United States Department of the Interior

Fish and Wildlife Service

Ecological Services
Montana Field Office
585 Shepard Way, Suite 1
Helena, Montana 59601-6287
Phone: (406) 449-5225, Fax: (406) 449-5339

In Reply Refer To:
File: M19 Helena-Lewis and Clark National Forest
Terrestrial Species: 06E11000-2016-F-0413 Stonewall Vegetation Project
Aquatic Species: 06E11000-2015-F-0406 Stonewall Vegetation Project

August 24, 2016

Michael Stansberry, District Ranger
Lincoln Ranger District
Helena-Lewis and Clark National Forest
7269 Highway 200
Lincoln, Montana 59639

Dear Mr. Stansberry:

This is in response to your request for U.S. Fish and Wildlife Service (Service) review of the biological assessments for the proposed Stonewall Vegetation Project (Stonewall Project). The biological assessments analyzed the effects of the proposed action on federally listed threatened species and designated critical habitat, specifically grizzly bears (*Ursus arctos horribilis*), Canada lynx (*Lynx canadensis*), designated Canada lynx critical habitat, bull trout (*Salvelinus confluentus*), and designated bull trout critical habitat. The Helena-Lewis and Clark National Forest (Forest) made a determination of may affect, likely to adversely affect for grizzly bears, lynx, lynx critical habitat, bull trout, and bull trout critical habitat. Although your initial request was dated May 5, 2015, revisions and additional information to both the action and the analysis regarding the Stonewall Project were received through August 8, 2016.

This document represents the findings required of the Service under section 7(a)(2) of the Endangered Species Act of 1973 (as amended) (Act) regarding the effects from the proposed action to species listed and critical habitat designated under the Act. We discuss and explain our findings below.

The Stonewall Project is located on the Lincoln Ranger District of the Forest, approximately three miles north and west of Lincoln, Montana. The project focuses on reducing hazardous fuel buildup and improving forest health by using various vegetative treatments on approximately 4,868 acres including: 1,423 acres of commercial harvest; 690 acres of precommercial thinning; and 2,755 acres of prescribed burning. Approximately 32.4 miles of road would be used as haul routes during implementation. This includes 31.5 miles of existing road requiring maintenance or improvements and 4 new road segments of temporary road totaling 0.9 mile. Each of the four new segments of temporary road will be obliterated within two years of construction. Additional project information can be found in the biological assessments prepared for the Stonewall Project.

Grizzly Bear

The following paragraphs describe the relationship of access management to the proposed action. Recently, on August 3, 2016, the Service issued a programmatic non-jeopardy biological opinion and incidental take statement (2016 programmatic biological opinion) regarding the effects of the Blackfoot Non-Winter Travel Plan (Travel Plan) (U.S. Fish and Wildlife Service 2016). The 2016 programmatic biological opinion was prepared in accordance with section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. § 1531 et seq.).

The biological opinion on the Travel Plan analyzed the effects of Forest access management direction on grizzly bears, including access management in the action area (U.S. Fish and Wildlife Service 2016, pp 20-32). This includes the effects of existing, ongoing access management conditions (i.e., baseline condition) in each Northern Continental Divide Ecosystem (NCDE) recovery zone grizzly bear subunit on the Forest as well as areas outside of the recovery zone.

The 2016 programmatic biological opinion was designed as the first-tier of a tiered consultation framework on the programmatic direction of the Travel Plan. Second-tier consultations include the review of site specific projects related to the programmatic consultation on the Travel Plan. This consultation for the Stonewall Project is a second-tier consultation. The intent of this second-tier consultation is to evaluate whether the adverse effects on grizzly bears related to the proposed action are consistent with the 2016 programmatic biological opinion and incidental take statement.

In our review of the adverse effects of the Stonewall Project, we find that the existing access condition of the Red Mountain and Arrastra Mountain grizzly bear subunits and the road use within these subunits associated with the proposed action are consistent with our analysis of effects on grizzly bears in the 2016 programmatic biological opinion and incidental take statement. This second-tier consultation for the Stonewall Project illustrates how these adverse effects on grizzly bears related to the proposed action fall within the scope of our 2016 programmatic biological opinion and incidental take statement. The proposed action would not adversely affect grizzly bears in ways other than those previously analyzed in the 2016 programmatic biological opinion.

The existing condition of open and total motorized route density and core do not meet the 19/19/68 Guidelines (as explained in the biological opinion on the Travel Plan) within the Red Mountain subunit and total motorized route density does not meet the 19/19/68 guidelines within the Arrastra Mountain subunit. The existing, ongoing access condition is likely resulting in adverse effects to grizzly bears. Under the proposed action, no changes from the existing access condition would occur within the Red Mountain subunit. Approximately 0.9 mile of temporary road would be constructed and used within the Arrastra Mountain subunit, temporarily increasing open motorized route density (OMRD). However, the increase in OMRD would continue to meet the 19/19/68 guidelines and adverse effects to grizzly bears due to this increase would not occur. Upon completion of the proposed action the 0.9 mile of temporary road would be obliterated and OMRD would return to the existing condition. No other changes from the existing access condition would occur within the Arrastra Mountain subunit.

Upon review of the 2016 revised biological assessment for the proposed action (U.S. Forest Service 2016) and the 2016 programmatic biological opinion (U.S. Fish and Wildlife Service 2016), it is our opinion that the existing access condition and the road use associated with the Stonewall Project would not impart any adverse effects to grizzly bears in addition to those analyzed in the 2016 programmatic biological opinion and that the proposed action is in compliance with the incidental take statement of that opinion.

In addition to access management, effects of other aspects of the proposed action have also been considered. Project-related effects of the proposed action other than the effects related to access described above will not result in adverse effects to grizzly bears. Proposed activities may result in short-term disturbance in the immediate vicinity of the treatment units. Greater than 80 percent of the harvest is located in close proximity to existing roads and residences, thus much of the area may already be avoided by grizzly bears. Untreated habitat is widely available within the action area to accommodate grizzly bear use during activity. Additionally, seasonal operating restrictions until May 31 would reduce the potential to disturb grizzly bears during the spring season. Disturbance effects to grizzly bears as a result of the Stonewall Project would be short-term and insignificant.

A temporary reduction in cover will occur with regeneration harvest. In the partial or intermediate harvest units, residual overstory cover will be maintained on 25 to 50 percent of the sites treated. Also, riparian buffers would be maintained and interspersed throughout many of the units. While the amount of cover in some treatment units may decrease temporarily, it is expected that overall intermediate harvest prescriptions would provide adequate cover. Where a reduction in forested cover will occur, forage availability is likely to increase within treatment areas as opening the canopies would stimulate the understory growth of grasses and forbs, thus enhancing the forage value. Cover and forage availability will vary over time and by site. Opportunities for grizzly bears to move between habitats would continue to be present within the project area as well as lands within the remainder of the action area. No denning habitat occurs in the harvest units. While some potential denning habitat occurs within the prescribed burn units, none is within denning habitat that supports north slopes, which are more frequently selected for denning. The effects of the proposed action on grizzly bear cover, forage, and denning habitat would be insignificant.

Forest Order H-05-01, which addresses food and garbage storage in a bear-resistant manner, is in effect in the action area and a clause that requires contractors to adhere to this order will be included in all contracts associated with the proposed action. With proper food and attractant storage, the potential of attracting grizzly bears into the treatment units would be reduced and the potential for conflicts between grizzly bears and personnel associated with the action would be minimized. With such measures taken to minimize the potential for grizzly bear-human conflicts, the effects of such conflicts are expected to be discountable.

In summary, with the exception of effects related to access, the remaining effects to grizzly bears as a result of the proposed action would be insignificant and/or discountable. Additional analysis on the effects of the proposed action can be found in the revised biological assessment prepared for the proposed action (U.S. Forest Service 2016).

Grizzly Bear Summary

The Service has reviewed the revised biological assessment regarding the effects of the Stonewall Project on grizzly bears. Other than access, no activities under the proposed action are likely to adversely affect grizzly bears. We find that the adverse effects related to the existing, ongoing access conditions were adequately analyzed in the 2016 programmatic biological opinion and the proposed actions related to access conform to the incidental take statement associated with this opinion. Our finding is based on: (1) the baseline access condition falls within the scope of the programmatic biological opinion, (2) the effects of access management are consistent with those anticipated and analyzed in the programmatic biological opinion, (3) the amount of incidental take anticipated in the incidental take statement will not be exceeded, and (4) the proposed action adheres to the appropriate terms and conditions associated with the reasonable and prudent measures identified in the 2016 incidental take statement. Thus, the proposed action is consistent with the 2016 programmatic biological opinion and it's incidental take statement.

In summary, we reviewed: the revised biological assessment regarding the environmental baseline for the action area, the effects of the action, and the cumulative effects within the action area; the 2016 programmatic biological opinion on the Travel Plan; the information we relied upon to develop the 2016 programmatic biological opinion; and information in our files. After our review of the those documents and the status of grizzly bears, the environmental baseline, the effects of the action, and the cumulative effects, it is the Services biological opinion that the Stonewall Project is **not likely to jeopardize** the continued existence of grizzly bears.

As provided in 50 C.F.R. § 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: (a) the amount or extent of taking specified in the incidental take statement is exceeded; (b) new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (c) the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion; or (d) a new species is listed or critical habitat designated that may be affected by the identified action.

Canada Lynx

On March 23, 2007, the Service issued a programmatic non-jeopardy biological opinion and incidental take statement (2007 programmatic biological opinion) on the effects of the Northern Rocky Mountains Lynx Management Direction (NRLMD) Amendment on the Distinct Population Segment (DPS) of Canada lynx (lynx) in the contiguous United States (U.S. Fish and Wildlife Service 2007). This opinion was prepared in accordance with section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. § 1531 et seq.).

The 2007 programmatic biological opinion was designed as the first tier of a tiered consultation framework on the programmatic direction of the NRLMD. Second-tier consultations include the review of subsequent projects related to the programmatic consultation on the NRLMD (U.S. Fish and Wildlife Service 2007, pp 39-41). This consultation for the Stonewall Project is a second-tier consultation. The intent of this second-tier consultation is to evaluate whether the

adverse effects on Canada lynx related to the proposed action are consistent with the 2007 programmatic biological opinion and incidental take statement.

Under the exceptions and/or exemptions from the NRLMD standards VEG S1, S2, S5, and S6, limited fuel or timber management projects would be conducted within the wildland urban interface (WUI) and limited pre-commercial thinning for other resource benefits that affect snowshoe hare habitat (lynx foraging habitat) would occur. The Forest Service provided explicit estimates on the number of acres that would be impacted under the exceptions and exemptions. In our 2007 programmatic biological opinion, we analyzed the effects of such impacts on lynx and also provided an incidental take statement for these activities. This second-tier consultation for the Stonewall Project illustrates how the effects of the proposed action on Canada lynx fall within the scope of our 2007 programmatic biological opinion and incidental take statement. The proposed action would not adversely affect Canada lynx in ways other than those previously analyzed in the 2007 programmatic biological opinion.

Adverse effects to lynx as a result of the Stonewall Project are likely to occur due to the treatment of lynx foraging habitat (snowshoe hare habitat). Snowshoe hare habitat would be affected through the treatment of the horizontal structure of natural forest succession phases, and/or by altering the mosaics of the forested landscape in localized areas as discussed in the effects section of the 2007 programmatic biological opinion (U.S. Fish and Wildlife Service 2007, p. 37). In addition to effects to lynx foraging habitat, other effects to lynx have been considered. All other effects to lynx would be insignificant, also discussed in the effects section of the 2007 programmatic biological opinion (*Ibid*.).

The proposed action will treat approximately 379 acres of stand initiation lynx foraging habitat (all within LAU BL-07) using the exemption from amendment standard VEG S5 to thin conifers in the WUI for fuels reduction. Approximately 493 acres of multistory lynx foraging habitat (338 acres in LAU BL-07 and 155 acres in LAU BL-08) within the WUI would also be treated as part of the fuels reduction using the exemption from standard VEG S6. From 2007 to date, the total acreage of lynx habitat treated or proposed to be treated (have gone through consultation with the Service) in the WUI where exemptions to the standards are applied through Forest decisions, including the proposed action, is 1,003 acres. This total amount is well within the six percent (26,400 acres) anticipated for the Forest and analyzed in the 2007 programmatic biological opinion and incidental take statement. A large number of acres are not treated in any one limited geographic area of the Forest. Thus, the proposed action is consistent with the assumptions made in the 2007 programmatic biological opinion that fuel management projects within the WUI would be distributed throughout the Forest and would not be excessively concentrated within adjacent LAUs.

Approximately 2,373 acres of stem exclusion and/or mid-seral non-foraging habitat is proposed for treatment under the proposed action. These specific stands are characterized as having closed canopies with limited understories that lack dense cover preferred by hares and are generally not progressing towards year-round snowshoe hare habitat. These treatments do not reduce existing snowshoe hare habitat and have the potential to improve the habitat for snowshoe hares by either creating openings to allow understory growth or stimulating the regeneration of dense stands of young trees used by hares. Often, this type of treatment opens the closed canopy in these stands and as mentioned above, would likely create the potential for growth of new trees and thus

horizontal structure in the understory, providing snowshoe hare habitat in the long-term. Impacts to this stem exclusion habitat would be insignificant to Canada lynx.

Lynx denning habitat does occur within the action area. As described in the biological assessment, large blocks of mature forest with significant amounts of coarse woody debris occur within the action area. Thus, denning habitat is not considered to be limiting on the landscape. Widespread, unaffected denning habitat is available within the action area and any effects to denning habitat would be minimal. Thus, we anticipate that any effects to lynx denning habitat would be insignificant to lynx.

The project area borders the western edge of the valley bottom where Forest lands and forest cover extend to Highway 200, providing a potential movement corridor to lands south of the project area. Although lynx movements may be altered by the harvest and burning activities and associated openings created, from a landscape perspective, these sites are scattered, interconnected with unaffected habitat, and are similar to openings created by natural disturbances. The proposed treatments are not expected to reduce connectivity within or between the LAUs.

In summary, with the exception of adverse effects related treatment of snowshoe hare habitat, the remaining effects to Canada lynx as a result of the proposed action would be insignificant. Additional analysis on the effects of the proposed action can be found in the revised biological assessment prepared for the proposed action (U.S. Forest Service 2016).

Canada lynx Summary

The Service has reviewed your revised biological assessment regarding the effects of the Stonewall Project on Canada lynx. We find that the adverse effects were adequately analyzed in the 2007 programmatic biological opinion and that the project conforms to the 2007 incidental take statement. Our finding is based on: (1) the proposed site-specific project falls within the scope of the 2007 programmatic biological opinion,(2) the effects of the proposed action from fuels reduction treatments in the WUI that result in snowshoe hare habitat degradation are consistent with those anticipated and analyzed in the 2007 programmatic biological opinion, (3) the amount of incidental take anticipated in the 2007 incidental take statement has not been exceeded, and (4) the proposed action adheres to the appropriate terms and conditions associated with the reasonable and prudent measures identified in the 2007 incidental take statement. Therefore, the proposed action is consistent with the 2007 programmatic biological opinion and incidental take statement.

In summary, we reviewed: the revised biological assessment regarding the environmental baseline for the action area, the effects of the action, and the cumulative effects within the action area; the 2007 programmatic biological opinion on the NRLMD; the information we relied upon to develop that opinion; and information in our files. After our review of the those documents and the status of Canada lynx, the environmental baseline for the Stonewall Project action area, and the effects of the Stonewall Project including the cumulative effects, it is the Services biological opinion that the Stonewall Project is **not likely to jeopardize** the continued existence of Canada lynx.

As provided in 50 C.F.R. § 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: (a) the amount or extent of taking specified in the incidental take statement is exceeded; (b) new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (c) the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion; or (d) a new species is listed or critical habitat designated that may be affected by the identified action.

Canada Lynx Critical Habitat, Bull Trout, and Bull Trout Critical Habitat

The attached biological opinion addresses the effects of the proposed action on Canada lynx critical habitat, bull trout, and bull trout critical habitat and is based on information provided for this action in the biological assessments prepared for the Stonewall Project and additional information received during the consultation process as well as information in our files. The biological opinion was prepared in accordance with section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.). A complete project file of this consultation is on file at the Service's Montana Field Office.

We appreciate your efforts to ensure the conservation of threatened and endangered species as part of your responsibilities under the Endangered Species Act, as amended. If you have questions or comments related to this consultation, please contact Katrina Dixon at 406-449-5225, extension 222 or Tom Olenicki at extension 213.

Sincerely,

Jodi L. Bush
Office Supervisor

Enclosure

cc: AES, R-6, MS 60120 (Attn: Doug Laye)
Randy Arnold, Region 2-Regional Manager, Montana Department of Fish, Wildlife, and Parks, Missoula, MT
File: 7759 Biological Opinions – 2016

ENDANGERED SPECIES ACT SECTION 7 CONSULTATION

BIOLOGICAL OPINION

on the

Effects of the Stonewall Vegetation Project on Designated Critical Habitat for Canada Lynx

Agency:	U.S. Department of Agriculture Forest Service Helena-Lewis and Clark National Forest Lincoln Ranger District Lincoln, Montana
Consultation Conducted by:	U.S. Fish and Wildlife Service Montana Ecological Services Office Helena, Montana
Date Issued:	August 24, 2016

Table of Contents

I Introduction and Consultation History……. 11

II Description of the Proposed Action…….. 11

III Status of the Species and Critical Habitat …… 12

IV Environmental Baseline…….…... 15

V Effects of the Action……. 17

VI Cumulative Effects…….….. 19

VII Conclusion…… 20

Reinitiation Notice……..…….…….. 21

Literature Cited…….. 23

Designated Critical Habitat for Canada Lynx

I. INTRODUCTION

The U.S. Fish and Wildlife Service (Service) analyzed the proposed Stonewall Vegetation Project (Stonewall Project) on the Helena-Lewis and Clark National Forest (Forest), Montana and the potential effects of implementation of the project on designated critical habitat for Canada lynx (*Lynx canadensis*). On September 12, 2014, the Service published a revised designation of critical habitat for Canada lynx. The revised designation did not change the amount of designated lynx critical habitat within the action area. This biological opinion does not rely on the Northern Rockies Lynx Management Direction (NRLMD) for its analysis and conclusion.

Section 7(b)(3)(A) of the Endangered Species Act of 1973, as amended (Act) requires that the Secretary of Interior issue biological opinions on federal agency actions that may affect listed species or critical habitat. Biological opinions determine if the action proposed by the action agency is likely to jeopardize the continued existence of listed species or destroy or adversely modify critical habitat. Section 7(b)(3)(A) of the Act also requires the Secretary to suggest reasonable and prudent alternatives to any action that is found likely to result in jeopardy or adverse modification of critical habitat, if any has been designated. This biological opinion addresses only impacts to designated critical habitat for Canada lynx and does not address the overall environmental acceptability of the proposed action.

Consultation History

Formal consultation on the Stonewall Project began in May of 2015, when the Service received the first biological assessment for this project. Since that time, the Forest prepared a revised biological assessment that the Service received in January of 2016. The Service continued to receive information related to this consultation through August 8, 2016, when we received a final revised biological assessment (U.S. Forest Service 2016).

As discussed in the attached cover letter, the consultation on the effects to grizzly bears is tiered to the 2016 programmatic biological opinion on the Blackfoot Non-winter Travel Plan (U.S. Fish and Wildlife Service 2016). The consultation on the effects to Canada lynx is tiered to the 2007 programmatic biological opinion on the effects of the Northern Rocky Mountains Lynx Amendment (U.S. Fish and Wildlife Service 2007).

II. DESCRIPTION OF THE PROPOSED ACTION

The Stonewall Project is located on the Lincoln Ranger District of the Forest, approximately three miles north and west of Lincoln, Montana. The project focuses on reducing hazardous fuel buildup and improving forest health by using various vegetative treatments on approximately 4,868 acres including: 1,423 acres of commercial harvest; 690 acres of precommercial thinning; and 2,755 acres of prescribed burning. Approximately 32.4 miles of road would be used as haul routes during implementation. This includes 31.5 miles of existing road requiring maintenance or improvements and 4 new road segments of temporary road totaling .9 mile. Each of the four new segments of temporary road will be obliterated within two years of construction. Additional project information

can be found in the revised biological assessment prepared for the Stonewall Project (U.S. Forest Service 2016)

III. STATUS OF THE SPECIES /CRITICAL HABITAT DESCRIPTION

The Service published a revised designation of critical habitat for the contiguous United States distinct population segment of the Canada lynx. The final rule was published on September 12, 2014 and became effective on October 14, 2014 (79 FR 54782). In total, approximately 38,955 square miles fall within the boundaries of the revised critical habitat designation, in five units in the states of Maine, Minnesota, Montana, Wyoming, Idaho and Washington (see Table 1).

Table 1. Critical habitat units designated for lynx (79 FR 54782).

Critical Habitat Units	Area Designated (mi^2)	Land Ownership
Unit 1: Maine	10,123	Private, State, Federal
Unit 2: Minnesota	8,069	Federal, State, Private
Unit 3: Northern Rocky Mountains (MT and ID)	9,783	Federal, Private, State
Unit 4: North Cascades	1,834	Federal, Private
Unit 5: Greater Yellowstone Area (MT and WY)	9,146	Federal, State, Private
TOTAL	**38,955**	

The five units contain the physical and biological features essential to the conservation of the lynx as they are comprised of the primary constituent element and its components laid out in the appropriate quantity and spatial arrangement. The units are discussed below with information taken from the final rule revising designated critical habitat for lynx (79 FR 54782) followed by a discussion on the primary constituent element and its components.

Unit 1 is located in northern Maine in portions of Aroostook, Franklin, Penobscot, Piscataquis, and Somerset Counties. This area was occupied by the lynx at the time of listing and is currently occupied by the species. This area is the one area in the northeastern region of the lynx's range within the contiguous United States that currently supports breeding lynx populations and may serve as a source of lynx, or provide connectivity for more peripheral portions of the lynx's range, in the Northeast.

Unit 2 is located in northeastern Minnesota in portions of Cook, Koochiching, Lake, and St. Louis Counties. This area was occupied by the lynx at the time of listing and is currently occupied by the species. Lynx are currently known to be distributed throughout northeastern Minnesota. This area is essential to the conservation of lynx because it is the only area in the Great Lakes region for which there is evidence of recent lynx reproduction. It likely acts as a source or provides connectivity for more peripheral portions of the lynx's range in the region. National Forest land in Unit 2 is managed under Forest Plans that have incorporated management direction similar to the NRLMD, which reduces or eliminates adverse effects on lynx, by reducing adverse effects on habitat important to lynx.

Unit 3 is located in the Northern Rocky Mountains of northwestern Montana, in portions of Flathead, Glacier, Granite, Lake, Lewis and Clark, Lincoln, Missoula, Pondera, Powell, and Teton Counties and in a small portion of northeastern Idaho in Boundary County. This area is

approximately 9,783 square miles, was occupied by the lynx at the time of listing, and is currently occupied by the species. Lynx are known to be widely distributed throughout this unit and breeding has been documented in multiple locations. This area is essential to the conservation of lynx because it appears to support the highest density lynx populations in the Northern Rocky Mountain region of the lynx's range. It likely acts as a source for lynx and provides connectivity to other portions of the lynx's range in the Rocky Mountains, particularly the Yellowstone area. Table 2 illustrates the preponderance of federal lands, which are primarily National Forest system lands, within Unit 3. Timber harvest and management is a dominant land use, and so special management is required depending upon the silvicultural practices conducted. Timber management practices that provide for a dense understory are beneficial to lynx and snowshoe hares. National Forest lands in Unit 3 are managed under the NRLMD (U.S. Forest Service 2007). The NRLMD includes a suite of management directives that enhance, maintain, and conserve dense understories within this habitat.

Table 2. Square miles of lynx critical habitat per ownership per state in Lynx Critical Habitat Unit 3: Montana and Idaho (79 FR 54782).

	Federal (mi^2)	State (mi^2)	Private(mi^2)
Montana	8,743	156	839
Idaho	45	0.04	0

Unit 4 is located in the North Cascade Mountains of north-central Washington in portions of Chelan and Okanogan Counties and includes BLM lands in the Spokane District as well as Loomis State Forest lands. This area was occupied by the lynx at the time of listing and is currently occupied by the species. This unit supports the highest densities of lynx in Washington. This area is essential to the conservation of lynx because it is the only area in the Cascades region of the lynx's range that is known to support breeding lynx populations. National Forest lands in Unit 4 are managed under the 2006 Conservation Agreement (U.S. Forest Service and U.S. Fish and Wildlife Service 2006), which defers any projects that adversely affect lynx until Forest Plans are amended to consider the conservation needs of lynx and lynx habitat.

Unit 5 is located in the Greater Yellowstone Area of southwestern Montana, in portions of Carbon, Gallatin, Park, Stillwater, and Sweetgrass Counties, and in northwestern Wyoming in portions of Fremont, Lincoln, Park, Sublette, and Teton Counties. This area was occupied by the lynx at the time of listing and is currently occupied by the species. The Greater Yellowstone Area is inherently marginal lynx habitat with highly fragmented foraging habitat (snowshoe hare habitat). For this reason, lynx home ranges in this unit are likely to be larger and incorporate large areas of non-foraging matrix habitat. National Forest lands in Unit 5 are managed under either the NRLMD (U.S. Forest Service 2007) or the Southern Rockies Lynx Management Direction (U.S. Forest Service 2008), which provides management direction similar to the NRLMD.

Conservation Needs of the Species

The physical and biological features that are essential to the conservation of the species were identified within the geographical area occupied by the lynx at the time of listing. These physical and biological features are the primary constituent elements (PCEs) laid out in a specific quantity and spatial arrangement to be essential to the conservation of the species. Based on this and the

current knowledge of the life history, biology, and ecology of the species, the PCE for lynx critical habitat is:

1. Boreal forest landscapes supporting a mosaic of differing successional forest stages and containing:
    a. Presence of snowshoe hares and their preferred habitat conditions, which include dense understories of young trees, shrubs or overhanging boughs that protrude above the snow, and mature multistoried stands with conifer boughs touching the snow surface;
    b. Winter conditions that provide and maintain deep, fluffy snow for extended periods of time;
    c. Sites for denning that have abundant coarse woody debris, such as downed trees and root wads; and
    d. Matrix habitat (e.g., hardwood forest, dry forest, non-forest, or other habitat types that do not support snowshoe hares) that occurs between patches of boreal forest in close juxtaposition (at the scale of a lynx home range) such that lynx are likely to travel through such habitat while accessing patches of boreal forest within a home range.

The final rule also described three types of Federal actions that may affect critical habitat, and therefore should result in consultation. Briefly, these are summarized (79 FR54827):

1. Actions that would reduce or remove understory vegetation within boreal forest stands on a scale proportionate to the large landscape used by lynx…These activities could significantly reduce the quality of snowshoe hare habitat such that the landscape's ability to produce adequate densities of snowshoe hares to support persistent lynx populations is at least temporarily diminished.

2. Actions that would cause permanent loss or conversion of the boreal forest on a scale proportionate to the large landscape used by lynx…Such activities could eliminate and fragment lynx and snowshoe hare habitat.

3. Actions that would increase traffic volume and speed on roads that divide lynx critical habitat…These activities could reduce connectivity within the boreal landscape for lynx, and could result in increased mortality of lynx within the critical habitat units.

Further, the rule notes that in matrix habitat, activities that change vegetation structure or condition would not be considered an adverse effect to lynx critical habitat unless those activities would create a barrier or impede lynx movement between patches of foraging habitat and between foraging and denning habitat within a potential home range, or if they adversely affect adjacent foraging or denning habitat.

Analysis of the Species/Critical Habitat Likely to be Affected

Critical habitat has been designated for Canada lynx within the action area, which lies in critical habitat Unit 3. The revised biological assessment for the Stonewall Project determined that the proposed action would likely adversely affect areas of designated critical habitat within the action area. Therefore, formal consultation with the Service has been initiated and this biological opinion

has been written to determine whether or not activities associated with this project are likely to result in destruction or adverse modification of designated critical habitat for lynx.

