United States Department of the Interior

FISH AND WILDLIFE SERVICE
Idaho Fish and Wildlife Office- Spokane
Northern Idaho
11103 East Montgomery Drive
Spokane Valley, Washington 99206

January 12, 2018

Cheryl Probert
Forest Supervisor
Nez Perce Clearwater National Forest
903 3rd Street
Kamiah, ID 83536

Subject: Gospel Hump Wilderness Invasive Plants Management, Idaho County, Idaho—Biological Opinion
In Reply Refer to: 01EIFW00-2017-F-1274

Dear Ms. Probert:

Enclosed are the U.S. Fish and Wildlife Service's (Service) Biological Opinion (Opinion) and concurrence with the Nez Perce Clearwater National Forest's (Forest) determinations of effect on species listed under the Endangered Species Act (Act) of 1973, as amended, for the proposed Gospel Hump Wilderness Invasive Plants Management Project (Project) in Idaho County, Idaho. In a letter dated December 15, 2017, and received by the Service on December 15, 2017, the Forest requested formal consultation on the determination under section 7 of the Act that the proposed project is likely to adversely affect bull trout (*Salvelinus confluentus*). The Forest determined that the proposed Project is not likely to adversely affect bull trout critical habitat, and requested our concurrence with this determination. The Forest also determined that the proposed Project is not likely to adversely affect Canada lynx (*Lynx canadensis*) and will not jeopardize the continued existence of North American wolverine (*Gulo gulo luscus*).

The enclosed Opinion and concurrence are based primarily on our review of the proposed action, as described in your November 9, 2017, Biological Assessment (Assessment) and supplemental information received on October 17, November 12, and December 14, 2017, and the anticipated effects of the action on listed species, and were prepared in accordance with section 7 of the Act. Our Opinion concludes that the proposed project will not jeopardize the survival and recovery of bull trout. A complete record of this consultation is on file at this office.

Thank you for your continued interest in the conservation of threatened and endangered species. Please contact Katherine Sarensen at (509) 893-8021 or katherine_sarensen@fws.gov if you have questions concerning this Opinion.

Sincerely,

Stefanie K Blikavde

For Gregory M. Hughes
State Supervisor

cc: IDFG, Clearwater (Swearingen)

BIOLOGICAL OPINION
FOR THE
GOSPEL HUMP INVASIVE PLANTS MANAGEMENT PROJECT
01EIFW00-2017-F-1274

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

Supervisor Stefanie K Blickwede
For Gregory M. Hughes
State Supervisor

Date 1/12/18

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1. BACKGROUND AND INFORMAL CONSULTATION

1.1 Introduction

The U.S. Fish and Wildlife Service (Service) has prepared this Biological Opinion (Opinion) of the effects of the Gospel Hump Invasive Plants Management Project (Project) on bull trout (*Salvelinus confluentus*). In a letter dated December 21, 2017, and received by email on December 21, 2017, the Nez Perce Clearwater National Forest (Forest) requested formal consultation with the Service under section 7 of the Endangered Species Act (Act) of 1973, as amended, for its proposal to carry out the action. The Forest determined that the proposed action is likely to adversely affect bull trout. As described in this Opinion, and based on the Biological Assessment (Assessment) (U.S. Department of Agriculture (USDA) 2017, entire) developed by the Forest and other information, the Service has concluded that the action, as proposed, is not likely to jeopardize the continued existence of bull trout.

The Forest has determined that the Project is not likely to adversely affect bull trout critical habitat. The Service is providing concurrence with that determination. The Forest has also determined the proposed action is not likely to adversely affect Canada lynx (*Lynx canadensis*), and the Project will not jeopardize the continued existence of North American wolverine (*Gulo gulo luscus*). As the proposed action falls under the 2014 Regional Programmatic Biological Assessment for Activities That Are Not Likely to Adversely Affect Canada Lynx, Grizzly Bear, and Canada Lynx Critical Habitat (Service reference number 06E11000-2015-I-0019) and the Northern Region FS Wolverine Programmatic (Service reference number 01EIFW00-2014-I-0512), Canada lynx and North American wolverine will not be discussed further.

1.2 Consultation History

The Service and the Forest have held the following meetings and correspondence concerning the proposed Project.

April 13, 2017	The Forest discussed the fisheries portion of the Assessment at the Level 1 meeting.
Aug 9, 2017	Draft Assessment for fisheries portion of the Project received by Service.
Sept 1, 2017	The Service received additional information regarding the Project from the Forest through the U.S. NOAA Fisheries Service.
Sept 15, 2017	The Service returned comments to the Forest.
Sept 23, 2017	The Service received responses to comments from the Forest.
Oct 12, 2017	The Forest and the Service held a phone call to discuss the Project and potential effects.

Nov 9, 2017	The Forest and the Service held a phone call to discuss the Project and potential effects.
Dec 14, 2017	The Service received further clarification for activities in spawning and rearing habitat after August 15.
Dec 19, 2017	The Service submitted a draft Opinion to the Forest for review.
Dec 20, 2017	The Forest responded that they reviewed the draft Opinion and has no comments.
Dec 21, 2017	The Service received the official request for formal consultation.

1.3 Concurrences

1.3.1 Bull Trout Critical Habitat

The Service concurs with the Forest's determination that the Project, as described in the accompanying Opinion, may effect, but is not likely to adversely affect, bull trout critical habitat. This concurrence was determined by assessing the effects of the proposed action against the nine key components of critical habitat that provide for the conservation of bull trout, hereafter referred to as "physical and biological features" (PBFs). As a result of chemical contamination, resulting from an accidental spill or herbicides that enter the water following herbicide application, or through the removal of riparian vegetation, the Project may affect water quality, food base, and migratory habitats. Concurrence that the Project is not likely to affect bull trout critical habitat is based on the following rationale:

- Water quality, food base, and migratory habitats may be affected by chemical contamination. Of the 98 miles of bull trout critical habitat within the Project area, there are currently approximately 50 acres of infestation within 100 feet of bull trout critical habitat, located primarily along the Salmon River drainage that serves primarily as foraging, migrating, and overwintering habitat. Herbicide application within riparian areas is expected to be minimal (USDA 2017, p. 53), and is expected to decrease over time as invasive weeds are brought under control. Through the implementation of project design criteria described in the Assessment (USDA 2017, pp. 5-13) including, but not limited to, strict transportation, mixing, and disposal measures; ground-based hand spraying of individual plants; and herbicide/surfactant use restrictions within the riparian habitat conservation areas, any instances where chemicals may enter streams are expected to be infrequent and localized. Any herbicide that does enter streams would be rapidly diluted as it moves downstream. Therefore, effects to water quality at the watershed or core area scale are expected to be insignificant and would not prevent or delay bull trout seasonal migrations. In addition, any impacts to aquatic insects or other fish that serve as bull trout prey would be localized and would not correspond to a significant reduction in bull trout food base.
- Food base may be impacted through the removal of riparian vegetation. However, removal of riparian vegetation targets invasive species that exist in a patchy distribution,

leaving native vegetation that serves as habitat for aquatic insects. In addition, only approximately 50 acres of infestation occurs within 100 feet of the 98 miles of bull trout critical habitat in the Project area. The quantity of vegetation removed would be insignificant compared to the amount of remaining native vegetation. Therefore, the loss of riparian vegetation would not significantly alter bull trout food base.

