designation

The Service published a final critical habitat designation for the coterminous United States population of the bull trout on October 18, 2010 (USFWS 2010, entire); the rule became effective on November 17, 2010. A justification document was also developed to support the rule and is available on the Service's website: (http://www.fws.gov/pacific/bulltrout). The scope of the designation involved the species' coterminous range, which includes the Coastal, Klamath, Mid-Columbia, Upper Snake, Columbia Headwaters and St. Mary's Recovery Unit population segments. Rangewide, the Service designated reservoirs/lakes and stream/shoreline miles as bull trout critical habitat (Table 1). Designated bull trout critical habitat is of two primary use types: 1) spawning and rearing, and 2) FMO.

Table 1. Stream/Shoreline Distance and Reservoir/Lake Area Designated as Bull Trout Critical Habitat.

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[1]	2,835.9	4,563.9	30,255.5	12,244.0
Oregon/Idaho[2]	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[3]	19,729.0	31,750.8	488,251.7	197,589.2

[1] No shore line is included in Oregon
[2] Pine Creek Drainage which falls within Oregon
[3] Total of freshwater streams: 18,975

The 2010 revision 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 compared to the 2005 designation.

The final 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 migratory bull trout populations based on currently available scientific information. These unoccupied areas often include lower main stem river environments that can provide seasonally important migration habitat for bull trout. This type of habitat is essential in areas where bull trout habitat and population loss over time necessitates reestablishing bull trout in currently unoccupied habitat areas to achieve recovery.

The final rule continues to exclude some critical habitat segments based on a careful balancing of the benefits of inclusion versus the benefits of exclusion. Critical habitat does not include: 1) waters adjacent to non-Federal lands covered by legally operative incidental take permits for habitat conservation plans (HCPs) issued under section 10(a)(1)(B) of the Endangered Species Act of 1973, as amended (Act), 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 2010, p. 63903). 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.

The Physical and Biological Features

Conservation Role and Description of Critical Habitat

The conservation role of bull trout critical habitat is to support viable core area populations (USFWS 2010, p. 63898). 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.

Thirty-two CHUs within the geographical area occupied by the species at the time of listing are designated under the revised 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 biological features associated with physical and biological features (PBFs) 5 and 6, which relate to breeding habitat.

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 (Hard 1995, pp. 314-315; Healey and Prince 1995, p. 182; 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 (Hard 1995, pp. 321-322; MBTSG 1998, pp. 13-16; Rieman and Allendorf 2001, p. 763; Rieman and McIntyre 1993, p. 23).

Physical and Biological Features for Bull Trout

Within the designated critical habitat areas, the PBFs for bull trout are those habitat components that are essential for the primary biological needs of foraging, reproducing, rearing of young, dispersal, genetic exchange, or sheltering. Based on our current knowledge of the life history, biology, and ecology of this species and the characteristics of the habitat necessary to sustain its essential life-history functions, we have determined that the PBFs, as described within USFWS 2010, are essential for the conservation of bull trout. A summary of those PBFs follows.

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 °C to 15 °C, 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 departure 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 non-native 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.

The revised PBF's are similar to those previously in effect under the 2005 designation. The most significant modification is the addition of a ninth PBF to address the presence of nonnative predatory or competitive fish species. Although this PBF applies to both the freshwater and marine environments, currently no non-native fish species are of concern in the marine environment, though this could change in the future.

Note that only PBFs 2, 3, 4, 5, and 8 apply to marine nearshore waters identified as critical habitat. Also, lakes and reservoirs within the CHUs also contain most of the physical or biological features necessary to support bull trout, with the exception of those associated with PBFs 1 and 6. Additionally, all except PBF 6 apply to FMO habitat designated as critical habitat.

Critical habitat includes the stream channels within the designated stream reaches and has a lateral extent as defined by the bankfull elevation on one bank to the bankfull elevation on the opposite bank. Bankfull elevation is the level at which water begins to leave the channel and move into the floodplain and is reached at a discharge that generally has a recurrence interval of 1 to 2 years on the annual flood series. If bankfull elevation is not evident on either bank, the ordinary high-water line must be used to determine the lateral extent of critical habitat. The lateral extent of designated lakes is defined by the perimeter of the waterbody as mapped on standard 1:24,000 scale topographic maps. The Service assumes in many cases this is the full-pool level of the waterbody. In areas where only one side of the waterbody is designated (where only one side is excluded), the mid-line of the waterbody represents the lateral extent of critical habitat.