Other Listed Species

In addition to designated critical habitat for Canada lynx, other federally listed species and designated critical habitat that may be present in the action area include the Canada lynx, grizzly bear, bull trout, and bull trout critical habitat. Both the Canada lynx and grizzly bear are discussed in the attached cover letter while bull trout and bull trout critical habitat are addressed in this biological opinion.

IV. ENVIRONMENTAL BASELINE

Under the provisions of section 7(a)(2), when considering the "effects of the action," the Service is required to consider the environmental baseline. Regulations implementing the Act (50 C.F.R. § 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.

For the purposes of this biological opinion on the effects of the Stonewall Project to designated critical habitat for Canada lynx, we have defined the action area to include the BL-07 and BL-08 Lynx Analysis Units (LAUs). LAUs are typically large enough to represent the average home range size of a female lynx and contain adequate habitat and landscapes to support lynx year-round.

In 2007, the Service prepared a biological opinion on the effects of the Northern Rockies Lynx Management Direction (NRLMD) on lynx and determined that the NRLMD was not likely to jeopardize lynx (U.S. Fish and Wildlife Service 2007). The NRLMD applies to all areas mapped as "lynx habitat" by the Forest Service within LAUs on lands within 18 National Forests. The NRLMD provides direction primarily for lynx habitat management to avoid or reduce the potential for projects proposed under Forest Plans to adversely affect lynx. The direction accomplishes this through a suite of standards and guidelines that reduce or avoid adverse effects on lynx from land management activities primarily by reducing or avoiding adverse effects on lynx habitat and snowshoe hare habitat. Thus, the NRLMD promotes and conserves the habitat conditions needed to produce snowshoe hare (lynx primary prey) densities that are adequate to sustain lynx within their home ranges, and thus sustain lynx populations and promote recovery of Canada lynx. Some exceptions to avoiding adverse effects to lynx may occur within the wildland-urban interface, or WUI, to protect human safety and property.

The Forest manages all mapped lynx habitat on Forest land within the action area in accordance with the NRLMD. Much of this same habitat is also designated as critical habitat. The Forest Service mapped lynx habitat using criteria provided in the 2000 Canada Lynx Conservation and Assessment Strategy (Ruediger et al. 2000), prior to the Service's 2009 and 2014 critical habitat designations. The Service designated critical habitat on Forest Service lands that in some instances were not initially mapped as lynx habitat by the Forest Service. This situation occurs where critical habitat, specifically PCE1d, was designated in areas of 'matrix' habitat. Where not mapped by the

Forest Service as lynx habitat, these matrix lands are not managed directly under the NRLMD. Forest biological assessments of projects in lynx critical habitat must still analyze the effects of project activities on this matrix habitat. As for all critical habitat, including this matrix habitat, the Forest Service may use the guidance in the Service's 2014 critical habitat designation (79 FR 54782) to assess and/or reduce or avoid negative effects on critical habitat**.**

Table 3 displays the acres of critical habitat by structural condition within each of the LAUs affected by the proposed action. Each of these forest structural conditions is part of the PCE: boreal forest landscapes supporting a mosaic of differing successional forest stages. The entire action area, which includes both BL-07 and BL-08 LAUs, is designated as critical habitat.

Table 3. Critical habitat acres and structural type included within affected LAUs (*adapted from U.S. Forest Service 2015*).

Lynx Analysis Unit (LAU)	BL-07	BL-08
Total LAU Acres	26,662	27,352
Total Critical Habitat Acres	26,662	27,352
Stand Initiation[1] Acres	1,732	10,242
Multistory[2] Acres	8,401	2,953
Other[3] (stem exclusion) Acres	7,499	8,227
Matrix Habitat[4] Acres	9,030	5,930

[1] Stand initiation structural stages that currently provide snowshoe hare habitat because the trees have grown tall enough to protrude above the snow in the winter (stand initiation) or is providing summer snowshoe hare habitat that will develop into winter snowshoe hare habitat (early stand initiation) – relates to PCE 1a.

[2] Multistory structural stage with many age classes and vegetation layers that provide snowshoe hare habitat, dense horizontal cover – relates to both PCE 1a and PCE 1c.

[3] Stem exclusion and mid-seral structural stages - closed canopy with limited understory vegetation; does not provide snowshoe hare habitat due to the lack of dense horizontal cover. Provides potential denning habitat – likely relates to PCE 1c.

[4] Matrix habitat includes dry forest habitat types, rock outcrops, sites dominated by dry grass/forb/shrubs, low elevations – PCE 1d.

The action area is within Unit 3 of designated lynx critical habitat and contains physical and biological elements essential for the conservation of the species, including the PCE. Stand initiation habitat, including early stand initiation habitat, provides for PCE 1a and is approximately 6 percent of the critical habitat in the BL-07 LAU and 37 percent of the critical habitat in the BL-08 LAU. The modeled multistory habitat contains both PCE 1a and 1c and is approximately 32 percent and 11 percent of the critical habitat in the BL-07 and BL-08 LAUs, respectively. Habitat in a stem exclusion and/or mid-seral condition is one of the boreal forest successional stages comprising the PCE, potentially providing denning habitat PCE 1c, and is approximately 28 percent and 30 percent of the critical habitat in the BL-07 and BL-08 LAUs, respectively. The remaining habitat has been identified as matrix habitat (PCE 1d), which is approximately 34 percent and 22 percent of the critical habitat in the BL-07 and BL-08 LAUs, respectively. The action area in general provides deep, fluffy snow conditions (PCE 1b).

Canada lynx are known to be present within both the BL-07 and BL-08 LAUs. Lynx use of the upper reaches of the LAUs has been documented over time by various winter tracking efforts. However, data regarding lynx use of lower elevation harvest units in the more southern portion of

the action area is lacking. Tracking efforts and hair snare stations in recent years have failed to detect lynx in the southern portion of the action area (U.S. Forest Service 2016).

V. EFFECTS OF THE ACTION

Under section 7(a)(2) of the Act, "effects of the action" refers to the direct and indirect effects of an action on the species or critical habitat, with the effects of other activities interrelated or interdependent with that action. Indirect effects are those caused by the proposed action and are later in time, but still are reasonably certain to occur (50 C.F.R. § 402.02). The effects of the action are added to the environmental baseline to determine the future baseline and to form the basis for the determination in this opinion. Should the federal action result in a jeopardy situation and/or adverse modification conclusion, the Service may propose reasonable and prudent alternatives that the federal agency can take to avoid violation of section 7(a)(2). The effects discussed below are the result of direct and indirect impacts of implementing the proposed project.

The analysis for the Stonewall Project indicated that project activities would affect snowshoe hare habitat. As described in the revised biological assessment (U.S. Forest Service 2016), adverse effects to lynx critical habitat as a result of the proposed action are likely to occur due to treatment of lynx critical habitat, specifically the treatment of PCE 1a or lynx foraging habitat (snowshoe hare habitat). This includes treating 379 acres of stand initiation (348 acres) and early stand initiation (31 acres) lynx critical habitat and 493 acres of multi-storied lynx critical habitat. Treatment of 2,373 acres of forest in the stem exclusion or mid-seral structural phases is not likely to adversely affect critical habitat as it currently lacks the dense understory required for snowshoe hare habitat and treatments provide an opportunity for the stands to move toward future snowshoe habitat. Treatment of 1,517 acres of matrix critical habitat (PCE1d) is also not likely to adversely affect critical habitat as habitat connectivity within and between LAUs would be maintained.

The conservation role of lynx critical habitat is to support viable core area lynx populations. The activities proposed for units in stand initiation and multi-storied conditions that provide snowshoe hare habitat may have adverse effects on lynx critical habitat by reducing snowshoe hare forage and numbers. Snowshoe hare forage would be diminished primarily through the removal of the dense horizontal structure of natural forest succession phases and/or perhaps altering the mosaics of the forested landscape in localized areas. Thus, this project fits under the first criteria described above as containing actions that are likely to adversely affect lynx critical habitat, and specifically would likely adversely affect PCE1a by resulting in a temporary reduction in snowshoe hare habitat affecting snowshoe hare numbers.

Snowshoe hare habitat in the LAUs is comprised of young forests in stand initiation phases and older, multistoried forest (see Table 3). Early stand initiation phase stands are characterized by dense growth of young trees, providing abundant forage and hiding cover for snowshoe hare during the summer. In the winter, these stands are covered by snow and unavailable to snowshoe hares. Later stand initiation phase trees have grown tall enough to protrude above the snow, and provide forage and dense hiding cover for snowshoe hares in the winter. Multistoried forests with dense horizontal cover (a dense understory of young trees and shrubs) provide both lynx and snowshoe hares with abundant forage and hiding cover during summer and winter.

As a result of project implementation, snowshoe hare habitat quality would be temporarily degraded on approximately 872 acres of lynx critical habitat, affecting PCE 1a. Of this amount,

approximately 379 acres of stand initiation and early stand initiation lynx critical habitat would be precommercial thinned, which would remove trees and impact the existing dense horizontal structure required by snowshoe hares for forage and cover. Approximately 493 acres of multi-storied lynx critical habitat would be treated with regeneration and intermediate treatments. These treatments would impact the existing dense horizontal structure (understory) that provides the forage and cover required for snowshoe hare and lynx habitat. In Table 4, stand initiation, early stand initiation, and multistory habitat, all providing PCE 1a, have been combined. Approximately 7 percent of the critical habitat providing PCE1a within the BL-07 LAU would be affected and approximately 1 percent of the critical habitat providing PCE1a within the BL-08 LAU would be affected. In the affected LAUs, the boreal forest landscape would continue to support a mosaic of differing successional forest stages and thus, would support the critical habitat PCE, including PCE 1a.

Table 4. Lynx critical habitat treated within the LAUs (adapted from *U.S. Forest Service 2016*).

LAU	Acres Treated PCE1a: Stand Initiation, Early Stand Initiation, and Multistory (% of critical habitat providing PCE1a)	Acres Treated: PCE 1c: denning habitat	Acres Treated: stem exclusion, non-foraging	Acres Treated PCE1d: Matrix Habitat
BL-07	717 (7%)	1,755	1,417	858
BL-08	155 (1%)	1,111	956	659
Total	872 (4%)	2,866	2,373	1,517

As discussed in the biological assessment, stands of trees with a relatively closed overstory canopy and limited understory vegetation are characterized as stem exclusion or mid-seral lynx habitat. These phases are forest successional stages that are part of the critical habitat boreal forest landscape described in the PCE. These stages are described as having a closed canopy with limited understory. Little light reaches the forest floor so understory vegetation (including trees) are shaded and grow slowly; shrubs become dormant and new trees are precluded by a lack of sunlight and/or moisture. Thus, these structural stages do not currently provide snowshoe hare habitat due to the lack of horizontal cover described in PCE1a. In some stands, a limited amount of snowshoe hare forage may be available during the summer as a greater variety and quantity of forage is available to hares due to lack of snow cover and growth of seasonal vegetation. Deciduous as well as coniferous vegetation provide cover for hares and lynx. This summer habitat is covered by snow during the winter and so unavailable to hares or lynx. Summer habitat is not believed to limit snowshoe hare or lynx populations. However, winter habitat is believed to be a factor limiting snowshoe hare and lynx populations. Treatment of stem exclusion stands that have a limited understory and lack dense horizontal cover is not likely to adversely affect snowshoe hare habitat, or lynx critical habitat.

As previously mentioned, approximately 2,373 acres of existing stem exclusion and mid-seral lynx critical habitat is proposed for treatment under the proposed action. No adverse effects to critical habitat are anticipated as a result of these treatments. These specific stands are characterized as

having a closed canopy with limited understory, lacking dense cover preferred by hares (U.S. Forest Service 2016), and are generally not progressing towards year-round snowshoe hare habitat. The proposed treatment of stem exclusion stands would open up the stands and encourage an increase in horizontal cover (understory regeneration). Thus, the proposed treatments in these stands do not reduce existing snowshoe hare habitat and have the potential to improve the habitat for snowshoe hares by either creating openings to allow understory growth or stimulating the regeneration of dense stands of young trees used by hares.

Activities would not impact deep fluffy snow conditions providing PCE 1b. Lynx denning habitat, PCE 1c, does occur within the action area and some acres would be affected by treatments in the multi-story and stem exclusion stands. Denning habitat is well distributed and is not a limiting factor at the broad scale and would continue to be abundant and well distributed within the action area post-project. Any impacts to PCE 1c would be insignificant and would have no discernible impact on its conservation function. Project related activities would affect matrix habitat, PCE1d. This matrix habitat would continue to support the ability of lynx to travel between suitable patches of habitat within their home range.

No permanent loss (such as paving or building construction) of habitat or conversion of the boreal forest would occur as a result of activities. The habitat would retain its inherent capacity to regenerate. Proposed road use would not create barriers to or impede movements of lynx. Although the proposed action would adversely affect areas of critical habitat, the affected LAUs are expected to remain capable of producing adequate densities of snowshoe hares to support continual lynx presence and would continue to serve their intended conservation role for lynx. The physical and biological features would not be altered to an extent that would appreciably reduce the conservation value of critical habitat for lynx and the PCE would continue to function.

Effects Summary for Designated Critical Habitat for Canada Lynx

Overall, we anticipate adverse effects to lynx critical habitat only from the project related activities that occur within lynx foraging habitat (i.e. snowshoe hare habitat), PCE1a. The Stonewall Project would affect approximately 872 acres of designated critical habitat for Canada lynx that provide PCE 1a. The effects of treatments are likely to be adverse based on the location and lynx habitat conditions. We do not anticipate adverse effects to critical habitat as a result of the treatments in stem exclusion and mid-seral stands that do not provide snowshoe hare habitat, areas that provide PCE1c (denning habitat), or areas that provide PCE1d (matrix habitat).

Although the proposed action would adversely affect areas of critical habitat (PCE1a) within the BL-07 and BL-08 LAUs, the small scale and resulting low severity of effects are not expected to diminish the capacity of the LAUs to produce adequate densities of snowshoe hares to support continual lynx presence. Thus, the LAUs would continue to serve their intended conservation role for lynx. The physical and biological features would not be altered to an extent that would appreciably reduce the conservation value of critical habitat for lynx and the PCE would continue to function.

VI. CUMULATIVE EFFECTS

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 biological 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.

The majority of state and private lands in the action area are located in lower elevation habitat supporting warm dry forest types. These areas support open forest conditions and do not support suitable lynx habitat. Consequently, these lands do not support snowshoe hare habitat. Lynx may use some of these areas on occasion for dispersal or moving between more suitable habitat patches. While future development is anticipated to continue at a moderate level, because the habitat does not support snowshoe hares, activities on these state and private lands will have minimal impact to lynx critical habitat and are not anticipated to create barriers or impede lynx movements. Therefore, we anticipate that the action area LAUs would retain their current ability for the PCE to function and critical habitat would continue to serve its intended conservation role for the species.

VII. CONCLUSION

After reviewing the current status of designated lynx critical habitat, the environmental baseline for the action area, the effects of the action, and the cumulative effects, it is the Service's biological opinion that the effects of the Stonewall Project are not likely to result in the destruction or adverse modification of designated Canada lynx critical habitat. Implementing regulations for section 7 define "destruction or adverse modification" as "a direct or indirect alteration that appreciably diminishes the value of critical habitat for the conservation of 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" (50 C.F.R. § 402.02). The Lynx Critical Habitat Final Rule (79 FR 54826) explains that "the key factor related to the adverse modification determination is whether, with implementation of the proposed Federal action, the affected critical habitat would continue to serve its intended conservation role for the species. Activities that may destroy or adversely modify critical habitat are those that alter the physical and biological features to an extent that appreciably reduces the conservation value of critical habitat for the lynx DPS." The role of critical habitat is to support life-history needs of the species and provide for conservation of the species.

The proposed action has components that will likely adversely affect lynx critical habitat via impacts to PCE 1a (snowshoe hare habitat) in the BL-07 and BL-08 LAUs. However, the scale of the proposed action will not preclude continued adequate amounts of snowshoe hare habitat needed to sustain lynx in the LAUs and thus the critical habitat in each of the LAUs would remain functional. When added to the status of the critical habitat unit, the effects of the project are such that the conservation role of the lynx critical habitat Unit 3 will continue to support its intended conservation role for lynx and the physical or biological features, including the PCE components essential to the conservation of lynx, will not be altered to a point that precludes or significantly delays development of these features.

Our conclusion is based primarily on the information presented in the revised biological assessment (U.S. Forest Service 2016), information in our files, and informal discussions between the Service, the Forest, and other personnel. Our rationale for the no destruction or adverse modification conclusion is based on, but not limited to the following factors summarized below, as detailed earlier in this biological opinion.

- Overall, we anticipate adverse effects to lynx critical habitat only from the project related activities that occur within lynx foraging habitat (snowshoe hare habitat) and impact PCE1a. Moreover, for those areas of the project that provide lynx critical habitat but not snowshoe hare habitat (i.e. stem exclusion, denning, matrix), we do not anticipate adverse effects to critical habitat as a result of the Stonewall Project.

- Actions conducted under the Stonewall Project will occur within the BL-07 and BL-08 LAUs and will adversely affect snowshoe hare habitat on approximately 872 acres that currently provide conditions for PCE 1a. As previously mentioned, the proposed action would treat approximately seven percent of the critical habitat providing PCE 1a within the BL-07 LAU and approximately one percent of the critical habitat providing PCE 1a within the BL-08 LAU.

- The adverse effects on lynx critical habitat would occur on a very small portion of critical habitat Unit 3. The entire action area (54,014 acres) is approximately 0.9 percent of the entire critical habitat Unit 3, which is 9,783 square miles (6,261,095 acres). The proposed action would adversely affect 872 acres of critical habitat, which is 0.01 percent of critical habitat Unit 3. Including all treatments, the action would treat a total of 4,762 acres of critical habitat (not all would result in adverse effects), which is about 0.08 percent of critical habitat Unit 3. Thus, the impacts on critical habitat Unit 3 are very small.

- Project-related activities would adversely affect lynx critical habitat, however the nature of most vegetation management alteration is temporary and reversible (i.e. forests regrow or can be restored). The project's adverse effects on lynx critical habitat are temporary and no permanent loss of the inherent capacity of treated stands to provide lynx habitat is expected.

Post-project, the action area LAUs are expected to provide conditions that would continue to be conducive to supporting lynx. Although the proposed action would adversely affect areas of critical habitat within two LAUs, the treatments have small to insignificant and nonpermanent effects on critical habitat Unit 3 as a whole. The critical habitat in both LAUs is expected to remain capable of producing adequate densities of snowshoe hares to support continual lynx presence because the project would leave snowshoe hare habitat in adequate amounts to sustain hare populations.

We conclude that the adverse effects of the proposed action on snowshoe hare habitat are limited in severity and in scale to the extent that upon completion of the proposed action, critical habitat would continue to produce adequate densities of snowshoe hares and adequate levels of cover to support persistent lynx populations across Unit 3. We conclude that the proposed action will not alter the physical and biological features of critical habitat to an extent that appreciably diminishes the value of critical habitat for the conservation of lynx. The alterations will not preclude or significantly delay development of such features. The unit would retain its current ability for the primary constituent element(s) to be functionally established. Therefore, the proposed action is not likely to result in the destruction or adverse modification of designated Canada lynx critical habitat.

REINITIATION NOTICE

This concludes consultation on the action outlined in your August 8, 2016 revised biological assessment on the effects of the Stonewall Project. As provided in 50 C.F.R. § 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: (a) the amount or extent of taking specified in the incidental take statement is exceeded; (b) new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (c) the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion; or (d) a new species is listed or critical habitat designated that may be affected by the identified action.

LITERATURE CITED

Ruediger, B., S. Mighton, B. Naney, T. Rinaldi, F. Wahl, N. Warren, D. Wenger, A. Williamson, L. Lewis, B. Holt, G. Patton, A. Vandehey, and S. Gniadek. 2000. Canada Lynx Conservation Assessment and Strategy. Unpublished interagency document prepared for the U.S. Forest Service, U.S. Fish and Wildlife Service, Bureau of Land Management and National Park Service. Missoula, Montana.

U.S. Fish and Wildlife Service. 2007. Biological opinion on the effects of the Northern Rocky Mountains lynx amendment on the distinct population segment of Canada lynx in the contiguous United States. U.S.D.I. Fish and Wildlife Service, Helena, Montana. 125pp.

U.S. Fish and Wildlife Service. 2010. Region 6 guidance for effect determinations on lynx critical habitat. U.S.D.I Fish and Wildlife Service, Mountain-Prairie Region, Lakewood, Colorado. 5pp.

U.S. Fish and Wildlife Service. 2016. Biological opinion on the effects of the Blackfoot non-winter travel plan on grizzly bears. U.S.D.I. Fish and Wildlife Service, Helena, Montana. 51pp.

U.S. Forest Service and U.S. Fish and Wildlife Service. 2006. Amended Canada lynx conservation agreement between the U.S. Fish and Wildlife Service and the U.S. Forest Service. U.S. Forest Service Agreement 00-MU-11015600-013. Denver, Colorado.

U.S. Forest Service. 2007. Northern Rockies lynx management direction record of decision. U.S.D.A. Forest Service, Northern Region 1, Missoula, Montana. 71pp.

U.S. Forest Service. 2008. Southern Rockies lynx management direction record of decision. U.S.D.A. Forest Serv, Rocky Mountain Region, Golden, Colorado. 78pp.

U.S. Forest Service. 2016. Stonewall vegetation project revised biological assessment for terrestrial wildlife species. U.S.D.A. Forest Serv., Helena National Forest, Lincoln Ranger District, Lincoln, Montana. 56pp.

Endangered Species Act - Section 7 Consultation

BIOLOGICAL OPINION
for
Effects to Bull Trout and Bull Trout Critical Habitat
Stonewall Vegetation Project
Helena-Lewis and Clark National Forest
2016

U.S. Fish and Wildlife Service Reference: 06E11000-2015-F-0406

Agency:	U.S. Forest Service Helena-Lewis and Clark National Forest Lincoln Ranger District
Consultation Conducted by: Montana Field Office	U.S. Fish and Wildlife Service
Date Issued:	August 24, 2016

Table of Contents

I. Introduction and Consultation History 2-1

II. Description of the Proposed Action 2-1

III. Range-Wide Status of Bull Trout and Critical Habitat 2-2
A. Range-Wide Status of Bull Trout 2-2
B. Critical Habitat 2-13
C. Previous Consultations and Conservation Efforts 2-17

IV. Analytical Framework for Jeopardy and Adverse Modification Determinations 2-17
A. Jeopardy Determination 2-17
B. Adverse Modification Determination 2-18

V. Analytical Framework for the Environmental Baseline and Effects of the Action 2-19

VI. Environmental Baseline 2-22
A. Existing Conditions and Factors Affecting Species Environment in the Core Area 2-22
B. Action Area 2-25
C. Status of Bull Trout in the Core Area and Action Area 2-27
D. Status of Bull Trout Critical Habitat in the Action Area 2-30

VII. Effects of the Action 2-31
A. Methods for Analyses of Effects 2-31
B. Effects to Framework/Matrix Indicators 2-32
C. Species Response to the Proposed Action 2-36
D. Effects to Designated Critical Habitat 2-38

VIII. Cumulative Effects 2-39

IX. Conclusion 2-40
A. Jeopardy Analysis 2-40
B. Adverse Modification Analysis 2-42

INCIDENTAL TAKE STATEMENT 2-42

References Cited 2-48

Appendix Tables 2-60

I. Introduction

This biological opinion addresses project related effects to the threatened bull trout (*Salvelinus confluentus*) and bull trout critical habitat in accordance with the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.). The U.S. Fish and Wildlife Service (Service) based this opinion on our review of the biological assessment (BA) prepared for the Stonewall Vegetation Project (Stonewall Project) by the Helena-Lewis and Clark National Forest (Forest), additional information provided during consultation, and information in our files.
Section 7(b)(3)(A) of the Act requires that the Secretary of Interior issue biological opinions on federal agency actions that may affect listed species or critical habitat. Biological opinions determine if the action proposed by the action agency is likely to jeopardize the continued existence of listed species or destroy or adversely modify critical habitat. Section 7(b)(3)(A) of the Act also requires the Secretary to suggest reasonable and prudent alternatives to any action that is found likely to jeopardize the continued existence of listed species or result in an adverse modification of any designated critical habitat.

This biological opinion only addresses impacts to federally listed bull trout and bull trout critical habitat from proposed actions within the action area and does not address the overall environmental acceptability of the proposed action.

Consultation History: Significant events during the consultation period for this project are summarized below.

May 5, 2015: The Service received a letter requesting concurrence for the determinations of "May Affect, Not Likely to Adversely Affect" and the biological assessment on effects to bull trout and bull trout critical habitat from the proposed Stonewall Vegetation Project.

August 28, 2015: The Service received a revised BA that included a change in determination from "May Affect, Not Likely to Adversely Affect" to "May Affect, Likely to Adversely Affect" bull trout and bull trout critical habitat.

December 14, 2015: The Service received a revised BA incorporating changes in the project activities and baseline conditions due to two wildfires in the project area.

August 3, 2016: The Service issued the biological opinion for the Blackfoot Travel Plan. The Blackfoot Travel Plan made travel planning decisions for the entire ranger district, including the Stonewall Project area.

August 10, 2016: Supplemental information to the amended fisheries BA was received from the Forest.

August 12, 2016: The Service received an updated amended BA for the Stonewall Project from the Forest reflecting changes associated with the Blackfoot Travel Plan.

II. Description of the Proposed Action

The project area encompasses 24,010 acres, of which 23,670 acres are on the Lincoln District of the Forest (Figure 1). Proposed activities on 4,868 acres include:

- Intermediate Harvest to Promote Mature Open Forests on 235 acres
- Intermediate Harvest to Thin Young Forests on 690 acres
- Regeneration Harvest in Areas of High Mortality Retaining Seed and Shelter Trees on 476 acres
- Regeneration Harvest in Areas of High Mortality Retaining Rare Live Trees on 184 acres
- Intermediate Harvest to Remove Minor Amounts of Dead/Dying Trees on 25 acres
- Low Severity Prescribed Fire to Create Mortality Patches of 5 to 10 acres on 549 acres
- Mixed Severity Fire to create mortality patches up to 5, 10, or 20 acres on 363 acres
- Mixed severity fire to create mortality patches up to 30 or 75 acres on 1,288 acres
- Intermediate Harvest to Promote Mature Open Ponderosa Pine and Regenerate Aspen on 503 acres
- Whitebark Pine Restoration on 555 acres
- Total Road Miles Used for Log Hauling is 32.4 miles
- Construction of New Temporary Roads is 0.9 miles
- Road Maintenance on 31.5 miles of haul roads

III. Range-Wide Status of Bull Trout and Critical Habitat

This section provides information about the bull trout's life history, habitat preferences, geographic distribution, population trends, threats, and conservation needs. This includes description of the effects of past human activities and natural events that have led to the current status of the bull trout. This information provides the background for analyses in later sections of the biological opinion.

A. Range-Wide Status of Bull Trout

A.1 Listing Status

The coterminous United States population of the bull trout (*Salvelinus confluentus*) was listed as threatened on November 1, 1999 (U.S. Fish and Wildlife Service 1999, 64 FR 58910). The threatened bull trout occurs in the Klamath River Basin of south-central Oregon; the Jarbidge River in Nevada; the Willamette River Basin in Oregon; Pacific Coast drainages of Washington, including Puget Sound; major rivers in Idaho, Oregon, Washington, and Montana, within the Columbia River Basin; and the St. Mary-Belly River, east of the Continental Divide in northwestern Montana (Bond 1992, Brewin and Brewin 1997, Cavender 1978, Howell and Buchanan 1992, Leary and Allendorf 1997, U.S. Fish and Wildlife Service 1999, 64 FR 58910).