- Water quality may also be affected through increased sediment input resulting from removal of riparian vegetation. However, vegetation removal will be completed by hand or through controls that remove vegetation slowly, allowing for the establishment and recolonization of replacement vegetation. Soil exposure will be patchy in distribution and of short duration, and is not expected to significantly alter sediment input to streams.
- The Project will benefit critical habitat by removing non-native vegetation and promoting a healthy native plant community and properly functioning riparian area.

In summary, Project implementation may affect migratory habitats, food base, and water quality. However, the effects to bull trout critical habitat will be localized and temporary. There are no effects anticipated for the remaining PBFs. Therefore, the Service believes the overall effects to bull trout critical habitat will be insignificant. Since the Service has concurred with the Corp's critical habitat determination here, critical habitat will not be discussed further in the accompanying Opinion.

2. BIOLOGICAL OPINION

2.1 Description of the Proposed Action

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

2.1.1 Action Area

The action area is defined as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02). The action area is located within the 205,539- acre Gospel Hump Wilderness, located approximately 24 air miles east of Grangeville, Idaho (Figure 1). The legal description is Townships 25N, 26N, and 27N, Ranges 4-7E. Proposed activities will take place in 2 subbasins (South Fork Clearwater River subbasin and the Salmon River subbasin) that have been further divided into 13 subwatersheds (Table 1). The action area is comprised of these 13 subwatersheds and includes the Salmon River, which flows along the southern boundary of the Wilderness. Subwatersheds with less

than 10 percent occurrence inside the Wilderness were reviewed but not analyzed in detail, and are not considered part of the action area.

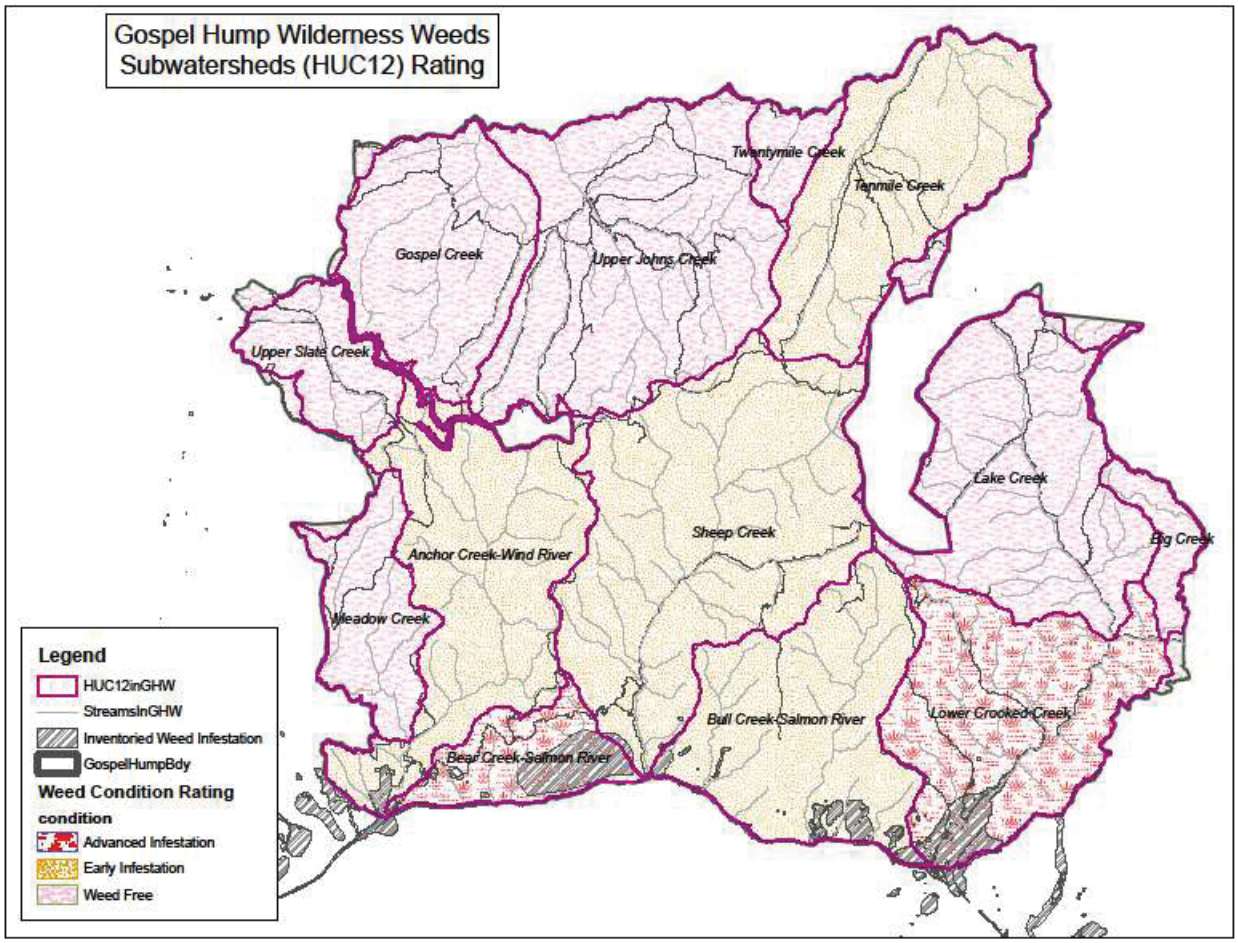

Figure 1. Gospel Hump Wilderness boundary (dark gray outline) with action area comprised of 13 subwatersheds (outlined in magenta). The map also shows weed class designations by subwatershed and documented weed infestations (gray hatched). Source: USDA 2017, p. 8.

2.1.2 Proposed Action

The purpose of the Project is to manage invasive plants using an integrated strategy to reduce the impacts of established invaders on native plant community stability, sustainability, and diversity, and to prevent new invaders from becoming established. Controlling invasive weeds will promote a healthy native plant community with properly functioning riparian areas throughout the wilderness.

Table 1. Subwatersheds located within the Project area. Source: USDA 2017, p. 5.

Watershed	Subwatershed Name (HUC 12)	Subwatershed (acres with in Project Area)	Percent of Subwatershed Located within the Project Area	Weed Infestation Designation	High or Extreme Infestation Risk (Acres (%))
South Fork Clearwater River Drainage					
Johns Creek	Upper Johns Creek	27,745	90	Weed Free	0%
	Gospel Creek	15,070	99	Weed Free	213 (1%)
Upper South Fork Clearwater River	Tenmile Creek	19,271	56	Weed Free	0%
	Twentymile Creek	2,638	18	Weed Free	0%
Salmon River Drainage					
Slate Creek	Upper Slate Creek	6,158	58	Weed Free	94 (2%)
Wind River	Anchor Creek- Wind River	21,617	91	Early	513 (2%)
	Meadow Creek	7,601	43	Early	104 (1%)
Sheep Creek-Salmon River	Bear Creek-Salmon River	6,290	36	Advanced	473 (8%)
	Bull Creek-Salmon River	19,412	69	Early	304 (2%)
	Sheep Creek	32,771	94	Early	762 (2%)
Crooked Creek	Big Creek	2,920	16	Weed Free	0%
	Lake Creek	22,021	76	Weed Free	0%
	Lower Crooked Creek	19,755	98	Advanced	1,320 (7%)
	TOTAL	**194,269**			**3,783 (2%)**

