UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
1201 NE Lloyd Boulevard, Suite 1100
PORTLAND, OREGON 97232

Refer to NMFS No.: WCRO-2019-00412

August 5, 2019

Thomas Montoya
Forest Supervisor
Wallowa-Whitman National Forest
1550 Dewey Avenue, Suite A
Baker City, Oregon 97814

Re: Endangered Species Act Section 7(a)(2) Biological Opinion for the Buck Creek Allotment in the Westside Range Analysis, Wallowa County, Oregon, HUC 1706010602

Dear Mr. Montoya: Tom

Thank you for your letter dated May 1, 2019 requesting initiation of consultation with NOAA's National Marine Fisheries Service (NMFS) pursuant to section 7 of the Endangered Species Act of 1973 (ESA) (16 U.S.C. 1531 et seq.) for the Buck Creek Allotment in the Westside Range analysis area. The enclosed document contains a biological opinion (Opinion) prepared by NMFS pursuant to section 7(a)(2) of the ESA on the effects of the Wallowa-Whitman National Forest (WWNF) authorizing livestock grazing on federal lands within the Buck Creek Allotment.

In this Opinion, NMFS concludes that the action, as proposed, is not likely to jeopardize the continued existence of Snake River Basin steelhead or result in the destruction or adverse modification of steelhead designated critical habitat.

As required by section 7 of the ESA, NMFS provides an incidental take statement (ITS) with the Opinion. The ITS describes reasonable and prudent measures (RPMs) NMFS considers necessary or appropriate to minimize the impact of incidental take associated with this action. The take statement sets forth nondiscretionary terms and conditions, including reporting requirements, that the WWNF and any person who performs the action must comply with to carry out the RPMs. Incidental take from actions that meet these terms and conditions will be exempt from the ESA take prohibition.

Please contact Jim Morrow, Southern Snake Branch Office, at (208) 378-5695 or jim.morrow@noaa.gov if you have any questions concerning this consultation, or if you require additional information.

Sincerely,

Michael P. Tehan
Assistant Regional Administrator
Interior Columbia Basin Office

Enclosure

cc: M. Lopez – NPT
A. Huber – CTUIR

bcc: SBAO – Read File; File Copy; J. Morrow; B. Lind
GCNW – S. Brick (electronic copy)

Morrow:Lind:BuckCreekAllotment:am:20190730:WCRO-2019-00412

<u>cc Addresses</u>:

Mike Lopez
Nez Perce Tribe
mikel@nezperce.org

Audie Huber
Confederated Tribes of the Umatilla Indian Reservation
audiehuber@ctuir.org

Endangered Species Act Section 7(a)(2) Biological Opinion

Buck Creek Allotment, Wallowa County, Oregon, HUCs 1706010602
NMFS Consultation Number: WCRO-2019-00412

Action Agency: USDA Forest Service, Wallowa-Whitman National Forest

Affected Species and NMFS' Determinations:

ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species or Critical Habitat?	Is Action Likely To Jeopardize the Species?	Is Action Likely To Destroy or Adversely Modify Critical Habitat?
Snake River Basin steelhead (*Oncorhynchus mykiss*)	Threatened	Yes	No	No

Consultation Conducted By: National Marine Fisheries Service, West Coast Region

Issued By:

Michael P. Tehan
Assistant Regional Administrator

Date: July 30, 2019

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ACRONYMS

ACRONYM	DEFINITION
Allotment	Buck Creek Allotment
BA	Biological Assessment
CTUIR	Confederated Tribes of the Umatilla Indian Reservation
DMA	Designated Monitoring Areas
DPS	Distinct Population Segment
DQA	Data Quality Act
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
FR	Federal Register
GRLM	Grande Ronde River Lower Mainstem
ICBTRT	Interior Columbia Basin Technical Recovery Team
ITS	Incidental Take Statement
MIM	Multiple Indicator Monitoring
MPG	Major Population Groups
MSL	mean sea level
NMFS	National Marine Fisheries Service

ACRONYM	DEFINITION
ODFW	Oregon Department of Fish and Wildlife
Opinion	Biological Opinion
PBF	Physical or Biological Features
PCE	Primary Constituent Element
RMO	Riparian Management Objective
RPM	Reasonable and Prudent Measures
Services	U.S. Fish and Wildlife Service and National Marine Fisheries Service
VSP	Viable Salmonid Population
WRAA	Westside Range Analysis Area
WWNF	Wallowa-Whitman National Forest

1. INTRODUCTION

This Introduction section provides information relevant to the other sections of this document and is incorporated by reference into Sections 2 and 3 below.

1.1 Background

National Marine Fisheries Service (NMFS) prepared the biological opinion (Opinion) and incidental take statement (ITS) portions of this document in accordance with section 7(b) of the Endangered Species Act (ESA) of 1973 (16 U.S.C 1531 et seq.), and implementing regulations at 50 CFR 402. We completed pre-dissemination review of this document using standards for utility, integrity, and objectivity in compliance with applicable guidelines issued under the Data Quality Act (DQA) (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001, Public Law 106-554). A complete record of this consultation is on file at the Snake Basin Office in Boise, Idaho.

1.2 Consultation History

The Wallowa-Whitman National Forest (WWNF) proposes to authorize livestock grazing on the Buck Creek Allotment (Allotment), in the Westside Range Analysis Area (WRAA), from 2019 to 2029. There are six allotments in the WWRA. There is currently no proposal to graze the Day Creek Allotment, and the WWNF determined that effects of grazing on the other four (i.e., Mud Creek, North Powwatka, South Powwatka, and Tope Creek) were not likely to adversely affect ESA-listed species or designated critical habitat. Consultation on those four allotments was concluded with a letter of concurrence issued by NMFS on May 16, 2019 (WRCO-2019-00509). Livestock grazing on the WWRA is ongoing and NMFS previously consulted with the WWNF on all of the allotments in the WRAA in 1998 (NMFS 1998) and again in 2010 (NMFS 2010).

The WWNF presented a draft biological assessment (BA) on grazing in the WRAA to the Level 1 Team in March, 2018. The Level 1 Team reviewed several drafts of the BA from March through November of 2018, but were unable to reach consensus on the need for mid-season trigger monitoring to protect aquatic resources. This issue was elevated to the Level 2 Team on November 14, 2018, and the Level 2 team reached consensus on April 17, 2019 (Appendix A) that mid-season monitoring would be required. The WWNF then incorporated the Level 2 direction into the proposed action and submitted a final BA to NMFS on May 2, 2019. The Level 1 Team members agreed that the proposed grazing of the Buck Creek Allotment may affect, and is likely to adversely affect, Snake River Basin steelhead (steelhead) and steelhead designated critical habitat. Level 1 Team members also agreed that, upon resolution of questions on mid-season trigger monitoring, proposed grazing of the other four allotments could be addressed through informal consultation.

Between May 1, 2019 and June 19, 2019, the WWNF provided additional information to NMFS through e-mails, via phone conversations, and through review of language describing the proposed action. This additional information ensured that descriptions of the proposed action, baseline conditions, and effects of the proposed action were accurate. NMFS drafted an Opinion and shared sections of this draft (Proposed Action; Terms and Conditions) with the WWNF on July 3, 2019. Because this action has the potential to affect tribal trust resources, NMFS provided copies of the proposed action and terms and conditions from our draft Opinion to the Nez Perce Tribe and the Confederated Tribes of the Umatilla Indian Reservation (CTUIR) on July 3, 2019. Neither the Nez Perce Tribe nor the CTUIR provided comments.

1.3 Proposed Action

"Action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by federal agencies (50 CFR 402.02). The Wallowa Valley Ranger District of the WWNF proposes to authorize livestock grazing on the Allotment from 2019 until 2029 (a 10-year permit). The Allotment is approximately 22 miles due north of Enterprise, Oregon, and State Highway 3 (Lewiston Highway) runs along its eastern edge. The Allotment consists of eight[1] pastures, has a total area of 22,718 acres, and is entirely within the Mud Creek drainage (Figure 1). Mud Creek is a tributary of the lower Grand Ronde River, flowing in from the south at river mile 52.

From 2009 through 2013, the Allotment was managed to limit the amount of hot season grazing on the Buck Creek Riparian, McCubbin, Highway I, and Highway II pastures, which necessitated grazing those pastures during the steelhead spawning/emergence period. Although this increased the chance of redd trampling, it facilitated long-term improvement of riparian conditions. In 2014, the Allotment management was changed to avoid grazing of these four pastures during the spawning/emergence period. The proposed action will authorize grazing under the same management scheme that was used during 2009 through 2013.

[1]However, pastures are sometimes combined and sometimes split, for management purposes. For example, the single Kuhm Ridge Pasture is actually managed as two separate pastures with the Ridge effectively separating the north and south portions, and the Highway II and Buck Creek Riparian Pastures are combined and effectively managed as a single pasture.

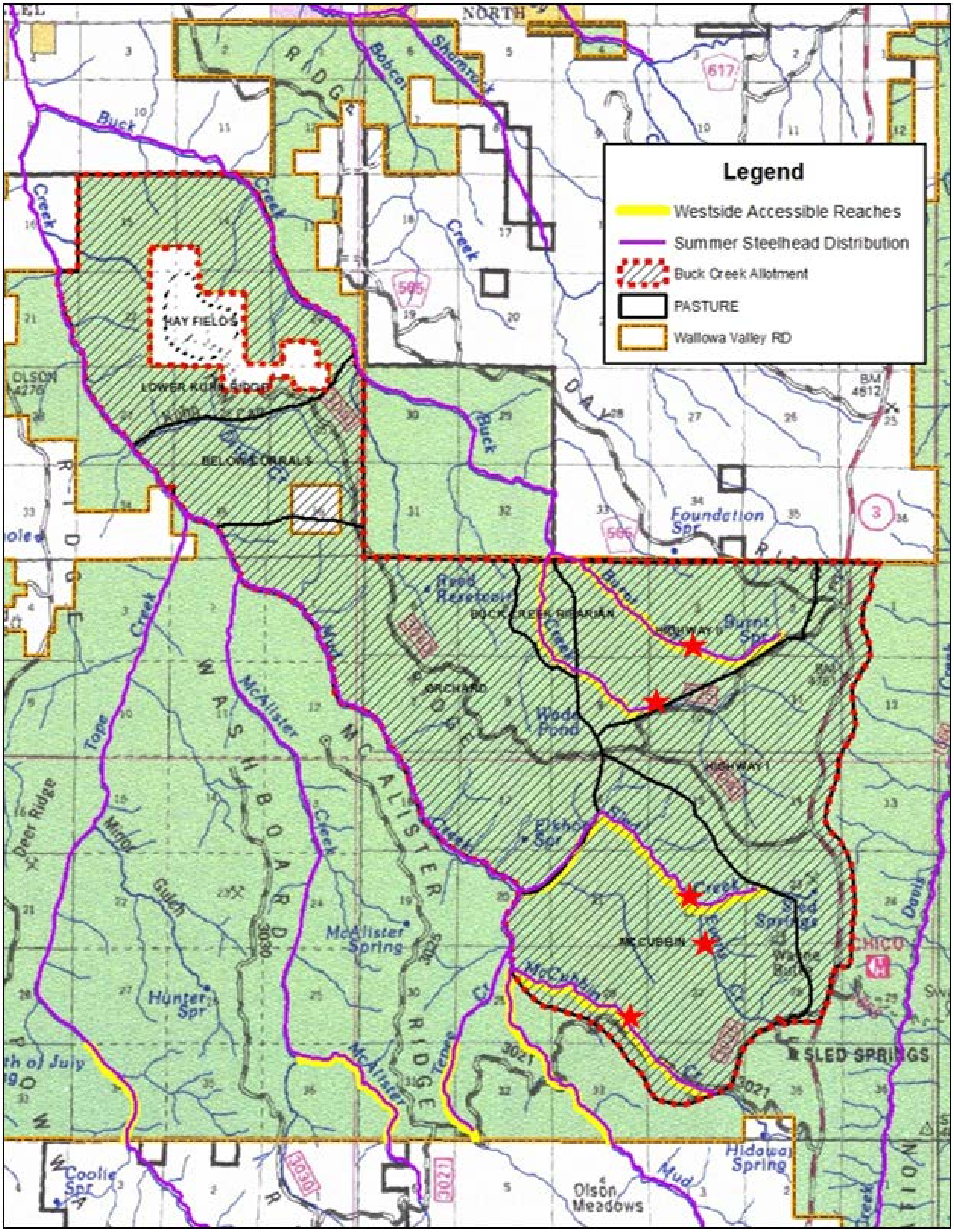

Figure 1. Map of the Buck Creek Allotment showing Allotment boundaries, pasture boundaries, steelhead habitat that is accessible to livestock, and designated monitoring areas (DMA) (red stars).[2]

[2] The steelhead distribution was determined by the WWNF and does not necessarily include all stream reaches designated as critical habitat by NMFS or determined to be spawning and rearing habitat by Oregon Department of Fish and Wildlife (ODFW).

1.3.1 Livestock Numbers, Periods of Use, and Conservation Measures

The proposed action will authorize 1,579 head-months of livestock grazing from June 1 through October 1. The proposed management is a deferred stocking strategy, wherein livestock will enter the Allotment when the range readiness indicators have been met. Livestock will be moved among the eight pastures on schedules designed to allow the use of the available forage while not exceeding the maximum utilization standards (Table 1). Active riding and herding will be used to keep livestock distributed. The maximum utilization standards for grass and grass-like forage are 45 percent in moist meadows and riparian floodplains, 55 percent in open grasslands and dry meadows, and 45 percent in forested stands. These standards roughly translate to 3- to 4-inch stubble height in upland areas. The maximum utilization standard for shrub based forage is 40 percent in both riparian floodplains and forested stands. In addition to the utilization standards, pastures with steelhead habitat that is assessable to livestock also have standards for streambanks and riparian vegetation that must be met (Table 2). The measures to minimize adverse effects on riparian and aquatic resources are:

- Ensure that terms and conditions of the grazing permit are met.

- Meet objectives for in-season and end-of-season grazing indicators for streambanks and riparian vegetation. Monitor long-term indicators to determine if restoration and maintenance of streambank integrity and late-seral riparian vegetation is occurring. Adjust grazing, and in-season and annual grazing indicators as needed to accomplish restoration and maintenance of streambank integrity and late-seral riparian vegetation.

- Low stress livestock handling techniques will be used to limit the length of time livestock spend in riparian areas. Permittees will regularly ride areas containing spawning and rearing habitat[3] prior to July 1 and move cattle that are congregating in riparian areas to areas away from streams. Individual cows that are repeatedly found congregating in riparian areas will be removed from the pasture and placed in the Highway I Pasture.

- A professional fish biologist will conduct spawning surveys in the McCubbin, Buck Creek Riparian, and Highway II Pastures when those pastures are grazed prior to July 1:

    - A redd survey will occur in mid to late-May to count and flag redds in the affected stream reaches.

    - Where feasible, vulnerable redds will be protected with temporary fencing or other methods.

    - Repeat redd surveys will occur after June 1 to determine if disturbance of redds by livestock occurs:

[3] For the purposes of determining areas that will be regularly ridden by permittees, and for determining frequency and timing of some of the required end-of-season monitoring, the WWNF determines if steelhead designated critical habitat is also steelhead spawning habitat. The current WWNF classification of steelhead spawning habitat does not necessarily include all steelhead designated critical habitat nor does it include all stream reaches classified as steelhead spawning and rearing habitat by ODFW.

- NMFS will be contacted when disturbed redds are found.
- Livestock will be removed from the pasture once one redd has been disturbed. The permittee will be given 2 days to remove livestock.

- Construct exclosures, where feasible, around stream reaches that consistently contain steelhead redds.

- A pasture fence located along lower Sled Creek that separates the Orchard and McCubbin Pastures, will be relocated from the stream bottom to mid-slope on the Orchard Pasture side. Moving this fence will eliminate access to Sled Creek by livestock in the Orchard Pasture. Due to terrain, this reach of Sled Creek is less accessible from the McCubbin Pasture than the Orchard Pasture, so moving the fence should reduce overall livestock use of riparian habitat along lower Sled Creek.

Table 1. Grazing schedule and for the nine pastures in the Buck Creek Allotment and the maximum number grazed during each use period.