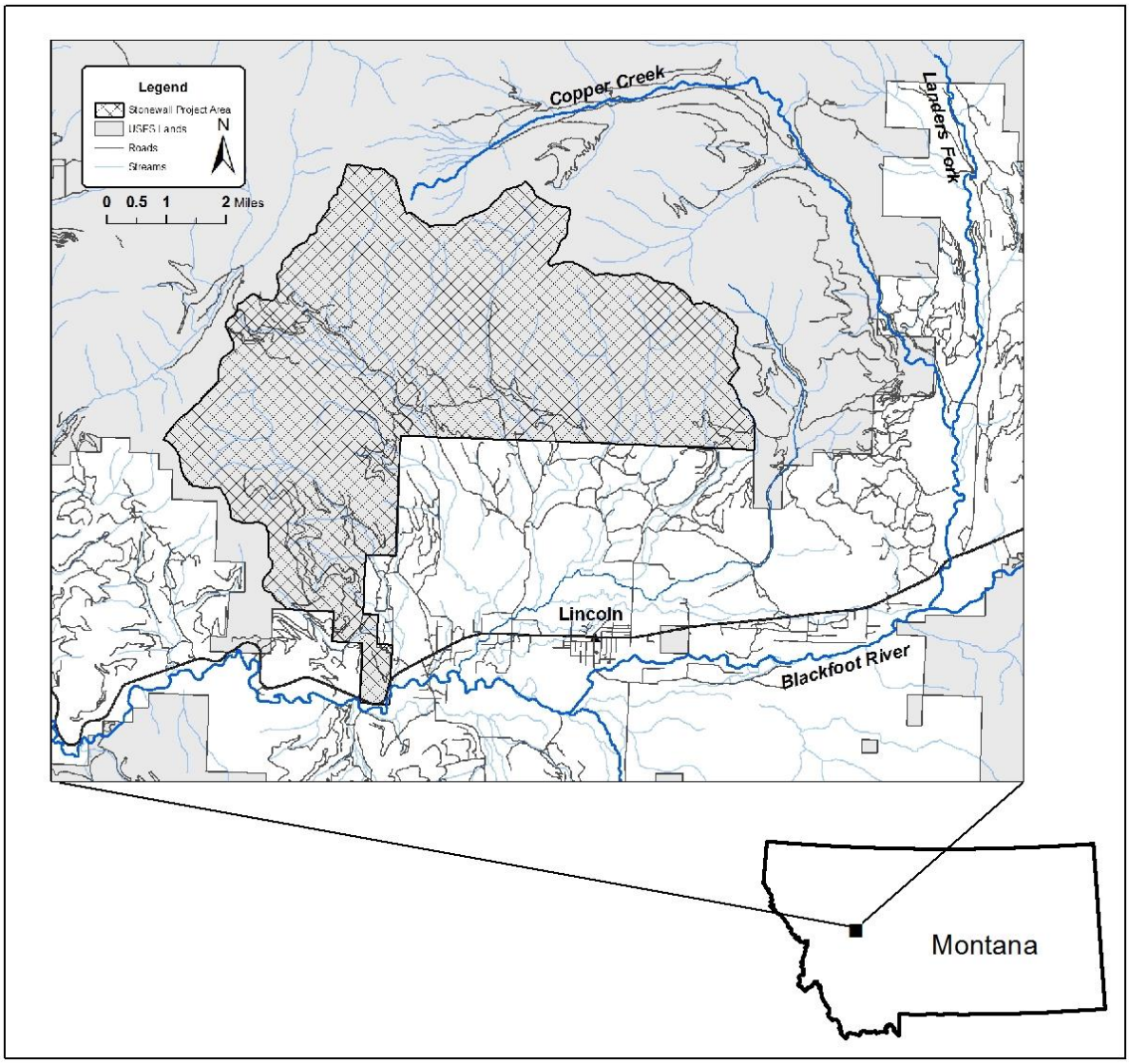

Figure 1. Location of the Stonewall Vegetation Project.

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

Six draft recovery units were identified based on new information (U.S. Fish and Wildlife Service 2010, 75 FR 63898) that confirmed they were needed to ensure a resilient, redundant, and representative distribution of bull trout populations throughout the range of the listed entity. The final bull trout recovery plan (U.S. Fish and Wildlife Service 2015) formalized these six recovery units. The final recovery units replace the previous five interim recovery units and will be used in the application of the jeopardy standard for Section 7 consultation procedures.

A.2 Reasons for Listing and Emerging Threats

Throughout its range, the bull trout is threatened by the combined effects of habitat degradation, fragmentation, and alterations associated with dewatering, road construction and maintenance, mining, grazing, the blockage of migratory corridors by dams or other diversion structures, poor water quality; incidental angler harvest; entrainment (a process by which aquatic organisms are pulled through a diversion or other device) into diversion channels; and introduced non-native species (U.S. Fish and Wildlife Service 1999, 64 FR 58910). Poaching and incidental mortality of bull trout during other targeted fisheries are additional threats. Since the time of coterminous listing of the species (U.S. Fish and Wildlife Service 1999, 64 FR 58910) and designation of its critical habitat (U.S. Fish and Wildlife Service 2004, 69 FR 59996, U.S. Fish and Wildlife Service 2005, 70 FR 56212, 2010, 75 FR 63898) a great deal of new information has been collected on the status of bull trout. The Service's Science Team Report (Whitesel et al 2004), the bull trout core areas templates (U.S. Fish and Wildlife Service 2005a, 2009), Conservation Status Assessment (U.S. Fish and Wildlife Service 2005b), and 5-year Review (U.S. Fish and Wildlife Service 2008, 2015) have provided additional information about threats and status. The final recovery plan lists many other documents and meetings that compiled information about the status of bull trout (U.S. Fish and Wildlife Service 2015). As did the prior 5-year review (2008), the current 5-year status review (U.S. Fish and Wildlife Service 2015g) maintains the listing status as threatened based on the information compiled in the final bull trout recovery plan (U.S. Fish and Wildlife Service 2015) and the recovery unit implementation plans (U.S. Fish and Wildlife Service 2015a-f)

When first listed, the status of bull trout and its threats were reported by the Service at subpopulation scales. In 2002 and 2004, the draft recovery plans (U.S. Fish and Wildlife Service 2002, 2004a, 2004b) included detailed information on threats at the recovery unit scale (i.e., similar to subbasin or regional watersheds), thus incorporating the metapopulation concept with core areas and local populations. In the 5-year Review, the Service established threats categories (i.e., dams, forest management, grazing, agricultural practices, transportation networks, mining, development and urbanization, fisheries management, small populations, limited habitat, and wildfire) (U.S. Fish and Wildlife Service 2008, U.S. Fish and Wildlife Service 2015).

Currently, in the final recovery plan, threats are described at a recovery unit scale that typically incorporates multiple watersheds, and describes threats for 109 core areas, local populations, forage/migration/overwintering areas, and includes research needs areas (U.S. Fish and Wildlife Service 2015).

The final recovery plan (U.S. Fish and Wildlife Service 2015) and associated recovery unit implementation plans (RUIP) (U.S. Fish and Wildlife Service 2015a-f) further identified primary threats affecting bull trout as historical habitat loss and fragmentation, interaction with nonnative species, and fish passage.

The 2015 draft 5-year status review references the final recovery plan and the recovery unit implementation plans and incorporates by reference the threats described therein (U.S. Fish and Wildlife Service 2015g). The review maintains that the threats have not been removed and thus the listing status should remain as "threatened" (U.S. Fish and Wildlife Service 2015g).

Emerging Threats: Climate change was not addressed as a known threat when bull trout were 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 (U.S. Fish and Wildlife Service 2015, U.S. Fish and Wildlife Service 2015a-f). Mote et al. (2014) summarized climate change effects to include rising air temperature, changes in the timing of streamflow related to changing snowmelt, increases in extreme precipitation events, lower summer stream flows, and other changes. A warming trend in the mountains of western North America is expected to decrease snowpack, hasten spring runoff, reduce summer stream flows, and increase summer water temperatures (Poff et al. 2002, Nelson and Palmer 2007, Koopman et al. 2009). Lower flows as a result of smaller snowpack could reduce habitat, which might adversely affect bull trout reproduction and survival. Warmer water temperatures could lead to physiological stress and could also benefit nonnative fishes that prey on or compete with bull trout. Increases in the number and size of forest fires could also result from climate change (Westerling et al. 2006) and could adversely affect watershed function by resulting in faster runoff, lower base flows during the summer and fall, and increased sedimentation rates. Lower flows also may result in increased groundwater withdrawal for agricultural purposes and resultant reduced water availability in certain stream reaches occupied by bull trout (U.S. Fish and Wildlife Service 2015c). 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, Rieman et al. 2007). Climate change is expected to reduce the extent of cold water habitat (Isaak et al. 2015), and increase competition with other fish species (e.g., lake trout, brown trout, brook trout, and northern pike) for resources in remaining suitable habitat. Several authors project that brook trout, a fish species that competes for resources with and predates on the bull trout, will continue increasing their range in several areas (an upward shift in elevation) due to the effects from climate change (Wenger et al. 2011, Isaak et al. 2010, 2014, Peterson et al. 2013).

A.3 Life History and Population Dynamics

Distribution: 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 Jarbridge River in Nevada to the headwaters of the Yukon River in the Northwest Territories, Canada (Cavender 1978, Bond 1992). To the west, the bull trout's range includes Puget Sound, various coastal rivers of British Columbia, Canada, and southeast Alaska (Bond 1992). 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 197, Brewin and Brewin 1997).

Reproductive Biology: The iteroparous reproductive strategy (i.e., fishes that spawn multiple times, and therefore require safe two-way passage upstream and downstream) 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 (i.e., 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 safe 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, Pratt 1985). The largest verified bull trout is a 32-pound specimen caught in Lake Pend Oreille, Idaho, in 1949 (Simpson and Wallace 1982).

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). Redds are often constructed in stream reaches fed by springs or near other sources of cold groundwater (Goetz 1989, Pratt 1992, Rieman and McIntyre 1996). Depending on water temperature, incubation is normally 100 to 145 days (Pratt 1992). After hatching, fry remain in the substrate, and time from egg deposition to emergence may surpass 220 days. Fry normally emerge from early April through May, depending on water temperatures and increasing stream flows (Pratt 1992, Ratliff and Howell 1992).

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) 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). 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). 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 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). 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). 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, Goetz 1989), or saltwater (anadromous form) to rear as subadults and to live as adults (Brenkman and Corbett 2005, McPhail and Baxter 1996, WDFW et al. 1997). Bull trout

normally reach sexual maturity in 4 to 7 years and may live longer than 12 years. They are iteroparous (i.e., 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, Leathe and Graham 1982, Pratt 1992, Rieman and McIntyre 1996).

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 required foraging, migrating, or overwintering habitats for migratory fish are greatly reduced (Brenkman and Corbett 2005, Goetz et al. 2004). 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). 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 in response 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, MBTSG 1998, Rieman and McIntyre 1993). In the absence of the migratory bull trout life form, isolated populations are difficult to replenish when disturbances make local habitats temporarily unsuitable. Therefore, the range of the species can be diminished, and the potential for a greater reproductive contribution from larger size fish with higher fecundity is lost (Rieman and McIntyre 1993).

Whitesel et al. (2004) noted that although there are multiple resources that contribute to the subject, Spruell et al. (2003) best summarized genetic information on bull trout population structure. Spruell et al. (2003) 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). They were characterized as:

1. “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.

2. “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.

3. “Upper Columbia River” which includes the entire basin in Montana and northern Idaho. A tentative assignment was made by Spruell et al. (2003) of the Saskatchewan River

drainage populations (east of the continental divide), grouping them with the upper Columbia River group.

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

More recently, the U.S. Fish and Wildlife Service identified additional genetic units within the coastal and interior lineages (Ardren et al. 2011). Based on a recommendation in the U.S. Fish and Wildlife Service's 5-year review of the species' status (U.S. Fish and Wildlife Service 2008), the U.S. Fish and Wildlife Service reanalyzed the 27 recovery units identified in the 2002 draft bull trout recovery plan (U.S. Fish and Wildlife Service 2002) by in part utilizing information from previous genetic studies and new information from additional analysis (Ardren et al. 2011). In this examination, the U.S. Fish and Wildlife Service applied relevant factors from the joint U.S. Fish and Wildlife Service and NMFS Distinct Population Segment (DPS) policy (U.S. Fish and Wildlife Service 1996) 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 (U.S. Fish and Wildlife Service 2010). 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 are described and identified in the final bull trout recovery plan (U.S. Fish and Wildlife Service 2015) and RUIPs (U.S. Fish and Wildlife Service 2015a-f).

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). Increased habitat fragmentation reduces the amount of available habitat and increases isolation from other populations of the same species (Saunders et al. 1991). Burkey (1989) 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, Burkey 1995).

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, Dunham and Rieman 1999, Rieman and Dunham 2000). A metapopulation is an interacting network of local populations with varying frequencies of migration and gene flow among them (Meffe and Carroll 1997). 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). 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, Dunham and Rieman 1999, Spruell et al. 1999, Rieman and Dunham 2000).

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). 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) 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). Research does, however, provide genetic evidence for the presence of a metapopulation process for bull trout, at least in the Boise River Basin of Idaho (Whiteley et al. 2003), while Whitesel et al. (2004) identifies that bull trout fit the metapopulation theory in several ways.

Habitat Characteristics: The habitat requirements of bull trout are often generally expressed as the four "Cs": cold, clean, complex, and connected habitat. Cold stream temperatures, clean water quality that is relatively free of sediment and contaminants, complex channel characteristics (including abundant large wood and undercut banks), and large patches of such habitat that are well connected by unobstructed migratory pathways are all needed to promote conservation of bull trout throughout all hierarchical levels.

Bull trout have more specific habitat requirements than most other salmonids (Rieman and McIntyre 1993). 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, Goetz 1989, Hoelscher and Bjornn 1989, Howell and Buchanan 1992, Pratt 1992, Rich 1996, Rieman and McIntyre 1993, Rieman and McIntyre 1995, Sedell and Everest 1991, Watson and Hillman 1997). Watson and Hillman (1997) 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), 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). 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, Spruell et al. 1999). 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, Pratt 1992, Rieman and McIntyre 1993).

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, Rieman and McIntyre 1993). 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, Goetz 1989). In Granite Creek, Idaho, Bonneau and Scarnecchia (1996) 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) 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, Fraley and Shepard 1989, Rieman and McIntyre 1993, Rieman and McIntyre 1995). Availability and proximity of cold water patches and food productivity can influence bull trout ability to survive in warmer rivers (Myrick et al. 2002).

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, Goetz 1989, Hoelscher and Bjornn 1989, Pratt 1992, Rich 1996, Sedell and Everest 1991, Sexauer and James 1997, Thomas 1992, Watson and Hillman 1997). Maintaining bull trout habitat requires natural stability of stream channels and maintenance of natural flow patterns (Rieman and McIntyre 1993). Juvenile and adult bull trout frequently inhabit side channels, stream margins, and pools with suitable cover (Sexauer and James 1997). 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, Pratt 1992, Pratt and Huston 1993). Pratt (1992) 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). Resident and juvenile migratory bull trout prey on terrestrial and aquatic insects, macrozooplankton, and small fish (Boag 1987, Donald and Alger 1993, Goetz 1989). Subadult and adult migratory bull trout generally feed on various fish species (Donald and Alger 1993, Fraley and Shepard 1989, Leathe and Graham 1982). Bull trout of all sizes other than fry have been found to eat fish half their length (Beauchamp and VanTassell 2001). 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, WDFW et al. 1997).

Bull trout migration and life history strategies are closely related to their feeding and foraging strategies and their environment. 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). 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, Goetz et al. 2004).

A.4 Conservation Status and Needs

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 stable 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 (U.S. Fish and Wildlife Service 2015).

Information presented in prior draft recovery plans published in 2002 and 2004 (U.S. Fish and Wildlife Service 2002, 2004, 2004a) 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 (U.S. Fish and Wildlife Service 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 (U.S. Fish and Wildlife Service 2015).

To implement the recovery strategy, the 2015 recovery plan establishes four categories of recovery actions for each of the six Recovery Units (U.S. Fish and Wildlife Service 2015):

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 (U.S. Fish and Wildlife Service 2015). 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) (U.S. Fish and Wildlife Service 2015).

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 (U.S. Fish and Wildlife Service 2015). 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 (U.S. Fish and Wildlife Service 2015).Core areas can be further described as complex or simple (U.S. Fish and Wildlife Service 2015). 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 (SR) and foraging, migration, and overwintering habitats (FMO). Simple core areas are those that contain one bull trout local population. Simple core areas are small in scope, isolated from other core areas by natural barriers, and may contain unique genetic or life history adaptations.

A local population is a group of bull trout that spawn within a particular stream or portion of a stream system (U.S. Fish and Wildlife Service 2015). 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.

A.5 Population Units

The final recovery plan (U.S. Fish and Wildlife Service 2015) designates six bull trout recovery units as described above. These units replace the five interim recovery units previously identified (U.S. Fish and Wildlife Service 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 (U.S. Fish and Wildlife Service 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 RUIPs (U.S. Fish and Wildlife Service 2015a-f), which identify conservation actions and recommendations needed for each core area, forage/ migration/ overwinter (FMO) areas, historical core areas, and research needs areas. Each recovery unit is necessary to maintain the bull trout's distribution, as well as its genetic and phenotypic diversity, all of which are important to ensure the species' resilience to changing environmental conditions. The proposed action is located in the Columbia Headwaters Recovery Unit, as described below.

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 (U.S. Fish and Wildlife Service 2015b). 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 (U.S. Fish and Wildlife Service 2015b). 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 (U.S. Fish and Wildlife Service 2015b). Fish passage improvements within the recovery unit have reconnected some previously fragmented habitats (U.S. Fish and Wildlife Service 2015b), 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 (U.S. Fish and Wildlife Service 2015b). The current condition of the bull trout in this recovery unit is attributed to significant threats from climate change, water quality issues driven by 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 impacts to habitat and water quantity and quality, and from residential development (U.S. Fish and Wildlife Service 2015b). Conservation measures or recovery actions implemented include habitat improvement, fish passage, and removal of nonnative species.

B. Critical Habitat

The final rule designating critical habitat for bull trout uses the term Primary Constituent Element (PCE). The new critical habitat regulations (CFR 402.01 and 402.12) eliminated the term PCE and use the Act's phrase Physical or Biological Features (PBF). The change does not alter the approach used in conducting a ''destruction or adverse modification'' analysis. In this

biological opinion, we maintain the use of the term PCE as identified in the final rule for designated bull trout critical habitat.

B.1 Legal Status

Litigation resulted in the U.S. District Court for the District of Oregon granting the Service a voluntary remand of the 2005 critical habitat designation. Subsequently, the Service published a proposed critical habitat rule on January 14, 2010 (75 FR 2260) and a final rule on October 18, 2010 (75 FR 63898). The rule became effective on November 17, 2010. A justification document was also developed to support the rule and is available on our website (http://www.fws.gov/pacific/bulltrout). The scope of the designation involved the species' coterminous range.

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

The final rule increases the amount of designated bull trout critical habitat by approximately 76 percent for miles of stream/shoreline and by approximately 71 percent for acres of lakes and reservoirs compared to the 2005 designation. This rule also identifies and designates as critical habitat approximately 1,323.7 km (822.5 miles) of streams/shorelines and 6,758.8 ha (16,701.3 acres) of lakes/reservoirs of unoccupied habitat to address bull trout conservation needs in specific geographic areas in several areas not occupied at the time of listing. No unoccupied habitat was included in the 2005 designation. These unoccupied areas were determined by the Service to be essential for restoring functioning migratory bull trout populations based on currently available scientific information. These unoccupied areas often include lower mainstem river environments that can provide seasonally important migration habitat for bull trout. This type of habitat is essential in areas where bull trout habitat and population loss over time necessitates reestablishing bull trout in currently unoccupied habitat areas to achieve recovery.

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

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

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 (75 FR 63898). Excluded areas are approximately 10 percent of the stream/shoreline miles and 4 percent of the lakes and reservoir acreage of designated critical habitat. Each excluded area is identified in the relevant CHU text, as identified in paragraphs (e)(8) through (e)(41) of the final rule. It is important to note that the exclusion of water bodies 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.

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

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

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

The Olympic Peninsula and Puget Sound CHUs are essential to the conservation of amphidromous bull trout, which are unique to the Coastal-Puget Sound population segment. These CHUs contain marine nearshore and freshwater habitats, outside of core areas, that are

used by bull trout from one or more core areas. These habitats, outside of core areas, contain PCEs that are critical to adult and subadult foraging, migrating, and overwintering.

In determining which areas to propose as critical habitat, the Service considered the physical and biological features that are essential to the conservation of bull trout and that may require special management considerations or protection. These features are the PCEs laid out in the appropriate quantity and spatial arrangement for conservation of the species. The PCEs for bull trout are those habitats components that are essential for the primary biological needs of foraging, reproducing, rearing of young, dispersal, genetic exchange, or sheltering (75 FR 63898).

B.2 Range-Wide Condition of Bull Trout Critical Habitat

The condition of proposed 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 (67 FR 71240). This condition reflects the condition of bull trout habitat.

The primary land and water management activities impacting the physical and biological features essential to the conservation of bull trout include timber harvest and road building, agriculture and agricultural diversions, livestock grazing, dams, mining, urbanization and residential development, and non-native species presence or introduction (75 FR 2282). There is widespread agreement in the scientific literature that many factors related to human activities have impacted bull trout and their habitat, and continue to do so. Among the many factors that contribute to degraded PCEs, 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 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, Rieman et al. 2006).

4. In the Coastal-Puget Sound region where amphidromous bull trout occur, degradation of mainstem river FMO habitat, and the degradation and loss of marine nearshore foraging and migration habitat due to urban and residential development.

5. Degradation of FMO habitat resulting from reduced prey base, roads, agriculture, development, and dams.

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 PCEs 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).

C. Previous Consultations and Conservation Efforts

This section includes a discussion on previously consulted actions and subsequent effects that have been analyzed through section 7 consultation as reported in a Biological Opinion. These effects are an important component of objectively characterizing the current condition of the species. To assess consulted-on effects to bull trout, we analyzed all of the Biological Opinions received by the Region 1 and Region 6 Forest Service Offices, from the time of listing until August 2003; this totaled 137 Biological Opinions. Of these, 124 Biological Opinions (91 percent) applied to activities affecting bull trout in the Columbia Basin population segment, 12 Biological Opinions (9 percent) applied to activities affecting bull trout in the Coastal-Puget Sound population segment, 7 Biological Opinions (5 percent) applied to activities affecting bull trout in the Klamath Basin population segment, and one Biological Opinion (< 1 percent) applied to activities affecting the Jarbidge and St. Mary-Belly population segments (Note: these percentages do not add to 100 because several Biological Opinions applied to more than one population segment). The geographic scale of these consultations varied from individual actions (e.g., construction of a bridge or pipeline) within one basin to multiple-project actions occurring across several basins.

The current bull trout recovery plan modified the previous demographic units used in the interim recovery plan. Based on the current recovery plan, there have been 62 Biological Opinions issued for take in the Upper Clark Fork Geographic Region of the Columbia Headwaters Recovery Unit from August 2003 until now. Of these 62 Biological Opinions, 11 have occurred within the Blackfoot River Core Area where this project is located or have been programmatics that included the Blackfoot River Core Area. Most of the Biological Opinions have included mandatory terms and conditions and reporting requirements, which are binding on the action agency, in order to reduce the potential impacts of anticipated incidental take to bull trout.

IV. Analytical Framework for the Jeopardy and Adverse Modification Determinations

A. Jeopardy Determination

In accordance with policy and regulation, the jeopardy analysis in this biological opinion relies on four components: (1) the Status of the Species, which evaluates the bull trout's range-wide condition, the factors responsible for that condition, and its survival and recovery needs; (2) the Environmental Baseline, which evaluates the condition of the bull trout in the action area, the factors responsible for that condition, and the relationship of the action area to the survival and recovery of the bull trout; (3) the Effects of the Action, which determines the direct and indirect impacts of the proposed federal action and the effects of any interrelated or interdependent activities on the bull trout; and (4) Cumulative Effects, which evaluates the effects of future, non-federal activities reasonably certain to occur in the action area on the bull trout. In accordance with policy and regulation, the jeopardy determination is made by evaluating the

effects of the proposed federal action in the context of the bull trout's current status, taken together with cumulative effects, to determine if implementation of the proposed action is likely to cause an appreciable reduction in the likelihood of both the survival and recovery of the bull trout in the wild.

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

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

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

B. Adverse Modification Determination

The adverse modification analysis in this biological opinion relies on four components: (1) The status of critical habitat, which evaluates the condition of critical habitat that has been designated for the species in terms of physical or biological features, the factors responsible for that condition, and the intended conservation role of the critical habitat overall; (2) the environmental baseline, which evaluates the current condition of the critical habitat in the action area, the factors responsible for that condition, and the relationship of the affected critical habitat in the action area to the entire critical habitat with respect to the conservation of the listed species; (3) the effects of the action, which includes the direct and indirect effects of the action (and the effects of any interrelated or interdependent activities) and describes how those effects alter the value of critical habitat within the action area; and (4) cumulative effects (as defined at 50 C.F.R. § 402.02), which evaluates the effects of future, non-federal activities in the action area and describes how those effects are expected to alter the value of critical habitat within the action area.

For purposes of the adverse modification determination, the effects of the proposed federal action on bull trout critical habitat are evaluated in the context of the range-wide condition of the critical habitat, together with any cumulative effects, to determine if the critical habitat range-wide would remain functional (or would retain the current ability for the PCE to be functionally established in areas of currently unsuitable but capable habitat) to serve its intended recovery role for the bull trout.

The analysis in this biological opinion places an emphasis on using the intended range-wide recovery function of bull trout critical habitat, especially in terms of maintaining and/or restoring habitat conditions that are necessary to support viable core area populations, and the role of the action area relative to that intended function as the context for evaluating the significance of the effects of the proposed federal action, taken together with cumulative effects, for purposes of making the adverse modification determination.

V. Analytical Framework for the Environmental Baseline and Effects of the Action

To assess baseline conditions and effects to bull trout and bull trout critical habitat, the Service created "A Framework to Assist in Making Endangered Species Act Determinations of Effect for Individual or Grouped Actions at the Bull Trout Subpopulation Watershed Scale" (Framework/Matrix; U.S. Fish and Wildlife Service 1998). The Framework provides a way to systematically assess baseline conditions and project-related effects using four Species Indicators to assess Subpopulation Characteristics and 6 Habitat Pathways incorporating 19 Habitat Indicators (Table 2). Ratings of the species and habitat indicators are then used to derive an "Integration of Species and Habitat Conditions" ratings. This single value integrating habitat and subpopulation conditions is intended to help arrive at a determination of the potential effects of land management activities on bull trout. Baseline ratings are typically assessed for each of four species indicators, 19 habitat indicators, and an Integration of Species and Habitat Indicators for every 6th field Hydrologic Unit Code (HUC) that is currently occupied or was historically occupied by bull trout within the analysis area. In unoccupied HUCs due to limited aquatic habitat or with barriers to fish passage, subpopulation characteristics are excluded and the habitat indicators and Integration of Species and Habitat Indicators are used to address habitat conditions.

The Forest Service considers four habitat indicators (*temperature, barriers, pool frequency and quality,* and *fine sediment*) as the primary habitat indicators because they are the most important attributes of bull trout habitat within Forest Service control. The *barriers* indicator refers to man-made barriers and does not consider natural barriers to fish passage such as waterfalls and natural dewatering. Ratings of primary indicators provide baseline conditions and serve as a starting point to gage potential need for habitat change in any given 6th field HUC. These four indicators are also used to generate an overall "Integrated Status of Habitat Conditions" for each HUC (U.S. Forest Service 2013).