Existing Conditions and Setting

The Forest has documented weed infestations on approximately 5,800 acres (3 percent) of the Wilderness. Invasive weed species within the Project area are rated as either "established invaders" or "new invaders." Established invaders include: spotted knapweed (*Centaurea maculosa*), sulpher cinquefoil (*Potentilla recta*), cheatgrass (*Bromus tectorum*), ventenata (*Ventenata dubia*), St. John's wort (*Hypericum perforatum*), hoary alyssum (*Berteroa incana*), common tansy (*Tanacetum vulgare*), houndstongue (*Cynoglossum officinale*), Canada thistle (*Cirsium arvense*), rush skeletonweed (*Chondrilla juncea*), and burdock (*Arctium spp.*). The most common established invaders are spotted knapweed and sulphur cinquefoil which account for 43 percent and 35 percent of the occupied areas, respectively. New invaders are weeds that are not yet well established, but pose a significant threat of spreading within the project area. New invaders include: diffuse knapweed (*Centaurea diffusa*), yellow starthistle (*Centaurea solstitialis*), leafy spurge (*Euphorbia esula*), yellow toadflax (*Linaria vulgaris*), Japanese knotweed (*Fallopia japonica*), common crupina (*Crupina vulgaris*), meadow hawkweed (*Hieracium caespitosum Dumort*), dalmation toadflax (*Linaria dalmatica*), oxeye daisy (*Leucanthemum vulgare*), and medusahead (*Taeniatherum caput-medusae*). Most documented weeds occur along the face drainages of the Salmon River.

Description of the Action

Infestation areas are spatially divided into two general locations, termed "designated" and "dispersed," each with slightly different management objectives. Designated treatments are those that are focused on high use areas with existing, known weed infestations. High use areas include trails, campsites, airstrips, dam sites, and roads. Most of these areas are located within the Wilderness, but the Project area also included roads located in the non-wilderness portion of the Project area along the boundary of the Wilderness. Most designated treatment areas fall within the Advanced Infestation watershed condition class, described below. The objective for designated treatment is to reduce visitor and livestock contact with invasive weeds, thereby reducing the potential for spread by contact from infested areas to non-infested areas. Dispersed treatments are those focused in more remote, low use areas included in the Early Infestation and Weed-Free watershed condition classes, described below. The objective for dispersed treatments is to eradicate or reduce new starts and colonies of weeds as soon as they are discovered.

Based on the most current information regarding distribution, density, and composition of invasive plants, the Project area is divided spatially by watershed into three broad watershed condition classes, and are defined as follows (Figure 1):

- Advanced Infestation Areas: Those areas containing large concentration of weed infestation where widespread density and distribution of established invaders exceeds the capability of managers to eliminate or eradicate existing populations without active management. About 21 percent of the wilderness has an Advanced Infestation rating, with documented weed infestations occurring on approximately 4,100 acres, or 2 percent of the Wilderness. The Forest will focus treatments at high use areas, such as trails, trailheads, and campsites to reduce the risk of spread from these areas to other areas via contact with humans and livestock. Biocontrols will be introduced in the densest infestations to begin moving the populations of invaders from epidemic to endemic levels. New invaders will be eradicated wherever new starts are discovered using a variety of weed treatments described below.
- Early Infestation Areas: Those areas dominated by native plant communities with scattered low densities of weed infestations (relative to Advanced Infestation Areas). About 29% of the wilderness has an Early Infestation rating, with documented weed infestations occurring on approximately 1,700 acres, or 0.8 percent of the Wilderness. Many of these infestations occur in proximity to high use areas. Established weed populations and newly discovered invaders will be contained to prevent spread and eradicated using a variety of treatment methods, described below.
- Weed Free Areas: Those areas dominated by native plant species with no known weed infestations. Approximately 50 percent of the wilderness is considered Weed Free. Newly discovered populations of established infestations as well as new invaders will be eradicated using a variety of treatment methods, described below.

Weed Treatments

Over a 15-year period, the Forest will treat invasive weeds using manual and cultural, biological, and chemical treatments. Manual and cultural treatments involve physically removing weeds

and seeding, transplanting, or fertilizing native plants. Manual and cultural treatments will be conducted by hand and will occur on up to 200 acres per year. Biological control agents usually involve the use of insects, but may involve bacteria or fungi, and will be applied on up to 20,000 acres during the 15-year life of the Project. Chemical treatments in the form of ground-applied herbicides and supplemental compounds (Table 2) will be applied on up to 1,775 acres, annually, across the action area. Of the 1,775 acres, up to 150 acres will be treated within 100 feet of streams, and up to 50 acres will be treated within 100 feet of streams designated as bull trout critical habitat. Acres of "dispersed" treatments (i.e., treatments in low use, remote areas) within 100 feet of streams will not exceed 10 percent of the total acres treated annually within 100 feet of streams.

Herbicides will be hand-applied directly to weeds using a spray nozzle attached to horseback-mounted or backpack sprayers. There will be no aerial or broadcast herbicide applications with this Project, and only aquatic-approved herbicides will be applied within 15 feet of streams. Chemical applications will take place April through September and will occur primarily in the spring; however, applications may also be applied during the late summer and fall months when appropriate, considering targeted species and environmental factors such as proximity to water, plant growth stage, and adjacent sensitive flora and fauna.

Table 2. Herbicides, adjuvants, and dyes proposed for use during Project implementation. Source: USDA 2017, p. 8.

Common name	Selective?	Common product names
Aminopyralid	Yes	Milestone, ForeFront R&P[1]
2,4-D	Yes	Weedar Weedar 64, Amine 4[1], ForeFront R&P[1], Curtail[1], Cimarron Max[1], Tordon 101[1], Weedmaster[1]
Chlorsulfuron	Yes	Telar XP, Cimarron X-tra[1]
Clopyralid	Yes	Transline, Curtail[1], Redeem R&P[1]
Dicamba	Yes	Banvel, Clarity, Vanquish, Cimarron Max[1], Weedmaster[1]
Glyphosate	No	Rodeo, Aqua Neat, Aquamaster, Glyphos Aquatic
Imazapic	Yes	Plateau
Metsulfuron methyl	Yes	Escort, Cimarron Max[1], Cimarron X-tra[1]
Picloram	Yes	Tordon 22K, Grazon, Pathway, Tordon 101[1]
Sulfometuron methyl	No	Oust
Triclopyr	Yes	Garlon 3A, Remedy Ultra, Redeem R&P[1]
Dyes	N/A	SPI Max, Hi-Light, Dye marker

[1]These products are combinations of chemicals: Fore Front R&P = Aminopyralid and 2,4-D; Cimarron X-tra = Chlorsulfuron and Metsulfuron Methyl; Curtail = Clopyralid and 2,4-D; Redeem R&P = Clopyralid and Trioclopyr; Cimarron Max = Dicamba, Metsulfuron Methyl, and 2,4-D; Weedmaster = Dicamba and 2,4-D; Tordon 101 = Picloram and 2,4-D.

All herbicide use will follow labeled requirements. Adjuvants may be used in certain situations to increase efficacy when conditions, such as plant phenology and label requirements, are ideal but other conditions (e.g., target species has a waxy cuticle or working in sub-optimal temperature and humidity conditions) are not. Adjuvants would be used in accordance with all

applicable label requirements. Surfactants may also be applied in conjunction with herbicides to increase effectiveness. Surfactants proposed for use, along with their restrictions regarding use and distances to water, are displayed in Table 3. New technology, biological controls, herbicide formulations, and supplemental compounds are likely to be developed during Project implementation. The Project allows newly registered herbicides with similar characteristics or mechanisms of toxicity to be used as they become available following separate consultation with the Service.