<table>
<tr><th colspan="2" rowspan="2">Pasture</th><th colspan="6">Grazing Schedule</th></tr>
<tr><th colspan="2">Years 1, 4, 7, and 10</th><th colspan="2">Years 2, 5, and 8</th><th>Years 3 and 9</th><th>Year 6</th></tr>
<tr><td rowspan="2">Kuhn Ridge</td><td>North</td><td colspan="2">Jun 1-15</td><td colspan="2">Jun 1-15</td><td>Jun 1-15</td><td>Jun 1-15</td></tr>
<tr><td>South</td><td colspan="2">Jul 15-31</td><td colspan="2">Jun 1-15</td><td>Jun 1-15</td><td>Jun 1-15</td></tr>
<tr><td colspan="2">Hayfield</td><td colspan="2">Aug 1 – Oct 31</td><td colspan="2">Jul 1-31</td><td>Jul 1-31</td><td>Jul 1-31</td></tr>
<tr><td colspan="2">Below Corral</td><td>Jun 1-30</td><td rowspan="2">Oct 1-31</td><td>Jun 1-30</td><td rowspan="2">Oct 1-31</td><td>Oct 1-31</td><td>Oct 1-31</td></tr>
<tr><td colspan="2">Orchard</td><td>Jul 1-21</td><td>Jul 1-31</td><td>Sep 1-30</td><td>Sep 1-30</td></tr>
<tr><td colspan="2">Highway I</td><td colspan="2">Jul 21 – Aug 30</td><td colspan="2">Jul 31-Sep 10</td><td>Aug 1-31</td><td>Aug 1-30</td></tr>
<tr><td colspan="2">McCubbin</td><td colspan="2">Sep 1-30</td><td colspan="2">Rest</td><td>Jun 1-Jul 15</td><td>Jul 15-31</td></tr>
<tr><td colspan="2">Highway II</td><td colspan="2" rowspan="2">Rest</td><td colspan="2" rowspan="2">Sep 10-30</td><td rowspan="2">Jul 1-15</td><td rowspan="2">Jun 1-Jul 15</td></tr>
<tr><td colspan="2">Buck Creek Riparian</td></tr>
<tr><th colspan="2" rowspan="2">Pasture</th><th colspan="6">Number Grazed</th></tr>
<tr><th colspan="2">Years 1, 4, 7, and 10</th><th colspan="2">Years 2, 5, and 8</th><th>Years 3 and 9</th><th>Year 6</th></tr>
<tr><td rowspan="2">Kuhn Ridge</td><td>North</td><td colspan="2">50</td><td colspan="2">50</td><td>50</td><td>50</td></tr>
<tr><td>South</td><td colspan="2">50</td><td colspan="2">50</td><td>50</td><td>50</td></tr>
<tr><td colspan="2">Hayfield</td><td colspan="2">50</td><td colspan="2">100</td><td>100</td><td>100</td></tr>
<tr><td colspan="2">Below Corral</td><td>260</td><td rowspan="2">260</td><td>210</td><td rowspan="2">310</td><td>310</td><td>310</td></tr>
<tr><td colspan="2">Orchard</td><td>260</td><td>210</td><td>310</td><td>310</td></tr>
<tr><td colspan="2">Highway I</td><td colspan="2">260</td><td colspan="2">310</td><td>310</td><td>310</td></tr>
<tr><td colspan="2">McCubbin</td><td colspan="2">260</td><td colspan="2">Rest</td><td>210</td><td>210</td></tr>
<tr><td colspan="2">Highway II</td><td colspan="2" rowspan="2">Rest</td><td colspan="2" rowspan="2">310</td><td rowspan="2">210</td><td rowspan="2">210</td></tr>
<tr><td colspan="2">Buck Creek Riparian</td></tr>
</table>

1.3.2 Monitoring Program

The WWNF proposes to use a combination of stubble height, streambank alteration, and shrub browse to monitor the impacts of livestock on riparian areas. These measures are collectively referred to as riparian (or greenline) utilization standards, or “annual use indicators” when referring to end-of-season monitoring. Stubble height is the height of grass and grass-like species at the edge of a stream. Streambank alteration is the amount of trampling of the bank by current year livestock. The WWNF will measure streambank alteration using the Multiple Indicator Monitoring (MIM) method (Burton et al. 2011). Shrub utilization is the percent of annual leader production removed from riparian shrubs. To be in compliance with the requirements of their permits, permittees must meet the end-of-season riparian utilization standards in Table 2 (if the permittee does not meet the standards at the end of the grazing season, the WWNF will issue the permittee a non-compliance notification that will require adaptive management so as to meet the standards the following year. Adaptive management protocols are described in Section 1.3.3).

Table 2. Riparian objectives for implementation indicators, Buck Creek Allotment.

Pasture	Stream	Indicators	End of Season Objective
Buck Creek Riparian	Buck Creek	Greenline Stubble Height	≥6 inches
		Streambank Alteration	≤20%
		Riparian Shrub Utilization	≤35%
Highway I	Buck Creek headwaters	Greenline Stubble Height	≥6 inches
		Streambank Alteration	≤20%
		Riparian Shrub Utilization	≤35%
Highway II	Burnt Creek, Buck Creek	Greenline Stubble Height	≥6 inches
		Streambank Alteration	≤20%
		Riparian Shrub Utilization	≤35%
McCubbin	Sled Creek, Evans Creek, McCubbin Creek	Greenline Stubble Height	≥6 inches
		Streambank Alteration	≤20%
		Riparian Shrub Utilization	≤35%

1.3.2.1 Implementation Monitoring

Seven stream reaches in the Allotment have end-of-season objectives and four pastures, Buck Creek Riparian, Highway I, Highway II, and McCubbin contain one or more of those reaches (Table 2). Implementation monitoring will occur annually in all reaches with end-of-season objectives that are in pastures that are grazed during that year. There will be no implementation monitoring in the Kuhn Ridge, Hayfield, Below Corral, and Orchard Pastures because those pastures do not contain stream reaches with end-of-season objectives. End-of-season objectives for stream reaches in the Buck Creek Allotment are in Table 2.

In order to meet and not exceed objectives for end-of-season indicators in pastures with ESA-listed fish or designated critical habitat, permittees will conduct trigger monitoring midway during the grazing season in each pasture, and notify their range management specialist when they think livestock should be moved to the next pasture or off the WWNF. Trigger monitoring can vary from numerical measurements of stubble height, streambank alteration and/or riparian shrub utilization to more qualitative indicators that permittees have developed to inform them of when to begin moving livestock from a pasture in order to successfully meet, without exceeding end-of-season objectives. It is acceptable for permittee ocular monitoring to be a stubble height estimate for all grass and grass-like species along the greenline, not specific to hydric species. Where there are non-compliances, the following year, the WWNF will conduct the mid-season trigger monitoring and collect data in lieu of permittee observations.

1.3.2.2 Effectiveness Monitoring

Effectiveness monitoring will occur at DMAs every 3 to 5 years. There are five DMAs in the Buck Creek Allotment. These are located on Burnt, Buck, Sled, Evans, and McCubbin Creeks. The Burnt Creek and Buck Creek DMAs are in the Highway II Pasture and the Sled Creek, Evans Creek, and McCubbin Creek DMAs are in the McCubbin Pasture. If objectives for effectiveness indicators are not met, the WWNF Adaptive Management procedures (Section 1.3.3) will be implemented.

In addition to the effectiveness monitoring that will occur every 3 to 5 years, when the McCubbin, Highway II, or Buck Creek Riparian Pastures are grazed prior to July 1, the following monitoring will occur:

1. Within 2 weeks of livestock entry, complete ocular monitoring of streambanks for streambank alterations. If alterations are present and livestock are remaining in the pasture, complete MIM streambank alteration monitoring to determine if triggers have been reached.

2. If triggers have been reached, implement adaptive management (including but not limited to removal of livestock from the pasture or increased riding pressure from permittees) to meet management objectives, and avoid take.

3. Complete post grazing period streambank alteration monitoring within 1-week (if possible) of livestock removal from the pasture using MIM protocol.

<u>1.3.3 Adaptive Management</u>

The WWNF will use the following adaptive management steps to adjust grazing management for specific pastures, both over the long term (3–5 years) and annually, if needed to minimize the impact of livestock on streams. The annual adaptive management strategy describes how the WWNF will adjust grazing management annually, if needed, to ensure that annual use indicators are met. The long-term strategy describes how the WWNF will use effectiveness monitoring results to adjust grazing management to meet aquatic and riparian desired conditions.

1.3.3.1 Annual Adaptive Management Strategy

a. Monitor annual use indicators as required by the BA and Opinion.

b. Were the annual use indicators met?

    - Yes: Continue current management and monitoring (short- and long-term) to continue to determine if desired condition is being achieved.

    - No: Determine why the end-of-season use indicator was not met. Was the failure due to causes outside the permittee's control (e.g., a grazing design problem, a changed condition outside the control of the permittee, or annual use indicator was not appropriate)? [An inappropriate annual use indicator is an indicator that is not the first attribute that might show excessive livestock impacts. In this situation, changing to a more appropriate indicator will help achieve or maintain desired conditions.]

- o Yes: Determine if there were effects on riparian or stream habitat. Develop a plan with the permittee, fisheries biologist, and rangeland management specialist for the next year's grazing to respond to the cause (e.g., bad design, inappropriate use indicator, etc.) and/or effects to the resource.

- o No: Determine if there were effects on riparian or stream habitat. Work with the permittee to determine why the indicator was not met and develop a plan (adaptive management) to be implemented the following year to correct grazing management in order to meet the indicator. Change grazing management as needed if long-term effects to riparian and aquatic conditions occurred.

c. Contact the Line Officer with a recommendation for change(s) for the next grazing season. The Line Officer will work with the biologist and rangeland management specialist to determine if effects on riparian and stream habitat are different than anticipated in this consultation.

d. The Line Officer will contact the U.S. Fish and Wildlife Service and National Marine Fisheries Service (i.e., the Services).

1.3.3.2 Long-Term Adaptive Management Strategy

a. Determine current aquatic and riparian conditions using MIM trend data and local knowledge of results described in the annual monitoring reports.

b. Compare current aquatic and riparian conditions to riparian management objective (RMO) values described in the current WWNF Plan. Review and analyze aquatic and riparian condition trends.

c. Are RMO values being met on the Allotment?

- Yes: Continue management as prescribed, allowing for annual changes as needed to ensure annual use indicators described in the BA and this Opinion are met.

- No: Are livestock the limiting factor (annual use indicators are not being met and/or are ineffective) and is the trend in habitat conditions downward or static?

    - o No: Provide information to the appropriate Line Officer who then contacts the Services. Continue monitoring.

    - o Yes: Provide information to the Line Officer who then works with the resource specialists to assess effects of grazing on aquatic and riparian conditions.

Develop changes to the grazing strategy to reduce livestock use and effects on riparian areas in the pasture.

- The Line Officer contacts the Services to inform the Services of changes to grazing management on the Allotment and to determine if reinitiation of consultation is required.

1.3.4 Interrelated and Interdependent Actions

"Interrelated actions" are those that are part of a larger action and depend on the larger action for their justification. "Interdependent actions" are those that have no independent utility apart from the action under consideration (50 CFR 402.02). Permittees for the Buck Creek Allotment also graze livestock on adjacent private land, where grazing may cause adverse effects to listed species. However, grazing on private land adjacent to WWNF pastures would continue to occur regardless of whether or not the permittees are able to the use the WWNF pastures. Therefore, adjacent private land grazing is not interrelated to or interdependent on the proposed action. NMFS does not know of any other potential interrelated or interdependent actions associated with the proposed action.

2. ENDANGERED SPECIES ACT: BIOLOGICAL OPINION AND INCIDENTAL TAKE STATEMENT

The ESA establishes a national program for conserving threatened and endangered species of fish, wildlife, plants, and the habitat upon which they depend. As required by section 7(a)(2) of the ESA, federal agencies must ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species, or adversely modify or destroy their designated critical habitat. Per the requirements of the ESA, federal action agencies consult with NMFS and section 7(b)(3) requires that, at the conclusion of consultation, NMFS provides an Opinion stating how the agency's actions would affect listed species and their critical habitat. If incidental take is reasonably certain to occur, section 7(b)(4) requires NMFS to provide an ITS that specifies the impact of any incidental taking and includes non-discretionary reasonable and prudent measures (RPMs) and terms and conditions to minimize such impacts.

2.1 Analytical Approach

This Opinion includes both a jeopardy analysis and an adverse modification analysis. The jeopardy analysis relies upon the regulatory definition of "to jeopardize the continued existence of" a listed species, which is "to engage in an action that 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" (50 CFR 402.02). Therefore, the jeopardy analysis considers both survival and recovery of the species.

This Opinion relies on the definition of "destruction or adverse modification," which "means 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 (PBFs) essential to the conservation of a species or that preclude or significantly delay development of such features" (81 FR 7214).

The designations of critical habitat for ESA-listed species use the term primary constituent element (PCE) or essential features. The new critical habitat regulations (81 FR 7414) replace this term with PBFs. The shift in terminology does not change the approach used in conducting a "destruction or adverse modification" analysis, which is the same regardless of whether the original designation identified PCEs, PBFs, or essential features. In this Opinion, we use the term PBF to mean PCE or essential feature, as appropriate for the specific critical habitat. We use the following approach to determine whether a proposed action is likely to jeopardize listed species or destroy or adversely modify critical habitat:

- Identify the rangewide status of the species and critical habitat likely to be adversely affected by the proposed action.

- Describe the environmental baseline in the action area.

- Analyze the effects of the proposed action on both species and their habitat using an "exposure-response-risk" approach.

- Describe any cumulative effects in the action area.

- Integrate and synthesize the above factors by: (1) Reviewing the status of the species and critical habitat; and (2) adding the effects of the action, the environmental baseline, and cumulative effects to assess the risk that the proposed action poses to species and critical habitat.

- Reach a conclusion about whether species are jeopardized or critical habitat is adversely modified.

- If necessary, suggest a reasonable and prudent alternative to the proposed action.

2.2 Rangewide Status of the Species and Critical Habitat

This Opinion examines the status of each species that would be adversely affected by the proposed action. The status is determined by the level of extinction risk that the listed species face, based on parameters considered in documents such as recovery plans, status reviews, and listing decisions. This informs the description of the species' likelihood of both survival and recovery. The species status section also helps to inform the description of the species' current "reproduction, numbers, or distribution" as described in 50 CFR 402.02. The Opinion also examines the condition of critical habitat throughout the designated area, evaluates the conservation value of the various watersheds that make up the designated area, and discusses the current function of the essential PBFs that help to form that conservation value.

The proposed action may affect, and is likely to adversely affect Snake River Basin steelhead and steelhead designated critical habitat. Table 3 identifies the listing status, status of critical habitat designations and protective regulations, and relevant Federal Register (FR) decision notices for the one ESA-listed species considered in this Opinion.

Table 3. Listing status, status of critical habitat designations and protective regulations, and relevant Federal Register decision notices for ESA-listed species considered in this Opinion.

	Listing Status	Critical Habitat	Protective Regulations
Steelhead (*Oncorhynchus mykiss*)			
Snake River Basin	T 1/05/06; 71 FR 834	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160

This section describes the present condition of the Snake River Basin steelhead distinct population segment (DPS). NMFS expresses the status of an evolutionarily significant unit (ESU) or DPS in terms of likelihood of persistence over 100 years (or risk of extinction over 100 years). NMFS uses McElhaney et al.'s (2000) description of a viable salmonid population (VSP) that defines "viable" as less than a 5 percent risk of extinction within 100 years and "highly viable" as less than a 1 percent risk of extinction within 100 years. A third category, "maintained," represents a less than 25 percent risk within 100 years (moderate risk of extinction). To be considered viable (with a negligible risk of extinction due to threats from demographic variation, local environmental variation, and genetic diversity changes over a 100-year time frame), an ESU or DPS should have multiple populations so that a single catastrophic event is less likely to cause the ESU/DPS to become extinct, and so that the ESU/DPS may function as a metapopulation as necessary to sustain population-level extinction and recolonization processes (ICBTRT 2007). The risk level of the ESU/DPS is built up from the aggregate risk levels of the individual populations and major population groups (MPGs) that make up the ESU/DPS. A summary of VSP population parameter risks and overall status for Snake River Basin steelhead populations is in Table 4.

Table 4. Summary of viable salmonid population parameter risks and overall current status for each population in the Snake River Basin steelhead DPS (NWFSC 2015). Risk ratings with "?" are based on limited or provisional data series.

MPG	Population	VSP Risk Parameter: Abundance/ Productivity	VSP Risk Parameter: Spatial Structure/ Diversity	Overall Viability Rating
Lower Snake River	Tucannon River	High?	Moderate	High Risk?
	Asotin Creek	Moderate?	Moderate	Maintained?
Grande Ronde River	Lower Grande Ronde	N/A	Moderate	Maintained?
	Joseph Creek	Very Low	Low	**Highly Viable**
	Wallowa River	N/A	Low	Maintained?
	Upper Grande Ronde	Low	Moderate	**Viable**
Imnaha River	Imnaha River	Moderate?	Moderate	Maintained?
Clearwater River (Idaho)	Lower Mainstem Clearwater River*	Moderate?	Low	Maintained?
	South Fork Clearwater River	High?	Moderate	High Risk?
	Lolo Creek	High?	Moderate	High Risk?
	Selway River	Moderate?	Low	Maintained?
	Lochsa River	Moderate?	Low	Maintained?
	North Fork Clearwater River			*Extirpated*
Salmon River (Idaho)	Little Salmon River	Moderate?	Moderate	Maintained?
	South Fork Salmon River	Moderate?	Low	Maintained?
	Secesh River	Moderate?	Low	Maintained?
	Chamberlain Creek	Moderate?	Low	Maintained?
	Lower Middle Fork Salmon R.	Moderate?	Low	Maintained?
	Upper Middle Fork Salmon R.	Moderate?	Low	Maintained?
	Panther Creek	Moderate?	High	High Risk?
	North Fork Salmon River	Moderate?	Moderate	Maintained?
	Lemhi River	Moderate?	Moderate	Maintained?
	Pahsimeroi River	Moderate?	Moderate	Maintained?
	East Fork Salmon River	Moderate?	Moderate	Maintained?
	Upper Mainstem Salmon R.	Moderate?	Moderate	Maintained?
Hells Canyon	Hells Canyon Tributaries			*Extirpated*

*Current abundance/productivity estimates for the Lower Clearwater Mainstem population exceed minimum thresholds for viability, but the population is assigned moderate risk for abundance/productivity due to the high uncertainty associated with the estimate.