Indicators and integrated values are rated as "functioning appropriately" (FA), "functioning at risk" (FAR), and "functioning at unacceptable risk" (FUR). Indicators rated FA provide habitats that maintain strong and significant populations, are interconnected and promote recovery of a proposed or listed species or its critical habitat to a status that will provide self-sustaining and self-regulating populations. When a habitat indicator is FAR, they provide habitats for persistence of the species but in more isolated populations and may not promote recovery of a proposed or listed species or its habitat without active or passive restoration efforts. FUR indicates the proposed or listed species continues to be absent from historical habitat, or is rare or being maintained at a low population level; although the habitat may maintain the species at this low persistence level, active restoration is needed to begin recovery of the species. Parameters describing indicator ratings can be found in Appendix Table A-1.

Due to natural variability and large spatial extent of 6th field HUCs, a Geographical Information System (GIS) modeling approach was used to provide a structured, single determination of habitat indicators for each HUC within the range of bull trout in Montana. Ratings were determined by the Forest Service for HUCs dominated by federal ownership (>50%). The Natural Resources Conservation Service (NRCS) determined ratings for HUCs containing 50% or greater non-federal ownership using a slightly modified version of the Forest Service method to account for differences in data availability. Ratings should be considered surrogates for actual conditions and as a modeled average of the natural variability that occurs within any watershed. Field data should be used when possible to update modeled values.

Project effects are considered to either "maintain," restore," or "degrade" habitat indicators relative to existing or baseline conditions. Effects are characterized as either "major" effects that will likely produce a change in one functional level to baseline conditions (e.g., change FAR to FA), or minor effects that may result in an incremental or cumulative effect but will not result in a functional change within the HUC. Together, the influence of project effects to the individual habitat indicators, subpopulation characteristics, Integrated Status of Habitat Conditions, and Integration of Species and Habitat Indicators provide a way to systematically assess the effects of proposed actions.

Designated critical habitat for bull trout is comprised of the nine PCEs described below. These physical, chemical, and biological features correspond to many of the Framework habitat parameters. Table 2 (U.S. Fish and Wildlife Service 2011) shows the relationship between the PCEs for bull trout critical habitat and the Framework indicators. The *refugia* indicator is relevant to all PCEs because in order for the *refugia* indicator to be rated "functioning appropriately", most if not all of the PCEs must be present. The PCEs are predominately based on habitat indicators rather than species indicators. Only one of the species indicators applies to the evaluation of any PCE; *persistence and genetic integrity* is used with two habitat indicators (*temperature* and *refugia*) to address PCE9. Further descriptions of the relationships between indicators and PCEs can be found in Appendix Table A-2.

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

PCE 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.

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

PCE 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.

Table 2. Relationship between Diagnostic Indicators and Primary Constituent Elements (PCE) of bull trout critical habitat. For example, the Subpopulation Characteristic *persistence & genetic integrity* and the Habitat Indicators *temperature* and *refugia* (indicated by an "X" are used to assess the condition of PCE 9.

Diagnostic Pathway / *Indicator*	PCE's of Bull Trout Critical Habitat								
	PCE 1	PCE 2	PCE 3	PCE 4	PCE 5	PCE 6	PCE 7	PCE 8	PCE 9
Species Indicators									
Subpopulation Characteristics									
Subpopulation Size									
Growth & Survival									
Life History Diversity & Isolation									
Persistence & Genetic Integrity									X
Habitat Indicators									
Water Quality									
Temperature	X	X			X			X	X
Sediment	X	X	X	X		X			
Chemical Contamination/ Nutrients	X	X	X					X	
Habitat Access									
Physical Barriers		X							
Habitat Elements									
Substrate Embeddedness	X	X	X	X		X			
Large Woody Debris			X	X					
Pool Frequency & Quality			X	X					
Large Pools				X	X				
Off Channel Habitat	X		X	X	X				
Refugia	X	X	X	X	X	X	X	X	X
Channel Condition & Dynamics									
Wetted Width/Depth Ratio		X		X	X			X	
Streambank Condition	X		X	X	X	X	X	X	
Floodplain Connectivity	X		X	X	X	X	X	X	
Flow Hydrology									
Change in Peak/Base Flows	X	X			X		X	X	
Drainage Network Increase	X				X	X	X	X	
Watershed Conditions									
Road Density & Location	X			X	X	X	X	X	
Disturbance History	X				X		X		
Riparian Conservation Areas	X		X	X	X	X	X	X	
Disturbance Regime				X		X		X	

PCE 5 - Water temperatures ranging from 2 to 15 °C (36 to 59 °F), with adequate thermal refugia available for temperatures that exceed the upper end of this range. Specific temperatures within this range will depend on bull trout life-history stage and form; geography; elevation; diurnal and seasonal variation; shading, such as that provided by riparian habitat; streamflow; and local groundwater influence.

PCE 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.

PCE 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.

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

PCE 9 - Sufficiently low levels of occurrence of nonnative predatory (e.g., lake trout, walleye, northern pike, smallmouth bass); interbreeding (e.g., brook trout); or competing (e.g., brown trout) species that, if present, are adequately temporally and spatially isolated from bull trout.

VI. Environmental Baseline

Regulations implementing the Act, as amended (16 U.S.C. 1531 et seq.; 50 C.F.R. § 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 already undergone section 7 consultation, and the impacts of state and private actions in the action area that are contemporaneous with the consultation in progress. The environmental baseline should characterize the effects of past and ongoing human factors leading to the current status of the species, their habitats, and ecosystem within the action area. For this biological opinion, environmental baseline conditions for bull trout were assessed using information in the biological assessment (U.S. Forest Service 2016), Bull Trout Core Area Templates (U.S. Fish and Wildlife Service 2005a), bull trout recovery plan for the Columbia Headwaters recovery unit (U.S. Fish and Wildlife Service 2015b), Conservation Strategy for Bull Trout on USFS lands in Western Montana (U.S. Forest Service 2013), watershed baseline conditions for the Blackfoot River section 7 watershed (U.S. Forest Service 2010) and other sources of information.

A. Existing Conditions and Factors Affecting Species Environment in the Core Area

Glaciers strongly influenced the landscape and hydrology of the Blackfoot river basin. When the glaciers receded, large deposits of glacial till, glacial outwash, and glacial lake bed sediments were left behind. Due to the highly permeable nature of coarse outwash sediments, streams generally lose water through infiltration and often go dry where they cross outwash plains. As a result, many streams or stream reaches in the Blackfoot River basin are intermittent. Streams in confined valleys are usually perennial but have intermittent reaches when the valley widens or enters a larger valley. The lower end of intermittent reaches often provide ideal spawning habitat for bull trout where the water resurfaces or upwells and is typically clean and cold.

Anthropogenic factors such as mining, logging, and ranching have influenced the Blackfoot River core area. Beginning in the late 1800's, typically small-scale placer mining disrupted fish habitat and stream function in area bull trout streams. Streams rarely have the ability to naturally recover from placer operations. Ranching and homesteading began in the late 1800's and early 1900's, resulting in water diversions that reduced flows and the ability to provide adequate fish habitat. Water diversions were typically not screened, which likely led to entrainment of various age classes of bull trout. Clearing of riparian shrubs and damage to streambanks from over-grazing affected stream geomorphology and introduced high amounts of sediment where erosion occurred. Significant timber harvest and road building took place from the 1930's through 1980's. Roads increased water temperature and the amount of sediment delivered to streams. Undersized culverts created fish barriers. Log drives down the Blackfoot River and major tributaries removed log jams that created adult bull trout habitat and eliminated pools and spawning habitat in major tributaries. Construction of the Milltown Dam in 1906 isolated bull trout populations in the Blackfoot River from other core populations prior to removal of the dam in 2008.

A number of tributaries within the Blackfoot River drainage have received special designations for conservation of bull trout. Copper Creek is a tributary to the Landers Fork. Combined, the Landers Fork/Copper Creek is considered a priority watershed, a drainage still containing either excellent habitat, an assemblage of native fish, provides for metapopulation objectives, or is a watershed having excellent potential for restoration. In addition to priority watersheds designated when the Forest Plan was amended by INFISH, special emphasis watersheds were established as a means of identifying a refugia network of streams to assist in the protection and recovery of bull trout as specified under "Additional Agency Commitments" in the 1998 Biological Opinion for continued Land and Resource Management Plans (U.S. Fish and Wildlife Service 1998a). Arrastra Creek, Beaver Creek, Moose Creek, Willow Creek, Poorman Creek, Hogum Creek, Alice Creek, and upper Nevada Creek are special emphasis watersheds in the Blackfoot drainage.

Many restoration actions targeting the recovery of bull trout in the Blackfoot River watershed have occurred since 1990 (Pierce and Podner 2016). These activities include: (1) enhancing instream flows and improving fish passage by screening major irrigation canals, (2) flow enhancement, livestock fencing and improved irrigation for fish passage, (3) placement of conservation easements on segments of several spawning streams, and (4) fish passage enhancement on two low-head dams on the mainstem Clearwater River. Recent purchases of timber company lands also have the potential to benefit bull trout. In 2003, the Blackfoot Challenge and The Nature Conservancy initiated the Blackfoot Community Project, which involved the purchase and re-sale of 89,215 acres of Plum Creek Timber Company lands from the Blackfoot River headwaters near Rogers Pass to the Clearwater drainage. Approximately 75% of the lands have been or will be transferred into federal or state ownership. In 2008, The Nature Conservancy and The Trust for Public Land entered into an agreement with Plum Creek Timber, referred to as the Montana Legacy Project, to purchase 312,500 acres of timberland in western Montana. As part of the Montana Legacy Project, a total of 71,754 acres in the Clearwater and Potomac valleys of the Blackfoot Subbasin will be purchased and resold to public agencies and/or private buyers. The majority of these lands are intended to be re-sold to the Forest Service and DNRC.

Threats to the Blackfoot River Core Area: The bull trout recovery plan for the Columbia Headwaters Recovery Unit (U.S. Fish and Wildlife Service 2015) identifies primary threats to habitat, demographics, and from nonnative species. Small population size and fragmentation are the primary demographic threats to bull trout. The occurrence and hybridization with brook trout are the primary threats from nonnative fish. Past and ongoing land management practices have resulted in the following primary threats to bull trout habitat in the Blackfoot River Core Area: (1) riparian and instream degradation, (2) loss of large woody debris, (3) reduction in large pools, (4) seasonally high summer temperatures and dewatered reaches, and (5) contamination from historic mine runoff.

The transportation network is a major contributing factor to habitat threats in the Blackfoot River Core Area. Negative factors include increased erosion and sedimentation, alterations in stream channel morphology, changes in flow regimes, barriers to movement, and increased human access (Furniss et al. 1991, Lee et al. 1997). High road density in a watershed can increase the amount of fine sediment in streams (Opperman et al. 2005) and can influence stream hydrology by altering the routing of surface and subsurface flow and the timing and magnitude of flow events (Moore and Wondzell 2005). Riggers et al. (1998) found increased sediment levels as road densities increased. Generally, watersheds that are considered aquatic strongholds occur in areas of low road density (Baxter et al. 1999). An assessment of fish populations in the Interior Columbia River Basin found that bull trout are less likely to use streams for spawning and rearing in highly road systems (Quigley and Arbelbide 1997). The Montana Bull Trout Restoration Team (2000) ranked forest practices (including road construction and use of secondary forest roads) as the greatest risk to restoration of bull trout in Montana.

Interruption of hill-slope drainage patterns by roads can alter the timing and magnitude of peak flows and changes base stream discharge (Furniss et al. 1991, Harr et al. 1975) and sub-surface flows (Furniss et al. 1991). Road-related mass soil movements can continue for decades after the roads have been constructed (Furniss et al. 1991). Such habitat alterations can adversely affect all life-stages of fishes, including migration, spawning, incubation, emergence, and rearing (Furniss et al. 1991, Henjum et al. 1994, Rhodes et al. 1994). Road networks can increase water temperature by reducing streamside shading, allowing drainage of warmer water along roads into streams, and reducing pool frequency and quality by limiting the amount of large wood available for recruitment into streams (U.S. Forest Service 2013). As linear compacted features, roads in forested watershed can substantially alter hill slope hydrology, causing surface flow in areas far from established stream channels (Luce 1997). Roads and drainage ditches are essentially ephemeral stream channels (Leopold and Miller 1956) and greatly expand the natural watershed drainage network (Montgomery 1994). Watersheds with high road densities commonly produce elevated sediment levels and experience increased peak flows (Meehan 1991, Luce 1997).

Road/stream crossings may influence stream geomorphology, act as barriers to fish movements, fragment stream habitat, and be a source of sediment delivery to streams. Unnatural channel widths, slope, and streambed form occur upstream and downstream of stream crossings (Heede 1980). Alterations in channel morphology may persist for long periods of time. Riprapping roads adjacent to streams can channelize stream sections, accentuate the delivery of sediment to streams during road maintenance, and trigger fill slope erosion and failure. Erosion of channel fill may occur around culverts which in turns adds sediment and can lead to crossing failures (Furniss et al. 1991). Many culverts on U.S. Forest Service lands have high constriction ratios

that limit the ability of culverts to pass 100-year flow events and increase the potential for culvert failure over time (U.S. Forest Service 2006). Plugged culverts and fill slope failures often lead to catastrophic increases in stream channel sediment, especially on old abandoned or unmaintained roads (Weaver et al. 1987). Because improper culverts can reduce or eliminate fish passage (Belford and Gould 1989), road crossings are a common migration barrier to fish (Evans and Johnston 1980, Furniss et al. 1991, Clancy and Reichmuth 1990). A large percentage of culverts on Forest Service lands are either a total or partial barrier for juvenile salmonids (U.S. Forest Service 2006). Recent information concerning climate change indicates that these non-climate stressors (fish passage barriers and undersized culverts) can exacerbate climate impacts (Rieman and Isaak 2010). As stream temperatures increase, access to first and second order streams (higher elevation and cooler) becomes more important. In addition, the likelihood of road crossing failures increases as rain-on-snow events become more frequent or intense.

Traffic and road maintenance are two components of road management that have the potential to influence sediment movement from forest roads (Grace and Clinton 2007). Reducing traffic in the Clearwater River watershed reduced surface erosion by a factor of 10 (Reid and Dunne 1984). Increased recreational use of all National Forests has resulted in an 11 fold increase in traffic in comparison to the 1950s and is expected to continue to increase as the U.S. population increases. Roads located near streams may facilitate the creation of dispersed campsites and unauthorized roads near streams that can adversely affect riparian conservation areas and further degrade habitat indicators.

B. 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 C.F.R. § 402.02). It is based upon the geographic extent of the physical, chemical, and biological effects to land, air, and waters resulting from the proposed action, including direct and indirect effects. For bull trout, 5th or 6th field HUCs are the recommended geographic scale for analysis of effects (U.S. Fish and Wildlife Service 1998). Consistent with this recommended scale of analysis, watershed baseline conditions (U.S. Forest Service 2010) and the Conservation Strategy for Bull Trout on USFS lands in Western Montana (U.S. Forest Service 2013) are conducted at the 6th field sub-watershed scale.

The Stonewall Project area encompasses all or parts of four 6th field HUCs on the Lincoln Ranger District of the Forest (Figure 2). One additional HUC downstream of the project boundary was included in the action area to address potential downstream effects. Four of the five HUCs are considered occupied (Figure 2), where bull trout presence has been recorded in at least a portion of the watershed. Bull trout presence in the Keep Cool Creek HUC is limited to the lower section of Keep Cool Creek because dewatering on private land due to natural and/or irrigation purposes prevents bull trout utilization in the upper portions on Forest land.

Access Management in the Action Area: The following paragraphs describe the relationship of ongoing access management to the proposed action. On August 3, 2016, in accordance with section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. § 1531 et seq.), the Service issued a programmatic biological opinion and incidental take statement (2016 programmatic biological opinion, U.S. Fish and Wildlife Service 2016) on the effects of the Blackfoot Non-Winter Travel Plan (Travel Plan). The 2016 programmatic biological opinion

analyzed the effects of Forest access management on bull trout and designated bull trout critical habitat on the Lincoln Ranger district of the Forest, including access management in the action area. Analysis included the effects of existing, ongoing access management conditions (i.e., baseline condition) in each watershed. The 2016 programmatic biological opinion determined the Travel Plan would not jeopardize the continued existence of bull trout and is not likely to destroy or adversely modify designated bull trout critical habitat.

The 2016 programmatic biological opinion was designed as the first-tier of a tiered consultation framework on the programmatic direction of the Travel Plan. Second-tier consultations include the review of site specific projects related to the programmatic consultation on the Travel Plan. Consultation for the Stonewall Project is a second-tier consultation. The intent of this second-tier consultation is to evaluate whether the adverse effects to bull trout and designated bull trout critical habitat related to the proposed action are consistent with the 2016 programmatic biological opinion and incidental take statement.

In our review of the adverse effects of the Stonewall Project, we find that the existing, ongoing access condition and road use within the action area are consistent with our analysis of effects on bull trout and bull trout critical habitat in the 2016 programmatic biological opinion and incidental take statement. This second-tier consultation for the Stonewall Project illustrates how these adverse effects on bull trout and bull trout critical habitat fall within the scope of our 2016 programmatic biological opinion and incidental take statement. Additional effects to bull trout and bull trout critical habitat as a result of the Stonewall Project are discussed in the effects section below.

The 2016 programmatic biological opinion (U.S. Fish and Wildlife Service 2016) analyzed the effects of changing the existing non-winter motorized public access routes and restrictions on the non-wilderness portion of the Lincoln Ranger District. The Stonewall Project would not create new roads, stream crossings, or dispersed campsites in Riparian Habitat Conservation Areas (RHCA). Changes to access restrictions analyzed in the 2016 programmatic biological opinion remain unchanged by the Stonewall Project. Upon review of the 2016 biological assessment for the Stonewall Project (U.S. Forest Service 2016) and its resultant programmatic biological opinion (U.S. Fish and Wildlife Service 2016), it is our opinion that the existing access condition and ongoing road use would not impart adverse effects to bull trout or bull trout critical habitat in addition to those analyzed in the 2016 programmatic biological opinion and that the proposed action is in compliance with the incidental take statement of that opinion.

In summary, we find that the adverse effects related to the existing, ongoing access conditions were adequately analyzed in the 2016 programmatic biological opinion and the proposed actions related to access conform to the incidental take statement associated with this opinion. Our finding is based on: (1) the baseline access condition falls within the scope of the programmatic biological opinion, (2) the effects of access management are consistent with those anticipated and analyzed in the programmatic biological opinion, (3) the amount of incidental take anticipated in the incidental take statement will not be exceeded, and (4) the proposed action adheres to the appropriate terms and conditions associated with the reasonable and prudent measures identified in the 2016 incidental take statement.

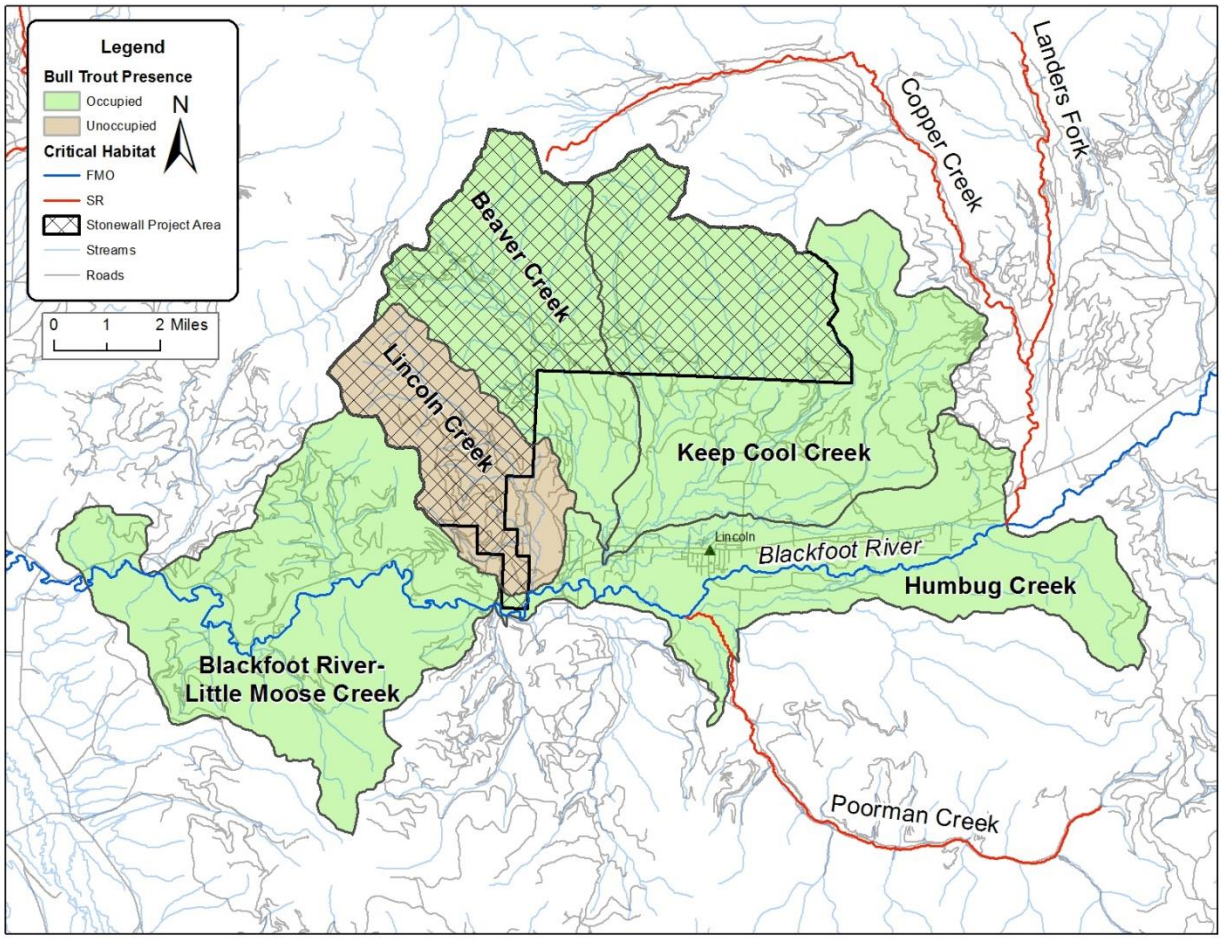

Figure 2. Bull trout critical habitat and watersheds in the Stonewall Vegetation Project action area.

C. Status of Bull Trout in the Core Area and Action Area

The Blackfoot River extends from its headwaters near the continental divide to the confluence with the Clark Fork River near Bonner, Montana. The Blackfoot River Core Area contains the Blackfoot River and all tributaries to the Blackfoot River. Historically, bull trout populations were well distributed throughout the Blackfoot River Core Area and in much higher densities than they are today. It is hypothesized that up to 1,000 bull trout redds may have been present in the core area (U.S. Forest Service 2013). The average number of redds between 1989 and 2010 in three primary spawning tributaries (Monture Creek, North Fork Blackfoot and Copper Creek) has been about 126 (U.S. Forest Service 2013). There has been an upward trend in redd counts during this period, but it is believed the population is still well below its potential.

The bull trout recovery plan considers a hierarchical order of demographic units ranging from local populations to the range of bull trout within the coterminous United States (Table 3). The Stonewall Project is located within the Blackfoot River Core Area, Upper Clark Fork Geographic Region, of the Columbia Headwaters Recovery Unit. Core areas represent the closest approximation of a biologically functioning unit for bull trout, containing habitat that could

supply all elements for the long-term security of bull trout and one or more local bull trout populations (U.S. Fish and Wildlife Service 2015). Local populations are considered the smallest group of fish that are known to represent an interacting reproductive unit.

Table 3. Hierarchy of bull trout demographic units for the Blackfoot River Core Area.

Bull Trout Analysis Scale	Hierarchical Relationship
Coterminous United States (DPS)	Range of bull trout
Columbia Headwaters Recovery Unit	One of 6 Recovery Units in the range of the species within the coterminous United States
Upper Clark Fork Geographic Region	One of 5 Geographic Regions in the Columbia Headwaters Recovery Unit
Blackfoot River Core Area	One of 7 Core Areas in the Upper Clark Fork Geographic Region
Local Populations (Landers Fork, North Fork Blackfoot River, Monture Creek, Cottonwood Creek, Belmont Creek, and Gold Creek)	Six local populations are designated within the Blackfoot River Core Area
Poorman Creek , Arastra Creek, Lower Alice Creek , Sauerkraut Creek, Hogum Creek	Other Important Populations that contribute to the Blackfoot Core Population

Designated local populations in the Blackfoot River drainage currently occur in Landers Fork, North Fork Blackfoot River, Monture Creek, Cottonwood Creek, Belmont Creek, and Gold Creek (U.S. Fish and Wildlife Service 2015). Other important populations of bull trout within the core area occur in Poorman Creek, Arastra Creek, Lower Alice Creek, Sauerkraut Creek, and Hogum Creek. Nevada Creek headwaters is also considered an “other important population,” but Nevada Reservoir and generally poor habitat below the reservoir prevent bull trout in the Nevada Headwaters population from contributing to the Blackfoot River Core Population. All local populations and other important populations occur outside the Stonewall Project action area.

C.1 Subpopulation Characteristics of the Blackfoot River Core Area

A core area represents the closest approximation of a biologically functioning unit for bull trout. The combination of core habitat (i.e., habitat that could supply all elements for the long-term security of bull trout) and a core population (a group of one or more local bull trout populations that exist within core habitat) constitutes the basic unit on which to gauge recovery within a recovery unit. Jeopardy analysis for the bull trout considers the relationship of the action area and affected core areas.

Subpopulation Characteristics are designed to help evaluate the status of the bull trout subpopulation in the area of the proposed action(s) under current habitat conditions (U. S. Fish

and Wildlife Service 1998). Evaluating Subpopulation Characteristics at both the core area and watersheds within the action area therefore provides a way to evaluate the subpopulation of bull trout within the action area relative to the core area. The following assessment of subpopulation characteristics for the entire Blackfoot River Core Area was summarized from the BA for the Blackfoot Travel Plan (U.S. Forest Service 2016a).

Subpopulation Size: **FAR.** Based on redd counts and limited electrofishing efforts, there are likely 400 to 500 adult bull trout between the six local populations in the Blackfoot River Core Area. When designated local populations are combined with adult bull trout from other populations in Priority Watersheds, Special Emphasis Watersheds, and undesignated streams, the overall number of adult bull trout in the Blackfoot drainage is probably less than 800. Recent redd surveys suggest that four of the local populations have been declining but the Copper/Landers population has been maintaining or improving.

Growth & Survival: **FAR.** The main stem Blackfoot River has been showing indications of increasing water temperatures over the last 15 years that is not optimal for growth of sub-adult bull trout. Brown trout occupying the same waters have the potential to fare better and increase the risk of predation to bull trout. The 2003 Snow-Talon fire in the Copper Creek drainage may have resulted in temperature increases that resulted in increased primary productivity when combined with increased radiation and nutrient inputs. Increased proactivity may be beneficial for sub-adult growth and survival in the Landers Fork Local Population but the temperature increases do not appear large enough to allow upstream expansion by brown trout.

Life History Diversity & Isolation: **FAR.** Connectivity within the Blackfoot River is good, allowing movement among several age classes of local populations and other occupied streams. However, the limited population size limits the potential for this to occur. Increased maximum summer water temperature in the main stem Blackfoot may be putting the migratory corridor at some undetermined level of risk.

Persistence and Genetic Integrity: **FAR**. There is connectivity among local populations but numbers appear to be declining in several local populations. Competition and predation by brown trout in the main stem Blackfoot River may increase if water temperatures increase. The presence of brook trout and associated threat of hybridization may decrease bull trout production in some local populations.