Table 3. Surfactants proposed for use during Project implementation. Use is limited by distance to water, given in feet. Source: USDA 2017, p.11.

Surfactant	Use Allowed By Distance to Live Water			
	0 – 15’	>15 – 50’	>50 – 100’	> 100’
Agri-Dex and Super Spread MSO	Yes	Yes	Yes	Yes
Cide Kick II	No	Yes	Yes	Yes
R-11, Activator 90, X-77, Latron AG-98, Pro-Spreader Activator, Cide-Kick, LI-700, Spreader 90, Syl-tac, Cygnet Plus, Sylgard 309, Freeway, Silwet L-77, Kinectic, and Inlet	No	No	Yes	Yes
R-900, R-56, Cohere, Dyne-Amic, Bond, Tacktic, and Latron Ag-98 (N)	No	No	No	Yes

Adaptive Management Strategy

The Project includes an adaptive management strategy that supports early detection, rapid response and eradication of new invaders, and containment of established weed populations. An adaptive management strategy will be utilized that includes the following actions:

- Rapid response with the use of chemical herbicides on small newly detected infestations of new or uncommon invaders wherever these sites are discovered.
- Use of newly approved herbicides (according to label restrictions) and biological control agents when they become available. However, application of new herbicides, biological control agents, or additional measures will require additional consultation with the Service prior to use.
- Addition of new invasive species to the list of targeted weeds to stay in compliance with current State and County noxious weed laws.

Design Criteria, Best Management Practices, and Spill Prevention

The Project includes a number of project design criteria (PDC) designed to protect water quality, aquatic habitats, and aquatic species. These PDC will be applied prior to or concurrent with herbicide application to reduce or prevent potential impacts to resources and values. These PDC include, but are not limited to, restricting the use of herbicides within Riparian Habitat

Conservation Areas (RHCA) (Table 4). Additional Project PDCs are given in Appendix A of this Opinion.

Table 4. Chemical use restrictions within Riparian Habitat Conservation Areas during Project implementation. Source: USDA 2017, p. 9.

Distance from water[1]	Maximum allowable wind speed	Application Activity	Herbicides[2]
0 feet	N/A	Chemicals will not be used over live water (streams, ponds, springs, etc.), including water standing or running in ditch lines.	None
< 15 feet	5 mph and blowing away from the direction of the water	Spot applications only such as: spot spraying, wicking, wiping, dripping, painting, or injecting of individual plants with aquatically approved chemicals. Apply spray pointed away from the water, not towards the water.	Glyphosate[3] 2,4-D
> 15 feet	5 mph and blowing away from the direction of the water	Spot applications only such as: spot spraying, wicking, wiping, dripping, painting, or injecting of individual plants with aquatically approved chemicals. Focused spraying of target species with aquatically approved chemicals– may include treating larger patches of weeds or multiple patches in close proximity. Apply spray pointed away from the water, not towards the water.	Glyphosate[3] Triclopyr Aminopyralid Metsulfuron methly Clopyralid Dicamba Imazapic 2,4-D amine
> 50 feet	5 mph	Spot applications only such as: spot spraying, wicking, wiping, dripping, painting, or injecting of individual plants.	All chemicals listed above, as well as Picloram[4].
> 100 feet	Less than 10 mph		All chemicals listed above, as well as: 2,4-D/Clopyralid blend[5] Chlorsulfuron

[1]Chemical use restrictions apply to live water as well as dry ephemeral streams or draws, and ditch lines that run into live water. Distance to water is considered from the edge of the bank.
[2]The chemical Sulfometuron methyl (Oust) would not be used within 300 feet of water.
[3]Trade name glyphosate products, not containing surfactants that can be used within the 0-15 foot buffer of live water include: Aqua Neat, Aquamaster, Glyphos Aquatic, and Rodeo.
[4]Picloram would not be used within 50 feet of any stream for any reason, and would generally not be used within a 100-foot buffer unless other herbicides are not considered effective in controlling certain weed species, such as leafy spurge or rush skeletonweed.
[5]The 2,4-D/Clopyralid is the only chemical combination authorized for use within 100 feet of water.

Project Monitoring

The Project includes Annual Implementation and Effectiveness Monitoring as well Long-term Effectiveness and Trend Monitoring. The details of the monitoring plans can be found in Appendices B and C, respectively, of this Opinion.

Project Reporting

An annual Plan of Operations for herbicide application will be reviewed by a Forest interdisciplinary team that includes, at a minimum, hydrology and/or fisheries, botany, and wildlife specialists, to ensure native flora and fauna are protected and herbicide thresholds are not exceeded. Project implementation will be evaluated periodically with respect to the general categories identified in the Annual Implementation and Effectiveness Monitoring and Long-term Effectiveness and Trend Monitoring to identify where adjustments may need to be made to Project elements. The report will document treatments, methods used, acreage, evaluation of objectives achieved, and a brief summary of unexpected effects.

Prior to each treatment year, the Forest will provide the Service a list of the acres planned for treatment in the upcoming year. The report will include an estimate of the number of acres planned for spraying within 100 feet of water, summarized by subwatershed. Following each treatment year, the Forest will submit a report to the Service with a summary of actual acreage sprayed within 100 feet of water, summarized by subwatershed. This report will be submitted to the Service in December of the following year.

2.2 Analytical Framework for the Jeopardy Determination

2.2.1 Jeopardy Determination

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

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

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

Recovery Units (RUs) for the bull trout were defined in the final *Recovery Plan for the Coterminous United States Population of [the] Bull Trout* (USFWS 2015a, entire). Pursuant to Service policy, when a proposed Federal action impairs or precludes the capacity of a RU from

providing both the survival and recovery function assigned to it, that action may represent jeopardy to the species. When using this type of analysis, the biological opinion describes how the proposed action affects not only the capability of the RU, but the relationship of the RU to both the survival and recovery of the listed species as a whole.

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

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

2.3 Status of the Species

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

2.3.1 Listing Status

The coterminous United States population of the bull trout was listed as threatened on November 1, 1999 (USFWS 1999, 64 FR 58910-58933). The threatened bull trout occurs in the Klamath River Basin of south-central Oregon; the Jarbidge River in Nevada; the Willamette River Basin in Oregon; Pacific Coast drainages of Washington, including Puget Sound; major rivers in Idaho, Oregon, Washington, and Montana, within the Columbia River Basin; and the St. Mary-Belly River, east of the Continental Divide in northwestern Montana (Bond 1992, p. 2; Brewin and Brewin 1997, p. 215; Cavender 1978, pp. 165-166; Howell and Buchanan 1992, entire; Leary and Allendorf 1997, pp. 716-719; USFWS 1999, 64 FR 58910).

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

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

recovery units and will be used in the application of the jeopardy standard for section 7 consultation procedures.

2.3.2 Reasons for Listing and Emerging Threats

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

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

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

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

New or Emerging Threats

The 2015 RP (USFWS 2015a, entire) describes new or emerging threats such as climate change and other threats. Climate change was not addressed as a known threat when bull trout was listed. The 2015 bull trout RP and RUIPs summarize the threat of climate change and acknowledge that some bull trout local populations and core areas may not persist into the future

due to anthropogenic effects such as climate change. The RP further states that use of best available information will ensure future conservation efforts that offer the greatest long-term benefit to sustain bull trout and their required coldwater habitats (USFWS 2015a, pp. vii, 17-20).