Attributes associated with a VSP are the levels of abundance (number of adult spawners in natural production areas), productivity (adult progeny per parent), and the spatial structure and diversity necessary to: (1) Safeguard the genetic diversity of the listed ESU or DPS; (2) enhance its capacity to adapt to various environmental conditions; and (3) allow it to become self-sustaining in the natural environment. In 2007, the Interior Columbia Basin Technical Recovery Team (ICBTRT) further defined population-level viability criteria to address, in combination, all four of the key parameters: (1) Abundance; (2) productivity; (3) spatial structure; and (4) diversity (ICBTRT 2007). These viability attributes are influenced by survival, behavior, and experiences throughout the entire life cycle, characteristics that are influenced in turn by habitat and other environmental and anthropogenic conditions. The present risk faced by the ESU/DPS informs NMFS' determination of whether additional risk will appreciably reduce the likelihood that the ESU/DPS will survive or recover in the wild.

2.2.1 Snake River Basin Steelhead

The Snake River Basin steelhead was listed as a threatened ESU on August 18, 1997 (62 FR 43937), with a revised listing as a DPS on January 5, 2006 (71 FR 834). This DPS occupies the Snake River basin, which drains portions of southeastern Washington, northeastern Oregon, and north/central Idaho. Reasons for the decline of this species include substantial modification of the seaward migration corridor by hydroelectric power development on the mainstem Snake and Columbia Rivers, and widespread habitat degradation and reduced streamflows throughout the Snake River basin (Good et al. 2005). Another major concern for the species is the threat to genetic integrity from past and present hatchery practices, and the high proportion of hatchery fish in the aggregate run of Snake River Basin steelhead over Lower Granite Dam (Good et al. 2005; Ford 2011). On May 26, 2016, in the agency's most recent 5-year review for Pacific salmon and steelhead, NMFS concluded that the species should remain listed as threatened (81 FR 33468).

Life History. Adult Snake River Basin steelhead enter the Columbia River from late June to October to begin their migration inland. After holding over the winter in larger rivers in the Snake River basin, steelhead disperse into smaller tributaries to spawn from March through May. Earlier dispersal occurs at lower elevations and later dispersal occurs at higher elevations. Juveniles emerge from the gravels in 4 to 8 weeks, and move into shallow, low-velocity areas in side channels and along channel margins to escape high velocities and predators (Everest and Chapman 1972). Juvenile steelhead then progressively move toward deeper water as they grow in size (Bjornn and Rieser 1991). Juveniles typically reside in fresh water for 1 to 3 years, although this species displays a wide diversity of life histories. Smolts migrate downstream during spring runoff, which occurs from March to mid-June depending on elevation, and typically spend 1 to 2 years in the ocean.

Spatial Structure and Diversity. This species includes all naturally-spawning steelhead populations below natural and manmade impassable barriers in streams in the Snake River basin of southeast Washington, northeast Oregon, and Idaho, as well as the progeny of six artificial propagation programs (71FR834). The hatchery programs include Dworshak National Fish Hatchery, Lolo Creek, North Fork Clearwater River, East Fork Salmon River, Tucannon River, and the Little Sheep Creek/Imnaha River steelhead hatchery programs. The Snake River Basin steelhead listing does not include resident forms of *O. mykiss* (rainbow trout) co-occurring with steelhead.

The ICBTRT identified 24 extant populations within this DPS, organized into five MPGs: Lower Snake River, Grande Ronde River, Imnaha River, Clearwater River, and Salmon River (ICBTRT 2003). Current steelhead distribution extends throughout the DPS, such that spatial structure risk is generally low. Diversity risk for the DPS is low to moderate. Moderate diversity risks for some populations are caused by the high proportion of hatchery fish on natural spawning grounds. The proposed action occurs within the range of the Grande Ronde River Lower Mainstem (GRLM) population, which is in the Grande Ronde River MPG.

Spatial structure for the GRLM steelhead population is rated at low risk (NWFSC 2015). Spawning is distributed broadly throughout the population area. Major production areas include the Wenaha River drainage, and Mud, Courtney, and Grossman Creeks, although substantial production also occurs in a number of smaller streams. Diversity risk is rated at moderate due to findings of Copeland et al. (2015) indicating that substantial numbers of hatchery steelhead are spawning in the GRLM steelhead population area. The combined spatial structure/diversity risk for the population is moderate risk and the recovery goal is moderate risk (NMFS 2017).

Abundance and Productivity. Historical estimates of steelhead production for the entire Snake River basin are not available, but the basin is believed to have supported more than half the total steelhead production from the Columbia River basin (Mallet 1974, as cited in Good et al. 2005). Historical estimates of steelhead passing Lewiston Dam (removed in 1973) on the lower Clearwater River were 40,000 to 60,000 adults (Ecovista et al. 2003), and the Salmon River basin likely supported substantial production as well (Good et al. 2005). In contrast, at the time of listing in 1997, the 5-year mean abundance for natural-origin steelhead passing Lower Granite Dam, which includes all but one population in the DPS, was 11,462 adults (Ford 2011). Counts have increased since then, with an average annual counts of 27,271 wild steelhead passing Lower Granite Dam during the most recent 5-year period (2013–2017) (ODFW and WDFW 2018).

Despite these recent increases in abundance, the status of many of the individual populations remains uncertain, and four out of the five MPGs are not meeting viability objectives (NWFSC 2015). In order for the species to recover, more populations will need to reach viable status through increases in abundance and productivity. Additionally, a great deal of uncertainty remains regarding the relative proportion of hatchery fish in natural spawning areas near major hatchery release sites (NWFSC 2015). The degree of diversity risk posed by these hatchery fish for individual wild steelhead populations is therefore also uncertain.

Abundance estimates for adult GRLM steelhead returning to spawning streams are available for 2012 through 2016 and ranged from 918 in 2013 to 1,815 in 2014, with a geomean of 1,215 (Copeland et al. 2014; Copeland et al. 2015; Stark et al. 2016: Stark et al. 2017; Stark et al. 2018). Although data are not available to calculate a 10-year geomean population size, or a productivity estimate, the data that are available suggests that population abundance may be sufficient to achieve a viable rating. Therefore, the tentative ICBTRT classification of moderate risk for abundance/productivity, might be conservative.

Fish survey data for the action area are limited to historic steelhead redd surveys conducted by the ODFW (downloaded from StreamNet https://www.streamnet.org) and more recent surveys conducted by the WWNF. The ODFW conducted steelhead redd surveys throughout Buck Creek in 1993, throughout McCubbin Creek in 1970 and 1993, and in the lower 4.1 miles of Mud Creek in 1969, 1970, 1992, and 1993. No redds were counted in 1969 or 1970. In 1992, three redds were counted in Mud Creek. In 1993, three were counted in Buck Creek, two were counted in McCubbin Creek, and one was counted in Mud Creek (StreamNet). The WWNF conducted steelhead redd surveys in portions of the accessible stream reaches on the Allotment in 2009, 2010, 2012, and 2018. One redd was counted in Buck Creek in 2009 and no redds were found in the other surveys. The ODFW lists Buck, Burnt, Sled, Evans, McCubbin, and Mud Creeks as occupied steelhead spawning and rearing habitat (StreamNet). The limited fish survey data and the lack of known barriers[4] suggests that presence of spawning and/or rearing steelhead

[4] There is a possible natural barrier on lower Sled Creek that might preclude fish migration into Sled and Evans Creeks;

is possible in streams throughout the action area. Those data also suggest that densities of steelhead within the action area are likely low.

2.2.2 Status of Critical Habitat

In evaluating the condition of designated critical habitat, NMFS examines the condition and trends of PBFs which are essential to the conservation of the ESA-listed species because they support one or more life stages of the species. Proper function of these PBFs is necessary to support successful adult and juvenile migration, adult holding, spawning, incubation, rearing, and the growth and development of juvenile fish. Modification of PBFs may affect freshwater spawning, rearing, or migration in the action area. Generally speaking, sites required to support one or more life stages of the ESA-listed species (i.e., sites for spawning, rearing, migration, and foraging) contain PBFs essential to the conservation of the listed species (e.g., spawning gravels, water quality and quantity, side channels, or food). The PBFs for steelhead are described in Table 5.

Table 6 describes the geographical extent of critical habitat for steelhead. Critical habitat includes the stream channel and water column with the lateral extent defined by the ordinary high-water line, or the bankfull elevation where the ordinary high-water line is not defined.

Spawning and rearing habitat quality in tributary streams in the Snake River varies from excellent in wilderness and roadless areas to poor in areas subject to intensive human land uses (NMFS 2017). Critical habitat throughout much of the Snake River Basin has been degraded by intensive agriculture, alteration of stream morphology (i.e., channel modifications and diking), riparian vegetation disturbance, wetland draining and conversion, livestock grazing, dredging, road construction and maintenance, logging, mining, and urbanization. Reduced summer streamflows, impaired water quality, and reduction of habitat complexity are common problems for critical habitat in non-wilderness areas. Human land use practices throughout the basin have caused streams to become straighter, wider, and shallower, thereby reducing rearing habitat and increasing water temperature fluctuations.

however, in the absence of confirmation of the actual status of the barrier, the Allotment is managed under the assumption that steelhead can access habitat in Sled and Evans Creeks.

Table 5. Types of sites, essential physical or biological features, and the species life stage each physical or biological features supports.

Site	Essential PBF	ESA-listed Species Life Stage
Snake River Basin Steelhead[a]		
Freshwater spawning	Water quality, water quantity, and substrate	Spawning, incubation, and larval development
Freshwater rearing	Water quantity & floodplain connectivity to form and maintain physical habitat conditions	Juvenile growth and mobility
	Water quality and forage[b]	Juvenile development
	Natural cover[c]	Juvenile mobility and survival
Freshwater migration	Free of artificial obstructions, water quality and quantity, and natural cover[c]	Juvenile and adult mobility and survival

[a] Additional PBFs pertaining to estuarine, nearshore, and offshore marine areas have also been described for Snake River steelhead. These PBFs will not be affected by the proposed action and have therefore not been described in this Opinion.
[b] Forage includes aquatic invertebrate and fish species that support growth and maturation.
[c] Natural cover includes shade, large wood, log jams, beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks.
[d] Food applies to juvenile migration only.

In many stream reaches designated as critical habitat in the Snake River basin, streamflows are substantially reduced by water diversions (NMFS 2017). Withdrawal of water, particularly during low-flow periods that commonly overlap with agricultural withdrawals, often increases summer stream temperatures, blocks fish migration, strands fish, and alters sediment transport (Spence et al. 1996). Reduced tributary streamflow has been identified as a major limiting factor for Snake River Basin steelhead in particular (NMFS 2017).

Table 6. Geographical extent of designated critical habitat.

ESU/DPS	Designation	Geographical Extent of Critical Habitat
Snake River Basin steelhead	70 FR 52630; September 2, 2005	Specific stream reaches are designated throughout the Snake Basin per 70 FR 52630

Many stream reaches designated as critical habitat for steelhead are listed on the Clean Water Act 303(d) list for impaired water quality, such as elevated water temperature (ODEQ 2012; IDEQ 2011). Many areas that were historically suitable rearing and spawning habitat are now unsuitable due to high summer stream temperatures, including stream reaches in northeast Oregon. Removal of riparian vegetation, alteration of natural stream morphology, and withdrawal of water for agricultural or municipal use all contribute to elevated stream temperatures.

The construction and operation of water storage and hydropower projects in the Columbia River basin, including the run-of-river dams on the mainstem lower Snake and lower Columbia Rivers, have altered biological and physical attributes of the mainstem migration corridor. These alterations have affected juvenile migrants to a much larger extent than adult migrants. However, changing temperature patterns have created passage challenges for summer migrating adults in recent years, requiring new structural and operational solutions (i.e., cold water pumps and exit "showers" for ladders at Lower Granite and Lower Monumental dams). Actions taken since 1995 that have reduced negative effects of the hydrosystem on juvenile and adult migrants including:

- Minimizing winter drafts (for flood risk management and power generation) to increase flows during peak spring passage;
- Releasing water from storage to increase summer flows;
- Releasing water from Dworshak Dam to reduce peak summer temperatures in the lower Snake River;
- Constructing juvenile bypass systems to divert smolts, steelhead kelts, and adults that fall back over the projects away from turbine units;
- Providing spill at each of the mainstem dams for smolts, steelhead kelts, and adults that fall back over the projects;
- Constructing "surface passage" structures to improve passage for smolts, steelhead kelts, and adults falling back over the projects; and,
- Maintaining and improving adult fishway facilities to improve migration passage for adult salmon and steelhead.

Steelhead designated critical habitat within the GRLM steelhead population area includes the vast majority of second and higher order streams. Habitat quality ranges from very good (possibly excellent) in wilderness portions of the Wenaha River drainage, to relatively poor in portions of the mainstem Grande Ronde River and in some of the lower tributaries to the mainstem. Limiting factors include excessive fine sediment, lack of pool habitat, high summer water temperatures, low summer flow, and impaired riparian condition (NMFS 2017). The limiting factors are primarily due to roads, livestock grazing, water withdrawals, and legacy issues from past timber harvest and livestock grazing. Much of the habitat degradation in the mainstem Grande Ronde River is due to activities occurring upstream from the GRLM population area (NMFS 2017). Steelhead designated critical habitat in the action area includes Burnt, Buck, Sled, Evans, and McCubbin Creeks, from approximately 0.75 miles downslope from Highway 3, downstream through Buck and Mud Creeks to the downstream boundary of the Allotment. Habitat condition in these streams is described in the Baseline Conditions (Section 2.4).

2.2.3 Climate Change Implications for ESA-listed Species and their Critical Habitat

One factor affecting the rangewide status of Snake River Basin steelhead and aquatic habitat is climate change. The U. S. Global Change Research Program reports average warming of about 1.3°F from 1895 to 2011, and projects an increase in average annual temperature of 3.3°F to 9.7°F by 2070 to 2099 (CCSP 2014). Climate change has negative implications for ESA listed anadromous fishes and their habitats in the Pacific Northwest (CIG 2004; Scheuerell and Williams 2005; Zabel et al. 2006; ISAB 2007). According to the Independent Science Advisory Board, these effects will cause the following:

- Warmer air temperatures will result in diminished snowpack and a shift to more winter/spring rain and runoff, rather than snow that is stored until the spring/summer melt season;

- With a smaller snowpack, watersheds will see their runoff diminished earlier in the season, resulting in lower flows in the June through September period, while more precipitation falling as rain rather than snow will cause higher flows in winter, and possibly higher peak flows; and

- Water temperatures are expected to rise, especially during the summer months when lower flows co-occur with warmer air temperatures.

These changes will not be spatially homogeneous across the entire Pacific Northwest. Low-lying areas are likely to be more affected. Climate change may have long-term effects that include, but are not limited to, depletion of important cold-water habitat, variation in quality and quantity of tributary rearing habitat, alterations to migration patterns, accelerated embryo development, premature emergence of fry, and increased competition among species.

Climate change is predicted to cause a variety of impacts to Pacific salmon (including steelhead) and their ecosystems (Mote et al. 2003; Crozier et al. 2008a; Martins et al. 2012; Wainwright and Weitkamp 2013). The complex life cycles of anadromous fishes, including salmon, rely on productive freshwater, estuarine, and marine habitats for growth and survival, making them particularly vulnerable to environmental variation. Ultimately, the effects of climate change on salmon and steelhead across the Pacific Northwest will be determined by the specific nature, level, and rate of change and the synergy between interconnected terrestrial/freshwater, estuarine, nearshore, and ocean environments.

The primary effects of climate change on Pacific Northwest salmon and steelhead include:

- Direct effects of increased water temperatures on fish physiology;

- Temperature-induced changes to streamflow patterns;

- Alterations to freshwater, estuarine, and marine food webs; and

- Changes in estuarine and ocean productivity.

While all habitats used by Pacific salmon will be affected, the impacts and certainty of the change vary by habitat type. Some effects (e.g., increasing temperature) affect salmon at all life stages in all habitats, while others are habitat-specific, such as streamflow variation in freshwater, sea-level rise in estuaries, and upwelling in the ocean. How climate change will affect each stock or population of salmon also varies widely depending on the level or extent of change, the rate of change, and the unique life-history characteristics of different natural populations (Crozier et al. 2008b). For example, a few weeks' difference in migration timing can have large differences in the thermal regime experienced by migrating fish (Martins et al. 2011).