C.2 Subpopulation Characteristics of Watersheds in the Action Area

Subpopulation Characteristics at the watershed scale provide an evaluation of the status of bull trout in each watershed. In four of the five HUCs within the Stonewall Project action area (Keep Cool Creek, Beaver Creek, Humbug Creek, and Blackfoot-Little Moose), *subpopulation size* and *growth & survival* are rated FAR, while *life history, diversity, & isolation* and *persistence and genetic integrity* are rated FUR (Appendix Table A-3). Subpopulation characteristics are not rated for the Lincoln Creek HUC because intermittent flows and historic mining impacts have limited the occurrence of bull trout and other salmonids to reaches below the Forest boundary near the confluence of Lincoln Gulch with the Blackfoot River.

C.3 Baseline Habitat Conditions of Watersheds in the Action Area

Ratings of the four primary habitat indicators and Integrated Status of Habitat Conditions for all watersheds in the Stonewall Project area are indicated in Appendix Table A-3. The Humbug Creek HUC is rated FA for all four primary habitat indicators. Keep Cool Creek, Beaver Creek, and Blackfoot-Little Moose are rated the same, with a rating of FUR for *sediment* and FAR for *temperature*, *barriers*, and *pool frequency & quality*. Lincoln Creek is rated FUR for *temperature* and *sediment*, FAR for *pool frequency & quality*, and FA for *barriers.* The FA rating is due to the lack of man-made barriers, although naturally occurring intermittent flows create barriers to use in this watershed. Subsequently, the Integrated Status of Habitat Conditions is rated FA for the Humbug Creek HUC and FUR for all others.

C.4 Baseline Conditions for the Integration of Species and Habitat Conditions

The Integration of Species and Habitat Conditions integrates values from the four species indicators with the 19 habitat indicators into one overall rating for the watershed. A rating for Lincoln Creek was not determined because subpopulation characteristics are not rated for this HUC, as discussed above. Humbug Creek is rated FA for the Integration of Species and Habitat Conditions (Appendix Table A-3) and the remaining HUCs are rated FUR.

D. Status of Bull Trout Critical Habitat in the Action Area

The proposed action will occur in the Blackfoot River subunit of the Clark Fork River Basin Critical Habitat Unit (CHU 31). CHU 31 contains 5,356.0 km (3,328.1 mi) of streams and 119,620.1 ha (295,586.6 ac) of lakes and reservoirs designated as critical habitat. The Clark Fork River Basin CHU is essential to maintaining bull trout distribution within this unique geographic region of the Columbia Headwaters Recovery Unit in large part because it represents the evolutionary heart of the migratory adfluvial bull trout life history form (U.S. Fish and Wildlife Service 2009a). Flathead Lake and Lake Pend Oreille are the two largest lakes in the range of the species. Bull trout from those core areas historically grew to be large and migrated upstream up to 322 km (200 mi) to spawning and rearing habitats. These habitats were partially fragmented by hydroelectric dams and other manmade barriers but are increasingly being reconnected with removal of dams (Milltown Dam) and improved fish passage (Cabinet Gorge, Noxon Rapids, Thompson Falls). The resident life history form of bull trout is minimally present in this CHU and fluvial bull trout play a reduced role relative to adfluvials. The two major lakes (Flathead Lake and Lake Pend Oreille), and over 20 additional core areas established in smaller isolated headwater lakes, are the primary refugia for the naturally occurring adfluvial form of bull trout across their range.

Critical habitat within the Stonewall Project action area occurs on the Blackfoot River (Fig. 2). All critical habitat in the action area is designated as foraging, migrating, and overwintering (FMO) habitat. The PCEs of critical habitat for the Blackfoot River is below optimal conditions as indicated by ratings for habitat indicators comprising the PCEs of critical habitat (Appendix Table A3). Critical habitat in the action area is not providing its intended recovery function.

VII. Effects of the Action

Effects of the action are 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. Direct effects are considered immediate effects of the project on the species or its

habitat. Indirect effects are those caused by the proposed action and are later in time, but are still reasonably certain to occur. These effects are considered along with the environmental baseline and the predicted cumulative effects to determine the overall effects to the species for purposes of preparing a biological opinion on the proposed action [50 C.F.R. § 402.02]. The environmental baseline covers past and present impacts of all federal actions within the action area. The environmental baseline also includes the effects of existing federal projects.

A. Methods for Analysis of Effects

This biological opinion analyzes the impacts of the Stonewall Project. All activities associated with the project can generally be categorized into two categories: (1) vegetation management/alteration, and (2) road use, construction, and maintenance. Vegetation management includes commercial logging, thinning, and burning that influences forest structure and species composition by altering the forest canopy and/or reducing ground cover. In addition to influencing forest structure and species composition, commercial logging utilizes forest roads for log hauling. All use, construction of new temporary roads, and maintenance of forest roads that are part of the log hauling process are included in the second category. To clarify, road use, construction, and maintenance identify as part of the action in the second category are the additional activities above baseline levels that are part of the Stonewall Project. Baseline conditions for existing roads and access management were covered in the 2016 programmatic biological opinion for the Blackfoot Travel Plan. Both long- and short-term benefits and effects influence the species and/or critical habitat and must be analyzed as part of Section 7 consultation.

The distance that activities occur from rivers and streams influences the effects they have on bull trout and designated critical habitat. The INFISH amendment to the Forest Plan established RHCAs where riparian dependent resources receive primary emphasis. Widths of RHCAs are defined for four categories of stream or water bodies, depending on flow conditions and presence of fish. A distance of 300 feet slope distance on each side of a stream channel is the designated width for fish bearing streams, based on the conclusions of Belt et al. (1992) that 200-300 foot riparian strips are effective at protecting streams from non-channelized sediment flow. A distance of 150 feet slope distance is used for permanently flowing non-fish bearing streams. Widths protecting streams from non-channelized sediment inputs should also be sufficient to maintain most other riparian functions (U.S. Forest Service 1995). Therefore, addressing project activities relative to RHCAs is a key element in assessing their effects.

As described in Section V, the Framework/Matrix (U. S. Fish and Wildlife Service 1998) is used to assess baseline conditions and effects to bull trout and bull trout critical habitat. Effects of the proposed action will either “degrade,” “maintain,” or “restore” framework indicators, leading to either “major” effects that will produce a change in one functional level to baseline conditions (e.g., change FAR to FA), or minor effects that may result in an incremental or cumulative effect but will not result in a functional change within the HUC. The following sections address effects of the proposed action to baseline conditions for: (1) the four Primary Habitat Indicators, (2) the Integration of Primary Habitat Indicators, (3) the Integration of Species and Habitat Conditions, and (4) any of the other 19 habitat indicators that effects “degrade”, “restore”, or have a high potential to be affected by the proposed action.

However, many indicators are interrelated. As an example, large woody debris (LWD) is an important driver of geomorphic and biological processes that sort sediment and force pool formation (Hough-Snee et al 2014). Further, roads near streams often influence the amount of large woody debris within streams (Meredith et al. 2014). In this example, *pool frequency and quality* and *sediment* are Primary Habitat Indicators that are affected by *large woody debris*, one of the non-primary indicators. In situations such as this where an indicator influences one or more primary indicators but the indicator itself is not affected to the level it is degraded or restored, it is discussed under the primary habitat indicator(s) it affects.

B. Effects to Framework/Matrix Indicators

B.1 Primary Habitat Indicators

Sediment

Habitat requirements for bull trout include water quality that is relatively free of sediment and contaminants. Direct effects of sediment to bull trout include gill trauma and impacts to spawning, redds, eggs, and alevins (suffocates them), while indirect effects include impacts to macroinvertebrates, feeding efficiency, habitat, physiological stress, and behavioral changes (Muck 2010).

Effects to Sediment from Vegetation Management: Ground disturbance and loss of vegetative cover from commercial logging, thinning, and burning can increase sediment delivery to streams depending on the distance to streams and/or the availability of conduits for delivery. Proposed logging and thinning would occur outside RHCAs. Ignition for prescribed burning would not occur within RHCAs and efforts will be made to restrict fire from backing into RHCAs. However, a limited amount of burning will occur within RHCAs.

Sediment from logging and thinning should not reach nearby streams due to the location of these activities outside RHCAs and the effectiveness of riparian buffers at trapping sediment. The potential to expose bare soil when burning in RHCAs creates a risk for sediment delivery to streams, but amounts should be minimized by reduced fire intensity and greater water infiltration of soils in RCHAs. Additional sediment delivery to streams in the Humbug Creek and Blackfoot River-Little Moose HUCs would not occur because vegetation management activities do not occur in them. Sediment from vegetation management activities in Keep Cool Creek, Beaver Creek, and Lincoln Creek HUCs should settle in floodplains, dewatered reaches, and low velocity reaches before reaching occupied bull trout reaches or designated critical habitat. Effects from vegetation management activities should maintain the *sediment* indicator.

Effects to Sediment from Road Use, Construction, and Maintenance: The scientific consensus is that forest roads generate the most sediment of all forest management activities (Anderson et al. 1976, Furniss et al. 1991). Factors that influence the delivery of sediment to streams from forest roads include the proximity of the road to the stream, stream gradient, road length near streams, degree of road use, road condition (maintenance), number of stream crossings and soil type. The location of forest roads in relation to the stream channel and the density of stream crossings within a watershed is a key factor in the amount of sediment delivered to the stream from the road surface and associated features (Baxter et al. 1999, McCaffery et al. 2007). A buffer distance of 200-300 feet slope distance on each side of a stream

channel is effective at protecting streams from non-channelized sediment flow (Belt et al. 1992). Much of the existing Forest road network was established decades ago and contains many miles of roads in RHCAs and numerous stream crossing structures (e.g. culverts). The aging of these structures and level (percent) of maintenance likely increases the potential for stream crossing failure that may result in significant sediment delivery to streams.

Rates of sediment production depend on the amount and type of traffic and road condition. Roads that are heavily used for log hauling can produce up to 25 times the amount of sediment as lightly used roads (Foltz 1996). The amount of rutting (Foltz and Burroughs 1990, Burroughs and King 1989), soil type (Foltz and Burroughs 1990), and the presence of aggregate over native surfaced roads (Burroughs and King 1989) all influence sediment production. Considerable reductions in road surface-generated sediment can be realized with timely and appropriate maintenance (Kennedy 1997).

For the Stonewall Project, road use, construction, and maintenance are proposed activities with the greatest potential to adversely affect the *sediment* indicator. All temporary roads would be constructed outside RHCAs and without hydrologic connection to stream channels. Overall, the project is expected to create 3,700-4,600 loads of logs on 32.4 miles of haul roads during the 2-year timber sale portion of the project. Haul roads contain 14 stream crossings, 17 sediment delivery points, and approximately 4.6 miles of roads occur within RHCAs. Road Best Management Practices (BMP) would be applied to all haul routes prior to commencement of and after completion of log hauling to minimize sediment delivery to streams. Application of road BMPs would occur on Forest land within the project boundary and where the Forest has road maintenance jurisdiction and responsibilities between the Forest boundary and MT Highway 200.

Application of road BMPs would reduce sediment delivery to streams from log hauling at stream crossings and other sediment delivery points, but increases in sediment delivery would still occur at some locations. Additionally, the implementation of road BMPs can increase sediment delivery until disturbed areas adjacent to roads become re-vegetated. Road use, construction, and maintenance activities from the Stonewall Project would produce a short-term increase in sediment delivery that results in a minor “degrade” to the *sediment* indicator in the Beaver Creek and Keep Cool Creek HUCs (Table 4).

Barriers

Barriers can limit fish movement to habitats required for spawning, growth, and as refuge from harsh conditions or disturbance events. The size of habitat networks and migratory connections may be the key to population persistence as climate change progresses (Rieman and Isaak 2010). Isolated populations are at a higher risk of extinction due to loss of genetic variability, loss of resilience, and both demographic and environmental stochasticity. Connected stream systems allow bull trout to recover from disturbance events at a more rapid rate than those that are fragmented by physical barriers (Rieman et al. 1997, Gresswell 1999).

Table 4. Effects of the Stonewall Project (m = maintain, r = restore, d = degrade) to the four Primary habitat Indicators, the Integration of Primary Habitat Indicators, and the Integration of Species and Habitat Conditions for 6th code HUCs in the Stonewall Project action area.

	Primary Habitat Indicators				Integrated Values	
Watershed	Sediment	Barriers	Temperature	Pools	Habitat	Species & Habitat
Beaver Creek	**d**	m	m	m	**d**	m
Humbug Creek	m	m	m	m	m	m
Keep Cool Creek	**d**	m	m	m	**d**	m
Lincoln Creek	m	m	m	m	m	m
Blackfoot River-Little Moose	m	m	m	m	m	m

Sub-watersheds rated FAR or FUR for the *barrier* indicator contain partial or complete fish passage barriers. A FUR rating indicates the sub-watershed contains a fish passage barrier in the road system on a third order or larger stream. A FAR rating indicates that a sub-watershed contains fish passage barriers in the road system on first and second order streams. These barriers, typically culverts, can delay migration and or limit access to refugia habitat.

Effects to Barriers from Vegetation Management: The proposed vegetation management activities do not have the potential to create or remove barriers to fish passage and will therefore maintain the *barriers* indicator in all watersheds.

Effects to Barriers from Road Use, Construction, and Maintenance: Proposed construction of temporary roads would occur outside RHCAs and therefore not create barriers on streams where bull trout are present. Proposed road maintenance activities would not create or remove barriers. The *barriers* indicator would be maintained by road use, construction, and maintenance activities from the Stonewall Project.

Temperature

Water temperature is particularly important to bull trout; they have been repeatedly associated with the coldest water within river basins (Quigley and Arbelbide 1997). Stream temperature can be increased by decreasing vegetation in the RHCA and increasing the amount of sunlight that reaches the stream (Moore et al. 2005). The resulting increases in stream temperature can reduce salmonid survival in systems where temperatures are already high (Beschta et al. 1987). Warmer temperatures can also increase the risk of invasion by other species that displace, compete with, or prey on juvenile bull trout.

Effects to Temperature from Vegetation Management: Proposed logging and thinning would occur outside RHCAs and would therefore not have an effect on stream shading or changes in temperature. Proposed burning would be allowed to back into RHCAs on some occasions that could potentially result in mortality to some trees providing streamside shading. However, the mortality rate and pattern of trees affected in RHCAs would not reduce shading and affect water temperature to the point it is measureable. Vegetation management activities would maintain the *temperature* indicator.

Effects to Temperature from Road Use, Construction, and Maintenance: Road and road management activities on roads in RHCAs can reduce the shading effects of streamside vegetation, thereby increasing the potential for solar gain. The risk for temperature increases is highest in very small streams, where roads are adjacent to or crossing stream channels, and when trees approximately one tree height from streams are removed. Sub-watersheds that are FAR or FUR for *temperature* often have a high percent of streams within 300 feet of roads.

Road use and the proposed construction of 0.9 miles of temporary roads outside RHCAs would not reduce streamside shading. Removal of hazard trees during road maintenance that provide shading is an ongoing activity that would not be increased during the Stonewall Project. Therefore, these activities would maintain the *temperature* indicator in all watersheds.

Pool Frequency and Quality

Cover provided by pools and habitat complexity are important components of bull trout habitat (Quigley and Arbelbide 1997), providing shelter from predators, thermal refugia, and habitat for prey. The presence of LWD is one of the primary means by which pools are formed in many stream channel types (Quigley and Arbelbide 1997).

Effects to Pool Frequency and Quality from Vegetation Management: Proposed logging and thinning would occur outside RHCAs and not have an effect on *pool frequency and quality*. Proposed burning would be allowed to back into RHCAs on some occasions that could potentially result in mortality to some trees. The mortality rate and pattern of trees affected by the limited burning in RHCAs would not affect recruitment of LWD into streams that is typically the precursor of pool formation. Vegetation management activities would maintain the *pool frequency and quality* indicator in all HUCs.

Effects to Pool Frequency and Quality from Road Use, Construction, and Maintenance: Removal of trees that have fallen across the road and into the stream and clearing material within stream crossing structures can reduce *pool frequency and quality* (Furniss et al. 1991). Additional removal of LWD upstream of crossings to reduce the risk of bridge or culvert failure/blockage can further reduce formation of pools. Potential recruitment of trees as LWD into streams can be reduced when trees are cleared for road construction near streams.

Similar to the discussion of effects on *temperature*, road use, construction, and maintenance activities from the Stonewall Project would not reduce trees near streams to the point LWD recruitment into streams is affected. These activities would maintain the *pool frequency and quality* indicator in all HUCs.

B2. Integration of Primary Habitat Indicators

The *integrated primary habitat indicator* provides an overall indication of habitat conditions for each HUC by integrating the four primary indicators into a single rating. Changing the *integrated primary habitat indicator* one functional level would require, at the minimum, a major effect that results in a functional change to at least one primary indicator (e.g., FAR to FA).

As discussed above for the primary indicators individually, the Stonewall Project would maintain all primary habitat indicators in three HUCs (Table 4, Humbug Creek, Lincoln Creek, and Blackfoot River-Little Moose Creek. The *integrated primary habitat indicator* would also be

maintained in these three HUCs. For the remaining two watersheds, the project would result in a minor "degrade" to *sediment* while maintaining the other primary habitat indicators. The net effect for the two HUCs with a minor degrade to *sediment* without a major restore to any primary indicators is a minor degrade for the *integrated primary habitat indicator* (Table 4).

B.3 Other Affected Habitat Indicators

In addition to effects to the four primary habitat indicators, the following habitat indicators will either be affected or have a high potential to be affected by the proposed action.

Substrate Embeddedness: Substrate embeddedness is defined as the degree to which large particles (e.g., boulders, gravel) are surrounded or covered by fine sediment, usually measured in classes according to percentage covered (U.S. Fish and Wildlife Service 2015). The *sediment* and *substrate embeddedness* indicators are therefore closely related, with the difference lying in the habitat pathway and bull trout life stage these two indicators address. The *sediment* indicator is intended to addresses the Water Quality pathway, while *substrate embeddedness* addresses the Habitat Elements pathway (U.S. Fish and Wildlife Service 1998). Due to their relationship, effects of the Stonewall Project to the indicator *substrate embeddedness* are the same as those for *sediment*.

Road density and location: The Stonewall Project includes 0.9 miles of temporary road that may influence this indicator. The short length of temporary roads, limited amount of time they would be used, and location outside RHCAs would "maintain" this indicator.

Change in Peak/Base Flow: Changes in the forest canopy can alter the timing of spring runoff and water yield by influencing snow interception, melt patterns and rates, and water uptake by plants. The estimated water yield increase for project watersheds from the Stonewall Project is 1.7%. Streams emanating from the project area lose flow as they move from the steeper, mountainous areas into alluvial valley floor sediments. Changes in flows would not be measureable, therefore the Stonewall Project would "maintain" the c*hange in peak/base flow* indicator.

B.4 Integration of Species and Habitat Conditions

The Integration of Species and Habitat Conditions integrates values from the four species indicators and the 19 habitat indicators into one overall rating. The Stonewall Project would "maintain" the three subpopulation characteristics and provide a minor "degrade" to some habitat indicators as discussed above. However, the minor "degrade" to habitat indicators would not be expected to degrade the Integration of Species and Habitat Conditions when effects to all 19 habitat indicators and the three subpopulation characteristics are considered. The Stonewall Project would maintain the Integration of Species and Habitat Conditions in all watersheds.

C. Species Response to the Proposed Action

The Stonewall Project would occur in an area of degraded baseline conditions. Baseline conditions for *sediment*, *substrate embeddedness*, and the *integrated primary habitat indicator* are rated FUR in four of the five HUCs of the Stonewall Project action area. Resiliency of habitat to recover from disturbance in these HUCs is low. Survival and growth rates of bull trout have

been reduced from those in the best habitats. Ongoing effects of the existing road network have been a major contributor to degraded baseline conditions. Effects of road management (i.e., baseline condition) were analyzed in the 2016 Blackfoot Non-Winter Travel Plan programmatic biological opinion (U.S. Fish and Wildlife Service 2016).

The greatest potential effects to bull trout from the Stonewall Project are due to increased sediment delivery to streams from use of the existing road system for log hauling and implementation of road BMPs to improve and maintain road conditions. The majority of sediment comes from a limited number of road segments (Luce and Black 1999). The greatest amount of sediment will be delivered at stream crossings and locations where the road is within RHCAs and sediment delivery points exist. Sediment delivery will be greatest when it rains and during spring runoff and breakup. However, chronic sediment delivery from roads can be as degrading as sediment delivery from catastrophic inputs (e.g., wildfire) because particles are finer and delivered over much longer periods than from burned drainages (Furniss et al. 1991). Overall, sediment increases from the Stonewall Project would result in a minor "degrade" to the *sediment* and *substrate embeddedness* indicators for two of the five HUCs in the action area.

The Service anticipates additional sediment resulting from the Stonewall Project will result in a low level of injury or mortality to individual bull trout that is additive to the existing effects from baseline conditions. The risk of injury or mortality is greatest where bull trout eggs or fry and juveniles are present, but increases in sediment can affect bull trout of all ages. Increased fine sediment affects developing bull trout eggs by filling interstitial spaces within stream substrate that reduces or eliminates the flow of water through the redd, thus limiting the supply of oxygen to developing eggs and removal of waste products. Elevated fine sediment (<6.4 mm) in spawning gravels can lead to reduced egg survival (Rieman and McIntyre 1993), reduced emergence success of bull trout (Weaver and White 1985 as cited in Rieman and McIntyre 1993), and limit access to substrate interstices that provide important cover during rearing and over-wintering periods (Goetz 1994, Jakober et al. 1998). Greater and more persistent mortality of salmonid embryos can occur from chronic sediment delivery compared to pulse events (Maturana et al. 2013).

Sediment decreases pool habitat quality, an essential rearing and cover component for bull trout which provides protection from predators and the elements. Fine sediments may reduce the availability of wintering habitat for adult and juvenile fish by increasing substrate embeddedness. Everest et al. (1987) concluded trout species can cope with natural variability in sediments, but population viability can be reduced by persistent sedimentation that exceeds the natural background levels they evolved in. High levels of sediment can result in direct mortality to fish by damaging delicate gill structures.

Sediment can also have an effect on bull trout and fish populations through impacts or alterations to the macroinvertebrate communities or populations. Aquatic insect abundance can decline by approximately 50 percent when substrate embeddedness reaches a level of one-third (Waters 1995). Decreased growth rates can occur when increased substrate embeddedness leads to a reduction in aquatic insect production (Bjornn et al. 1977, Weaver and Fraley 1991, Bowerman et. al 2014). Higher turbidity and suspended sediment can reduce primary productivity by decreasing light intensity and periphytic (attached) algal and other plant communities (Anderson et al. 1976, Henley et al. 2000, Suren and Jowett 2001). Sedimentation can alter the habitat for

macroinvertebrates, changing the species density, diversity and structure of the area (Waters 1995, Anderson et al. 1976, Reid and Anderson 1999, Shaw and Richardson 2001).

The level of road-related sediment impacts to bull trout is related to the location and condition of the road, road density, and amount of road use within each sub-watershed. Bull trout are most sensitive to changes in habitat that occur in headwater areas encompassing important spawning and rearing habitats for fluvial and adfluvial stocks as well as remnant resident populations (Quigley and Arbelbide 1997). Roads near small perennial and intermittent, non-fish-bearing streams are especially important because they can account for more than half the total drainage network and can direct runoff and sediment to downstream fish-bearing streams (Quigley and Arbelbide 1997). McCaffery et al. (2007) found that the number of stream crossings in a watershed is an important factor when considering the overall impact of road networks to fish habitat and in-stream sediment levels.

Downstream distance and duration of sediment increases is variable. Sediment pulses from activities in unoccupied tributaries can extend to occupied streams depending on the amount of sediment, distance, and gradient. In some situations, sediment will be deposited in floodplains and low velocity areas. Large woody debris can influence the location and duration sediment is stored (Faustini and Jones 2003). Flushing flows during high water may or may not remove additional sediment deposited in the streambed. Beschta and Jackson (1979) reported that stream energy may be used to transport and embed additional sediment occurring during high flows instead of flushing existing fines from the gravels. Quantitative estimates and effects of changes to the overall sediment budget in the action area cannot be accurately determined.

Brook trout and brown trout are present in the action area and will remain a threat to bull trout unless extensive efforts to reduce the threats of non-native species are undertaken. Brook trout commonly hybridize with bull trout and are better adapted to compete with bull trout, but the competitive advantage of brook trout is accentuated in degraded habitat (U.S. Forest Service 2013). Improved habitat conditions can lead to reduced competition by brook trout in addition to better habitat for bull trout.

D. Effects to Designated Critical Habitat

Effects to critical habitat are addressed by effects to the PCEs of critical habitat, which are assessed by influences to framework indicators. As determined above, the Stonewall Project would provide a minor “degrade” to *sediment* and *substrate embeddedness* in the Keep Cool Creek and Beaver Creek HUCs. Increased sediment and the corresponding increase in substrate embeddedness address the same five PCEs: (1) reduced hyporheic flow that decreases water quality and thermal refugia of PCE-1, (2) barriers to movement if sediment occurs at high enough concentrations for PCE-2, (3) reduce habitat for aquatic macroinvertebrates and other food sources for bull trout of PCE-3, (4) decreased substrate complexity of PCE-4, and (5) directly evaluates the quality of spawning and rearing areas of PCE-6.

The only designated spawning and rearing habitat within the Stonewall Project action area occurs on the lower reaches of Poorman Creek in the Humbug Creek HUC. All effects from the Stonewall Project would occur downstream of designated spawning and rearing critical habitat, therefore the Stonewall Project would not affect PCE-6. The duration and magnitude of degradation to *sediment* and *substrate embeddedness* would not affect PCE-2, PCE-3, or PCE-4.

The amount of sediment generated would not create a sediment plume large enough or to affect migration habitat (PCE 2) or migratory movements in FMO habitat of the Blackfoot River. Similarly, the duration and magnitude of additional sediment generated by the Stonewall Project would not rise to the level it would affect the food base or complex aquatic environments of PCE-3 or PCE-4.

For PCE-1, the *sediment* and *substrate embeddedness* indicators describe the level of fine sediment in the gravel which affects hyporheic flow; fine sediment fills interstitial spaces making the movement of water through the substrate less efficient. Additional sediment generated from ground-disturbing activities of the Stonewall Project would provide short-term degradation to PCE-1. These effects would be most pronounced at the confluence of tributaries to the Blackfoot River that provide areas of thermal refugia for bull trout when water temperature increases during the summer. Effects to PCE-1 will be greatest adjacent to sediment delivery points and typically last a year or two until flushing flows during spring and/or fall return conditions to pre-activity levels.

VIII. Cumulative Effects

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 biological 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.

Non-federal management occurs on about half the land in the cumulative effects analysis area. Activities on non-federal lands that cumulatively affect bull trout and bull trout critical habitat include green tree timber harvest, salvage timber harvest, log hauling on unpaved county and private roads, use of private roads for accessing Forest lands, road and highway maintenance or reconstruction, domestic livestock grazing, placer and hard-rock mining, construction or maintenance of power transmission corridors, maintenance of existing communication lines, use and maintenance of irrigation diversions, crop production, herbicide application for weed control, residential development, and incidental harvest of bull trout. The lack of coordination and long range planning among non-federal landowners makes it difficult to quantitatively assess these activities, but changes in sediment production and delivery to streams are the most anticipated effect. Effects can adversely or beneficially affect bull trout, regardless of the proposed action.

Private land development has slowed in recent years due to poor real estate markets, but is anticipated to increase throughout western Montana in the future. Overall activity levels on these private lands will unlikely change, but commercial and residential development at specific locations along stream corridors could lead to stream channel alterations that exacerbate water temperature, nutrient, and bank stability problems. Small improvements over time could be anticipated as landowners become more educated about the importance of bull trout and stream habitat management techniques. Any disturbance to the bed and banks of a stream would require a SPA 124 or MT 310 permit regulating these activities and potential affects to fish. Road densities may change on private and state lands but riparian buffers (defined by MT BMP laws) should remain in place. Montana Fish, Wildlife and Parks in conjunction with Trout Unlimited and the Blackfoot Challenge have developed a large number of habitat improvement projects on non-federal lands in the Blackfoot River sub-basin. Planned improvements include improved

irrigation practices, removal of fish barriers, improved livestock grazing practices, improvements to non-federal roads to reduce sediment delivery, streamside planting to increase shading and reduce water temperatures, installation of instream structures to increase pool habitats and to stabilize stream profile, obtaining conservation easements, and stream restoration to mitigate negative effects of past activities such as mining.