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

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

2.3.3 Species Description

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

2.3.4 Life History

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

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

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

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

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

Bull trout typically spawn from August to November during periods of decreasing water temperatures. Migratory bull trout frequently begin spawning migrations as early as April, and have been known to move upstream as far as 155 miles (mi) to spawning grounds (Fraley and

Shepard 1989, p. 135). Depending on water temperature, incubation is normally 100 to 145 days (Pratt 1992, p.1) and, after hatching, juveniles remain in the substrate. Time from egg deposition to emergence may exceed 200 days. Fry normally emerge from early April through May depending upon water temperatures and increasing stream flows (Pratt 1992, p. 1).

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

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

2.3.5 Population Dynamics

Population Structure

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

Bull trout are naturally migratory, which allows them to capitalize on temporally abundant food resources and larger downstream habitats. Resident forms may develop where barriers (either natural or manmade) occur or where foraging, migrating, or overwintering habitats for migratory fish are minimized (Brenkman and Corbett 2005, pp. 1075-1076; Goetz *et al.* 2004, p. 105; Starcevich *et al.* 2012, p. 10; Barrows *et al.* 2016, p. 98). For example, multiple life history forms (e.g., resident and fluvial) and multiple migration patterns have been noted in the Grande Ronde River (Baxter 2002, pp. 96, 98-106) and Wenatchee River (Ringel *et al.* 2014, pp. 61-64). Parts of these river systems have retained habitat conditions that allow free movement between spawning and rearing areas and the mainstem rivers. Such multiple life history strategies help to maintain the stability and persistence of bull trout populations to environmental changes.

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

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

i. "Coastal", including the Deschutes River and all of the Columbia River drainage downstream, as well as most coastal streams in Washington, Oregon, and British Columbia. A compelling case also exists that the Klamath Basin represents a unique evolutionary lineage within the coastal group.
ii. "Snake River", which also included the John Day, Umatilla, and Walla Walla rivers. Despite close proximity of the John Day and Deschutes Rivers, a striking level of divergence between bull trout in these two systems was observed.
iii. "Upper Columbia River" which includes the entire basin in Montana and northern Idaho. A tentative assignment was made by Spruell *et al.* (2003, p. 25) of the Saskatchewan River drainage populations (east of the continental divide), grouping them with the upper Columbia River group.

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

More recently, the USFWS identified additional genetic units within the coastal and interior lineages (Ardren *et al.* 2011, pp. 519-523). Based on a recommendation in the USFWS's 5-year review of the species' status (USFWS 2008, p. 45), the USFWS reanalyzed the 27 recovery units identified in the 2002 draft bull trout recovery plan (USFWS 2002a, p. 48) by utilizing, in part, information from previous genetic studies and new information from additional analysis (Ardren

et al. 2011, entire). In this examination, the USFWS applied relevant factors from the joint USFWS and NMFS Distinct Population Segment (DPS) policy (USFWS and NMFS 1996, 61 FR 4722-4725) and subsequently identified six draft recovery units that contain assemblages of core areas that retain genetic and ecological integrity across the range of bull trout in the coterminous United States. These six recovery units were used to inform designation of critical habitat for bull trout by providing a context for deciding what habitats are essential for recovery (USFWS 2010a, 75 FR 63898). These six recovery units, which were identified in the final bull trout recovery plan (USFWS 2015a) and described further in the RUIPs (USFWS 2015b-g) include: Coastal, Klamath, Mid-Columbia, Columbia Headwaters, Saint Mary, and Upper Snake.

Population Dynamics

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

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

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

River Basin of Idaho (Whiteley *et al.* 2003, entire). Whitesel *et al.* (2004 pp. 14-23) summarizes metapopulation models and their applicability to bull trout).

2.3.6 Status and Distribution

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

Coastal Recovery Unit

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

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

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

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

have their headwater habitats within relatively protected areas (Olympic National Park and wilderness areas).

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

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

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

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

Klamath Recovery Unit

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

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

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

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

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

Saint Mary Recovery Unit

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

Current status of bull trout in the Saint Mary River complex core area (U.S.) is considered strong. The three simple core areas (Slide Lake, Cracker Lake, and Red Eagle Lake) appear to be self-sustaining and fluctuating within known historical population demographic bounds. Note: the NatureServe status assessment tool ranks this RU as imperiled (Figure 2).

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

Columbia Headwaters Recovery Unit

The Columbia Headwaters RUIP describes the threats to bull trout and the site-specific management actions necessary for recovery of the species within the unit (USFWS 2015e, entire). The Columbia Headwaters RU is located in western Montana, northern Idaho, and the northeastern corner of Washington. The RU is divided into five geographic regions: Upper Clark Fork, Lower Clark Fork, Flathead, Kootenai, and Coeur d'Alene Geographic Regions (USFWS 2015e, pp. D-2 – D-4). This RU contains 35 bull trout core areas; 15 of which are complex core areas as they represent larger interconnected habitats and 20 simple core areas as they are isolated headwater lakes with single local populations. The 20 simple core areas are each represented by a single local population, many of which may have persisted for thousands of years despite small populations and isolated existence (USFWS 2015e, p. D-1). Fish passage improvements within the RU have reconnected some previously fragmented habitats (USFWS 2015e, p. D-1), while others remain fragmented. Unlike the other RUs in Washington, Idaho and

Oregon, the Columbia Headwaters RU does not have any anadromous fish overlap. Therefore, bull trout within the Columbia Headwaters RU do not benefit from the recovery actions for salmon (USFWS 2015e, p. D-41).

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

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

Conservation measures or recovery actions implemented include habitat improvement, fish passage, and removal of nonnative species.

Mid-Columbia Recovery Unit (includes a portion of the action area)

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

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

The current condition of the bull trout in this RU is attributed to the adverse effects of climate change, agricultural practices (e.g., irrigation, water withdrawals, livestock grazing), fish passage (e.g. dams, culverts), nonnative species, forest management practices, and mining. Of the 24

occupied core areas, six (25 percent) have no identified primary threats (USFWS 2015d, Table C-2).

Conservation measures or recovery actions implemented include road removal, channel restoration, mine reclamation, improved grazing management, removal of fish barriers, and instream flow requirements.

Upper Snake Recovery Unit (includes a portion of the action area)

The Upper Snake RUIP describes the threats to bull trout and the site-specific management actions necessary for recovery of the species within the unit (USFWS 2015f, entire). The Upper Snake RU is located in central Idaho, northern Nevada, and eastern Oregon. The Upper Snake RU is divided into seven geographic regions: Salmon River, Boise River, Payette River, Little Lost River, Malheur River, Jarbidge River, and Weiser River. This RU contains 22 core areas and 206 local populations (USFWS 2015a, p. 47), with almost 60 percent being present in the Salmon River Region.

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

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

Conservation measures or recovery actions implemented include instream habitat restoration, instream flow requirements, screening of irrigation diversions, and riparian restoration.