Temperature Effects

Like most fishes, salmon are poikilotherms (cold-blooded animals); therefore, increasing temperatures in all habitats can have pronounced effects on their physiology, growth, and development rates (see review by Whitney et al. 2016). Increases in water temperatures beyond their thermal optima will likely be detrimental through a variety of processes, including increased metabolic rates (and therefore food demand), decreased disease resistance, increased physiological stress, and reduced reproductive success. All of these processes are likely to reduce survival (Beechie et al. 2013; Wainwright and Weitkamp 2013; Whitney et al. 2016).

By contrast, increased temperatures at ranges well below thermal optima (i.e., when the water is cold) can increase growth and development rates. Examples of this include accelerated emergence timing during egg incubation stages, or increased growth rates during fry stages (Crozier et al. 2008a; Martins et al. 2011). Temperature is also an important behavioral cue for migration (Sykes et al. 2009), and elevated temperatures may result in earlier-than-normal migration timing. While there are situations or stocks where this acceleration in processes or behaviors is beneficial, there are also others where it is detrimental (Martins et al. 2012; Whitney et al. 2016).

Freshwater Effects

Climate change is predicted to increase the intensity of storms, reduce winter snow pack at low and middle elevations, and increase snowpack at high elevations in northern areas. Middle and lower-elevation streams will have larger fall/winter flood events and lower late-summer flows, while higher elevations may have higher minimum flows. How these changes will affect freshwater ecosystems largely depends on their specific characteristics and location, which vary at fine spatial scales (Crozier et al. 2008b; Martins et al. 2012). For example, within a relatively small geographic area (the Salmon River basin in Idaho), survival of some Chinook salmon populations was shown to be determined largely by temperature, while in others it was determined by flow (Crozier and Zabel 2006). Certain salmon populations inhabiting regions that are already near or exceeding thermal maxima will be most affected by further increases in temperature and, perhaps, the rate of the increases. The effects of altered flow are less clear and likely to be basin-specific (Crozier et al. 2008b; Beechie et al. 2013). However, flow is already becoming more variable in many rivers, and this increased variability is believed to negatively affect anadromous fish survival more than other environmental parameters (Ward et al. 2015). It is likely this increasingly variable flow is detrimental to multiple salmon and steelhead populations, and likely multiple other freshwater fish species in the Columbia River basin as well.

Stream ecosystems will likely change in response to climate change in ways that are difficult to predict (Lynch et al. 2016). Changes in stream temperature and flow regimes will likely lead to shifts in the distributions of native species and provide “invasion opportunities” for exotic species. This will result in novel species interactions, including predator-prey dynamics, where juvenile native species may be either predators or prey (Lynch et al. 2016; Rehage and Blanchard

2016). How juvenile native species will fare as part of "hybrid food webs," which are constructed from natives, native invaders, and exotic species, is difficult to predict (Naiman et al. 2012).

Estuarine Effects

In estuarine environments, the two big concerns associated with climate change are rates of sea level rise and water temperature warming (Wainwright and Weitkamp 2013; Limburg et al. 2016). Estuaries will be affected directly by sea-level rise: as sea level rises, terrestrial habitats will be flooded and tidal wetlands will be submerged (Kirwan et al. 2010; Wainwright and Weitkamp 2013; Limburg et al. 2016). The net effect on wetland habitats depends on whether rates of sea-level rise are sufficiently slow that the rates of marsh plant growth and sedimentation can compensate (Kirwan et al. 2010).

Due to subsidence, sea-level rise will affect some areas more than others, with the largest effects expected for the lowlands, like southern Vancouver Island and central Washington coastal areas (Verdonck 2006; Lemmen et al. 2016). The widespread presence of dikes in Pacific Northwest estuaries will restrict upward estuary expansion as sea levels rise, likely resulting in a near-term loss of wetland habitats (Wainwright and Weitkamp 2013). Sea-level rise will also result in greater intrusion of marine water into estuaries, resulting in an overall increase in salinity, which will also contribute to changes in estuarine floral and faunal communities (Kennedy 1990). While not all anadromous fish species are highly reliant on estuaries for rearing, extended estuarine use may be important in some populations (Jones et al. 2014), especially if stream habitats are degraded and become less productive. Preliminary data indicate that some Snake River Basin steelhead smolts actively feed and grow as they migrate between Bonneville Dam and the ocean (Beckman 2018), suggesting that estuarine habitat is important for this DPS.

Marine Effects

In marine waters, increasing temperatures are associated with observed and predicted poleward range expansions of fish and invertebrates in both the Atlantic and Pacific Oceans (Lucey and Nye 2010; Asch 2015; Cheung et al. 2015). Rapid poleward species shifts in distribution in response to anomalously warm ocean temperatures have been well documented in recent years, confirming this expectation at short time scales. Range extensions were documented in many species from southern California to Alaska during unusually warm water associated with "the blob" in 2014 and 2015 (Bond et al. 2015; Di Lorenzo and Mantua 2016) and past strong El Niño events (Pearcy 2002; Fisher et al. 2015). For example, recruitment of the introduced European green crab increased in Washington and Oregon waters during winters with warm surface waters, including 2014 (Yamada et al. 2015). Similarly, the Humboldt squid dramatically expanded its range northward during warm years of 2004–09 (Litz et al. 2011). The frequency of extreme conditions, such as those associated with El Niño events or "blobs" is predicted to increase in the future (Di Lorenzo and Mantua 2016), further altering food webs and ecosystems.

Expected changes to marine ecosystems due to increased temperature, altered productivity, or acidification will have large ecological implications through mismatches of co-evolved species and unpredictable trophic effects (Cheung et al. 2015; Rehage and Blanchard 2016). These effects will certainly occur, but predicting the composition or outcomes of future trophic interactions is not possible with current models.

Wind-driven upwelling is responsible for the extremely high productivity in the California Current ecosystem (Bograd et al. 2009; Peterson et al. 2014). Minor changes to the timing, intensity, or duration of upwelling, or the depth of water-column stratification, can have dramatic effects on the productivity of the ecosystem (Black et al. 2015; Peterson et al. 2014). Current projections for changes to upwelling are mixed: some climate models show upwelling unchanged, but others predict that upwelling will be delayed in spring, and more intense during summer (Rykaczewski et al. 2015). Should the timing and intensity of upwelling change in the future, it may result in a mismatch between the onset of spring ecosystem productivity and the timing of salmon entering the ocean, and a shift toward food webs with a strong sub-tropical component (Bakun et al. 2015).

Columbia River anadromous fishes also use coastal areas of British Columbia and Alaska and midocean marine habitats in the Gulf of Alaska, although their fine-scale distribution and marine ecology during this period are poorly understood (Morris et al. 2007; Pearcy and McKinnell 2007). Increases in temperature in Alaskan marine waters have generally been associated with increases in productivity and salmon survival (Mantua et al. 1997; Martins et al. 2012), thought to result from temperatures that are normally below thermal optima (Gargett 1997). Warm ocean temperatures in the Gulf of Alaska are also associated with intensified downwelling and increased coastal stratification, which may result in increased food availability to juvenile salmon along the coast (Hollowed et al. 2009; Martins et al. 2012). Predicted increases in freshwater discharge in British Columbia and Alaska may influence coastal current patterns (Foreman et al. 2014), but the effects on coastal ecosystems are poorly understood.

In addition to becoming warmer, the world's oceans are becoming more acidic as increased atmospheric carbon dioxide is absorbed by water. The North Pacific is already acidic compared to other oceans, making it particularly susceptible to further increases in acidification (Lemmen et al. 2016). Laboratory and field studies of ocean acidification show that it has the greatest effects on invertebrates with calcium-carbonate shells, and has relatively little direct influence on finfish; see reviews by Haigh et al. (2015) and Mathis et al. (2015). Consequently, the largest impact of ocean acidification on salmon will likely be the influence on marine food webs, especially the effects on lower trophic levels (Haigh et al. 2015; Mathis et al. 2015). Marine invertebrates fill a critical gap between freshwater prey and larval and juvenile marine fishes, supporting juvenile salmon growth during the important early-ocean residence period (Daly et al. 2009, 2014).

Uncertainty in Climate Predictions

There is considerable uncertainty in the predicted effects of climate change on the globe as a whole, and on the Pacific Northwest in particular. Many of the effects of climate change (e.g., increased temperature, altered flow, coastal productivity, etc.) will have direct impacts on the food webs that species rely on in freshwater, estuarine, and marine habitats to grow and survive. Such ecological effects are extremely difficult to predict even in fairly simple systems, and minor differences in life-history characteristics among stocks of salmon may lead to large differences in their response (e.g. Crozier et al. 2008b; Martins et al. 2011, 2012). This means it is likely that there will be "winners and losers," meaning some salmon populations may enjoy different degrees or levels of benefit from climate change while others will suffer varying levels of harm. Climate change is expected to impact anadromous fishes during all stages of their complex life cycle. In addition to the direct effects of rising temperatures, indirect effects include alterations in flow patterns in freshwater and changes to food webs in freshwater, estuarine, and marine habitats. There is high certainty that predicted physical and chemical changes will occur; however, the ability to predict bio-ecological changes to fish or food webs in response to these physical/chemical changes is extremely limited, leading to considerable uncertainty. In additional to physical and biological effects, there is also the question of indirect effects of climate change and whether human "climate refugees" will move into the range of salmon and steelhead, increasing stresses on their respective habitats (Dalton et al. 2013; Poesch et al. 2016).

Summary

Climate change is expected to impact Pacific Northwest anadromous fishes during all stages of their complex life cycle. In addition to the direct effects of rising temperatures, indirect effects include alterations in stream-flow patterns in freshwater and changes to food webs in freshwater, estuarine, and marine habitats. There is high certainty that predicted physical and chemical changes will occur; however, the ability to predict bio-ecological changes to fish or food webs in response to these physical/chemical changes is extremely limited, leading to considerable uncertainty. As we continue to deal with a changing climate, management actions may help alleviate some of the potential adverse effects (e.g., hatcheries serving as a genetic reserve and source of abundance for natural populations, increased riparian vegetation to control water temperatures, etc.).

Climate change is expected to make recovery targets for steelhead populations more difficult to achieve. Climate change is expected to alter critical habitat by generally increasing temperature and peak flows and decreasing base flows. Although changes will not be spatially homogenous, effects of climate change are expected to decrease the capacity of critical habitat to support successful spawning, rearing, and migration. Habitat action can address the adverse impacts of climate change on steelhead. Examples include restoring connections to historical floodplains and freshwater and estuarine habitats to provide fish refugia and areas to store excess floodwaters, protecting and restoring riparian vegetation to ameliorate stream temperature increases, and purchasing or applying easements to lands that provide important cold water habitat and cold water refugia (Battin et al. 2007; ISAB 2007).

The 10-year timeframe for implementing the proposed action will occur while climate change-related effects are expected to become more evident within the range of the Snake River Basin steelhead DPS. However, the expected improvement in riparian habitat within the action area, should improve resilience of steelhead to the adverse effects of climate change.

2.3 Action Area

"Action area" means all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action (50 CFR 402.02). For this consultation, the action area is limited to the lands and streams within the boundaries of the Buck Creek Allotment. The Allotment is 22,718 acres and is entirely within the Mud Creek drainage, which is tributary to the lower Grande Ronde River in northeastern Oregon. The approximate center of the action area is 45° 45' 42" N, 117° 21' 01" W.

The action area is used by all freshwater life history stages of Snake River Basin steelhead. Within the action area, designated critical habitat for steelhead is basically the same as the current steelhead distribution. There are approximately 25.7 stream miles of occupied, and designated, steelhead habitat in the action area. Streams in the action area that contain steelhead habitat are: McCubbin Creek, Evans Creek, Sled Creek, Burnt Creek, Buck Creek, and Mud Creek (Figure 1).

2.4 Environmental Baseline

The "environmental baseline" includes the past and present impacts of all federal, state, or private actions and other human activities in the action area, the anticipated impacts of all proposed federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of state or private actions which are contemporaneous with the consultation in process (50 CFR 402.02).

Elevation in the action area ranges from approximately 2,100 feet mean sea level (MSL) in Mud Creek at the north end of the Allotment, to approximately 4,800 feet MSL along the ridge that forms the southern portion of the eastern boundary of the Allotment. This ridge is also the break between the Mud Creek drainage and the Joseph Creek drainage to the east. Highway 3 roughly follows the ridge. Streams on the Allotment start just below this ridge and flow in a northwesterly direction toward the Grande Ronde River. The headwater streams combine to form Mud Creek, which constitutes most of the western boundary of the Allotment, and Buck Creek, which is a tributary of Mud Creek and forms the northeastern boundary of the Allotment. The majority of Mud and Buck Creeks flow through steep canyons and, due to steepness of terrain, are mostly inaccessible to livestock, have been minimally impacted by human activities, and contain habitat that is in a near natural condition. These "canyon reaches" of Mud and Buck Creeks constitute approximately 45 percent of steelhead habitat, measured as stream miles, in the action area. The other 55 percent of steelhead habitat is in McCubbin, Evans, Sled, and Burnt Creeks, and in the headwater portion of Buck Creek. These "headwater" stream reaches are in relatively flat terrain, have been adversely impacted by a variety of past activities, have relatively high road densities, and are mostly accessible to domestic livestock. The remainder of this section describes conditions in the headwater portion of the action area.

Steelhead habitat in the headwater portion of the action area has been adversely impacted by past logging, construction of railroads to facilitate logging, construction of roads, and grazing. Historical railroad logging severely impacted streams and riparian areas resulting in channelized stream and a lack of large overstory trees. Railroad grades are still present and overstory trees have yet to reach the sizes that were present before the logging occurred. The combination of railroad logging and historical grazing likely resulted in the elimination of riparian shrubs along many stream reaches. These adverse effects are most pronounced along Burnt, Sled, Evans, and McCubbin Creeks, and the headwater portion of Buck Creek. Most of these stream reaches also have roads in the riparian habitat conservation area, sometimes on both sides of the stream.

In spite of the past habitat perturbations, approximately one third of steelhead habitat in the headwater portion of the action area is properly functioning, with the remainder functioning at risk. Portions of Buck Creek are Rosgen (1996) F channel (i.e., incised and disconnected from the historic floodplain) and summer water temperature in Sled and Buck Creeks regularly exceeds Oregon standards for cold water fishes. Condition of steelhead habitat is on an upward trend throughout the headwater portion of the action area.

The *ESA Recovery Plan for Northeast Oregon Snake River Spring and Summer Chinook Salmon and Snake River Steelhead Populations* (NMFS 2017) identifies the following strategies for addressing habitat limiting factors in Grande Ronde River tributaries, including Mud Creek: (1) Increase habitat complexity and pool habitat; (2) reduce sediment input; (3) moderate summer water temperatures; (4) improve riparian habitat conditions. Habitat restoration actions, within the action area, primarily consists of exclosures and riparian plantings. In 2010 approximately 7.7 acres of upper Buck Creek was protected with an exclosure and in 2012 existing riparian shrubs were protected with cages and new plantings with cages were established along a 2.75 miles of Buck Creek, 2.5 miles of Burnt Creek, 1.17 miles of Evans Creek, 1-mile of Sled Creek, and 1.5 miles of McCubbin Creek. As of 2017, most of the plantings were surviving and growing.

In summary, due to limited access, habitat surveys in stream reaches in the canyon portion of the action area are mostly lacking. However, anecdotal evidence suggests that habitat in those reaches is in a near natural condition. Habitat in the headwater portion of the action area is functioning at risk (seven of 11 surveyed reaches) or properly functioning (five of 11 surveyed reaches), with an upward trend in all but one of the reaches. Habitat surveys conducted in 2010 and 2015 indicated that the upland portion of the action area was generally not meeting objectives for streambank stability and streambank cover but that trends for both of these indicators were positive. Steelhead redd surveys were conducted in the headwater portion of the action area in 2009, 2010, 2012, and 2018 with one redd identified in 2009 and none in the other years. The canyon reaches have not been surveyed for steelhead spawning.

2.5 Effects of the Action

Under the ESA, "effects of the action" means the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline (50 CFR 402.02). Indirect effects are those that are caused by the proposed action and are later in time, but still are reasonably certain to occur. This section will evaluate the effects of the action starting from the time of the issuance of this Opinion through the term of the permit.

2.5.1 Effects on Critical Habitat

Numerous symposia and publications have documented the detrimental effects of livestock grazing on stream and riparian habitats (Johnson et al. 1985; Menke 1977; Meehan and Platts 1978; Cope 1979; American Fisheries Society 1980; Platts 1981; Peek and Dalke 1982; Ohmart and Anderson 1982; Kauffman and Krueger 1984; Clary and Webster 1989; Gresswell et al. 1989; Kinch 1989; Chaney et al. 1990; Belsky et al. 1997). These publications describe a series of synergistic effects that can occur when cattle over-graze riparian areas, including: (1) Woody and hydric herbaceous vegetation along a stream can be reduced or eliminated; (2) streambanks can collapse due to livestock trampling; (3) without vegetation to slow water velocities, hold the soil, and retain moisture, streambanks can erode; (4) the stream can become wider and shallower, and in some cases downcut; (5) the water table can drop; and (6) hydric, deeply rooted herbaceous vegetation can die out and be replaced by upland species with shallower roots and less ability to bind the soil. These effects have the potential to adversely affect steelhead critical habitat in the action area through reductions in riparian vegetation and natural cover, increased summer water temperature, loss of pools and habitat adjacent to and connected to streambanks, and increased substrate fine sediment and cobble-embeddedness.