Angler harvest and poaching has been identified as one reason for bull trout decline (U.S. Fish and Wildlife Service 2015b). It is likely that recreational fishing, especially in known spawning streams in the fall, will increase as the human population in western Montana increases. Misidentification of bull trout has been a concern because of the similarity of appearance with brook trout. Although harvest of bull trout is illegal, incidental catch does occur. The fate of released bull trout is unknown, but some level of hooking mortality is likely due to the associated stress and handling of the fish (Long 1997). Unintentional and illegal harvest could have a direct effect on the resident bull trout population and possibly the migratory adfluvial component of bull trout populations in Montana. The extent of the effect is dependent on the amount of increased recreational fishing pressure, which is a function of the increased number of fishermen each season. Illegal poaching is difficult to quantify, but generally increases in likelihood as the human population in the vicinity grows (Ross 1997).

Global climate change and the related warming of our climate have been well documented. Evidence of global climate change/warming includes widespread increases in average air and ocean temperatures, accelerated melting of glaciers, and rising sea level. Given the increasing certainty that climate change is occurring and is accelerating (IPCC 2007, Battin et al. 2007), we can no longer assume that climate conditions in the future will resemble those in the past. Potential increases in water temperature due to climate change and the accompanying increased potential for non-native fish also have the potential to affect bull trout.

Cumulative effects within the core areas are reflected in bull trout population numbers and life history forms. All core areas are at risk of increased activities and concern for the viability and effects to bull trout populations are well documented (U.S. Fish and Wildlife Service 2015). Activities occurring on private lands at the same time the proposed federal activities are occurring may result in additive adverse effects to bull trout, at least in the short-term. However, some non-federal activities will likely improve conditions for bull trout over the long-term and will work in conjunction with federal actions toward recovery of bull trout in some instances. At present, there are not any known foreseeable non-federal activities that would increase adverse effects to bull trout.

IX. Conclusion

A. Jeopardy analysis of Columbia Basin Bull Trout Population

After reviewing the current status of bull trout, the environmental baseline (including effects of federal actions covered by previous biological opinions) for the action area, the effects of the proposed vegetation management project, and cumulative effects, it is the Service's biological opinion that the actions as proposed are not likely to jeopardize the continued existence of bull trout. This conclusion is based on the magnitude of the project effects to reproduction, distribution, and abundance in relation to the listed population. Implementing regulations for section 7 (50 CFR 402) defines "jeopardize the continued existence of" as "to engage in an

action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species." Our conclusion is based on but not limited to the information presented in the 2016 Stonewall Project biological assessment (U.S. Forest Service 2016), the 2016 Blackfoot Non-Winter Travel Plan programmatic biological opinion (U.S. Fish and Wildlife Service 2016), correspondence during this consultation process, information in our files, and informal discussions between the Service and the Forest.

Jeopardy determinations for bull trout are made at the scale of the listed entity, which is the coterminous United States population (64 FR 58910). This follows the April 20, 2006, analytical framework guidance described in the Service's memorandum to Ecological Services Project Leaders in Idaho, Oregon and Washington from the Assistant Regional Director – Ecological Services, Region 1 (U.S. Fish and Wildlife Service 2006). The guidance indicates that a biological opinion should concisely discuss all the effects and take into account how those effects are likely to influence the survival and recovery functions of the affected IRU(s), which should be the basis for determining if the proposed action is "likely to appreciably reduce both survival and recovery of the coterminous United States population of bull trout in the wild."

As discussed earlier in this biological opinion (see Part IV), the approach to the jeopardy analysis in relation to the proposed action follows a hierarchical relationship between units of analysis (i.e., geographical subdivisions) that characterize effects at the lowest unit or scale of analysis (the local population) toward the highest unit or scale of analysis (the Columbia Headwaters Recovery Unit). The hierarchical relationship between units of analysis (local population, core areas) is used to determine whether the proposed action is likely to jeopardize the survival and recovery of bull trout. As mentioned previously, should the adverse effects of the proposed action not rise to the level where it appreciably reduces both survival and recovery of the species at a lower scale, such as the local or core population, the proposed action could not jeopardize bull trout in the coterminous United States (i.e., range wide). Therefore, the determination will result in a no-jeopardy finding. However, should a proposed action cause adverse effects that are determined to appreciably reduce both survival and recovery of the species at a lower scale of analysis (i.e., local population or core area), then further analysis is warranted at the next higher scale.

Our conclusion is based on the magnitude of the project effects in relation to the existing Blackfoot River population of bull trout. Our rationale for this no jeopardy conclusion is based on the following:

- Adverse effects from the Stonewall Project would not rise to the level where they appreciably reduce survival and recovery for any local populations or other important populations in the core area. Therefore, the proposed action would not jeopardize bull trout at higher analysis units, in the Blackfoot River Core Area or for the coterminous United States.

- Minimization measures employed by the Forest during implementation of the proposed action would likely be effective in reducing sediment generated by the project, thus reducing short-term adverse effects.

As a result, the Service concludes that implementation of this project is not likely to appreciably reduce the continued existence of bull trout in Blackfoot River Core Area. Therefore, by extension, the Service concludes that this project will not appreciably reduce both the survival and recovery of the coterminous United States population of the bull trout in the wild.

B. Adverse Modification Analysis

Pursuant to current national policy and the statutory provisions of the Act, destruction or adverse modification is determined on the basis of whether, with implementation of the proposed action, the affected critical habitat would remain functional (or retain the current ability for the Primary Constituent Elements to be functionally established) to serve the intended conservation role for the species. After reviewing the current status of the Blackfoot River Critical Habitat Subunit and its relationship to the Upper Columbia River bull trout population, the environmental baseline for the action area, the effects of the proposed action, and cumulative effects, it is the Service's opinion the actions as proposed are not likely to destroy or adversely modify bull trout critical habitat.

The proposed Project is likely to adversely affect designated critical habitat for bull trout by changing sediment dynamics. Habitat degradation may occur throughout the 9 year period of project implementation but will be spatially limited to the vicinity where sediment is introduced to streams (e.g. stream crossings). While these effects may reduce the capacity of particular sites to support bull trout, these effects are unlikely to change the functional capacity of the entire action area. On that basis, the Service has determined PCE-1 of designated bull trout critical habitat would not be adversely affected to the extent it would appreciably reduce the conservation value of a core area for bull trout or reduce the function of critical habitat to support the recovery of bull trout. Therefore, it is the Service’s conclusion that the Stonewall Project is not likely to destroy or adversely modify designated critical habitat of the Columbia River basin.

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 further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary and must be undertaken by the Helena-Lewis and Clark National Forest (Forest) so that they become binding conditions of any contract issued for the exemption in section 7(o)(2) to apply. The Forest has a continuing duty

to regulate and oversee the activity covered by this Incidental Take Statement. If the Forest fails to assume and implement the terms and conditions of the Incidental Take Statement, the protective coverage of section 7(o)(2) may lapse. To monitor the impact of incidental take, the Forest must report the progress of the action and its impact on the species to the Service as specified in the Incidental Take Statement [50 CFR 402.14(i)(3)].

Amount or Extent of Take Anticipated

The Service anticipates that the Stonewall Project would result in incidental take of bull trout in the form of harm or harassment. Ongoing effects of the existing road network have contributed to adverse baseline conditions for bull trout in the action area and reduced the ability for watersheds to function appropriately (U.S. Fish and Wildlife Service 2016). Additional short-term, minor degrade to habitat indicators *sediment* and *substrate embeddedness* during implementation of the Stonewall Project would be additive to those currently occurring. However, the amount of take is difficult to quantify for the following reasons:

1) The amount of sediment produced from the existing road network and project activities is influenced by site parameters (topography, soil type, and vegetation), weather, location and condition of roads, traffic patterns, and frequency of use.

2) Location and amount of sediment delivered to streams depends on numerous factors (flow regime, size of stream, channel roughness, gradient).

3) Identification and detection of dead or impaired species is unlikely. Losses may also be masked by seasonal fluctuations in numbers.

4) Aquatic habitat modifications are difficult to ascribe to particular sources, especially in sub-watersheds that are currently degraded.

For these reasons, the Service has determined the actual amount or extent of incidental take is difficult to determine.

According to Service policy, as stated in the Endangered Species Consultation Handbook (Handbook; U.S. Fish and Wildlife Service. National Marine Fisheries Service, 1998), some detectable measure of effect should be provided, such as the relative occurrence of the species or a surrogate species in the local community, or amount of habitat used by the species, to serve as a measure for take. Take also may be expressed as a change in habitat characteristics affecting the species (Handbook, p 4-47 to 4-48). In instances where incidental take is difficult to quantify, the Service uses a surrogate measure of take.

In this biological opinion, the Service uses “timely implementation of road BMPs (described in the *Biological Assessment of Road Related Actions on Western Montana Federal Lands that are Likely to Adversely Affect Bull Trout* (U.S. Forest Service 2008)) on 4.6 miles of roads in Stonewall Project riparian conservation areas used for log hauling throughout the duration of the project” and “temporary degradation to habitat indicators (Table 4) that results from use of the existing road network during implementation of the Stonewall Project” as surrogates for anticipated levels of take. The level of take covered by these surrogate measures would be exceeded if; (1) road BMPs are not implemented prior to the first season of log hauling, maintained throughout the project duration, and applied after completion of log hauling, (2) if

road BMPs are determined to be ineffective and corrective actions are not implemented within 10 working days (14 calendar days), or as agreed to by the Service, (3) the project extends beyond 9 years.

The Service anticipates that incidental take of bull trout would occur in the Blackfoot River and lower part of Keep Cool Creek in the Blackfoot River Core Area. The continued presence of bull trout in these streams is susceptible to adverse effects from project-related effects. Incidental take of bull trout is anticipated to occur during BMP implementation and log hauling activities for the duration of the project.

Effect of the Take

In the accompanying biological opinion, the Service determined that the extent and type of take described is not likely to jeopardize the continued existence of bull trout in the Blackfoot River Core Area of the Columbia Headwaters Recovery Unit.

Reasonable and Prudent Measures

Biological opinions provide reasonable and prudent measures that are expected to reduce the amount of incidental take. Reasonable and prudent measures are those measures necessary and appropriate to minimize incidental take resulting from proposed actions. Reasonable and prudent measures are nondiscretionary and must be implemented by the agency in order for the exemption in section 7(o)(2) to apply.

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

1. Implement road BMPs and specific minimization measures identified for each Activity Type as developed in the *Biological Assessment of Road Related Actions on Western Montana Federal Lands that are Likely to Adversely Affect Bull Trout* (U.S. Forest Service 2008) on log haul routes in the Stonewall Project action area to reduce sediment production that increases the potential for incidental take of bull trout..

2. Reduce additional effects of the Stonewall Project that result from use of the existing road network. .

3. Implement reporting requirements as outlined in the terms and conditions below.

Terms and Conditions

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

To fulfill reasonable and prudent measure #1 the following terms and conditions shall be implemented:

A. The Forest will ensure that all road improvements, maintenance, and standards for construction, as described by the proposed action, will be implemented.

B. During all road management actions, the Forest shall implement soil and water BMPs, as appropriate. BMPs will be installed prior to the first log haul season, preferably the season before log haul occurs.

C. During the implementation of harvest treatments, the Forest shall monitor riparian conservation area buffers to ensure they are not compromised by management activities or climatic events that influence buffer efficacy.

To fulfill reasonable and prudent measure #2 the following terms and conditions shall be implemented:

D. Within 4 years of starting the Stonewall Project, the Forest will complete all road closure, storage, decommissioning, removal of stream crossings, and the closure and rehabilitation of dispersed campsites near streams that were proposed under the Blackfoot Travel Plan for the five HUCs that comprise the Stonewall Project action area (Table 5).

Table 5. Change in open high risk roads, stream crossings, and dispersed campsites near streams that were proposed in the Blackfoot Travel Plan for 6th code HUCs in the Stonewall Project action area.

Watershed	High-Risk Roads[1] (miles)	Stream Crossings (#)	Dispersed Campsites near Streams[2] (#)
Beaver Creek	-1.5	-9	-6
Humbug Creek	-0.1	0	0
Keep Cool Creek	-2.7	-10	-3
Blackfoot River-Little Moose	-0.3	-3	0
Lincoln Creek	-0.8	-1	0
Total	-5.4	-23	-9

[1] High-risk roads are roads within INFISH buffers

[2] Within 50 feet of streams

To fulfill reasonable and prudent measure #3, the following terms and conditions shall be implemented:

E. The Forest shall provide reports on the progress of terms and conditions A, B, C, D, above, annually by December 1, or by an alternate date as agreed upon with the Service.

F. Upon locating dead, injured or sick bull trout, or upon observing destruction of redds, notification must be made within 24 hours to the Montana Field Office at 406-449-5225. Record information relative to the date, time, and location of dead or injured bull trout when found, and possible cause of injury or death of each fish and provide this information to the Service.

Closing statement

The Service is unable to precisely quantify the number of bull trout that will be incidentally

taken as a result of the Stonewall Project. Therefore, we use a surrogate measure for the amount of take we anticipate and provide, in the incidental take statement, specific measures of the incidental take we anticipate. We use "timely implementation of road BMPs on 4.6 miles of roads in Stonewall Project riparian conservation areas used for log hauling throughout the duration of the project" and "temporary degradation to habitat indicators (Table 4) that results from use of the existing road network during implementation of the Stonewall Project" as our surrogate measure of the incidental take we anticipate to result from the Stonewall Project.

Reasonable and prudent measures, with their implementing terms and conditions, are typically designed to minimize the impact of incidental take that might otherwise result from the proposed action. If, during the course of the action, the level of take occurring exceeds that anticipated in this incidental take statement, such incidental take represents new information requiring reinitiation of consultation and review of the incidental take statement. 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.

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 recommendations that: (1) identify discretionary measures a federal agency can take to minimize or avoid the adverse effects of a proposed action on listed or proposed species, or designated or proposed critical habitat, (2) identify studies, monitoring, or research to develop new information on listed or proposed species, or designated or proposed critical habitat, and (3) include suggestions on how an action agency can assist species conservation as part of their action and in furtherance of their authorities under section 7(a)(1) of the Act. The Service provides the following recommendations:

1. Section 2672.2 of the Forest Service Manual states: "The Forest Service must manage habitats at levels that accomplish the recovery of federally listed species so that protective measures under the Act are no longer necessary." The Conservation Strategy for Bull Trout on USFS Lands (U.S. Forest Service 2013) was intended, in part, to "help direct resources to the most important opportunities, where FS management has the potential to increase habitat quality and connectivity". The Bull Trout Conservation Strategy (U.S. Forest Service 2013) should be reviewed for management opportunities that will improve habitat conditions that are conducive to the recovery of bull trout.

2. The Forest should continue to monitor, inventory, investigate, and document bull trout populations and spawning activities throughout the action area and other potential areas of the Forest. For example, recent techniques using eDNA provide efficient, cost-effective methods to document bull trout that other methods may not provide. The use of eDNA sampling or some other method of sampling is especially encouraged in priority watersheds on the Forest. All existing bull trout spawning surveys should be continued as a population monitoring tool using historic methods.

3. Work cooperatively with state, private, and other federal agencies to reduce adverse

conditions, including impacts caused by lack of connectivity, drought, habitat degradation, water quality issues, barriers to fish passage, irrigation related issues including irrigation withdrawal and entrainment on private and other government lands in Blackfoot River Core Area of the Columbia Headwaters Recovery Unit. Areas for translocations in the core area should also be considered.

4. The Forest should consider the feasibility of relocating Copper Creek Road (FSR #330) to the bench outside of the Copper Creek floodplain starting approximately ¾ mile upstream of the Copper Creek Campground Road and tie back in with the road near Cotter Creek to remove the road from the dynamic floodplain.

5. The Forest should continue to explore right-of-way options to relocate reaches of FSR #330 in T15NR7WS23 to reduce chronic sediment delivery to Copper Creek.

6. The Forest should pursue collaborative funding and implementation with NGOs, Lewis and Clark County, and private landowners to replace any undersized or barrier culverts on Poorman Creek on Stemple Pass Road and its spurs. The Forest should work with Big Blackfoot Chapter of Trout Unlimited, the Blackfoot Challenge or other private partners to assess all stream crossings on Poorman Creek, regardless of ownership or management.

7. When possible, the Forest should consider conducting field surveys to verify or update indicator ratings of 6th level watersheds. Accurate representation of indicator values would provide improved assessments of watersheds that help identify areas for improvement to reach desired ratings (FA or FAR).

Reinitiation Notice

This concludes formal consultation for bull trout on the Stonewall Project for the Helena-Lewis and Clark National Forest. 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.

Literature Cited

Anderson, H.W., M.D. Hoover, and K.G. Reinhart. 1976. Forests and water: effects of forest management on floods, sedimentation, and water supply. U.S. Forest Service Gen. Tech. Rep. PSW-18. 115 p., Pacific Southwest Forest and Range Exp. Stn., Berkeley, CA

Ardren, W.R., P.W. DeHaan , C.T. Smith , E.B. Taylor , R. Leary , C.C. Kozfkay , L. Godfrey , M. Diggs , W. Fredenberg , J. Chan, C.W. Kilpatrick , M.P. Small, and D.K. Hawkins. 2011. Genetic Structure, Evolutionary History, and Conservation Units of Bull Trout in the Coterminous United States, Transactions of the American Fisheries Society, 140:2, 506-525.

Battin, J., M.W. Wiley, M.H. Ruckelshaus, R.N. Palmer, E. Korb, K.K. Bartz, and H. Imaki. 2007. Projected impacts of climate change on salmon habitat restoration. Proceedings of the National Academy of Sciences of the United States of America 104(16):6720-6725.

Baxter, C.V. 2002. Fish movement and assemblage dynamics in a Pacific Northwest riverscape. Doctor of Philosophy in Fisheries Science. Oregon State University, Corvallis, Oregon. 174 pp.

Baxter, C.V., C.A. Frissell, and F.R. Hauer. 1999. Geomorphology, logging roads, and the distribution of bull trout spawning in a forested river basin: implications for management and conservation. Transactions of the American Fisheries Society 128: 854-867.

Beauchamp, D.A., and J.J. VanTassell. 2001. Modeling seasonal trophic interactions of adfluvial bull trout in Lake Billy Chinook, Oregon. Transactions of the American Fisheries Society 130:204-216.

Belford, D. A., and W. R. Gould. 1989. An evaluation of trout passage through six highway culverts in Montana. N. Am. J. Fish. Manage. 9: 437-445.

Belt, G., O'Laughlin, J. Merrill, T. 1992. Design of forest riparian buffer strips for the protection of water quality: Analysis of scientific literature. Idaho Forest, Wildlife and Range Policy Analysis Group. Report No. 8

Beschta, R. L. and W. L. Jackson, 1979. The Intrusion of fine sediments into a stable gravel. Journal of Fisheries Research Board Canada. 36(2):204-21

Beschta, R.L., R.E. Bilby, G.W. Brown, L.B. Holtby and T.D. Hofstra. 1987. Stream temperature and aquatic habitat: fisheries and forestry interactions. In: Streamside management: Forestry and fisheries interactions, E.O. Salo and T.W. Cundy (eds.), College of Forest Resources, University of Washington, Seattle WA. Contribution 75

Bjornn, T.C., Brusven, M. A., Molnau, M. P., Milligan, J. H., Klamt, R. A., Chacho, E. and Scbaye, C. 1977. Transport of granitic sediment and iu effects on insects and fish. Bulletin Number 17, College o(Forestry, Wildlife, and Range Sciences, University of Idaho, Boise, ID, 43 p

Boag, T.D. 1987. Food habits of bull char (*Salvelinus confluentus*), and rainbow trout (*Salmo gairdneri*), coexisting in a foothills stream in northern Alberta. Canadian Field-Naturalist 101(1):56-62.

Bond, C.E. 1992. Notes on the nomenclature and distribution of the bull trout and the effects of human activity on the species. Pages 1-4 in Howell, P.J. and D.V. Buchanan, editors. Proceedings of the Gearhart Mountain bull trout workshop. Oregon Chapter of the American Fisheries Society, Corvallis.

Bonneau, J.L., and D.L. Scarnecchia. 1996. Distribution of juvenile bull trout in a thermal gradient of a plunge pool in Granite Creek, Idaho. Transactions of the American Fisheries Society 125(4):628-630. Can. J. Fish. Aquat. Sci. 71: 1059–1071

Bowermann, T., B. T. Nielson, and P. Budy. 2014. Effects of fine sediment, hyporheic flow, and spawning site characteristics on survival and development of bull trout embryos.

Brenkman, S.J., and S.C. Corbett. 2005. Extent of anadromy in bull trout and implications for conservation of a threatened species. North American Journal of Fisheries Management 25:1073-1081.

Brewin, P.A., and M.K. Brewin. 1997. Distribution maps for bull trout in Alberta. Pages 209-216 In Mackay, W.C., M.K. Brewin and M. Monita eds. Friends of the Bull Trout, Bull Trout Task Force (Alberta), c/o Trout Unlimited, Calgary, Alberta T2P 2C8, Canada. 8 pp.

Buchanan, D.V., and S.V. Gregory. 1997. Development of water temperature standards to protect and restore habitat for bull trout and other cold water species in Oregon. Pages 119-126 In Mackay, W.C., M.K. Brewing and M. Monita eds. Friends of the Bull Trout, Alberta, Canada.

Burkey, T.V. 1989. Extinction in nature reserves: the effect of fragmentation and the importance of migration between reserve fragments. Oikos 55:75-81.

Burkey, T.V. 1995. Extinction rates in archipelagoes: Implications for populations in fragmented habitats. Conservation Biology 9: 527-541

Burroughs, E. R., and J. G. King. 1989. Reduction of soil erosion on forest roads. Gen. Tech. Rep. INT-264. Ogden, UT. USDA Forest Service, Intermountain Research Station. 21 p.

Clancy, C.G.; Reichmuth, D.R. 1990. A detachable fishway for steep culverts. North American Journal of Fisheries Management. 10(2): 244-246.

Cavender, T.M. 1978. Taxonomy and distribution of the bull trout, *Salvelinus confluentus* (Suckley), from the American Northwest. California Fish and Game 64(3):139-174.

Costello, A.B., T.E. Down, S.M. Pollard, C.J. Pacas, and E.B. Taylor. 2003. The influence of history and contemporary stream hydrology on the evolution of genetic diversity within species: an examination of microsatellite DNA variation in bull trout, *Salvelinus confluentus* (Pisces: Salmonidae). Evolution. 57(2): 328-344.

Donald, D.B., and D.J. Alger. 1993. Geographic distribution, species displacement, and niche overlap for lake trout and bull trout in mountain lakes. Canadian Journal of Zoology 71:238-247.

Dunham, J.B. and B.E. Rieman. 1999. Metapopulation structure of bull trout: influences of physical, biotic, and geometrical landscape characteristics. Ecological Applications. 9: 642-655.

Dunham, J., B. Rieman, and G. Chandler. 2003. Influences of temperature and environmental variables on the distribution of bull trout within streams at the southern margin of its range. North American Journal of Fisheries Management 23:894-905.

Evans, W.A. and F. B. Johnston. 1980. Fish Migration and Fish Passage. A Practical Guide to Solving Fish Passage Problems. U.S. Department of Agriculture-Forest Service Region 5 report. June 1972. Revised March 1974. Revised 1980. 63 pages.

Everest, F. H., R. L. Beschta, J. C. Scrivener, K. V. Koski, J. R. Sedell, and C. J. Cederholm. 1987. Fine sediment and salmonid production: A paradox. Pages 98-142 *in* E. O. Salo and T. W. Cundy, editors. Streamside management: Forestry and fishery interactions. University of Washington Institute of Forest Resources Contribution 57.

Faustini, J. M., and J. Jones. 2003. Influence of large woody debris on channel morphology and dynamics in steep, boulder-rich mountain streams, western Cascades, Oregon. Geomorphology. 51:187-205.

Foltz, R.B. 1996. Traffic and no-traffic on an aggregate surfaced road: sediment production differences. *In* Proceedings of the Seminar on environmentally sound forest roads and wood transport, Sinaia, Romania, Food and Agricultural Organization, Rome, Italy. 195-204

Foltz, R.B. and E. R. Burroughs. 1990. Sediment production from forest roads with wheel ruts. Watershed Planning and Analysis in Action Symposium, Proceedings of IR Conference Watershed Mgt/IR Div/ASCE Durango, CO. July 9-11 1990. p. 266-275.

Fraley, J.J., and B.B. Shepard. 1989. Life history, ecology and population status of migratory bull trout (*Salvelinus confluentus*) in the Flathead Lake and River system, Montana. Northwest Science 63(4):133-143.

Frissell, C.A. 1999. An ecosystem approach to habitat conservation for bull trout: groundwater and surface water protection. Flathead Lake Biological Station, University of Montana, Open File Report Number 156-99, Polson, MT, January 07, 1999. 46 pp.

Furniss, M.J., T.D. Roelofs, and C.S. Yee. 1991. Road construction and maintenance. Pages 297-323 in W.R. Meehan, editor. American Fisheries Society Special Publication.

Goetz, F. 1989. Biology of the bull trout, *Salvelinus confluentus*, a literature review. Willamette National Forest, Eugene, Oregon, February 1989. 53 pp.

Goetz, F., E.D. Jeanes, and E.M. Beamer. 2004. Bull trout in the nearshore. U.S. Army Corps of Engineers, Preliminary draft, Seattle, Washington, June 2004. 396 pp.

Grace, J.M. III and B.D. Clinton. 2007. Protecting soil and water in forest road management. Trans. ASABE 50(5): 1579-1584

Gresswell, R. E. 1999. Fire and aquatic ecosystems in forested biomes of North America. Transactions of the American Fisheries Society. 128:193–221

Haas, G.R., and J.D. McPhail. 2001. The post-Wisconsin glacial biogeography of bull trout (Salvelinus confluentus): a multivariate morphometric approach for conservation biology and management. Canadian Journal of Fisheries and Aquatic Sciences 58:2189-2203.

Harr, R. D., W. C. Harper, J. T. Krygier, and F. S. Hsieh. 1975 Changes in storm hydrographs after road building and clear-cutting in the Oregon Coast Range, Water Resour. Res., 11(3), 436-444.

Heede, B.H. 1980. Stream dynamics: an overview for land managers. Gen. Tech. Rep. RM-72. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 26 p.

Henjum. M. G.. and seven coauthors. 1994. Interim protection for late-successional forests, fisheries, and watersheds. National forests cast of the Cascade Crest, Oregon and Washington. The Wildlife Society.Bethesda. Maryland.

Henley, W. F., M. A. Patterson, R. J. Neves, and A. D. Lemly. 2000. Effects of sedimentation and turbidity on lotic food webs: a concise review for natural resource managers. Reviews in Fisheries Science 8(2): 125-139.

Hoelscher, B., and T.C. Bjornn. 1989. Habitat, density, and potential production of trout and char in Pend Oreille Lake tributaries. Idaho Department of Fish and Game, Project F-710R-10, Subproject III, Job No. 8., Boise, Idaho, January 1989. 60 pp.

Hough-Snee, N., Kasprak, A., Roper, B., Meredith, C. 2014. Direct and indirect drivers of instream wood in the interior Pacific Northwest, USA: decoupling climate, vegetation, disturbance, and geomorphic setting. Riparian Ecology and Conservation. 2:14-34.

Howell, P.J., and D.V. Buchanan. 1992. Proceedings of the Gearhart Mountain bull trout workshop. Oregon Chapter of the American Fisheries Society, Corvallis, Oregon. 67 pp.