Status Summary

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

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

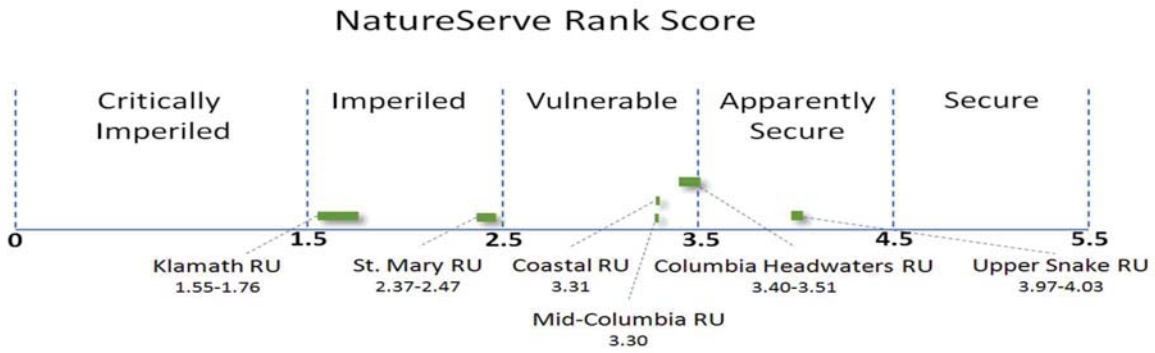

Figure 2. NatureServe status assessment tool scores for each of the six bull trout recovery units. The Klamath RU is considered the least robust and most vulnerable, and the Upper Snake RU the most robust and least vulnerable (from USFWS 2015, Figure 2).

2.3.7 Conservation Needs

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

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

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

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

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

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

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

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

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

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

2.3.8 Previous Consultations

Rangewide

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

Our analysis showed that we consulted on a wide array of actions which had varying levels of effect. Many of the actions resulted in only short-term adverse effects, some with long-term beneficial effects. Some of the actions resulted in long-term adverse effects. No actions that have undergone consultation were found to appreciably reduce the likelihood of survival and recovery of the bull trout. Furthermore, no actions that have undergone consultation were anticipated to result in the loss of local populations of bull trout.

Idaho County

For this Opinion, the Service examined the record for biological opinions issued since 2003 for those action areas that overlap any or all of the following three bull trout core areas: Lower Salmon, Middle Salmon-Chamberlain, and South Fork Clearwater.

There have been 28 biological opinions that pertain to bull trout issued across the three bull trout core areas. Of those, four are broad-scale, program-level Opinions. In two of the four program-level Opinions, no take was anticipated or none has occurred. In one Opinion, lethal and sublethal take was anticipated, but none was reported. In one Opinion, no lethal take was anticipated, but sublethal take was anticipated in the form of harassment. In the remaining 24 Opinions, varying amounts of lethal and nonlethal take of adult bull trout, juvenile bull trout, and bull trout redds were anticipated. All 28 Opinions concluded that the proposed actions would not likely jeopardize the continued existence of the coterminous U.S. population of bull trout.

2.4 Environmental Baseline of the Action Area

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

2.4.1 Status of the Bull Trout in the Action Area

As described in the *Action Area* section of this Opinion, the action area includes portions of two subbsins, one of which is located within the Mid-Columbia RU. Of the 24 occupied bull trout core areas in the Mid-Columbia RU, the action area overlaps one core area, located within the Clearwater River basin. The second subbasin is located within the Upper Snake RU. Of the 22 complex core areas within the Salmon River basin, the action area overlaps two core areas, both located in the Salmon River basin.

The Clearwater River basin contains 44 local bull trout populations within four complex core areas (South Fork Clearwater River, North Fork Clearwater River, Lochsa River, and the Selway River). Bull trout within the Clearwater River basin primarily exhibit fluvial and resident life history patterns, although adfluvial populations do exist, and the Clearwater River watershed, along with the Salmon River watershed, is one of the only watersheds in Idaho currently supporting anadromous salmon. Bull trout are distributed throughout most of the large rivers and associated tributary systems in the basin; however, construction of the Dworshak Dam has resulted in connectivity loss between the North Fork Clearwater Core Area and the rest of the basin. Connectivity is provided between the remaining core areas are as well as the broader Snake River and Salmon River regions via the Clearwater and Middle Fork Clearwater Rivers. The Clearwater River basin currently contains some of the healthiest and most stable bull trout populations in the Mid-Columbia RU, and recent trend data indicate that populations in the Northfork Clearwater River and Lochsa River Core Areas appear to be increasing over the long-term (Meyer *et al.* 2014, Table 2, p. 207; *In* USFWS 2015d, p. C-327). Conversely, populations in the Southfork Clearwater River appear to be in decline.

The Salmon River basin contains over 70 percent of occupied habitat in the Upper Snake Recovery Unit well as 123 of the 206 local populations. The Salmon River basin contains two simple core areas (Opal Lake and Lake Creek) and eight complex core areas (Little Lower Salmon River, South Fork Salmon River, Middle Salmon River-Chamberlain, Middle Salmon River-Panther, Lemhi River, Pahsimeroi River, and Upper Salmon River). Most core areas in the Salmon River basin contain large populations with many occupied stream segments. The Upper Salmon River, Lake Creek, and Opal Lake Core Areas contain adfluvial populations of bull trout, while most of the remaining core areas contain fluvial populations; only the Pahsimeroi core area contains strictly resident populations. While the Salmon River region is disconnected from other watersheds in the Upper Snake RU due to Hells Canyon Dam, it is the only drainage in the Upper Snake RU that still flows directly into the Snake River. Other drainages have lost direct connectivity to the Snake River due to irrigation uses or instream barriers. Connectivity is mostly intact between core areas within the Salmon River watershed, except for the Pahsimeroi River and portions of the Lemhi River Core Areas; therefore, it is

possible for fish in the mainstem Salmon to migrate to almost any Salmon River core area or even the Snake River. Current population trends are unknown for the Middle Salmon River-Panther, Pahsimeroi, Lake Creek, or Opal Lake Core Areas. Recent trend data by the Idaho Department of Fish and Game (IDFG) indicate that populations are increasing in the South Fork Salmon River, Middle Salmon River-Chamberlain, and the Upper Salmon River Core Areas; stable to increasing in the Lemhi River Core Area; and stable in the Little Lower Salmon River Core Area (Meyer *et al.* 2014, Table 2 p. 207).

Detailed information for each specific core area is provided below.

South Fork Clearwater Core Area

The South Fork Clearwater Core Area extends from the confluence with the Middle Fork Clearwater River at Kooskia, Idaho, to the headwaters above Elk City and Red River. The mainstem South Fork Clearwater River (SFCR) provides for migration, and adult and subadult foraging, rearing, and overwintering habitat and serves as essential connectivity habitat for local populations within the core area to populations in other core areas within the Mid-Columbia RU (USFWS 2015d, p. C-322-323). The lower reaches of many tributaries to the SFCR serve as essential thermal refuge habitat for bull trout when summer water temperatures exceed thermal tolerance thresholds. Currently, bull trout use SR habitat in at least five streams or stream complexes (i.e., local populations). Local populations include Red River Complex, Crooked River Complex, Newsome Creek Complex, Tenmile Creek Complex, and Johns Creek Complex.

Bull trout abundance and distribution across the core area is considered lower than historical levels, with extremely low levels of fluvial migratory adults (USFWS 2002d, pp. 25-26). Risk assessments in 2002 determined long-term viability of the South Fork Clearwater Core Area by examining the number of local populations, adult abundance, reproductive rate, and connectivity between local populations (USFWS 2002d, pp. 95). Bull trout within the South Fork Clearwater River Core Area were ranked at an increased to intermediate risk of extinction. Extinction risk was later calculated for the 5-year status review using an alternative method that included population abundance, distribution, population trend, and threats (USFWS 2008, p. 11). Bull trout in the South Fork Clearwater River Core Area were ranked "at risk" due to substantial and imminent threats, intermediate distribution of key habitats, and unknown population trends (USFWS 2008, p.34). Through an extensive modeling effort (High *et al.* 2005, pp. 3-7; High *et al.* 2008, 1688-1691), the IDFG reported population numbers for the South Fork Clearwater Core Area (High *et al.* 2005, p. 32). The approximate population of adult and young bull trout was reported as 2,347 (±1,248) individuals. Assuming that 10 percent of the total number represents adult fish (K. Meyer, IDFG, pers. comm. March 11, 2009), the adult population in the core area is approximately 234 bull trout. Recent trend modeling by the IDFG indicate that populations in this core area may be in decline (Meyer *et al.* 2014, Table 2 p.207).