The WWNF proposes to use several conservation measures and grazing management techniques to minimize the impacts of livestock grazing on steelhead critical habitat in the Buck Creek Allotment. For all pastures, the permittees will conduct mid-season trigger monitoring and will move livestock, as needed, to ensure that all applicable utilization standards are met. For pastures with steelhead habitat that can be accessed by livestock (i.e., Highway I, Highway II, McCubbin, and Buck Creek Riparian Pastures), additional measures to reduce impacts include: Maintaining existing livestock exclosures on Burnt and Buck Creeks; relocating a fence to reduce livestock access to Sled Creek; resting the Highway II and Buck Creek Riparian Pastures in four of the ten years; resting the McCubbin Pasture in three of the ten years; redd surveys by fish biologists when pastures with accessible steelhead habitat are grazed prior to July 1; and regular riding by permittees and herding cows out of riparian areas whenever pastures with steelhead habitat are grazed prior to July 1. The long-term and annual adaptive management procedures, which are part of the Proposed Action, will help the WWNF adjust grazing management as needed to ensure that riparian objectives are met, thus minimizing impacts on steelhead habitat. With the minimization measures described in this paragraph, and in the proposed action, adverse impacts on steelhead and steelhead habitat should be confined to isolated locations within the Highway I, Highway II, McCubbin, and Buck Creek Riparian Pastures.

Stubble height has a direct relationship to the health of herbaceous riparian plants and the ability of the vegetation to provide streambank protection; to filter out and trap sediment from overbank flows; and in small streams to provide overhead cover (University of Idaho Stubble Height Review Team 2004; Roper 2016; Saunders and Fausch 2007). On monitoring sites across 17 National Forest and four Bureau of Land Management units (i.e., pastures) in the Interior Columbia River basin, Goss (2013) found a linear relationship between increasing stubble height and multiple components of high quality salmonid habitat, including: increasing residual pool depth; increasing streambank stability; increasing percent undercut banks; and decreasing streambank angle. This suggests that across stream and riparian conditions evaluated within the

Interior Columbia River basin, the higher the stubble height the greater the likelihood that stream conditions favored by salmonids will be present (Goss 2013).

Multiple studies have evaluated minimum stubble heights necessary to protect stream habitat from the impacts of livestock grazing. Most studies have reported stubble height of the entire greenline graminoid and herbaceous community as opposed to a subset of key plant species because it is simpler to evaluate, avoids controversy over which species to monitor, and is likely more informative of actual streambank conditions than knowing the height of a subset of plant species (Roper 2016). Using the PACFISH-INFISH Opinion monitoring data from federal lands in the Columbia basin, Goss (2013) found that stubble height was related to streambank disturbance, and streambank disturbance began to increase substantially when stubble heights fell below 10 inches. Bengeyfield (2006) found that a 4-inch stubble height did not initiate an upward trend in stream channel morphology at sites on the Beaverhead-Deerlodge National Forest in Montana, based on 7 to 9 years of monitoring. Clary (1999) found that while 5-inch stubble height at the end of the growing season resulted in improvements in most measured aquatic and riparian conditions in an Idaho meadow after 10 years, 6.5-inch stubble height was needed to improve all measured habitat metrics. Pelster et al. (2004) found that during summer and fall grazing, more than 40 percent of cattle diets were willow when stubble heights were less than eight inches; and consequently suggested that stubble heights greater than eight inches were needed to reduce willow consumption during these critical periods. Willows enhance salmonid habitat by providing fish with cover, modulating stream temperatures, and contributing leaf detritus and terrestrial insects that expand food sources (Bryant et al. 2006; Clary and Leininger 2000; Murphy and Meehan 1991). This reinforces the idea that higher stubble heights lead to improved fish habitat.

After reviewing the available scientific literature, including all of the studies mentioned above, Roper (2016) strongly recommended 6 inches as a starting point for a stubble height objective, measured at the end of the growing season, for small to medium sized cold water streams inhabited by salmon and trout. This is consistent with Clary and Webster (1990), who suggested a 6-inch starting point for stubble height objectives in the presence of ESA-listed or sensitive fish. Roper (2016) acknowledges that 4 inches or 8 inches could be appropriate stubble height objectives for some stream sites, but that site-specific data would be necessary to support these more liberal or conservative objectives. Furthermore, a 4-inch stubble height could suffice as a move trigger on spring pastures if there is sufficient time for the graminoid and herbaceous vegetation to grow to meet end-of-growing-season objectives (Roper 2016). The scientific literature therefore suggests that the WWNF's proposed stubble height endpoint objective of 6 inches will protect most streams from livestock damage.

Streambank alteration provides an indicator of the amount of livestock activity in riparian zones, increasing with both the number of cows present and the time spent by those cows in riparian areas. The streambank alteration standard measures the amount of annual bank disturbance caused by livestock grazing, the levels of which can then be related to streambank stability and riparian vegetation conditions within the greenline (Cowley and Burton 2005). Excessive bank trampling can lead to increased channel widths, decreased depths, and slower water velocity. These channel changes can cause mid-channel sediment deposition, which can further erode and reduce water storage in streambanks, resulting in vegetation transitioning from willows and sedges to species preferring drier habitats. These impacts all reduce the quality of fish habitat. Of indicators evaluated by Bengeyfield (2006), bank alteration levels was the most sensitive.

Cowley (2002) suggested that the maximum allowable streambank alteration that maintains streambank stability is 30 percent, and that applying a 20 percent streambank alteration standard should allow streambanks to recover. Cowley (2002) cited additional studies to support a recommendation that "Ten percent or less alteration would seem to allow for near optimal recovery and should not retard or prevent attainment of resource management objectives." The WWNF proposes a 20 percent maximum streambank alteration standard. Based on Cowley (2002), we expect this standard to: (1) Prevent negative impacts to streambanks from grazing; (2) maintain properly functioning conditions where they currently occur on the Allotment; and (3) allow for stream habitat recovery and an upward trend where habitat indicators are not currently properly functioning. However, where habitat indicators are not properly functioning, continued grazing has the potential to retard the rate of habitat recovery compared to no grazing. A more protracted recovery period could result in greater sediment delivery, wider stream channels, reduced vegetative vigor, and higher water temperatures in the action area for a longer period of time than would occur absent grazing.

2.5.1.1 Impacts to Physical and Biological Features

As described above, continued grazing with a maximum of 20 percent streambank alteration would allow the streambanks to recover; however, it could slow the recovery of several stream habitat components that are not meeting objectives on some streams in the Allotment. These habitat components include temperature, streambank stability, fine sediment, and channel incision. Slowing the recovery of properly functioning stream temperatures, amount of fine sediments, streambank stability, and stream channel stability would have small adverse effects on some of the essential PBFs in the action area. The PBFs that could be affected are water quality, forage, natural cover, riparian vegetation, substrate, and floodplain connectivity. We expect that grazing with a maximum of 20 percent streambank alteration would allow for an improving trend in PBFs, but at a slower rate than without grazing. Because impacts to riparian areas on the Allotment would be limited to isolated locations within the Highway I, Highway II, McCubbin, and Buck Creek Riparian Pastures, we only expect localized delays in improving trends for PBFs.

Water Quality and Forage. Continued grazing could affect water quality through impacts to temperature. Summer stream temperatures on the Allotment are high in some stream reaches, with summer temperatures in Sled and Buck Creeks frequently above the Oregon Department of Environmental Quality standard of 64°F (seven-day-average maximum) for rearing salmonids. Shade provided by vegetation can be important in keeping stream temperatures cool for salmonids (Zoellick 2004). Shade from vegetation will continue to be important in the future, as stream temperatures rise across the Pacific Northwest. Slight changes in environmental conditions during the 10-year permit term, due to climate change, could therefore amplify the proposed action's effects on water quality. Livestock grazing can directly increase water temperature if riparian vegetation removal results in increased solar exposure. Additionally, reduced riparian vegetation and bank trampling can result in increased streambank instability, which in turn can lead to over-widened streams. Over-widened streams with high width-to-depth ratios expose a greater surface area of shallower water to the sun, which can further increase water temperatures. Based on the scientific literature, we expect that grazing with a minimum 6-inch greenline stubble height and a maximum of 20 percent streambank alteration will protect existing riparian vegetation and streambank stability and therefore not cause increases in stream temperature. For approximately 45 percent of the steelhead habitat in the Allotment, livestock access to riparian areas is precluded by steep topography. For the stream reaches that are accessible to livestock, continued grazing with a maximum of 20 percent streambank alteration could be one factor slowing the recovery of shade-producing riparian vegetation, thereby prolonging the time to recovery of the stream temperature RMO in Sled and Buck Creeks, creating an adverse impact on the water quality PBF. However, the impacts will be localized and are not likely to cause an actual degradation in this PBF; rather it is likely that there will possibly be a slowing of recovery toward properly function conditions.

Salmonids rely on terrestrial and aquatic invertebrates as a food source. Terrestrial invertebrates fall into stream from riparian vegetation and aquatic invertebrates feed on dead leaves from riparian vegetation (Saunders and Fausch 2009). Livestock grazing could therefore affect forage for salmonids by altering riparian vegetation. However, Saunders and Fausch (2009) observed no difference in invertebrate biomass entering streams between sites managed for rotation grazing and ungrazed sites. Based on the cited literature, we therefore anticipate only very small impacts to the forage PBF.

Substrate. Grazing can negatively impact substrate by increasing substrate fine sediment and cobble-embeddedness when livestock trample streambanks. Stream surveys showed streambank stability at less than 90 percent for four of the five DMAs in the Allotment, but it was improving, and exceeded 78 percent, at three of the five DMAs. Because streambank stability is improving, and meeting or approaching a properly functioning condition in most cases, continued grazing with a maximum of 20 percent streambank alteration will have only a small effect on critical habitat by slowing the recovery of substrate conditions in localized and dispersed stream reaches. The proposed action will not likely result in a degradation in this PBF, just a slowing of recovery toward properly functioning conditions.

Natural Cover and Riparian Vegetation. Riparian vegetation provides cover for salmonids in the form of overhanging vegetation and undercut banks. Salmonids appear to prefer spawning in close proximity of overhead cover (Bjornn and Reiser 1991), and overhead cover protects juvenile salmonids from predation. Riparian vegetation also stabilizes streambanks, and thick riparian vegetation can reduce livestock access to streams, reducing trampling (Gregory and Gamett 2009). Grazing can negatively impact natural cover by consuming or trampling riparian vegetation. Streambank cover was less than 90 percent at all DMAs, but it was improving, and exceeded 80 percent, at three of the five DMAs. The scientific literature suggests that the combination of WWNF's stubble height and streambank alteration endpoint objectives (6-inch stubble height minimum and 20 percent maximum streambank alteration) will likely protect most riparian areas from livestock damage and thus should facilitate continued recovery. However, it will not eliminate the risk of livestock damage and NMFS expects some adverse impacts to riparian vegetation and natural cover PBFs. Due to the anticipated effectiveness of proposed utilization standards and the proposed monitoring, these effects should be localized and should not persist for multiple grazing seasons.

Water Quantity and Floodplain Connectivity. With the exception of portions of upper Buck Creek, streams on the Allotment are not incised and are largely connected to their historic floodplain. Due to historic timber harvest, but possibly exacerbated by historic grazing, portions of upper Buck Creek are incised and disconnected from the historic floodplain. The stubble height and streambank alteration objectives should protect stream reaches that are not incised and should facilitate continued, albeit possibly slowed, recovery of the incised portions of Buck Creek. Although recovery of proper function may be slowed in portions of Buck Creek, this localized impact should not significantly delay development of properly functioning PBFs, at the critical habitat designation scale. The proposed action will not significantly affect water quantity.

2.5.1.2 Impacts to Critical Habitat from Permittee Non-compliance

We assume that no more than two exceedances of the end-of-season riparian objectives will occur during any single year and we also assume that greenline stubble height will not be reduced to less than five inches. These assumptions are based on the following: (1) Between 2011 and 2017 there was a total of seven instances of permittees exceeding riparian utilization standards in the Buck Creek Allotment, but there were never more than two instances in any given year, and that only occurred in 1-year; (2) between 2011 and 2017 greenline stubble height was never less than 5-inches. When endpoint indicators are not met, the severity of the effects described above (e.g., minor impacts to riparian vegetation, reduction of shade, etc.) will increase. However, we expect that the WWNF's proposed adaptive management strategy will minimize the long-term impacts of any exceedances that occur and will reduce the number of exceedances that occur in the future.

The adaptive management strategy includes: (1) A short-term strategy of annual implementation monitoring and response protocols dependent on the monitoring results; and (2) a long-term strategy based on effectiveness monitoring results and response protocols dependent on the effectiveness monitoring results. For implementation monitoring, the WWNF will conduct annual monitoring of greenline stubble height, streambank alteration, and riparian shrub utilization in all pastures with end-of-season standards that are grazed during that year. If annual use indicators are not met in a particular pasture, the WWNF will meet with the permittees to develop a plan for the following year's grazing. Working with the WWNF fisheries biologist, WWNF rangeland management specialist, and the permittee, the WWNF will establish measures (e.g., altering the season of use, increased riding pressure, additional fencing, etc.) for the next year's grazing season to prevent the exceedance from reoccurring. The long-term adaptive management strategy will use stream habitat data to assess the trend in the condition of stream habitat components. If monitoring data show that the trend in the condition of one or more habitat components is downward or static in a pasture or certain area, and livestock grazing is influencing this trend, then the WWNF will develop changes to the grazing strategy to reduce livestock use and effects in that area.

We do not expect that two exceedances of riparian utilization standards in a single year will prevent the development of habitat capable of supporting viable populations of ESA-listed salmonids for the following reasons: (1) The WWNF is proposing annual end-of-season monitoring of riparian utilization standards, such that any exceedances will be discovered either during or immediately after grazing; and (2) the WWNF has developed an adaptive management process to respond to exceedances or other problems encountered during the grazing season, such that grazing can be adjusted quickly and appropriately.

2.5.1.3 Summary of Effects on Critical Habitat

The proposed action will have localized adverse effects on steelhead PBFs. These adverse effects are not likely to degrade or halt recovery of PBFs, at the action area scale, but could slow recovery toward properly functioning conditions. Because quality of steelhead critical habitat in the action area is currently adequate to support steelhead (see Section 2.4) and will continue to improve, albeit at a slower rate with the proposed action, the proposed action is not likely to appreciably reduce the conservation value of steelhead designated critical habitat in the action area.

2.5.2 Effects on Listed Species

Cattle grazing has the potential to affect ESA-listed fishes by disturbing rearing, holding, or spawning salmonids; by trampling incubating redds as cows wade through or cross instream habitats; and through impacts to habitat (described above in Section 2.5.1 and summarized below in Section 2.5.2.3). All freshwater life stages of steelhead are likely to be present on the Buck Creek Allotment during the grazing season.

2.5.2.1 Disturbance

Cattle grazing adjacent to streams, crossing streams, drinking out of streams, or loafing near streams, are reasonably certain to startle or disturb juvenile or adult steelhead present in the action area. Portions of Burnt Creeks and Buck Creek are protected by livestock exclosures and moving the fence between the McCubbin and Orchard Pastures will reduce livestock access to Sled Creek. Most steelhead complete spawning prior to June 1 (i.e., the earliest proposed grazing) and when pastures with accessible steelhead habitat are grazed prior to July 1, permittees will regularly herd cattle away from riparian habitat to reduce chance of disturbing adult steelhead or steelhead redds. We therefore anticipate a low probability for cows disturbing adult steelhead. The greatest chance for cows disturbing steelhead will occur after July 1, when only juvenile steelhead will be present.

For juvenile steelhead, disturbance can lead to behavioral changes that can result in indirect effects through alteration in feeding success, increased exposure to predators, or displacement into less suitable habitat. Although these effects can result in injury or death, we expect the juveniles affected by this action to be able to access nearby cover and avoid injury or morality (behavioral effect only). The bank alteration riparian objective of less than 20 percent should ensure that disturbance of juvenile steelhead will be limited, and bank stability and streambank cover is sufficiently high to suggest that enough escape cover is available to protect fish from limited disturbance. NMFS therefore expects behavioral modifications will be infrequent and minor because disturbance will be limited and habitat conditions in the action area should provide some suitable escape cover.