In marine nearshore areas, the inshore extent of critical habitat is the mean higher high-water (MHHW) line, including the uppermost reach of the saltwater wedge within tidally influenced freshwater heads of estuaries. The MHHW line refers to the average of all the higher high-water heights of the two daily tidal levels. Marine critical habitat extends offshore to the depth of 10 meters (m) (33 ft) relative to the mean low low-water (MLLW) line (zero tidal level or average of all the lower low-water heights of the two daily tidal levels). This area between the MHHW line and minus 10 m MLLW line (the average extent of the photic zone) is considered the habitat most consistently used by bull trout in marine waters based on known use, forage fish availability, and ongoing migration studies and captures geological and ecological processes important to maintaining these habitats. This area contains essential foraging habitat and migration corridors such as estuaries, bays, inlets, shallow subtidal areas, and intertidal flats.

Adjacent shoreline riparian areas, bluffs, and uplands are not designated as critical habitat. However, it should be recognized that the quality of marine and freshwater habitat along streams, lakes, and shorelines is intrinsically related to the character of these adjacent features, and that human activities that occur outside of the designated critical habitat can have major effects on physical and biological features of the aquatic environment.

Activities that cause adverse effects to critical habitat are evaluated to determine if they are likely to "destroy or adversely modify" critical habitat by no longer serving the intended conservation role for the species or retaining those PBFs that relate to the ability of the area to at least periodically support the species. Activities that may destroy or adversely modify critical habitat are those that alter the PBFs to such an extent that the conservation value of critical habitat is appreciably reduced (USFWS 2010, pp. 63898:63943; USFWS 2004a, pp. 140-193; USFWS 2004b, pp. 69-114). The Service's evaluation must be conducted at the scale of the entire critical habitat area designated, unless otherwise stated in the final critical habitat rule (USFWS and NMFS 1998, Ch. 4 p. 39). Thus, adverse modification of bull trout critical habitat is evaluated at the scale of the final designation, which includes the critical habitat designated for the Klamath River, Jarbidge River, Columbia River, Coastal-Puget Sound, and Saint Mary-Belly River population segments. However, we consider all 32 CHUs to contain features or areas essential to the conservation of the bull trout (USFWS 2010, pp. 63898:63901, 63944). Therefore, if a proposed action would alter the physical or biological features of critical habitat to an extent that appreciably reduces the conservation function of one or more critical habitat units for bull trout, a finding of adverse modification of the entire designated critical habitat area may be warranted (USFWS 2010, pp. 63898:63943).

Current Critical Habitat Condition Rangewide

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 (Ratliff and Howell 1992, entire; Schill 1992, p. 40; Thomas 1992, p. 28; Buchanan et al. 1997, p. vii; Rieman et al. 1997, pp. 15-16; Quigley and Arbelbide 1997, pp. 1176-1177). This condition reflects the condition of bull trout habitat. The decline of bull trout is primarily due to habitat degradation and fragmentation, blockage of migratory corridors, poor water quality, past fisheries management practices, impoundments, dams, water diversions, and the introduction of nonnative species (USFWS 1998, pp. 31648-31649; USFWS 1999, p. 17111).

There is widespread agreement in the scientific literature that many factors related to human activities have impacted bull trout and their habitat, and continue to do so. Among the many factors that contribute to degraded PBFs, those which appear to be particularly significant and have resulted in a legacy of degraded habitat conditions are as follows: 1) fragmentation and isolation of local populations due to the proliferation of dams and water diversions that have eliminated habitat, altered water flow and temperature regimes, and impeded migratory movements (Dunham and Rieman 1999, p. 652; Rieman and McIntyre 1993, p. 7); 2) degradation of spawning and rearing habitat and upper watershed areas, particularly alterations in sedimentation rates and water temperature, resulting from forest and rangeland practices and intensive development of roads (Fraley and Shepard 1989, p. 141; MBTSG 1998, pp. ii - v, 20-45); 3) the introduction and spread of nonnative fish species, particularly brook trout and lake trout, as a result of fish stocking and degraded habitat conditions, which compete with bull trout for limited resources and, in the case of brook trout, hybridize with bull trout (Leary et al. 1993, p. 857; Rieman et al. 2006, pp. 73-76); 4) in the Coastal-Puget Sound region where amphidromous bull trout occur, degradation of mainstem river FMO habitat, and the degradation and loss of marine nearshore foraging and migration habitat due to urban and residential development; and 5) degradation of FMO habitat resulting from reduced prey base, roads, agriculture, development, and dams.

Effects of Climate Change on Bull Trout Critical Habitat

One objective of the final rule was 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 non-native fishes).

Many of the PBFs for bull trout may be affected by the presence of toxics and/or increased water temperatures within the environment. The effects will vary greatly depending on a number of factors which include which toxic substance is present, the amount of temperature increase, the likelihood that critical habitat would be affected (probability), and the severity and intensity of any effects that might occur (magnitude).

The ability to assign the effects of gradual global climate change bull trout critical habitat or to a specific location on the ground is beyond our technical capabilities at this time.

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