Primary threats to the South Fork Clearwater Core Area are related to forest practices, roads, mining, transportation corridors, agricultural practices, grazing, and nonnative brook trout (USFWS 2015d, p. C-323). The result has been increased sedimentation, instream degradation, and a loss of complex instream habitat in both SR and FMO habitats. Brook trout in some SR tributaries (e.g., upper Crooked and Red Rivers) and in mainstem FMO habitats contribute to competition, predation, and possible hybridization with bull trout. Resulting range reductions and fragmentation have led to a decline in the number of local populations and decreased resiliency of bull trout within the Core Area.

The action area overlaps the upper reaches of the South Fork Clearwater River Core Area, including both the Upper Tenmile Creek and Johns Creek Complexes (Figure 3).

Little Lower Salmon River Core Area

The Little Lower Salmon River Core Area extends from the watersheds of the confluence of the mainstem Salmon River with the Snake River, upstream to the confluence with French Creek, and also contains the Little Salmon River watershed. The mainstem Salmon River provides for migration, and adult and subadult foraging, rearing, and wintering habitat, while the Little Salmon River provides for foraging and adult rearing habitat and connectivity between local populations in the core area (USFWS 2002e, pp. 28-29). Bull trout currently use SR habitat in at least seven streams or stream complexes (i.e., local populations). Local populations include Slate Creek, John Day Creek, Rapid River, Boulder Creek, Hard Creek, Lake/Lower Salmon, and Partridge Creek. Rapid River is considered a population stronghold, with an increasing population. Current trend information for the Slate Creek and John Day populations indicate that those populations are decreasing.

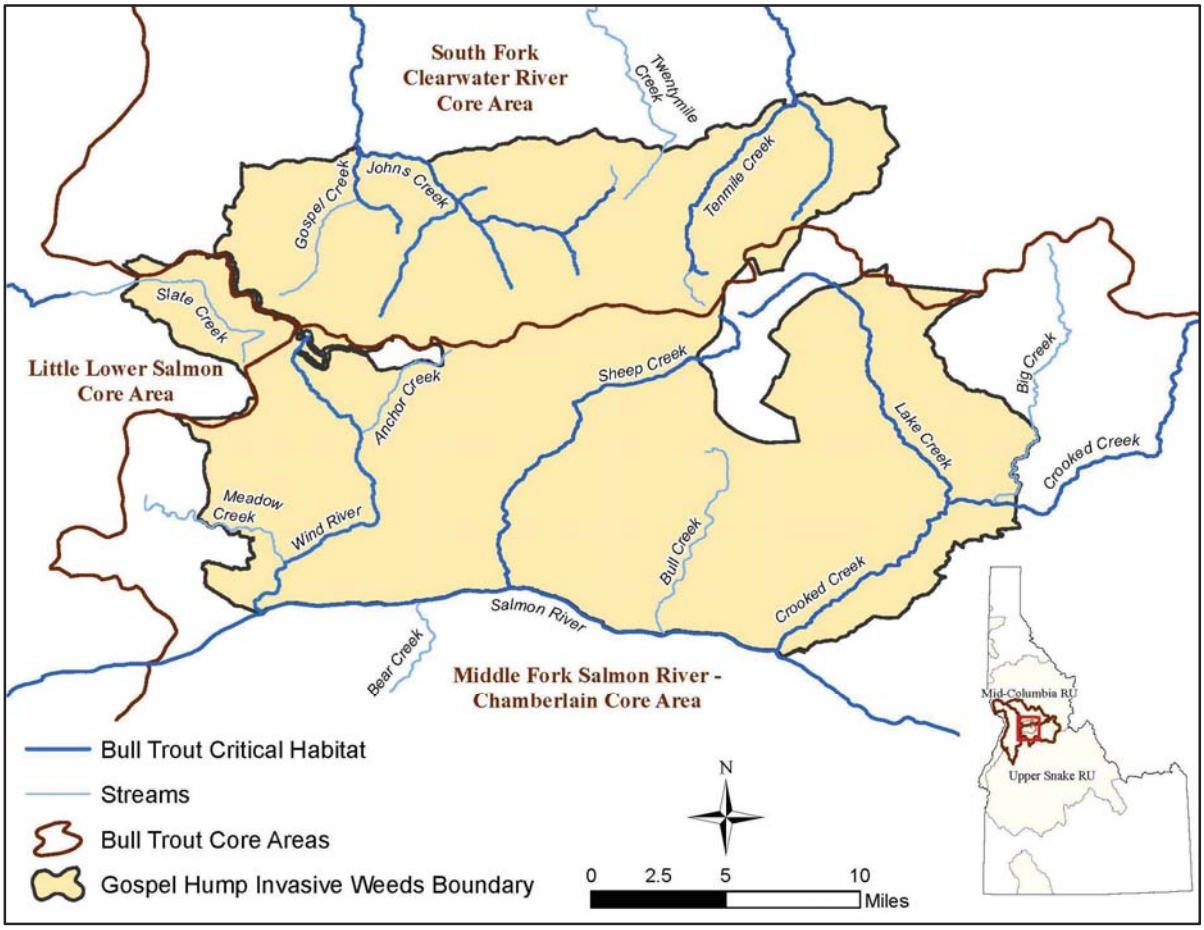

Figure 3. Map of the Action Area (yellow), including bull trout critical habitat (dark blue).

Bull trout within the Little Lower Salmon River Core Area were ranked at reduced to intermediate risk of extinction during the 2002 risk assessment, described above (USFWS 2002e, pp. 63-66). During the 5-year status review, bull trout in the Little Lower Salmon River Core Area were ranked at "high risk" due to substantial and imminent threats, low population size, and

unknown population trends (USFWS 2008, p.34). Through an extensive modeling effort (High *et al.* 2005, pp. 3-7; High *et al.* 2008, 1688-1691), the IDFG reported population numbers for the Little Lower Salmon Core Area (High *et al.* 2005, p. 32). The approximate population of adult and young bull trout was reported as 7,767 (±2,827) individuals. Assuming that 10 percent of the total number represents adult fish (K. Meyer, IDFG, pers. comm. March 11, 2009), the adult population in the core area is approximately 777 bull trout. Recent trend modeling suggests that populations in this core area are stable to increasing (Meyer *et al.* 2014, Table 2 p.207).

Threats to the Little Lower Salmon River Core Area have been attributed to livestock use of riparian areas (primarily in the upper reaches of the Little Salmon River), reduced stream flow and elevated summer water temperatures due to irrigation diversion structures, in-stream and riparian degradation resulting from road construction and private land development, past mining activities (particularly in the upper Slate Creek drainage), barriers to fish passage, and the introduction of nonnative species (USFWS 2005, pp. 391-392). Because of its lower elevation, the Little Lower Salmon River Core Area is also susceptible to the effects of climate change (USFWS 2015g, pg. E-13).

The action area overlaps upper Slate Creek; however, this section is not designated SR habitat (Figure 3).