2.5.2.2 Redd Trampling

Livestock grazing along salmonid spawning streams can result in trampling of redds and impacts to incubating eggs/embryos. Steelhead fry in the action area generally emerge from spawning gravels before July 1. Grazing will occur prior to July 1 on the Kuhn Ridge, Below Corral, McCubbin, Highway II, and Buck Creek Pastures. For the Kuhn Ridge and Below Corral Pastures, steelhead habitat in not accessible to livestock due to steep terrain, but redd trampling could potentially occur on the McCubbin, Highway II, and Buck Creek Riparian Pastures. The Highway II and Buck Creek Riparian Pastures will be grazed prior to July 1 in year-6 of the permit, and the McCubbin Pasture will be grazed prior to July 1 in years 3 and 9. There is therefore a potential for steelhead redd trampling in three of the 10 years of the permit. The WWNF will minimize the chance for redd trampling by conducting redd surveys, flagging all redds identified, protecting redds with exclosures when feasible, and requiring cattle to be moved out of the pasture if one redd is disturbed. However, the permittees have up to 2 days to remove the cattle, so there is a chance that another redd could be trampled, or the same redd could be trampled a second time. The proposed action could therefore result in disturbance of up to two steelhead reads during each of the 3 years that pastures with accessible steelhead spawning habitat are grazed prior to July 1, for a total of six steelhead redds disturbed over the 10-year duration of the permit.

Studies directly measuring the effects of cattle trampling on salmonid eggs and pre-emergent fry are lacking, but one study (i.e., Roberts and White 1992) measured the effects of human trampling on eggs and fry in experimental redds and another (i.e., Gregory and Gamett 2009) studied the effects of cattle trampling of simulated redds constructed of clay targets. Roberts and White (1992) determined that as many as 43 percent of eggs/fry in a redd could be killed by a single human trampling event and Gregory and Gamett (2009) found that approximately 51 percent of the surface area of simulated redds, that were trampled by cattle, were disturbed. Because cows are larger than humans and have four legs instead of two, it is reasonable to assume that a single cattle trampling event could kill more than 43 percent of eggs/fry in a redd. Guided by the information in these two studies, we assume that approximately 50 percent of eggs/fry in each trampled steelhead redd will be killed. Given that six steelhead redds could be disturbed, total mortality due to redd disturbance, could be equivalent to three steelhead redds. Assuming that each redd represents two adults, total mortality due to redd disturbance could be equivalent to six adult steelhead over the 10-year duration of the permit. The maximum mortality, due to redd disturbance, during any of the 3 years in which pastures with accessible steelhead spawning habitat are grazed prior to July 1, would be equivalent to one steelhead redd, or two adult returns.

2.5.2.3 Habitat-related Effects

Livestock grazing will adversely affect steelhead through the impacts to spawning, rearing, and migration habitat described in Section 2.5.1. The habitat effects which will impact the species include potential increased summer water temperature, loss of pools and habitat adjacent to and connected to streambanks, increased substrate fine sediment and cobble-embeddedness, and reductions in riparian vegetation, forage, and natural cover. These types of impacts to habitat could have the following effects on individual fish: reductions in natural cover increases exposure of juveniles to predators; reductions in pools and habitat connected to streambanks decreases the availability of habitat to rest from the current, which can lead to increased energy demands on fish; increased water temperature leads to increased metabolic demands for fish (Myrold and Kennedy. 2015); and increased sediment deposition can reduce forage (i.e., aquatic invertebrates) (Gleason et al. 2003). All of these effects can lead to harm, harassment, or mortality of rearing steelhead.

The long-term and annual adaptive management procedures, which are part of the Proposed Action, will help the WWNF adjust grazing management as needed to ensure that riparian objectives are met, thus minimizing impacts on steelhead habitat. With the minimization measures described above, and in the proposed action, adverse habitat-related impacts on steelhead should be confined to isolated locations within the Highway I, Highway II, McCubbin, and Buck Creek Riparian Pastures.

The WWNF proposes to use several conservation measures and grazing management techniques to minimize the impacts of livestock grazing on steelhead and critical habitat in the Buck Creek Allotment. For all pastures, the permittees will conduct mid-season trigger monitoring and will move livestock, as needed, to ensure that all applicable utilization standards are met. For pastures with steelhead habitat that can be accessed by livestock (i.e., Highway I, Highway II, McCubbin, and Buck Creek Riparian Pastures), additional measures to reduce impacts include: Maintaining existing livestock exclosures on Burnt and Buck Creeks; relocating a fence to reduce livestock access to Sled Creek; resting the Highway II and Buck Creek Riparian Pastures in four of the 10 years; resting the McCubbin Pasture in three of the 10 years; and regular riding by permittees and herding cows out of riparian areas whenever pastures with steelhead habitat are grazed prior to July 1. In addition to the forage utilization standards, greenline stubble height, bank alteration, and riparian shrub utilization standards (Table 2) will also be monitored in pastures with accessible steelhead habitat. The long-term and annual adaptive management procedures, which are part of the Proposed Action, will help the WWNF adjust grazing management as needed to ensure that riparian objectives are met, thus minimizing habitat-related impacts on steelhead. As described in Section 2.5.1, we expect that adverse impacts on steelhead habitat will be confined to isolated locations within the Highway I, Highway II, McCubbin, and Buck Creek Riparian Pastures. Although it is not possible to estimate how many, we expect that a small number of juvenile steelhead will experience harm, harassment, or mortality in these dispersed locations of adverse impacts to habitat over the course of the 10-year permit.

2.5.2.4 Summary of Effects on Listed Species

The proposed action would result in habitat-related adverse effects on rearing steelhead and direct effects on steelhead redds. The habitat-related effects on rearing steelhead will be localized and are not likely to appreciably reduce the number of rearing steelhead in the GRLM population. The direct effects on steelhead redds could result in mortality of the equivalent of two adult steelhead during each year that a pasture with accessible habitat is grazed prior to July 1, or six adult steelhead over the duration of the 10-year permit. This amount of mortality represents approximately 0.16 percent of the GRLM population, on an annual basis, and 0.049 percent of the population over the duration of the permit.

2.6 Cumulative Effects

"Cumulative effects" are those effects of future state or private activities, not involving federal activities, that are reasonably certain to occur within the action area of the federal action subject to consultation (50 CFR 402.02). 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 ESA. The entire action area is managed by the WWNF and no future private actions are anticipated.

2.7 Integration and Synthesis

The Integration and Synthesis section is the final step in our assessment of the risk posed to species and critical habitat as a result of implementing the proposed action. In this section, we add the effects of the action (Section 2.5) to the environmental baseline (Section 2.4) and the cumulative effects (Section 2.6), taking into account the status of the species and critical habitat (Section 2.2), to formulate the agency's Opinion as to whether the proposed action is likely to: (1) Reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing its numbers, reproduction, or distribution; or (2) reduce the value of designated or proposed critical habitat for the conservation of the species.

Critical Habitat. Snake River Basin steelhead designated critical habitat in the action area includes most of the perennial reaches of Buck, Mud, Burnt, Sled, Evans, and McCubbin Creeks. The condition of spawning and rearing habitat across the steelhead range varies from excellent in wilderness and roadless areas to poor in areas subject to intensive human land uses. Condition of critical habitat in the mostly inaccessible canyon reaches of the action area (approximately 45 percent of habitat) is probably in a near natural condition. Condition in the more accessible reaches is more degraded, ranging from at risk to properly functioning, and is generally improving. Future deterioration of water quality and water quantity due to climate change could partially offset future habitat improvements in the action area.

The WWNF has incorporated several conservation measures (e.g., fencing, herding, conservative riparian utilization standards, and monitoring) into grazing management on the Allotment in order to limit the impacts of livestock on designated critical habitat. Based on available scientific literature, NMFS expects that the proposed 20 percent maximum streambank alteration standard and 6-inch minimum stubble height will allow for stream habitat recovery and an upward trend for degraded PBFs. However, we expect that continued grazing could slow the rate of habitat recovery as compared to no grazing. The PBFs that could be affected are water quality, forage, natural cover, riparian vegetation, substrate, and floodplain connectivity. Nevertheless, those impacts will not preclude or significantly delay development of the critical habitat features in streams affected by the proposed action because: (1) Impacts to riparian areas on the Allotment would be limited to isolated reaches of Sled, Burnt, Buck, McCubbin and Evans Creeks; and (2) we expect the proposed long-term adaptive management strategy for the Allotment to identify trends in stream habitat conditions over the term of the permit, and for the WWNF to adjust grazing practices where habitat conditions and trends are not meeting resource objectives. The proposed action will therefore not appreciably diminish the conservation value of designated critical habitat in streams on the Buck Creek Allotment. Because the conservation value of critical habitat will not be appreciably diminished in the action area, the conservation value of critical habitat at the designation scale will not be appreciably diminished.

Species. Snake River Basin steelhead are likely present in most of the perennial streams in the action area. Steelhead in the action area are part of the GRLM steelhead population, which is tentatively rated as maintained. The most recent population estimates suggest that abundance may be sufficient to support a viable rating.

The proposed action has the potential to affect ESA-listed fish by disturbing redds, rearing juveniles, and spawning adults; and through impacts to riparian and stream habitat. Conservation measures to reduce the time livestock spend in riparian areas will: (1) Reduce the chance that spawning adults or redds are disturbed; (2) limit the potential impact of redd disturbance; and (3) reduce the amount of potential disturbance of individual rearing steelhead. The riparian objectives and the proposed adaptive management strategy will also reduce amount of time livestock will be in riparian areas and will minimize impacts on riparian and stream habitat. Habitat conditions suggests that escape cover is likely present that may minimize behavioral modifications of individual rearing steelhead that are disturbed by livestock.

NMFS expects that disturbance of spawning adults likely will not occur and/or will be very minor. NMFS expects that disturbance of redds by cattle could result in mortality of the equivalent of two adult returns during each of the 3 years in which pastures with accessible steelhead spawning habitat are grazed prior to July 1, for a total of six adult returns over the 10-year duration of the permit. Assuming an annual average of 1,215 adult returns to the GRLM population, redd disturbance could reduce abundance by 0.16 percent during each of the three years in which pastures with accessible steelhead spawning habitat are grazed prior to July 1, or 0.049 percent over the 10-year duration of the permit. In addition, we expect that a very small number of rearing juvenile steelhead will experience harm, harassment, or mortality due to localized impacts on rearing habitat. Because redd disturbance would kill a maximum of 0.049 percent of the GRLM population and because only a small number of individual juveniles would experience harm, harassment, or mortality, the adverse impacts due to the proposed action would not be great enough to significantly reduce abundance or productivity of the GRLM steelhead population. Because the proposed action would not significantly affect the attributes of a VSP for the GRLM population, the proposed action will not appreciably reduce the likelihood of survival and recovery of the Snake River Basin steelhead DPS.

2.8 Conclusion

After reviewing and analyzing the current status of the listed species and critical habitat, the environmental baseline within the action area, the effects of the proposed action, any effects of interrelated and interdependent activities, and cumulative effects, it is NMFS' Opinion that the proposed action is not likely to jeopardize the continued existence of Snake River Basin steelhead or destroy or adversely modify steelhead designated critical habitat.

2.9 Incidental Take Statement

Section 9 of the ESA and federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a 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 regulation to include significant habitat modification or degradation that actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering (50 CFR 222.102). On an interim basis, NMFS interprets "Harass" to mean "Create the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering." "Incidental take" is defined by regulation as takings that result from, but are not the purpose of, carrying out an otherwise lawful activity conducted by the federal agency or applicant (50 CFR 402.02). Section 7(b)(4) and section 7(o)(2) provide that taking that is incidental to an otherwise lawful agency action is not considered to be prohibited taking under the ESA if that action is performed in compliance with the terms and conditions of this ITS.

2.9.1 Amount or Extent of Take

The proposed action is reasonably certain to result in incidental take of ESA-listed steelhead. NMFS is reasonably certain the incidental take described here will occur because livestock will graze alongside streams occupied by steelhead. In the Opinion, NMFS determined that incidental take is reasonably certain to occur from disturbance of steelhead redds and from habitat-related impacts on rearing juveniles. NMFS expects that behavioral modifications of rearing juvenile steelhead, due to cows grazing alongside streams, will be minor because habitat conditions in the action area should provide adequate escape cover to mitigate for localized disturbance. Effects due to disturbance of rearing juvenile steelhead is therefore not reasonably certain to rise to the level of take.

It is not feasible to determine the number of eggs or fry harmed or killed in a disturbed redd. Accurately estimating egg and/or fry mortality in a natural redd under natural conditions, without causing additional mortality, is likely not possible with current technology. NMFS will therefore use the number of redds disturbed by cattle as a surrogate for take, pursuant to 50 CFR 402.14(i)(1)(i). Because redds disturbed by cattle can be accurately counted and mortality due to redd disturbance will increase with the number of redds disturbed, the number of redds disturbed by cattle is the best extent of take indicator for this pathway of incidental take.

It is not possible to observe the number of fish subjected to habitat-related impacts from grazing because we cannot precisely predict where and when habitat impacts will occur across the Allotment and over the course of the 10-year permit term. NMFS will therefore use the extent of streambank alteration as a surrogate for habitat-related take, pursuant to 50 CFR 402.14(i)(1)(i). Percent streambank alteration is the best extent of take indicator for the habitat pathways of incidental take. This is because: (1) The habitat effects of cattle grazing increase with the amount of time cattle spend in close proximity to streams; (2) all habitat pathways of take will vary in proportion to streambank alteration including shade, riparian conditions and natural cover, and fine sediment and substrate; (3) measured streambank alteration is a function of within-season grazing as opposed to other indicators that might require long-term monitoring; and (4) streambank alteration is measured by a standardized and repeatable methodology. It is important to point out here that NMFS is not saying that streambank alteration is, in itself, take. Nor does streambank alteration necessarily and directly cause take of steelhead in every case. Rather, NMFS is reasonably certain that the overall habitat effects of grazing cattle on the Allotment will cause take, and that measured streambank alteration is the best currently available single indicator that is proportional to all of those effects.

We estimate that six redds could be disturbed and five exceedances of percent streambank alteration could occur during the 10-year permit term, based on the past non-compliance history on the Allotment. NMFS anticipated this amount of redd disturbance and exceedances of streambank alteration in our analysis of effects. Therefore, our extent of take surrogate reflects those possibilities. Specifically, the extent of take will be exceeded if more than six redds are disturbed or if streambank alteration exceeds 20 percent at the end of the grazing season more than five times during the permit term. Redd disturbance and the exceedance of streambank alteration standards would be detected by the WWNF's proposed monitoring program, and reinitiation would be triggered if more than two redds were disturbed in any given year or if more than five exceedances of streambank alteration occurred over the 10-year duration of the permit.

2.9.2 Effect of the Take

In this Opinion, NMFS determined that the amount or extent of anticipated take, coupled with other effects of the proposed action, is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat.

2.9.3 Reasonable and Prudent Measures

"Reasonable and prudent measures" are nondiscretionary measures that are necessary or appropriate to minimize the impact of the amount or extent of incidental take (50 CFR 402.02).

The WWNF and its permittees shall:

1. Minimize incidental take from livestock grazing on the Allotment.

2. Ensure completion of a monitoring and reporting program to confirm that the terms and conditions in this ITS were effective in avoiding and minimizing incidental take from permitted activities and that the extent of take was not exceeded.

2.9.4 Terms and Conditions

The terms and conditions described below are non-discretionary, and the WWNF and its permittees must comply with them in order to implement the RPMs (50 CFR 402.14). The WWNF and its permittees have a continuing duty to monitor the impacts of incidental take and must report the progress of the action and its impact on the species as specified in this ITS

(50 CFR 402.14). If the entity to whom a term and condition is directed does not comply with the following terms and conditions, protective coverage for the proposed action would likely lapse.