IPCC, 2007: Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, Pachauri, R.K and Reisinger, A. (eds.)]. IPCC, Geneva, Switzerland, 104 pp.

Isaak, D.J., C.H. Luce, B.E. Rieman, D.E. Nagel, B.E. Peterson, D.L. Horan, S. Parkes, and G.L. Chandler. 2010. Effects of climate change and wildfire on stream temperatures and salmonid thermal habitat in a mountain river network. Ecological Applications 20:1350-1371.

Isaak, D.J., M.K. Young, D. Nagel, and D. Horan. 2014. Coldwater as a climate shield to preserve native trout through the 21st century. Pages 110-116 in: R.F. Carline and C.

LoSapio (editors). Looking back and moving forward. Proceedings of the Wild Trout Symposium XI, Bozeman, Montana.

Isaak, D.J., M.K. Young, D. Nagel, D. Horan and M.C. Groce. 2015. The coldwater climate shield: Delineating refugia to preserve salmonid fishes through the 21st century. Global Change Biology 21:2540-2553.

Jakober, M.J., T. E. McMahon, R. F. Thurow, and C. G. Clancy. 1998. Role of stream ice on fall and winter movements and habitat use by bull trout and cutthroat trout in Montana headwater streams. Transactions of the American Fisheries Society 127:223-235.

Kennedy, R. 1997. Road maintenance frequency verses sediment production. Engineering Field Notes, 29:11-15.

Koopman, M.E., R.S. Nauman, B.R. Barr, S.J. Vynne, and G.R. Hamilton. 2009. Projected future conditions in the Klamath Basin of Southern Oregon and Northern California. National Center for Conservation and Science Policy, Climate Change Leadership Initiative, MAPPS Team of U.S. Department of Agriculture, Forest Service, Ashland, Ore.

Leary, R.F.; F.W. Allendorf, and S. H. Forbes. 1993. Conservation genetics of bull trout in the Columbia and Klamath River watersheds. Conservation Biology. 7:856-865.

Leary, R.F., and F.W. Allendorf. 1997. Genetic confirmation of sympatric bull trout and Dolly Varden in western Washington. Transactions of the American Fisheries Society 126:715-720.

Leathe, S.A., and P.J. Graham. 1982. Flathead Lake fish food habits study. US EPA, Region VIII, Water Division, Contract R008224-01-4, Denver, Colorado, October, 1982. 209 pp.

Lee, D.C., J.R. Sedell, B.E. Rieman, R.F. Thurow and J.E. Williams. 1997. Chapter 4: Broadscale assessment of aquatic species and habitats. Pages 1057-1496 in Quigley, T.M. and S.J. Arbelbide, editors. An Assessment of Ecosystem Components in the Interior Columbia Basin and Portions of the Klamath and Great Basins: Volume III. PNW-GTR-405. U.S. Forest Service, Portland, Oregon.

Leopold and Miller. 1956. Ephemeral stream-hydraulic factors and their relation to the drainage network. USGS Professional Paper 282-A. USGS Gov. Printing office. Wash.DC.

Long, M.H. 1997. Sociological implications of bull trout management in northwest Montana: illegal harvest and game warden efforts to deter. In: W.C. Mackay, M.K. Brewin, and M. Monita, editors. Friends of the bull trout conference proceedings, Bull Trout Task Force (Alberta), c/o Trout Unlimited Canada, Calgary pp. 71-74.

Luce, C. H. 1997. Effectiveness of road ripping in restoring infiltration capacity of forest roads. Restoration Ecology. 5(3):265-270.

Luce, C. A. and T. A. Black 1999. Sediment production from forest roads in western Oregon. Water Resour. Res. 35(8):2561-2570.

MBTSG (Montana Bull Trout Scientific Group). 1998. The relationship between land management activities and habitat requirements of bull trout prepared for: The Montana Bull Trout Restoration Team, Montana Fish, Wildlife and Parks, Helena, MT

Maturana, O., Tonina, D., McKean, J. A., Buffington, J. M., Luce, C., Caamaño, D. 2013. Modeling the effects of pulsed versus chronic sand inputs on salmonid spawning habitat in a low-gradient gravel-bed river. Earth Surface Processes and Landforms, 39(7):877-889.

McCaffery, M. T. A. Switalski, and L. Eby. 2007. Effects of road decommissioning on stream habitat characteristics in the South Fork Flathead River. Transactions of the American Fisheries Society 136: 553-561.

McPhail, J.D., and J.S. Baxter. 1996. A review of bull trout (*Salvelinus confluentus*) life-history and habitat use in relation to compensation and improvement opportunities. Department of Zoology, University of British Columbia, Vancouver, British Columbia. Fisheries Management Report No. 104.

Meehan, W.R., editor. 1991. Influences of forest and rangeland management on salmonid fishes and their habitats. American Fisheries Society Special Publication 19.

Meffe, G.K., and C.R. Carroll. 1997. Principles of conservation biology, 2nd edition. Sinauer Associates, Sunderland, MA, 673p.

Meredith, C., Roper, B., Archer, E., 2014. Reductions in instream wood in streams near roads in the Interior Columbia River Basin. North American Journal of Fisheries Management. 34:493-506.

Montana Bull Trout Restoration Team. 2000. Restoration plan for bull trout in the Clark Fork River basin and Kootenai River basin, Montana. Montana Fish, Wildlife and Parks, Helena.

Montgomery, D. R. 1994. Road surface drainage, channel initiation and slope instability. Water Resour. Res. 30(6): 1925-1932.

Moore, R. D., Spittlehouse, D. L., Story, A. 2005. Riparian Microclimate and Stream Temperature Response to Forest Harvesting: A Review. Journal of the American Water Resources Association. 41(4):813-834.

Moore, R. D., and Wondzell, S. M. 2005. Physical hydrology and the effects of forest harvesting in the pacific northwest: A review. Journal of the American Water Resources Association. 41(4);763-784.

Mote, P., A.K. Snover, S. Capalbo, S.D. Eigenbrode, P. Glick, J. Littell, R. Raymondi, and S. Reeder. 2014. Chapter 21: Northwest. Pages 487-513 *in Climate Change Impacts in the United States: The Third National Climate Assessment*, J.M. Melillo, Terese (T.C.) Richmond, and G.W. Yohe, Eds., U.S. Global Change Research Programoi:10.7930/J04Q7RWX.

Muck, J. 2010. Biological effects of sediment on bull trout and their habitat – guidance for evaluating effects. USFWS, Lacey, Washington, July 13, 2010. 57 pp.

Myrick, C.A., F.T. Barrow, J.B. Dunham, B.L. Gamett, G.R. Haas, J.T. Peterson, B. Rieman, L.A. Weber, and A.V. Zale. 2002. Bull trout temperature thresholds: peer review summary. USFWS, Lacey, Washington, September 19, 2002. 14 pp.

Nelson, K. C. and M. A. Palmer. 2007. Stream temperature surges under urbanization and climate change: data, models, and responses. Journal of American Water resources Association 43(2):440-452.

ODEQ (Oregon Department of Environmental Quality). 1995. 1992-1994 water quality standards review: dissolved oxygen - final issue paper. Oregon Department of Environmental Quality, Portland, OR.

Opperman, J. J., Lohse, K. A., Brooks, C. B., Kelly, M., Merenlender, A. M. 2005. Influence of land use on fine sediment in salmonid spawning gravels within the Russian River Basin, California.

Pierce, R., and C. Podner. 2016. Fisheries investigations in the Big Blackfoot River Basin Montana, 2013-2015. Montana Fish, Wildlife and Parks, Missoula, MT. 273p.

Peterson, D.P., S.J. Wenger, B.E. Rieman, and D.J. Isaak. 2013. Linking climate change and fish conservation efforts using spatially explicit decision support tools. Fisheries 38:112-127.

Poff, N.L., M.M. Brinson, and J.W. Day, 2002. Aquatic Ecosystems and Global Climate Change, Pew Center on Global Climate Change, Arlington, Virginia, 44 pp.

Pratt, K. L. 1985. Pend Oreille trout and char life history study. Idaho Department of Fish and Game, Boise.

Pratt, K.L. 1992. A review of bull trout life history. Pages 5-9 In Howell, P.J. and D.V. Buchanan eds. Proceedings of the Gearhart Mountain bull trout workshop, Oregon Chapter of the American Fisheries Society, Corvallis, Oregon. 5 pp.

Pratt, K.L., and J.E. Huston. 1993. Status of bull trout (*Salvelinus confluentus*) in Lake Pend Oreille and the lower Clark Fork River: draft. The Washington Power Company, Spokane.

Quigley, T. M. and S. J. Arbelbide, tech. eds. 1997. An assessment of ecosystem components in the interior Columbia basin and portion of the Klamath and Great basins: volume III. Pages 1,057 - 1,713 in Quigley, T.M., editor. The Interior Columbia Basin Ecosystem Management Project: Scientific Assessment. PNW-GTR-405.U.S. Forest Service, Portland, Oregon.

Quinn, T. P. 2005. The behavior and ecology of Pacific salmon and trout. University of Washington Press, Seattle.

Ratliff, D.E., and P.J. Howell. 1992. The status of bull trout populations in Oregon. Pages 10-17 in Howell, P.J. and D.V. Buchanan, editors. Proceedings of the Gearhart Mountain bull trout workshop. Oregon Chapter of the American Fisheries Society, Corvallis.

Reid, S. and P. Anderson. 1999. Effects of sediment released during open-cut pipeline water crossings. Canadian Water Resources Journal 24: 23-39.

Reid, L. M., and T. Dunne. 1984. Sediment production from forest road surfaces. Water Resources Research. 20:1753–1761

Rhodes, J.J., McCullough, D.A., and Espinosa Jr., F.A. 1994. A Coarse Screening Process for Evaluation of the Effects of Land Management Activities on Salmon Spawning and Rearing Habitat in ESA Consultations. CRITFC Technical Report. 94-4, Portland, Or.

Rich, C. F. 1996. Influence of abiotic and biotic factors on occurrence of resident bull trout in fragmented habitats, western Montana. M. S. thesis Montana State University, Bozeman.

Rieman, B.E. and F.W. Allendorf. 2001. Effective population size and genetic conservation criteria for bull trout. North American Journal of Fisheries Management 21:756-764.

Rieman, B., and J. Clayton. 1997. Wildfire and native fish: Issues of forest health and conservation of sensitive species. Fisheries 22:6-14.

Rieman, B.E., and J.B. Dunham. 2000. Metapopulations and salmonids: a synthesis of life history patterns and empirical observations. Ecology of Freshwater Fish 9:51-64.

Rieman, B. E. and D. Isaak. 2010. Climate Change, Aquatic Ecosystems, and fishes in the Rocky Mountain West: Implications and Alternatives for Management. Gen. Tech. Rep. RMS-GTR-250. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 46p.

Rieman, B.E., D. Isaak, S. Adams, D. Horan, D. Nagel, C.H. Luce, and D. Myers. 2007. Anticipated climate warming effects on bull trout habitats and populations across the interior Columbia River Basin. Transactions of the American Fisheries Society 136(6):1552-1565.

Rieman, B. E., D.C. Lee, and R. F. Thurow. 1997. Distribution, status, and likely future trends of bull trout in the interior Columbia River basin and Klamath River basins. North American Journal of Fisheries Management 17:1111-1125.

Rieman, B. E. and J. D. McIntyre. 1993. Demographic and habitat requirements for conservation of bull trout. GTR-INT-302. U.S. Forest Service, Boise, Idaho.

Rieman, B. E. and J. D. McIntyre. 1995. Occurrence of bull trout in naturally fragmented habitat patches of varied size. Transactions of the American Fisheries Society 124:285-296.

Rieman, B.E., and J.D. McIntyre. 1996. Spatial and temporal variability in bull trout redd counts. North American Journal of Fisheries Management 16:132-141.

Rieman, B. E., J. T. Peterson, and D. L. Myers. 2006. Have brook trout displaced bull trout along longitudinal gradients in central Idaho streams? Canadian Journal of Fisheries and Aquatic Sciences 63:63–78.

Riggers, B.W., Rosquist, A., R. Kramer, and M. Bills. 1998. An analysis of fish habitat and population conditions in developed and undeveloped watersheds on the Lolo National Forest. Forest Report. 64p.

Ross, M.R.. 1997. Fisheries Conservation and Management. Chapter 4: The Human Factor in Fisheries Conservation and Management. Prentice Hall, New Jersey. 374pp.

Shaw, E. A. and J. S. Richardson. 2001. Direct and indirect effects of sediment pulse duration on stream invertebrate assemblages and rainbow trout (*Oncorhynchus mykiss*) growth and survival. Canadian Journal of Fisheries and Aquatic Science 58: 2213-2221.

Suren, A. M. and I. G. Jowett. 2001. Effects of deposited sediment on invertebrate drift: an experimental study. New Zealand Journal of Marine and Freshwater Research 35: 725-537

Saunders, D.A., R.J. Hobbs, and C.R. Margules. 1991. Biological consequences of ecosystem fragmentalion: A review. Conservation Biology 5:18-32.

Sedell, J.R., and F.H. Everest. 1991. Historic changes in pool habitat for Columbia River Basin salmon under study for TES listing. Pacific Northwest Research Station, Draft U.S. Department of Agriculture Report, Corvallis, Oregon. 6 pp.

Sexauer, H.M., and P.W. James. 1997. Microhabitat use by juvenile bull trout in four streams located in the eastern Cascades, Washington. Pages 361-370 *In* W.C. McKay, M.K. Brewin, and M. Monita, eds. Friends of the Bull Trout Conference Proceedings, Bull Trout Task Force (Alberta), c/o Trout Unlimited, Calgary, Alberta, Canada.

Simpson, J.C., and R.L. Wallace. 1982. Fishes of Idaho. University of Idaho Press, Moscow, ID. 93 pp.

Spruell, P., B.E. Rieman, K.L. Knudsen, F.M. Utter, and F.W. Allendorf. 1999. Genetic population structure within streams: microsatellite analysis of bull trout populations. Ecology of Freshwater Fish (8):114-121.

Spruell, P., A.R. Hemmingsen, P.J. Howell, N. Kanda, and F. Allendorf. 2003. Conservation genetics of bull trout: Geographic distribution of variation at microsatellite loci. Conservation Genetics 4: 17-29.

Stewart, D.B., N.J. Mochnacz, C.D. Sawatzky, T.J. Carmichael, and J.D. Reist. 2007. Fish life history and habitat use in the Northwest territories: Bull trout (*Salvelinus confluentus*). Department of Fisheries and Oceans, Canadian Manuscript Report of Fisheries and Aquatic Sciences 2801, Winnipeg, MB, Canada, 2007. 54 pp.

Taylor, B.E., S. Pollard, and D. Louie. 1999. Mitochondrial DNA variation in bull trout (*Salvelinus confluentus*) from northwestern North America: implications for zoogeography and conservation. Molecular Ecology 8:1155-1170.

Thomas, G. 1992. Status report: bull trout in Montana. Montana Department of Fish, Wildlife and Parks, Helena.

Taylor, E.B., S. Pollard, and D. Louie. 1999. Mitochondrial DNA variation in bull trout (*Salvelinus confluentus*) from northwestern North America: implications for zoogeography and conservation. Molecluar Ecology. 8:1155-1170.

U.S. Fish and Wildlife Service. 1996. Policy regarding the recognition of distinct vertebrate population segments under the Endangered Species Act. February 7, 1996. Federal Register 61:4722-4725

U.S. Fish and Wildlife Service. 1998. A framework to assist in making endangered species act determinations of effect for individual or grouped action at the bull trout subpopulation watershed scale. Region 1, USFWS.

U.S. Fish and Wildlife Service. 1998a. Biological Opinion for the Effects to Bull Trout from the Continued Implementation of Land and Resource Management Plans and Resource Management Plans as Amended by the Interim Strategies for Managing Fish Producing Watersheds in Eastern Oregon and Washington, Idaho, Western Montana and portions of Nevada (INFISH) and the Interim Strategy for Managing Anadromous Fish-producing Watersheds in Eastern Oregon and Washington, Idaho and portions of California (PACFISH). Region 1, USFWS.

U.S. Fish and Wildlife Service. National Marine Fisheries Service, 1998. Final endangered species consultation handbook: Procedures for conducting consultation and conference activities under section 7 of the Endangered Species Act. U. S. Fish and Wildlife Service and National Marine Fisheries Service, Washington, D.C., March 1998. 315 pp.

U.S. Fish and Wildlife Service. 1999. Endangered and Threatened Wildlife and Plants; Determination of Threatened Status for Bull Trout in the Coterminous United States. Fish and Wildlife Service, Department of the Interior. 50 CFR 17, Vol. 64, No. 210, p. 58910-58933.

U.S. Fish and Wildlife Service. 2002. Chapter 1, Introduction, Bull Trout (*Salvelinus confluentus*) Draft Recovery Plan. Portland, Oregon (www.fws.gov/pacific/bulltrout/colkla/recovery/).

U.S. Fish and Wildlife Service. 2004. Designation of critical habitat for the Klamath River and Columbia River populations of bull trout. 69 FR 59996 – 60076.

U.S. Fish and Wildlife Service. 2004a. Draft Recovery Plan for the Coastal-Puget Sound Distinct Population Segment of Bull Trout (*Salvelinus confluentus*). Volume I (of II): Puget Sound Management Unit. Portland Oregon.

U.S. Fish and Wildlife Service. 2004b. Draft Recovery Plan for the Jarbidge Distinct Population Segment of Bull Trout (*Salvelinus confluentus*). Volume I (of II): Puget Sound Management Unit. Portland Oregon.

U.S. Fish and Wildlife Service. 2005. Endangered and threatened wildlife and plants; designation of critical habitat for the bull trout. September 26, 2005. 70 FR 56212-56311.

U.S. Fish and Wildlife Service. 2005a. Bull trout core area templates - complete core area by core area analysis. U.S. Fish and Wildlife Service, Portland, Oregon. 662 pp.

U.S. Fish and Wildlife Service. 2005b. Bull trout core area conservation status assessment. W. Fredenberg, J. Chan, J. Young and G. Mayfield, editors. U. S. Fish and Wildlife Service. Portland, Oregon. 95 pages plus attachments.

U.S. Fish and Wildlife Service. 2006. Jeopardy Determinations under Section 7 of the Endangered Species Act for the Bull Trout. Memorandum to Ecological Services Project Leaders - Idaho, Oregon, Washington from Region 1 Assistant Regional Director, U.S. Fish and Wildlife Service, Ecological Services. Portland, Oregon. April 20, 2006.

U.S. Fish and Wildlife Service. 2008. Bull trout (*Salvelinus confluentus*) 5-year review: Summary and evaluation. U.S. Fish and Wildlife Service, Portland, Oregon.

U.S. Fish and Wildlife Service. 2009. Bull trout core area templates - complete core area by core area re-analysis. W. Fredenberg and J. Chan, editors. U. S. Fish and Wildlife Service. Portland, Oregon. XX pp

U.S. Fish and Wildlife Service. 2009a. Bull Trout Proposed Critical Habitat Justification: Rationale for Why Habitat is Essential, and Documentation of Occupancy. U. S. Fish and Wildlife Service. Portland, Oregon. 32 pages

U.S. Fish and Wildlife Service. 2010. Endangered and threatened wildlife and plants; revised designation of critical habitat for bull trout in the coterminous United States; final rule. October 18, 2010. Federal Register 75:63898-64070.

U.S. Fish and Wildlife Service. 2011. Crosswalk between bull trout matrix and bull trout critical habitat primary constituent elements. U.S. Fish and Wildlife Service, Wenatchee, WA. 7 pp.

U.S. Fish and Wildlife Service. 2015. Recovery plan for the coterminous United States population of bull trout (*Salvelinus confluentus*). U.S. Fish and Wildlife Service, Portland, Oregon. xii + 179 pp.

U.S. Fish and Wildlife Service. 2015a. Coastal recovery unit implementation plan for bull trout (*Salvelinus confluentus*). U.S. Fish and Wildlife Service, Lacey, Washington, and Portland, Oregon. 155 pp.

U.S. Fish and Wildlife Service. 2015b. Columbia headwaters recovery unit implementation plan for bull trout (*Salvelinus confluentus*). U.S. Fish and Wildlife Service, Kalispell, Montana, and Spokane, Washington. 179 pp.

U.S. Fish and Wildlife Service. 2015c. Klamath recovery unit implementation plan for bull trout (*Salvelinus confluentus*). U.S. Fish and Wildlife Service, Klamath Falls, Oregon. 35 pp.

U.S. Fish and Wildlife Service. 2015d.Mid-Columbia recovery unit implementation plan for bull trout (*Salvelinus confluentus*). U.S. Fish and Wildlife Service, Portland, Oregon. 345 pp.

U.S. Fish and Wildlife Service. 2015e. St. Mary recovery unit implementation plan for bull trout (*Salvelinus confluentus*). U.S. Fish and Wildlife Service, Kalispell, Montana. 30 pp.

U.S. Fish and Wildlife Service. 2015f. Upper Snake recovery unit implementation plan for bull trout (*Salvelinus confluentus*). U.S. Fish and Wildlife Service, Boise, Idaho. 113 pp.

U.S. Fish and Wildlife Service. 2015g. Bull trout (*Salvelinus confluentus*) 5-year review: Summary and evaluation. U.S. Fish and Wildlife Service, Portland, Oregon.

U.S. Fish and Wildlife Service. 2016. Biological opinion for the effects to bull trout and bull trout critical habitat; Blackfoot non-winter travel plan, Helena National Forest. Helena, MT

U.S. Forest Service, 1995. Inland Native Fish Strategy Environmental Assessment (INFISH), Decision Notice and Finding of No Significant Impact, 1995, Intermountain, Northern, and Pacific Northwest Regions. U.S. Department of Agriculture, Forest Service. July 28. http://www.fs.fed.us/r6/fish/9506-infish.pdf.

U.S. Forest Service. 2006 Northern Region Culvert/Aquatic Organism Passage Assessment October 2006. Region 1 Forest Service, Missoula Montana.

U.S. Forest Service. 2010 Watershed Baseline Conditions for the Blackfoot Section 7 Watershed. Helena National Forest, Helena MT

U.S. Forest Service. 2013. Conservation Strategy for Bull Trout on USFS Lands in Western Montana. USDA Forest Service, Northern Region. Missoula, MT.

U.S. Forest Service. 2016. Amended fisheries biological assessment, Stonewall Vegetation Project, including supplemental information received during consultation. Lincoln Ranger District, Helena-Lewis and Clark National Forest. U.S.D.A. Forest Service, Lincoln, Montana.

U.S. Forest Service. 2016a. Biological assessment for bull trout, Blackfoot travel plan, including supplemental information received during consultation. Lincoln Ranger District, Helena National Forest. U.S.D.A. Forest Service, Helena National Forest, Helena, Montana.

WDFW, FishPro Inc., and Beak Consultants. 1997. Grandy Creek trout hatchery biological assessment. Washington Department of Fish and Wildlife, Olympia, WA, March 1997. 47 pp.

WDOE. 2002. Evaluating criteria for the protection of freshwater aquatic life in Washington's surface water quality standards - dissolved oyxgen: Draft discussion paper and literature summary. Washington Department of Ecology, Publication Number 00-10-071, Olympia, WA, December 2002.
90 pp.

Waters, T. F. 1995. Sediment in streams: Sources, biological effects, and control. American Fisheries Society, Monograph 7, Bethesda, Maryland

Watson, G., and T.W. Hillman. 1997. Factors affecting the distribution and abundance of bull trout: an investigation at hierarchical scales. North American Journal of Fisheries Management 17(2):237-252.

Weaver, W. E., M. M. Hektner, D. K. Hagans, L.J. Reed, R.A. Sonneville, and G.]. Bundros. 1987. An evaluation of experimental rehabilita tion work, Redwood National Park. Technical report 19. Redwood National Park, Arcata, California.

Weaver, T. and Fraley, J. 1991. Fisheries habitat and fish populations. Flathead basin forest practices, water quality and fisheries cooperative program. Kalispell, MT: Flathead Basin Commission. 47 p.

Wenger, S.J., D.J. Isaak, J.B. Dunham, K.D. Fausch, C.H. Luce, H.M. Neville, B.E. Rieman, M.K. Young, D.E. Nagel, D.L. Horan, and G.L. Chandler. 2011. Role of climate change and invasive species in structuring trout distributions in the interior Columbia River Basin, USA. Canadian Journal of Fisheries and Aquatic Sciences 68:988-1008.

Westerling, A.L., H.G. Hidalgo, D.R. Cayan, and T.W. Swetnam. 2006. Warming and earlier spring increase western U.S. forest wildfire activity. Science 313:940-943.

Whiteley, A., P. Spruell and F.W. Allendorf. 2003. Population genetics of Boise Basin bull trout (*Salvelinus confluentus*). Final Report to Bruce Rieman, Rocky Mountain Research Station. University of Montana Wild Trout and Salmon Genetics Lab, Missoula, Montana.

Whitesel, T.A. and 7 coauthors. 2004. Bull trout recovery planning: A review of the science associated with population structure and size. Science Team Report #2004-01, U.S. Fish and Wildlife Service, Region 1, Portland, Oregon.

Appendix Table A-1. Framework/matrix indicators and values describing each functional level.