1. The following terms and conditions implement RPM 1 (minimize take from livestock grazing):

    a. The WWNF and its permittees shall ensure that pastures are monitored mid-season and end-of-season at the frequency described in the Proposed Action. Mid-season monitoring will be conducted by the WWNF in all pastures in which an end-of-season indicator was exceeded during the previous season.

    b. The WWNF shall ensure that appropriately trained WWNF staff monitor streambank alteration levels for each pasture with end-of-season objectives. If the take surrogate of 20 percent streambank alteration is exceeded, the WWNF shall contact the NMFS Snake Basin Office immediately.

    c. During years in which cattle are grazed on the Buck Creek Riparian Pasture prior to July 1, the WWNF shall ensure that appropriately trained WWNF staff conduct a steelhead redd survey on the portion of Buck Creek that is on the pasture, before any cows are turned into the pasture.

    d. During years in which cattle are grazed on the Highway II Pasture prior to July 1, the WWNF shall ensure that appropriately trained WWNF staff conduct steelhead redd surveys on the portion of Buck Creek that is on the pasture, and on Burnt Creek from the upstream extent of steelhead designated critical habitat (i.e., 45.769° N, 117.283° W) downstream to the pasture boundary, before any cows are turned into the pasture.

    e. During years in which cattle are grazed on the McCubbin Pasture prior to July 1, the WWNF shall ensure that appropriately trained WWNF staff conduct steelhead redd surveys on the portion of McCubbin Creek that is on the Pasture, the portion of Sled Creek that is on the Pasture, and on Evans Creek from the upstream extent of steelhead designated critical habitat (i.e., 45.710 N, 117.283 W) downstream to Sled Creek[5], before any cows are turned into the pasture. If the WWNF, in consultation with the NMFS, determines that the potential barrier in lower Sled Creek is a complete barrier to upstream fish passage, then redd surveys in Sled and Evans Creeks can be omitted. If this change occurs, it will be documented via an exchange of letters that includes the information used to determine the status of the barrier.

    f. Any redds found in the Buck Creek Riparian, Highway II, or McCubbin Pastures will be protected with fencing if feasible. Redds that cannot be protected with fencing will be monitored every two days during the workweek (i.e., Monday – Friday) from the time that cows are turned into the pasture until July 1 to

[5] Redd surveys include some stream reaches that are not currently considered spawning habitat by the WWNF. See footnote 2.

determine if disturbance by livestock occurs. If a steelhead redd is disturbed by livestock, the WWNF shall contact the NMFS Snake Basin Office immediately and cows will be removed from the pasture within 2 days.

g. During years in which cows would be removed from the Buck Creek Riparian, Highway II, or McCubbin Pastures and placed in the Highway I pasture before July 1, the WWNF shall ensure that appropriately trained WWNF staff conduct steelhead redd surveys from the upstream extent of steelhead critical habitat in Buck Creek (i.e., 45.758 N, 117.298 W) and Sled Creek (i.e., 45.730 N, 117.278 W) downstream to the Highway I pasture boundaries[6]. If any redds are found, cattle will not be placed into the Highway I pasture until after July 1.

h. The WWNF shall ensure all exclosures, fences, and water developments that reduce cattle use adjacent to streams are properly maintained and functioning as intended.

i. The WWNF shall use the Long-Term and Annual Adaptive Management Strategies described in the Proposed Action to adjust grazing management strategy when needed to maintain desired stream habitat conditions and minimize incidental take.

j. The WWNF shall discuss and consider input from NMFS Level 1 representative regarding proposed changes to Allotment administration resulting from adaptive management prior to implementation.

2. The following terms and conditions implement RPM 2 (monitoring and reporting). The WWNF shall:

    a. Submit an annual monitoring report to NMFS by February 1 each year with the following:

        i. Overview of proposed action and actual management (e.g., livestock numbers, on-off dates for each pasture, etc.).

        ii. Results from all implementation and effectiveness monitoring identified as part of the proposed action, including required move-trigger and end-of-season monitoring (i.e., stubble height, riparian shrub utilization, streambank alteration), seral condition, bank stability, water temperature, sediment, and width-to-depth ratio.

        iii. Discussion of any unauthorized use and/or any maintenance issues related to fences or water developments.

[6] See footnotes 5 and 2.

iv. Review of allotment compliance with annual use indicators. For any incidences of non-compliance, describe the WWNF response per the Annual Adaptive Management Strategy in the Proposed Action.

v. Detailed description of any adaptive management responses taken by the WWNF as part of the Long-Term and Annual Adaptive Management Strategies described in the Proposed Action.

vi. Any relevant information that becomes available regarding Snake River Basin steelhead habitat trends and/or spawning locations that would modify the assumptions made in this Opinion or result in effects not considered.

vii. Any management recommendations for subsequent years.

b. Submit the report to:

National Marine Fisheries Service
Attention: WCRO-2019-00412
800 East Park Boulevard
Plaza IV, Suite 220
Boise, Idaho 83712

2.10 Conservation Recommendations

Section 7(a)(1) of the ESA directs federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. Specifically, conservation recommendations are suggestions regarding discretionary measures to minimize or avoid adverse effects of a proposed action on listed species or critical habitat or regarding the development of information (50 CFR 402.02).

The following recommendations are discretionary measures that NMFS believes is consistent with this obligation and therefore should be carried out by WWNF:

1. To mitigate the effects of climate change on ESA-listed salmonids, follow recommendations by the Independent Scientific Advisory Board (2007) to plan now for future climate conditions by implementing protective tributary, mainstem, and estuarine habitat measures; as well as protective hydropower mitigation measures. In particular, implement measures to protect or restore riparian buffers, wetlands, and floodplains; remove stream barriers; and to ensure late summer and fall tributary streamflows.

2. Implement the potential habitat riparian restoration projects listed in Table 19 of the BA.

2.11 Reinitiation of Consultation

This concludes formal consultation for the permitting of grazing activities on the Buck Creek Allotment.

As 50 CFR 402.16 states, 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 taking specified in the ITS is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this Opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this Opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action.

3. DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

The DQA specifies three components contributing to the quality of a document. They are utility, integrity, and objectivity. This section of the Opinion addresses these DQA components, documents compliance with the DQA, and certifies that this Opinion has undergone pre-dissemination review.

3.1 Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The intended users of this Opinion are the WWNF and its permittees. Individual copies of this Opinion were provided to the WWNF. The format and naming adheres to conventional standards for style.

3.2 Integrity

This consultation was completed on a computer system managed by NMFS in accordance with relevant information technology security policies and standards set out in Appendix III, 'Security of Automated Information Resources,' Office of Management and Budget Circular A-130; the Computer Security Act; and the Government Information Security Reform Act.

3.3 Objectivity

Information Product Category: Natural Resource Plan

Standards: This consultation and supporting documents are clear, concise, complete, and unbiased; and were developed using commonly accepted scientific research methods. They adhere to published standards including NMFS' ESA Consultation Handbook, and ESA regulations, 50 CFR 402.01 et seq.

Best Available Information: This consultation and supporting documents use the best available information, as referenced in the References section. The analyses in this Opinion contain more background on information sources and quality.

Referencing: All supporting materials, information, data and analyses are properly referenced, consistent with standard scientific referencing style.

Review Process: This consultation was drafted by NMFS staff with training in ESA implementation, and reviewed in accordance with West Coast Region ESA quality control and assurance processes.

4. REFERENCES

American Fisheries Society. 1980. Western Division. Position paper on management and protection of western riparian stream ecosystems. 24 p.

Asch, R. 2015. Climate change and decadal shifts in the phenology of larval fishes in the California Current ecosystem. PNAS:E4065-E4074, 7/9/2015.

Bakun, A., B. A. Black, S. J. Bograd, M. García-Reyes, A. J. Miller, R. R. Rykaczewski, and J. Sydeman. 2015. Anticipated Effects of Climate Change on Coastal Upwelling Ecosystems. Current Climate Change Reports 1:85-93. DOI: 10.1007/s40641-015-0008-4, 3/7/2015.

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 104(16): 6720-6725.

Beckman, B. 2018. Estuarine growth of yearling Snake River Chinook salmon smolts. Progress report. Northwest Fisheries Science Center, Seattle, Washington, 7/3/2018.

Beechie, T., H. Imaki, J. Greene, and et al. 2013. Restoring Salmon Habitat for a Changing Climate. River Research and Application 29:939-960.

Belsky, J., A. Matzke, and S. Uselman. 1997. Survey of livestock influences on stream and riparian ecosystems in the western United States. Oregon Natural Desert Association. 38 p.

Bengeyfield, P. 2006. Managing cows with streams in mind. Rangelands, 28(1). pp. 3-6.

Bjornn, T. C. and D. W. Reiser. 1991. Habitat requirements of salmonids in streams. Pages 83–138 in W.R. Meehan, editor. Influences of forest and rangeland management on salmonid fishes and their habitats. American Fisheries Society, Special Publication 19. Bethesda, Maryland.

Black, B., J. Dunham, B. Blundon, J. Brim Box, and A. Tepley. 2015. Long-term growth-increment chronologies reveal diverse influences of climate forcing on freshwater and forest biota in the Pacific Northwest. Global Change Biology 21:594-604. DOI: 10.1111/gcb.12756.

Bond, N. A., M. F. Cronin, H. Freeland, and N. Mantua. 2015. Causes and impacts of the 2014 warm anomaly in the NE Pacific. Geophysical Research Letters 42:3414–3420. DOI: 10.1002/2015GL063306.

Bograd, S., I. Schroeder, N. Sarkar, X. Qiu, W. J. Sydeman, and F. B. Schwing. 2009. Phenology of coastal upwelling in the California Current. Geophysical Research Letters 36:L01602. DOI: 10.1029/2008GL035933.

Bryant, L., W. Burkhardt, T. Burton, W. Clary, R. Henderson, D. Nelson, W. Ririe, K. Saunders, and R. Wiley. 2006. Using stubble height to monitor riparian vegetation. Rangelands 28(1): 23-28.

Burton, T. A., S. J. Smith, and E. R. Cowley. 2011. Riparian area management: Multiple indicator monitoring (MIM) of stream channels and streamside vegetation. Denver, CO, USU: US Department of the Interior, Bureau of Land Management. Technical Reference BLM/OC/ST-10/003+ 1737. 155 p.

Chaney, E., W. Elmore, and W. S. Platts. 1990. Livestock grazing on western riparian areas. Report prepared for U.S. Environmental Protection Agency by Northwest Resource Information Center, Inc., Eagle, Idaho. 45 p.

Cheung, W., N. Pascal, J. Bell, L. Brander, N. Cyr, L. Hansson, W. Watson-Wright, and D. Allemand. 2015. North and Central Pacific Ocean region. Pages 97-111 in N. Hilmi, D. Allemand, C. Kavanagh, and et al. editors. Bridging the Gap Between Ocean Acidification Impacts and Economic Valuation: Regional Impacts of Ocean Acidification on Fisheries and Aquaculture. DOI: 10.2305/IUCN.CH.2015.03.en.

Clary, W. P. 1999. Stream channel and vegetation responses to late spring cattle grazing. Journal of Range Management 52:218-227.

Clary, W. P. and B. F. Webster. 1989. Managing grazing of riparian areas in the Intermountain Region. General Technical Report INT-263, U.S. Dept. of Agriculture, USFS, Intermountain Research Station, Ogden, Utah. 11 p.

Clary, W. P. and B. F. Webster. 1990. Riparian grazing guidelines for the Intermountain Region. Rangelands 12(4):209-212.

Clary, W. P. and W. C. Leininger. 2000. Stubble height as a tool for management of riparian areas. Journal of Range Management. 53 (6): 563-573.

Climate Change Science Program (CCSP). 2014. Climate Change Impacts in the United States. Third National Climate Assessment. U.S. Global Change Research Program. DOI:10.7930/J0Z31WJ2.

Climate Impacts Group (CIG). 2004. Overview of Climate Change Impacts in the U.S. Pacific Northwest, 7/29/2004.

Cope, O. B. (ed.). 1979. Proceedings of the forum - grazing and riparian/stream ecosystems. Trout Unlimited. 94 p.

Copeland, T., J. D. Bumgarner, A. Byrne, L. Denny, J. L. Hebdon, M. Johnson, C. A. Peery, S. Rosenberger, E. R. Sedell, G. E. Shippentower, C. Stiefel, and S. P. Yundt. 2014. Reconstruction of the 2011/2012 steelhead spawning run into the Snake River basin. Report to Bonneville Power Administration, Portland, Oregon.

Copeland, T., J. D. Bumgarner, A. Byrne, P. Cleary, L. Denny, J. L. Hebdon, C. A. Peery, S. Rosenberger, E. R. Sedell, G. E. Shippentower, C. Warren, and S. P. Yundt. 2015. Reconstruction of the 2012/2013 steelhead spawning run into the Snake River basin. Report to Bonneville Power Administration, Portland, Oregon.

Cowley, E. R. 2002. Guidelines for Establishing Allowable Levels of Streambank Alteration. Bureau of Land Management. Idaho State Office. March, 2002

Cowley, E. R. and T. A. Burton. 2005. Monitoring Streambanks and Riparian Vegetation – Multiple Indicators. Tech. Bull. No. 2005-002. USDI, BLM, Idaho State Office. Boise, ID.

Crozier, L. and R. W. Zabel. 2006. Climate impacts at multiple scales: evidence for differential population responses in juvenile Chinook salmon. Ecology 75:1100-1109. DOI: 10.1111/j.1365-2656.2006.01130.x.

Crozier, L. G., R. W. Zabel, and A. F. Hamlet. 2008a. Predicting differential effects of climate change at the population level with life-cycle models of spring Chinook salmon. Global Change Biology 14:236-249. DOI: 10.1111/j.1365-2486.2007.01497.x.

Crozier, L. G., A. P. Hendry, P. W. Lawson, T. P. Quinn, et al. 2008b. Potential responses to climate change for organisms with complex life histories: evolution and plasticity in Pacific salmon. Evolutionary Applications 1:252-270. DOI: 10.1111/j.1752-4571.2008.00033.x.

Dalton, M., P. W. Mote, and A. K. Stover. 2013. Climate change in the Northwest: implications for our landscapes, waters and communities. Island Press, Washington, D.C.

Daly, E. A., R. D. Brodeur, and L. A. Weitkamp. 2009. Ontogenetic Shifts in Diets of Juvenile and Subadult Coho and Chinook Salmon in Coastal Marine Waters: Important for Marine Survival? Transactions of the American Fisheries Society 138(6):1420-1438.

Daly, E. A., J. A. Scheurer, R. D. Brodeur, L. A. Weitkamp, B. R. Beckman, and J. A. Miller. 2014. Juvenile Steelhead Distribution, Migration, Feeding, and Growth in the Columbia River Estuary, Plume, and Coastal Waters. Marine and Coastal Fisheries: Dynamics, Management, and Ecosystem Science 6(1):62-80.

Di Lorenzo, E. and N. Mantua. 2016. Multi-year persistence of the 2014/15 North Pacific marine heatwave. Nature Climate Change 1-7. DOI:10.1038/nclimate3082, 7/11/2016.

Ecovista, Nez Perce Tribe Wildlife Division, and Washington State University Center for Environmental Education. 2003. Draft Clearwater Subbasin Assessment, Prepared for Nez Perce Tribe Watersheds Division and Idaho Soil Conservation Commission. 463 p.

Everest, F. H. and D. W. Chapman. 1972. Habitat selection and spatial interaction by juvenile Chinook salmon and steelhead trout in two Idaho streams. Journal of the Fisheries Research Board of Canada 29(1):91-100.

Fisher, J., W. Peterson, and R. Rykaczewski. 2015. The impact of El Niño events on the pelagic food chain in the northern California Current. Global Change Biology 21: 4401-4414. DOI: 10.1111/gcb.13054, 7/1/2015.

Ford, M. J. (ed.). 2011. Status review update for Pacific salmon and steelhead listed under the Endangered Species Act: Pacific Northwest. U.S. Dept. Commerce, NOAA Tech. Memo. NMFS-NWFSC-113, 281 p.

Foreman, M., W. Callendar, D. Masson, J. Morrison, and I. Fine. 2014. A Model Simulation of Future Oceanic Conditions along the British Columbia Continental Shelf. Part II: Results and Analyses. Atmosphere-Ocean 52(1):20-38. DOI: 10.1080/07055900.2013.873014.

Gargett, A. 1997. Physics to Fish: Interactions Between Physics and Biology on a Variety of Scales. Oceanography 10(3):128-131.

Gleason, R. A., N. H. Euliss, D. E. Hubbard, and W. G. Duffy. 2003. Effects of sediment load on emergence of aquatic invertebrates and plants from wetland soil egg and seed banks. Wetlands 23, 26–34.

Good, T. P., R. S. Waples, and P. Adams (editors). 2005. Updated status of federally listed ESUs of West Coast salmon and steelhead. U.S. Dept. Commerce, NOAA Tech. Memo. NMFS-NWFSC-66, 598 p.

Goss, L. 2013. Understanding the relationships between livestock disturbance, the protocols used the measure that disturbance, and stream conditions. All Graduate Plan B and Other Reports. Paper 258.

Gregory, J. S. and B. L. Gamett. 2009. Cattle trampling of simulated bull trout redds. North American Journal of Fisheries Management 29: 361.

Gresswell, R. E., B. A. Barton, and J. L. Kershner (eds.). 1989. Practical approaches to riparian resource management: an educational workshop. May 8 -11, 1989, Billings, Montana. USDI Bureau of Land Management: BLM-MT-PT-89-001-4351. 193 p.

Haigh, R., D. Ianson, C. A. Holt, H. E. Neate, and A. M. Edwards. 2015. Effects of Ocean Acidification on Temperate Coastal Marine Ecosystems and Fisheries in the Northeast Pacific. PLoS ONE 10(2):e0117533. DOI:10.1371/journal.pone.0117533, 2/11/2015.

Hollowed, A. B., N. A. Bond, T. K. Wilderbuer, W. T. Stockhausen, Z. T. A'mar, R. J. Beamish, J. E. Overland, et al. 2009. A framework for modelling fish and shellfish responses to future climate change. ICES Journal of Marine Science 66:1584-1594. DOI:10.1093/icesjms/fsp057.

Idaho Department of Environmental Quality (IDEQ). 2011. Idaho's 2010 Integrated Report, Final. IDEQ: Boise, Idaho. 776 p.

Interior Columbia Basin Technical Recovery Team (ICBTRT). 2003. Working draft. Independent populations of Chinook, steelhead, and sockeye for listed evolutionarily significant units within the Interior Columbia River domain. NOAA Fisheries. July.

ICBTRT. 2007. Viability Criteria for Application to Interior Columbia Basin Salmonid ESUs, Review Draft March 2007. Interior Columbia Basin Technical Recovery Team: Portland, Oregon. 261 pp.

Independent Scientific Advisory Board (ISAB). 2007. Climate change impacts on Columbia River Basin fish and wildlife. In: Climate Change Report, ISAB 2007-2. Independent Scientific Advisory Board, Northwest Power and Conservation Council, Portland, Oregon, 5/11/2007.

Johnson, R. R., C. D. Ziebell, D. R. Patton, P. F. Folliet, and R. H. Hamre (Tech. Coordinators). 1985. Riparian ecosystem and their management: reconciling conflicting uses; first North America riparian conference; April 16-18. Tucson, Arizona. USDA Forest Service Gen. Tech. Rpt. Rm-120. 523 p.

Jones, K. K., T. J. Cornwell, D. L. Bottom, L. A. Campbell, and S. Stein. 2014. The contribution of estuary-resident life histories to the return of adult Oncorhynchus kisutch. Journal of Fish Biology 85:52–80. DOI:10.1111/jfb.12380.

Kauffman, J. B. and W. C. Krueger. 1984. Livestock impacts on riparian ecosystems and streamside management implications - a review. Journal of Range Management 37(5):430-438.

Kennedy, V. S. 1990. Anticipated Effects of Climate Change on Estuarine and Coastal Fisheries. Fisheries 15(6):16-24.

Kinch, G. 1989. Riparian area management: grazing management in riparian areas. U.S. Bureau of Land Management, Denver, Colorado. Tech. Ref. 737-4. 44 p.

Kirwan, M. L., G. R. Guntenspergen, A. D'Alpaos, J. T. Morris, S. M. Mudd, and S. Temmerman. 2010. Limits on the adaptability of coastal marshes to rising sea level. Geophysical Research Letters 37:L23401. DOI: 10.1029/2010GL045489, 12/1/2010.

Lemmen, D. S., F. J. Warren, T. S. James, and C. S. L. Mercer Clarke (Eds.). 2016. Canada's Marine Coasts in a Changing Climate. Ottawa, ON: Government of Canada.

Limburg, K., R. Brown, R. Johnson, B. Pine, R. Rulifson, D. Secor, K. Timchak, B. Walther, and K. Wilson. 2016. Round-the-Coast: Snapshots of Estuarine Climate Change Effects. Fisheries 41(7):392-394, DOI: 10.1080/03632415.2016.1182506.

Litz, M. N., A. J. Phillips, R. D. Brodeur, and R. L. Emmett. 2011. Seasonal occurences of Humbolt Squid in the Northern California Current System. CalCOFI Reports 52:97-108.

Lucey, S. and J. Nye. 2010. Shifting species assemblages in the Northeast US Continental Shelf Large Marine Ecosystem. Marine Ecology Progress Series, Marine Ecology Progress Series 415:23-33. DOI: 10.3354/meps08743.

Lynch, A. J., B. J. E. Myers, C. Chu, L. A. Eby, J. A. Falke, R. P. Kovach, T. J. Krabbenhoft, T. J. Kwak, J. Lyons, C. P. Paukert, and J. E. Whitney. 2016. Climate Change Effects on North American Inland Fish Populations and Assemblages. Fisheries 41(7):346-361. DOI: 10.1080/03632415.2016.1186016, 7/1/2016.

Mantua, N. J., S. Hare, Y. Zhang, and et al. 1997. A Pacific interdecadal climate oscillation with impacts on salmon production. Bulletin of the American Meteorological Society 78:1069-1079, 1/6/1997.

Martins, E. G., S. G. Hinch, D. A. Patterson, M. J. Hague, S. J. Cooke, K. M. Miller, M. F. Lapointe, K. K. English, and A. P. Farrell. 2011. Effects of river temperature and climate warming on stock-specific survival of adult migrating Fraser River sockeye salmon (*Oncorhynchus nerka*). Global Change Biology 17(1):99–114. DOI:10.1111/j.1365-2486.2010.02241.x.

Martins, E. G., S. G. Hinch, D. A. Patterson, M. J. Hague, S. J. Cooke, K. M. Miller, D. Robichaud, K. K. English, and A. P. Farrell. 2012. High river temperature reduces survival of sockeye salmon (*Oncorhynchus nerka*) approaching spawning grounds and exacerbates female mortality. Canadian Journal of Fisheries and Aquatic 69:330–342. DOI: 10.1139/F2011-154.

Mathis, J. T., S. R. Cooley, N. Lucey, S. Colt, J. Ekstrom, T. Hurst, C. Hauri, W. Evans, J. N. Cross, and R. A. Feely. 2015. Ocean acidification risk assessment for Alaska's fishery sector. Progress in Oceanography 136:71-91.

McElhany, P., M. H. Ruckelshaus, M. J. Ford, T. C. Wainwright, and E. P. Bjorkstedt. 2000. Viable salmonid populations and the recovery of evolutionarily significant units. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-NWFSC-42, Seattle, Washington, 156 p.

Meehan, W. R. and W. S. Platts. 1978. Livestock grazing and the aquatic environment. Journal of Soil and Water Conservation November - December 1978:274-278.Menke, J. (ed.). 1977. Symposium on livestock interactions with wildlife, fish and the environment. Sparks, Nevada. USDA Forest Service Pacific Southwest Forest and Range Experiment Station. Berkeley, California.

Menke, J. (ed.). 1977. Symposium on livestock interactions with wildlife, fish and the environment. Sparks, Nevada. USDA Forest Service Pacific Southwest Forest and Range Experiment Station. Berkeley, California.

Morris, J. F. T., M. Trudel, J. Fisher, S. A. Hinton, E. A. Fergusson, J. A. Orsi, J. Edward, and V. Farley. 2007. Stock-Specific Migrations of Juvenile Coho Salmon Derived from Coded-Wire Tag Recoveries on the Continental Shelf of Western North America. American Fisheries Society Symposium 57:81-104.

Mote, P. W., E. A. Parson, A. F. Hamlet, et al. 2003. Preparing for Climatic Change: The Water, Salmon, and Forests of the Pacific Northwest. Climatic Change 61:45-88.

Murphy, M. L. and W. R. Meehan. 1991. Stream ecosystems. Pages 17-46. In: Meehan, editor. Influences of forest and rangeland management on salmonid fishes and their habitats. American Fisheries Society Special Publication 19, Bethesda, MD.

Myrold, K. M. and B. P. Kennedy. 2015. Interactions between body mass and water temperatures cause energetic bottlenecks in juvenile steelhead. Ecology of Freshwater Fish. 24:373 383.

Naiman, R. J., J. R. Alldredge, D. A. Beauchamp, P. A. Bisson, J. Congleton, C. J. Henny, N. Huntly, R. Lamberson, C. Levings, E. N. Merrill, W. G. Pearcy, B. E. Rieman, G. T. Ruggerone, D. Scarnecchia, P. E. Smouse, and C. C. Wood. 2012. Developing a broader scientific foundation for river restoration: Columbia River food webs. Proceedings of the National Academy of Sciences of the United States of America 109(52):21201-21207.

NMFS. 1998. Biological Opinion Addressing the 18 U.S. Forest Service (USFS) and Bureau of Land Management (BLM) Management Plans for the Upper Columbia and Snake River Basins. June 22, 1998.

NMFS. 2010. Endangered Species Act Section 7 Formal Consultation Biological Opinion for the Westside Range Analysis Project, in the Buck Creek, Day Ridge, Mud Creek, North Powwatka, South Powwatka, and Tope Creek Allotments of the Lower Grande Ronde River Subbasin (HUC 17060106), Wallowa County, Oregon. February 19, 2010. 48 pp.

NMFS. 2017. ESA Recovery Plan for Northeast Oregon Snake River Spring and Summer Chinook Salmon and Snake River Steelhead Populations. 565 pp.

Northwest Fisheries Science Center (NWFSC). 2015. Status review update for Pacific salmon and steelhead listed under the Endangered Species Act: Pacific Northwest. 356 p.

Ohmart, R. D. and B. W. Anderson. 1982. North American desert riparian ecosystems. P. 433-466. In: G. L. Bender, ed., Reference Handbook on the Deserts of North America. Greenwood Press, Westport, Connecticut.

Oregon Department of Environmental Quality (ODEQ). 2012. Water Quality Assessment - Oregon's 2012 Integrated Report Assessment Database and 303(d) List.

Oregon Department of Fish and Wildlife (ODFW) and Washington Department of Fish and Wildlife (WDFW). 2018. 2018 Joint Staff Report: Stock Status and Fisheries for Spring Chinook, Summer Chinook, Sockeye, Steelhead, and Other Species. Joint Columbia River Management Staff, Oregon Department of Fish & Wildlife, Washington Department of Fish & Wildlife, February 20, 2018. 93 pp.

Pearcy, W. G. 2002. Marine nekton off Oregon and the 1997–98 El Niño. Progress in Oceanography 54:399–403.

Pearcy, W. G. and S. M. McKinnell. 2007. The Ocean Ecology of Salmon in the Northeast Pacific Ocean-An Abridged History. American Fisheries Society 57:7-30.

Peek, J. M. and P. D. Dalke. 1982. Wildlife - livestock relationships symposium; Proceedings 10. (ed). April 20-22, 1982, Coeur d'Alene, Idaho. Univ. of Idaho Forest, Wildlife, and Range Experiment Station. Moscow, Idaho.

Pelster, A. J., S. Evans, W. C. Leininger, M. J. Trlica, and W. P. Clary. 2004. Steer diets in a montane riparian community. Journal of range management. 57: 546-552.

Peterson, W., J. Fisher, J. Peterson, C. Morgan, B. Burke, and K. Fresh. 2014. Applied Fisheries Oceanography Ecosystem Indicators of Ocean Condition Inform Fisheries Management in the California Current. Oceanography 27(4):80-89. 10.5670/oceanog.2014.88.

Platts, W. S. 1981. Influence of forest and rangeland management on anadromous fish habitat in western North America -effects of livestock grazing. USDA Forest Service Gen. Technical Report PNW-124. 25 p.

Poesch, M. S., L. Chavarie, C. Chu, S. N. Pandit, and W. Tonn. 2016. Climate Change Impacts on Freshwater Fishes: A Canadian Perspective. Fisheries 41:385-391.

Rehage J. S. and J. R. Blanchard. 2016. What can we expect from climate change for species invasions? Fisheries 41(7):405-407. DOI: 10.1080/03632415.2016.1180287.

Roberts, B. C. and R. G. White. 1992. Effects of angler wading on survival of trout eggs and pre-emergent fry. North American Journal of Fisheries Management 12:450-459.

Roper, B. B. 2016. Setting stubble height standards for riparian areas grazed by cattle in areas with Endangered Species Act listed or sensitive salmon and trout species. National Stream and Aquatic Center, USDA Forest Service. 7pp.

Rosgen, D. 1996. Applied River Morphology, Second Edition. Wildland Hydrology, Pagosa Springs, Colorado. ISBN 0-9653289-0-2.

Rykaczewski, R., J. P. Dunne, W. J. Sydeman, et al. 2015. Poleward displacement of coastal upwelling-favorable winds in the ocean's eastern boundary currents through the 21st century. Geophysical Research Letters 42:6424-6431. DOI:10.1002/2015GL064694.

Saunders, W. C. and K. D. Fausch. 2007. A field test of effects of livestock grazing regimes on invertebrate food webs that support trout in central rocky mountain streams. Annual Report, Colorado State University, Fort Collins, CO.

Saunders, W. C. and K. D. Fausch. 2009. A Field Test of Effects of Livestock Grazing Regimes on Invertebrate Food Webs that Support Trout in Central Rocky Mountain Streams. Department of Fish, Wildlife, and Conservation Biology Colorado State University Fort Collins, CO. September 2009.

Scheuerell, M. D. and J. G. WIlliams. 2005. Forecasting climate-induced changes in the survival of Snake River spring/summer Chinook salmon. Fisheries Oceanography 14(6):448–457.

Spence, B., G. Lomnicky, R. Hughes, and R. P. Novitski. 1996. An ecosystem approach to salmonid conservation. TR-4501-96-6057. ManTech Environmental Research Services Corp.: Corvallis, Oregon.

Stark, E. J., C. Bretz, A. Byrne, P. Cleary, T. Copeland, L. Denny, R. Engle, T. Miller, S. Rosenberger, E. R. Sedell, G. E. Shippentower, and C. Warren. 2016. Snake River basin steelhead 2013/2014 run reconstruction. Report to Bonneville Power Administration, Portland, Oregon.

Stark, E. J., A. Byrne, P. J. Cleary, T. Copeland, L. Denny, R. Engle, T. Miller, D. Nemeth, S. Rosenberger, E. R. Sedell, G. E. Shippentower, and C. Warren. 2017. Snake River basin steelhead 2014/2015 run reconstruction. Report to Bonneville Power Administration, Portland, Oregon.

Stark, E. J., A. Byrne, P. J. Cleary, J. Ebel, T. Miller, D. Nemeth, S. Rosenberger, E. R. Sedell, and C. Warren. 2018. Snake River Basin 2015-2016 steelhead run reconstruction. Report to Bonneville Power Administration, Portland, Oregon.

Sykes, G. E., C. J. Johnson, and J. M. Shrimpton. 2009. Temperature and Flow Effects on Migration Timing of Chinook Salmon Smolts. Transactions of the American Fisheries Society 138:1252-1265.

University of Idaho Stubble Height Review Team. 2004. University of Idaho Stubble Height Study Report. Submitted to Idaho State Director BLM and Regional Forester Region 4, U.S. Forest Service. University of Idaho Forest, Wildlife and Range Experiment Station Moscow, ID. 33p.

Verdonck, D. 2006. Contemporary vertical crustal deformation in Cascadia. Tectonophysics 417(3):221-230. DOI: 10.1016/j.tecto.2006.01.006.

Wainwright, T. C. and L. A. Weitkamp. 2013. Effects of Climate Change on Oregon Coast Coho Salmon: Habitat and Life-Cycle Interactions. Northwest Science 87(3):219-242.

Ward, E. J., J. H. Anderson, T. J. Beechie, G. R. Pess, and M. J. Ford. 2015. Increasing hydrologic variability threatens depleted anadromous fish populations. Global Change Biology 21(7):2500-2509.

Whitney, J. E., R. Al-Chokhachy, D. B. Bunnell, C. A. Caldwell, et al. 2016. Physiological Basis of Climate Change Impacts on North American Inland Fishes. Fisheries 41(7):332-345. DOI: 10.1080/03632415.2016.1186656.

Yamada, S., W. T. Peterson, and P. M. Kosro. 2015. Biological and physical ocean indicators predict the success of an invasive crab, Carcinus maenas, in the northern California Current. Marine Ecology Progress Series 537:175-189. DOI: 10.3354/meps11431.

Zabel, R. W., M. D. Scheuerell, M. M. McClure, et al. 2006. The Interplay Between Climate Variability and Density Dependence in the Population Viability of Chinook Salmon. Conservation Biology 20(1):190-200, 2/1/2006.

Zoellick, B. W. 2004. Density and biomass of redband trout relative to stream shading and temperature in southwestern Idaho. Western North American Naturalist. 64(1). pp. 18-26.

5. APPENDIX A

U.S. Forest Service/National Marine Fisheries Service Level II elevation memo

Forest Service | Wallowa-Whitman National Forest | 1550 Dewey Avenue, Suite A
Baker CityOR97814

File Code: 2200 **Date:**
Route To:

Subject: Elevated Grazing Allotment Mid-Season Monitoring

To: Level 1 Team

Level I elevated the "Grazing Allotment Mid-Season Monitoring" (trigger monitoring) issue described in the attached Elevation Memo to Level II dated November 14, 2018, after being unable to come to resolution. Level II met to discuss the issue on March 5, and resolved the issue with the formulation of some addition language described below. The language was developed to satisfy the request from NMFS for the USFS to require permittees to conduct mid-season trigger monitoring. This language will be inserted in the Allotment Operating instructions (AOIs):

"In order to meet and not exceed objectives for end of season indicators in pastures with ESA listed fish or Critical Habitat, permittees will conduct trigger monitoring midway during the grazing season in each pasture, and notify their range specialist when they think livestock should be moved to the next pasture or off the forest.

Trigger monitoring can vary from numerical measurements of stubble height, streambank alteration and/or riparian shrub utilization to more qualitative indicators that permittees have developed to inform them of when to begin moving livestock from a pasture in order to successfully meet without exceeding end of season objectives. It is acceptable for permittee ocular monitoring to be a stubble height estimate for all grass and grass-like species along the greenline, not specific to hydric species. "

Where there are non-compliances, the following year the FS will conduct mid-season trigger monitoring and collect data in lieu of permittee observations."

This language in the AOIs is in addition to the Forest Strategy agreed to by the Level II team on February 10, 2017. It is "Attachment A", following the "Elevation Memo" on the next page.

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