DIAGNOSTIC OR PATHWAY	INDICATORS	FUNCTIONING APPROPRIATELY	FUNCTIONING AT RISK	FUNCTIONING AT UNACCEPTABLE RISK
SPECIES:				
Subpopulation Characteristics within subpopulation watersheds	***Subpopulation Size***	Mean total subpopulation size or local habitat capacity more than several thousand individuals. All life stages evenly represented in the subpopulation.[1]	Adults in subpopulation are less than 500 but >50.[1]	Adults in subpopulation has less than 50. [1]
	Growth and Survival	Subpopulation has the resilience to recover from short term disturbances (e.g. catastrophic events, etc) or subpopulation declines within one to two generations (5 to 10 years).[1] The subpopulation is characterized as increasing or stable. At least 10+ years of data support this estimate.[2]	When disturbed, the subpopulation will not recover to predisturbance conditions within one generation (5 years). Survival or growth rates have been reduced from those in the best habitats. The subpopulation is reduced in size, but the reduction does not represent a long-term trend. [1] . At least 10+ years of data support this characterization.[2] If less data is available and a trend can not be confirmed, a subpopulation will be considered at risk until enough data is available to accurately determine its trend.	The subpopulation is characterized as in rapid decline or is maintaining at alarmingly low numbers. Under current management, the subpopulation condition will not improve within two generations (5 to 10 years). [1] This is supported by a minimum of 5+ years of data.
	Life History Diversity and Isolation	The migratory form is present and the subpopulation exists in close proximity to other spawning and rearing groups. Migratory corridors and rearing habitat (lake or larger river) are in good to excellent condition for the species. Neighboring subpopulations are large with high likelihood of producing surplus individuals or straying adults that will mix with other	The migratory form is present but the subpopulation is not close to other subpopulations or habitat disruption has produced a strong correlation among subpopulations that do exist in proximity to each other. [1]	The migratory form is absent and the subpopulation is isolated to the local stream or a small watershed not likely to support more than 2,000 fish.[1]

		subpopulation groups. [1]		
	Persistence and Genetic Integrity	Connectivity is high among multiple (5 or more) subpopulations with at least several thousand fish each. Each of the relevant subpopulations has a low risk of extinction. [1] The probability of hybridization or displacement by competitive species is low to nonexistent.	Connectivity among multiple subpopulations does occur, but habitats are more fragmented. Only one or two of the subpopulations represent most of the fish production. [1] The probability of hybridization or displacement by competitive species is imminent, although few documented cases have occurred.	Little or no connectivity remains for refounding subpopulations in low numbers, in decline, or nearing extinction. Only a single subpopulation or several local populations that are very small or that otherwise are at high risk remain.[1] Competitive species readily displace bull trout. The probability of hybridization is high and documented cases have occurred.
HABITAT:				
Water Quality:	***Temperature***	7 day average maximum temperature in a reach during the following life history stages: [1, 3] incubation 2 - 5°C rearing 4 - 12 °C spawning 4 - 9°C also temperatures do not exceed 15□C in areas used by adults during migration (no thermal barriers)	7 day average maximum temperature in a reach during the following life history stages: [1, 3] incubation <2°C or 6°C rearing <4°C or 13 - 15 °C spawning <4°C or 10°C also temperatures in areas used by adults during migration sometimes exceeds 15°C	7 day average maximum temperature in a reach during the following life history stages: [1, 3] incubation <1°C or >6°C rearing >15 °C spawning <4 °C or > 10°C also temperatures in areas used by adults during migration regularly exceed 15°C (thermal barriers present)
	Sediment (in areas of spawning and incubation; rearing areas will be addressed under substrate embeddedness)	Similar to chinook salmon [1]: for example (e.g.): < 12% fines (<0.85mm) in gravel[4]; e.g. ≤20% surface fines of ≤6mm[5, 6]	Similar to chinook salmon [1]: e.g. 12-17% fines (<0.85mm) in gravel[4]; e.g. 12-20% surface fines [7]	Similar to chinook salmon [1]: e.g. >17% fines (<0.85mm) in gravel[4]; e.g. >20% fines at surface or depth in spawning habitat[7]
	Chemical Contamination/ Nutrients	low levels of chemical contamination from agricultural, industrial and other sources, no excess nutrients, no CWA 303d designated reaches[8]	moderate levels of chemical contamination from agricultural, industrial and other sources, some excess nutrients, one CWA 303d designated reach[8]	high levels of chemical contamination from agricultural, industrial and other sources, high levels of excess nutrients, more than one CWA 303d designated reach[8]
Habitat Access:	***Physical Barriers*** (address subsurface flows impeding	man-made barriers present in watershed allow upstream and downstream fish	man-made barriers present in watershed do not allow upstream	man-made barriers present in watershed do not allow upstream

	fish passage under the pathway flow/hydrology)	passage at all flows	and/or downstream fish passage at base/low flows	and/or downstream fish passage at a range of flows
Habitat Elements:	***Substrate Embeddedness*** in rearing areas (spawning an1d incubation areas were addressed under the indicator sediment)	reach embeddedness <20%[9, 10]	reach embeddedness 20-30% [9,10]	reach embeddedness >30%[4,10]
	Large Woody Debris	current values are being maintained at greater than 80 pieces/mile that are >24"diameter and >50 ft length on the Coast [9], or >20 pieces/ mile >12"diameter >35 ft length on the Eastside[11] ; also adequate sources of woody debris are available for both long and short-term recruitment	current levels are being maintained at minimum levels desired for functioning appropriately, but potential sources for long term woody debris recruitment are lacking to maintain these minimum values	current levels are not at those desired values for functioning appropriately, and potential sources of woody debris for short and/or long term recruitment are lacking
	Pool Frequency and Quality	pool frequency in a reach closely approximates [5]: Wetted width (ft) #pools/mile 0-5 39 5-10 60 10-15 48 15-20 39 20-30 23 30-35 18 35-40 10 40-65 9 65-100 4 (can use formula: pools/mi = 5,280/wetted channel width / #channel widths per pool); also, pools have good cover and cool water[4], and only minor reduction of pool volume by fine sediment	pool frequency is similar to values in functioning appropriately, but pools have inadequate cover/temperature[4], and/or there has been a moderate reduction of pool volume by fine sediment	pool frequency is considerably lower than values desired for functioning appropriately; also cover/temperature is inadequate[4], and there has been a major reduction of pool volume by fine sediment
	Large Pools (in adult holding, juvenile rearing, and overwintering reaches where streams are >3m in wetted width at	each reach has many large pools >1 meter deep[4]	reaches have few large pools (>1 meter) present[4]	reaches have no deep pools (>1 meter)[4]

	baseflow)			
	Off-channel Habitat (see reference 18 for identification of these characteristics)	watershed has many ponds, oxbows, backwaters, and other off-channel areas with cover; and side-channels are low energy areas[4]	watershed has some ponds, oxbows, backwaters, and other off-channel areas with cover; but side-channels are generally high energy areas[4]	watershed has few or no ponds, oxbows, backwaters, or other off-channel areas[4]
	Refugia (see Checklist footnotes for definition of this indicator)	habitats capable of supporting strong and significant populations are protected and are well distributed and connected for all life stages and forms of the species [12, 13]	habitats capable of supporting strong and significant populations are insufficient in size, number and connectivity to maintain all life stages and forms of the species[12, 13]	adequate habitat refugia do not exist[12]
Channel Condition & Dynamics:	***Average Wetted Width/ Maximum Depth*** Ratio in scour pools in a reach	≤ 10[7, 5]	11 - 20[5]	>20[5]
	Streambank Condition	>80% of any stream reach has ≥90% stability[5]	50 - 80% of any stream reach has ≥90% stability[5]	<50% of any stream reach has ≥90% stability[5]
	Floodplain Connectivity	off-channel areas are frequently hydrologically linked to main channel; overbank flows occur and maintain wetland functions, riparian vegetation and succession	reduced linkage of wetland, floodplains and riparian areas to main channel; overbank flows are reduced relative to historic frequency, as evidenced by moderate degradation of wetland function, riparian vegetation/succession	severe reduction in hydrologic connectivity between off-channel, wetland, floodplain and riparian areas; wetland extent drastically reduced and riparian vegetation/succession altered significantly
Flow/Hydrology:	***Change in Peak/Base Flows***	watershed hydrograph indicates peak flow, base flow and flow timing characteristics comparable to an undisturbed watershed of similar size, geology and geography	some evidence of altered peak flow, baseflow and/or flow timing relative to an undisturbed watershed of similar size, geology and geography	pronounced changes in peak flow, baseflow and/or flow timing relative to an undisturbed watershed of similar size, geology and geography
	Increase in Drainage Network	zero or minimum increases in active channel length correlated with human caused disturbance	low to moderate increase in active channel length correlated with human caused disturbance	greater than moderate increase in active channel length correlated with human caused disturbance
Watershed Conditions:	***Road Density & Location***	<1mi/mi [13]; no valley bottom roads	1 - 2.4 mi/mi [13]; some valley bottom roads	>2.4 mi/mi [13]; many valley bottom roads

Disturbance History	<15% ECA of entire watershed with no concentration of disturbance in unstable or potentially unstable areas, and/or refugia, and/or riparian area; and for NWFP area there is an additional criteria of □15% LSOG in watersheds[14]	<15% ECA of entire watershed but disturbance concentrated in unstable or potentially unstable areas, and/or refugia, and/or riparian area; and for NWFP area there is an additional criteria of □15% LSOG in watersheds[14]	>15% ECA of entire watershed and disturbance concentrated in unstable or potentially unstable areas, and/or refugia, and/or riparian area; does not meet NWFP standard for LSOG
Riparian Conservation Areas (RHCA - PACFISH and INFISH) (Riparian Reserves - Northwest Forest Plan)	the riparian conservation areas provide adequate shade, large woody debris recruitment, and habitat protection and connectivity in subwatersheds, and buffers or includes known refugia for sensitive aquatic species (>80% intact), and adequately buffer impacts on rangelands: percent similarity of riparian vegetation to the potential natural community/ composition >50%[15]	moderate loss of connectivity or function (shade, LWD recruitment, etc.) of riparian conservation areas, or incomplete protection of habitats and refugia for sensitive aquatic species (□70-80% intact), and adequately buffer impacts on rangelands : percent similarity of riparian vegetation to the potential natural community/composition 25-50% or better[15]	riparian conservation areas are fragmented, poorly connected, or provides inadequate protection of habitats for sensitive aquatic species (<70% intact, refugia does not occur), and adequately buffer impacts on rangelands : percent similarity of riparian vegetation to the potential natural community/composition <25%[15]
Disturbance Regime	Environmental disturbance is short lived; predictable hydrograph, high quality habitat and watershed complexity providing refuge and rearing space for all life stages or multiple life-history forms. [1] Natural processes are stable.	Scour events, debris torrents, or catastrophic fire are localized events that occur in several minor parts of the watershed. Resiliency of habitat to recover from environmental disturbances is moderate.	Frequent flood or drought producing highly variable and unpredictable flows, scour events, debris torrents, or high probability of catastrophic fire exists throughout a major part of the watershed. The channel is simplified, providing little hydraulic complexity in the form of pools or side channels. [1] Natural processes are unstable.
SPECIES AND HABITAT:			
Integration of Species and Habitat Conditions	Habitat quality and connectivity among subpopulations is high. The migratory form is present. Disturbance has not altered channel equilibrium. Fine sediments and other habitat characteristics influencing survival or growth are consistent with pristine habitat. The subpopulation has the	Fine sediments, stream temperatures, or the availability of suitable habitats have been altered and will not recover to predisturbance conditions within one generation (5 years). Survival or growth rates have been reduced from those in the best habitats. The	Cumulative disruption of habitat has resulted in a clear declining trend in the subpopulation size. Under current management, habitat conditions will not improve within two generations (5 to 10 years). Little or no connectivity remains among subpopulations. The

	resilience to recover from short-term disturbance within one to two generations (5 to 10 years). The subpopulation is fluctuating around an equilibrium or is growing.[1]	subpopulation is reduced in size, but the reduction does not represent a long-term trend. The subpopulation is stable or fluctuating in a downward trend. Connectivity among subpopulations occurs but habitats are more fragmented.[1]	subpopulation survival and recruitment responds sharply to normal environmental events. [1]

[1] Rieman, B.E. and J.D. McIntyre. 1993. Demographic and habitat requirements for conservation of bull trout. U.S.D.A. Forest Service, Intermountain Research Station, Boise, ID.

[2] Rieman, B.E. and D.L. Meyers. 1997. Use of redd counts to detect trends in bull trout (*Salvelinus confluentus)* populations. Conservation Biology 11(4): 1015-1018.

[3] Buchanan, D.V. and S.V. Gregory. 1997. Development of water temperature standards to protect and restore habitat for bull trout and other cold water species in Oregon. *In* W.C. Mackay, M.K. Brewin, and M. Monita, eds. Friends of the Bull Trout Conference Proceedings. P8.

[4] Washington Timber/Fish Wildlife Cooperative Monitoring Evaluation and Research Committee, 1993. Watershed Analysis Manual (Version 2.0). Washington Department of Natural Resources.

[5] Overton, C.K., J.D. McIntyre, R. Armstrong, S.L. Whitewell, and K.A. Duncan. 1995. User□s guide to fish habitat: descriptions that represent natural conditions in the Salmon River Basin, Idaho. U.S. Department of Agriculture, Forest Service, Intermountain Research Station, Gen Tech. Rep. INT-GTR-322.

[6] Overton, C.K., S.P. Wollrab, B.C. Roberts, and M.A. Radko. 1997. R1/R4 (Northern/Intermountain Regions) Fish and Fish Habitat Standard Inventory Procedures Handbook. U.S. Department of Agriculture, Forest Service, Intermountain Research Station, Gen Tech. Rep. INT-GTR-346.

[7] Biological Opinion on Land and Resource Management Plans for the: Boise, Challis, Nez Perce, Payette, Salmon, Sawtooth, Umatilla, and Wallowa-Whitman National Forests. March 1, 1995.

[8] A Federal Agency Guide for Pilot Watershed Analysis (Version 1.2), 1994.

[9] Biological Opinion on Implementation of Interim Strategies for Managing Anadromous Fish-producing Watersheds in Eastern Oregon and Washington, Idaho, and Portions of California (PACFISH). National Marine Fisheries Service, Northwest Region, January 23, 1995.

[10] Shepard, B.B., K.L. Pratt, and P.J. Graham. 1984. Life histories of westslope cutthroat and bull trout in the Upper Flathead River Basin, MT. Environmental Protection Agency Rep. Contract No. R008224-01-5.

[11] Interior Columbia Basin Ecosystem Management Project Draft Environmental Impact Statement and Appendices.

[12] Frissell, C.A., Liss, W.J., and David Bayles, 1993. An Integrated Biophysical Strategy for Ecological Restoration of Large Watersheds. Proceedings from the Symposium on Changing Roles in Water Resources Management and Policy, June 27-30, 1993 (American Water Resources Association), p. 449-456.

[13] Lee, D.C., J.R. Sedell, B.E. Rieman, R.F. Thurow, J.E. Williams and others. 1997. Chapter 4: Broadscale Assessment of Aquatic Species and Habitats. *In* T.M. Quigley and S. J. Arbelbide eds □An Assessment of Ecosystem Components in the Interior Columbia Basin and Portions of the Klamath and Great Basins Volume III. U.S. Department of Agriculture, Forest Service, and U.S. Department of Interior, Bureau of Land Management, Gen Tech Rep PNW-GTR-405.

[14] Northwest Forest Plan, 1994. Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl. USDA Forest Service and USDI Bureau of Land Management.

[16] Winward, A.H., 1989 Ecological Status of Vegetation as a base for Multiple Product Management. Abstracts 42nd annual meeting, Society for Range Management, Billings MT, Denver CO: Society For Range Management: p277.

Appendix Table A-2. Descriptive relationships between Framework indicators and PCEs of bull trout critical habitat.

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

The analysis of *floodplain connectivity* considers the hydrologic linkage of off-channel areas with the main channel and overbank-flow maintenance of wetland function and riparian vegetation and succession. Floodplain and riparian areas provide hydrologic connectivity for springs, seeps, groundwater upwelling and wetlands and contribute to the maintenance of the water table. The *sediment* and *substrate embeddedness* indicators describe the level of fine sediment in the gravel which affects hyporheic flow. Fine sediment fills interstitial spaces making the movement of water through the substrate less efficient. The *chemical contamination/nutrients* and *temperature* indicators evaluate the water quality of groundwater. The *off-channel habitat* indicator suggests how much off-channel habitat is available, and generally off-channels are connected to adjacent channels via subsurface water. The *change in peak/base flows* indicator considers whether or not peak flow, base flow, and flow timing are comparable to an undisturbed watershed of similar size, geology, and geography. Peak flows, base flows, and flow timing are directly related to subsurface water connectivity and the degree to which soil compaction has decreased infiltration and increased surface runoff. The *drainage network increase* and *road density and location* indicators assess the influence of the road and trail networks on subsurface water connectivity. If there is an increase in drainage network and roads are located in riparian areas, it is likely that subsurface water is being intercepted before it reaches a stream. If groundwater is being intercepted then it is likely that water quality is being degraded through increased temperatures, fine sediment, and possibly chemical contamination. *Streambank condition* addresses groundwater influence through an assessment of stability. The *disturbance history* indicator evaluates disturbance across the watershed and provides a picture of how management may be affecting hydrology. The *riparian conservation areas* indicator determines whether riparian areas are intact and providing connectivity. If riparian areas are intact it is much more likely that springs, seeps, and groundwater sources are able to positively affect water quality and quantity.

PCE 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.

The *physical barriers* indicator provides the most direct assessment of this PCE. Analysis of this indicator includes consideration of whether man-made barriers within the watershed allow upstream and downstream passage of all life stages at all flows. However, some indicators further evaluate physical impediments and others evaluate the biological or water quality impediments that may be present. The *temperature, sediment, substrate embeddedness,* and *chemical contamination/nutrients* indicators assess whether other barriers may be created, at least seasonally, by conditions such as high temperatures, high concentrations of sediment, or contaminants. The *average wetted width/maximum depth ratio* indicator can help identify situations in which water depth for adult passage may be a problem. A very high average wetted width/maximum depth value may indicate a situation where low flows, when adults migrate, are so spread out that water depth is insufficient to pass adults. The *change in peak/base flows*

indicator can help determine if change in base flows have been sufficient to prevent adult passage during the spawning migration. The *persistence and genetic integrity* indicator addresses biological impediments by evaluating negative interactions (e.g., predation, hybridization, and competition) with other species.

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

None of the indicators directly address this PCE, but a number of them address it indirectly. The *sediment* and *substrate embeddedness* indicators document the extent to which substrate interstitial spaces are filled with fine sediment. Interstitial spaces provide important habitat for aquatic macroinvertebrates, sculpin, and other substrate-oriented prey which are important food sources for bull trout. The *chemical contamination/nutrients* indicator evaluates the level to which a stream is contaminated by chemicals or has a high level of nutrients. Chemicals and nutrients greatly affect the type and diversity of aquatic invertebrate communities present in a water body. The *large woody debris* and *pool frequency and quality* indicators assess habitat complexity. High stream habitat complexity is associated with diverse and abundant macroinvertebrate and fish prey. The *off-channel habitat* and *floodplain connectivity* indicators document the presence of off-channels which are generally more productive than main channels. Off channel areas are important sources of forage, particularly for juveniles. The *streambank condition* and *riparian conservation areas* indicators both shed light on the very basis of the food base of a stream. Vegetation along streambanks and in riparian areas provide important habitat for terrestrial macroinvertebrates that can fall into the water as well as sources of nutrient inputs that support aquatic invertebrate production.

PCE 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.

Several indicators address this PCE directly. The *sediment* and *substrate embeddedness* indicators provide insight into how complex substrates are within a stream by documenting percent fines and embeddedness. As percent fines and embeddedness increase, substrate complexity decreases. The *large woody debris* indicator provides an excellent picture of habitat complexity. The indicator rates the stream based on the amount of in-channel large woody debris. Habitat complexity increases as large wood increases. The *pool frequency and quality* and *large pools* indicators address habitat complexity by rating the stream based on the frequency of pools and their quality. Habitat complexity increases as the number of pools and their quality increase. The *off-channel habitat* indicator directly addresses complexity associated with side channels. The indicator is rated based on the amount of off-channel habitat, cover associated with off-channels, and flow energy levels. *Average wetted width/maximum depth ratio* is an indicator of channel shape and pool quality. Low ratios suggest deeper, higher quality pools. The *streambank condition* and *riparian conservation areas* indicators both shed light on the complexity of river and stream shorelines. Vegetation along streambanks and in riparian areas provides important habitat complexity and channel roughness. The *streambank condition* indicator also provides information about the capacity of an area to produce undercut banks,

which can be a very important habitat feature for bull trout. The *floodplain connectivity* indicator addresses complexity added by side channels and the ability of floodwaters to spread across the floodplain to dissipate energy and provide access to high-flow refugia for fish. The *road density and location* indicator addresses complexity by identifying if roads are located in valley bottoms. Roads located in valley bottoms reduce complexity by eliminating vegetation and replacing complex habitats with riprap or fill, and often confine the floodplain. The *disturbance regime* indicator documents the frequency, duration, and size of environmental disturbance within the watershed. If scour events, debris torrents, or catastrophic fires are frequent, long in duration, and large, then habitat complexity will be greatly reduced.

PCE 5 - Water temperatures ranging from 2 to 15 °C (36 to 59 °F), with adequate thermal refugia available for temperatures that exceed the upper end of this range. Specific temperatures within this range will depend on bull trout life-history stage and form; geography; elevation; diurnal and seasonal variation; shading, such as that provided by riparian habitat; streamflow; and local groundwater influence.

The *temperature* indicator addresses this PCE directly. The indicator rates streams according to how well temperatures meet bull trout requirements. Other matrix indicators address temperature indirectly. The *off-channel habitat* and *floodplain connectivity* indicators address how well stream channels are hydrologically connected to off-channel areas. Floodplains and off-channels are important to maintaining the water table and providing connectivity to the channel for springs, seeps, and groundwater sources which contribute cool water to channels. The *average wetted width/maximum depth ratio* indicator also corresponds to temperature. Low width to depth ratios indicate that channels are narrow and deep with little surface area to absorb heat. The *streambank condition* indicator documents bank stability. If the streambanks are stabilized by vegetation rather than substrate then it is likely that the vegetation provides shade which helps prevent increases in temperature. The *change in peak/base flows* indicator evaluates flows and flow timing characteristics relative to what would be expected in an undisturbed watershed. If base flow has been reduced, it is likely that water temperature during base flow has increased since the amount of water to heat has decreased. The *road density and location* and *drainage network increase* indicators documents where roads are located. If roads are located adjacent to a stream then shade is reduced and temperature is likely increased. Roads also intercept groundwater and can reduce this cooling influence, as well as discharge typically warmer stormwater. The *disturbance history* indicator describes how much of the watershed has been altered by vegetation management and therefore indicates how much shade has been removed. The *riparian conservation areas* indicator addresses stream shade which keeps stream temperatures cool. The presence of *large pools* may provide thermal refugia when temperatures are high.

PCE 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.

The *sediment* and *substrate embeddedness* indicators directly address this PCE. These indicators evaluate the percent fines within spawning areas and the percent embeddedness within rearing areas. The *streambank condition* and *riparian conservation areas* indicators indirectly address this PCE by documenting the presence or lack of potential fine sediment sources. If streambanks are stable and riparian conservation areas are intact then there is a low risk of introducing fine sediment from bank erosion. Also, the *floodplain connectivity* indicator indirectly addresses this PCE. If the stream channel is connected to its floodplain, then there is less risk of bank erosion during high flows because stream energy is reduced as water spreads across the floodplain. The *increase in drainage network* and *road density and location* indicators assess the effects of roads on the channel network and hydrology. If the drainage network has significantly increased as a result of human-caused disturbance or road density is high within a watershed and roads are located adjacent to streams, then it is likely that in-channel fine sediment levels will be elevated above natural levels. The *disturbance regime* indicator documents the nature of environmental disturbance within the watershed. If the disturbance regime includes frequent and unpredictable scour events, debris torrents, and catastrophic fire, then it is likely that fine sediment levels will be elevated above background levels. A consideration for all indicators directly or indirectly influencing this PCE is that it is desirable to achieve an appropriate balance of stable areas to provide undercut banks and eroding areas that are sources for recruiting new spawning gravels. Too little sediment in a stream can also be detrimental.

PCE 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.

The *change in peak/base flows* indicator addresses this PCE directly by documenting the condition of the watershed hydrograph relative to an undisturbed watershed of similar size, geology, and geography. There are several indicators that address this PCE indirectly. The *streambank condition* indicator documents bank stability. If the streambanks are stabilized by vegetation rather than substrate then it is likely that the streambank can store water during moist periods and releases that water during dry periods which contributes to water quality and quantity. The *floodplain connectivity* indicator is relevant to water storage within the floodplain which directly affects base flow. Floodplains are important to maintaining the water table and providing connectivity to the channel for springs, seeps, and groundwater sources which contribute to water quality and quantity. The *increase in drainage network* and *road density and location* indicators assess the influence of the road and trail networks on hydrology. If there is an increase in drainage network and roads are located in riparian areas, it is likely is being intercepted and quickly routed to a stream which can increase peak flow. The *disturbance history* indicator evaluates disturbance across the watershed and provides a picture of how management may be affecting hydrology; for example, it may suggest the degree to which soil compaction has decreased infiltration and increased surface runoff. The *riparian conservation areas* indicator determines whether riparian areas are intact, functioning, and providing connectivity. If riparian areas are intact it is much more likely that springs, seeps, and groundwater sources are able to positively affect water quality and quantity.

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

This PCE is closely related to PCE 7, with PCE 8 adding a water quality component (i.e., there is a high level of overlap in indicators that apply to both PCEs 7 and 8). The *temperature* and *chemical contamination/nutrients* indicators directly address water quality by comparing water temperatures to bull trout water temperature requirements, and documenting 303(d) designated stream reaches. Several other indicators indirectly address this PCE by evaluating the risk of fine sediment being introduced that would result in decreased water quality through increased turbidity. The *streambank condition* and *riparian conservation areas* indicators indirectly address this PCE by documenting the presence or lack of potential fine sediment sources. If streambanks are stable and riparian conservation areas are intact then there is a low risk of introducing fine sediment from bank erosion. Also, the *floodplain connectivity* indicator indirectly addresses this PCE. If the stream channel is connected to its floodplain, then there is less risk of bank erosion during high flows because stream energy is reduced as water spreads across the floodplain. *Average wetted width/maximum depth ratio* is an indication of water volume, which indirectly indicates water temperature, (i.e., low ratios indicate deeper water, which in turn indicates possible high-flow refugia). This indicator in conjunction with *change in peak/base flows* is an indicator of potential water quality and quantity deficiencies, particularly during low flow periods. The *increase in drainage network* and *road density and location* indicators assess the effects of roads on the channel network and hydrology. If the drainage network has significantly increased as a result of human-caused disturbance or road density is high within a watershed and roads are located adjacent to streams, then it is likely that suspended fine sediment levels will be elevated above natural levels. If roads are located adjacent to a stream then shade is reduced and temperature is likely increased. Roads also intercept groundwater and can reduce this cooling influence, as well as discharge typically warmer stormwater. The *disturbance regime* indicator documents the nature of environmental disturbance within the watershed. If the disturbance regime includes frequent and unpredictable scour events, debris torrents, and catastrophic fire, then it is likely that turbidity levels will be elevated above background levels.

PCE 9 - Sufficiently low levels of occurrence of nonnative predatory (e.g., lake trout, walleye, northern pike, smallmouth bass); interbreeding (e.g., brook trout); or competing (e.g., brown trout) species that, if present, are adequately temporally and spatially isolated from bull trout.

The only indicator that directly addresses this PCE is the *persistence and genetic integrity* indicator. This indicator addresses the likelihood of predation, hybridization, or displacement of bull trout by competitive species. The *temperature* indicator can provide indirect insights about whether conditions are conducive to supporting “warm water” species.

Appendix Table A-3. Baseline conditions[1] of Framework indicators for watersheds (last 5 numbers of 6th field HUC) in the Stonewall Project Action Area.

Diagnostic/Pathway *Indicator*	30304 Keep Cool Creek*	30305 Lincoln Creek	30303 Beaver Creek*	30301 Humbug Creek*	30415 Blackfoot-Little Moose *
Subpopulation Characteristics					
Subpopulation size	FAR	N/A	FAR	FAR	FAR
Growth & Survival	FAR	N/A	FAR	FAR	FAR
Life History Diversity & Isolation	FUR	N/A	FUR	FUR	FUR
Persistence and Genetic Integrity	FUR	N/A	FUR	FUR	FUR
Water Quality					
Temperature	FAR	FUR	FAR	FA	FAR
Sediment	FUR	FUR	FUR	FA	FUR
Chemical Contamination/Nutrients	FUR	FAR	FAR	FUR	FUR
Habitat Access					
Physical Barriers	FAR	FA	FAR	FA	FAR
Habitat Elements					
Substrate Embeddedness	FUR	FUR	FUR	FA	FUR
Large Woody Debris	FAR	FAR	FAR	FA	FAR
Pool Frequency & Quality	FAR	FAR	FAR	FA	FAR
Large Pools	FAR	FAR	FAR	FA	FAR
Off Channel Habitat	FAR	FAR	FUR	FA	FAR
Refugia	FAR	FUR	FUR	FUR	FUR
Channel Condition & Dynamics					
Wetted Width/Depth Ratio	FAR	FUR	FUR	FA	FAR
Streambank Condition	FAR	FUR	FUR	FA	FAR
Floodplain Connectivity	FUR	FUR	FUR	FA	FUR
Flow Hydrology					
Change in Peak/Base Flows	FAR	FUR	FAR	FA	FAR
Drainage Network Increase	FAR	FUR	FAR	FA	FAR
Watershed Conditions					
Road Density & Location	FUR	FUR	FUR	FA	FUR
Disturbance History	FAR	FAR	FAR	FA	FAR
Riparian Conservation Areas	FAR	FAR	FUR	FA	FAR
Disturbance Regime	FAR	FAR	FUR	FA	FAR
INTEGRATED PRIMARY HABITAT INDICATOR	FUR	FUR	FUR	FA	FUR
INTEGRATION OF SPECIES AND HABITAT CONDITIONS	FUR	N/A	FUR	FA	FUR

[1] FA = Functioning Appropriately, FAR = Functioning at Risk, FUR = Functioning at Unacceptable Risk, N/A indicates unoccupied watersheds that do not contain adequate aquatic habitat or barriers prevent passage by bull trout.
* Indicates subwatersheds considered occupied by bull trout.