Middle Fork Salmon River- Chamberlain Core Area

The Middle Fork Salmon River-Chamberlain Core Area is located in Idaho County and includes the Salmon River from its confluence with the Middle Fork Salmon River downstream to French Creek on the western boundary. The northern boundary is comprised of the peaks that separate the Salmon River basin from the Clearwater basin, and the southern boundary follows the ridges between Farrow Mountain and Mosquito Peak and then continues to the mouth of the South Fork Salmon River. The mainstem Middle Fork Salmon River provides for migration, and adult and subadult foraging, rearing, and overwintering habitat (USFWS 2015g, p. E-90). The lower reaches of many tributaries likely serve as essential thermal refuge habitat for bull trout when summer water temperatures exceed thermal tolerance thresholds. At least nine streams or stream complexes (i.e., local populations) support bull trout spawning and rearing. Local populations include Bargamin Creek, Warren Creek, Fall Creek, California Creek, Wind River, Sheep Creek, Big Squaw Creek, Sabe Creek, and Chamberlain Creek. Bull trout spawning and rearing occurs in the upper reaches of the creeks with subadult and adult rearing in the remainder of the drainages.

Bull trout within the Middle Fork Salmon River-Chamberlain Core Area were ranked at an intermediate risk of extinction during the 2002 risk assessment, described above (USFWS 2002e, pp. 63-66). During the 5-year status review, bull trout in the Middle Fork Salmon River-Chamberlain Core Area were ranked at "potential risk" due to lack of data and widespread low-severity threats (USFWS 2008, p.34). Through an extensive modeling effort (High *et al.* 2005, pp. 3-7; High *et al.* 2008, 1688-1691), the IDFG reported population numbers for the Middle Fork Salmon River-Chamberlain Core Area (High *et al.* 2005, p. 32). The approximate population of adult and young bull trout was reported as 2,930 (±2,016) individuals. Assuming that 10 percent of the total number represents adult fish (K. Meyer, IDFG, pers. comm. March 11, 2009), the adult population in the core area is approximately 293 bull trout. Recent trend modeling by IDFG suggests populations in this core area may be increasing (Meyer *et al.* 2014, Table 2 p.207).

No primary threats were identified in the Recovery Unit Implementation Plan for the Middle Fork Salmon River-Chamberlain Core Area. However, the core area has been impacted by effects from road densities, and mining and associated chemical contamination, particularly in Warren Creek and Crooked Creek (USFWS 2005b, pp. 401-402). The magnitude of these threats has been disputed. In addition, brook trout are reported to occupy over half of the streams currently supporting local bull trout populations (High *et al.* 2005, p. 39).

The action area overlaps the mainstem Salmon River, Wind River, Sheep Creek, and Lower Crooked Creek (Figure 3).

2.4.2 Factors Affecting Bull Trout in the Action Area

The action area includes the Gospel Hump Wilderness, a federally protected, undeveloped area that currently received no active management, including fire suppression. The action area also includes a short segment of road in the northwest that serves to access the Wilderness. Because of its "wilderness" designation, bull trout in the action area are impacted primarily by natural processes including fires, landslides, and floods. However, invasive weeds have become established along the southern extent of the action area, and may be spreading to interior regions, assisted by both natural and anthropogenic factors. In addition, bull trout are affected by anthropogenic stressors, where grazing and recreational use result in localized impacts to streams, and by stressors associated with global climate change.

Wildfires occur primarily along the Salmon River side of the Wilderness, and weeds readily establish on burned landscapes. Currently, invasive weeds have been documented on approximately 3 percent of the Wilderness with the largest concentrations currently located along the mainstem Salmon River and Lower Crooked Creek, in areas that have burned repeatedly since the 1980s. As invasive weeds become established, they replace native bunchgrass, forbs, and gramminoids, and soil erosivity increases (Lacey *et al.* 1989 pp. 629-630), which increases sediment yield to streams, and increases the potential for landslides. Landslides expose bare soils that are susceptible to further weed infestations.

Approximately 11 percent of the Wilderness has permitted cattle grazing. These two allotments, comprising four pastures, are located along the western portion of the Wilderness; however, one pasture has not been grazed for many years and a second receives little use likely due to limited forage availability. As there is limited stream access for cattle and very few stream crossings, the overall effects to bull trout and other aquatic resources from cattle grazing are likely minimal.

Campsites, pack stock and livestock grazing, trail erosion, fords, and areas of high recreational use can negatively affect aquatic habitat in the form of bank trampling, bank erosions, and channel widening. There are 125 stream crossings located across the Wilderness, which amounts to a very small portion of the landscape, but these activities have undoubtedly resulted in some localized impacts to bull trout. In addition, invasive plants are most often associated with human use areas, and mainline trails in the wilderness often follow along streams. Of the 275 miles of trail (approximately 3 percent of the wilderness), roughly 20 miles are within 100 feet of streams and half of those have documented weed infestations.

As stated in the *Conservation Needs* section of this Opinion, a large body of research has documented the potential impacts to bull trout as a result of human-induced climate change. Although thermal habitat in montane streams may be more resistant to climate-related

temperature changes due to their insular topography (Isaak *et al.* 2016, p. 4376), greater fire frequency may result in increases in peak flows and channel scouring, and high winter flows resulting from increased winter precipitation in the form of rain rather than snow threaten to displace recently emerged juveniles from rearing habitats. At lower elevations, increasing water temperatures may make bull trout more dependent on thermal refuge of tributary streams, and reduced flows in summer months may result in an inability for fluvial bull trout to migrate between spawning and rearing sites in the upper drainages to overwinter sites in larger mainstem rivers. In addition, increasing water temperatures may shift upstream the thermal barriers that protect bull trout from invasion by nonnative brook trout (Isaak *et al.* 2014, p. 111, 113). While there is evidence that bull trout distribution patterns may be changing in response to changing climate (Eby *et al.* 2014 p. 4, *In* Isaak *et al.* 2015, p. 2541), Isaak *et al.* suggest that climate change may be progressing more slowly than anticipated (2016, p. 4376-4377).

In summary, effects to bull trout in the action area are primarily related to natural processes, but are also impacted by effects associated with invasive weeds infestations, grazing and recreational uses, and climate change. Invasive weeds, while becoming increasingly established along the southern boundary of the action area, are expected to be reduced through Project implementation. Grazing and recreational uses will continue to exert minimal localized stresses to bull trout throughout the life of the Project. Climate change is likely having some measure of effect on bull trout movement and distribution, a trend that is expected to continue.

2.5 Effects of the Proposed Action

Effects of the action consider the direct and indirect effects of an action on the listed species and/or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action. These effects are considered along with the environmental baseline and the predicted cumulative effects to determine the overall effects to the species. Direct effects are defined as those that result from the proposed action and directly or immediately impact the species or its habitat. Indirect effects are those that are caused by, or will result from, the proposed action and are later in time, but still reasonably certain to occur. An interrelated activity is an activity that is part of the proposed action and depends on the proposed action for its justification. An interdependent activity is an activity that has no independent utility apart from the action under consultation.

2.5.1 Direct and Indirect Effects of the Proposed Action

The proposed action may affect bull trout directly or indirectly through the various treatment elements of the Project. While non-treatment elements (e.g., crews and horses; staging, hiking, and camping in the Project area) are integral to the successful implementation of the Project, they are not expected to result in any effects to aquatic species or their habitats. Therefore, the following analysis focuses on the herbicide preparation and treatment elements of the Project. The proposed action includes extensive PDC (USDA 2017, pp. 11-13) to avoid and/or minimize adverse effects to bull trout, and the following analysis assumes those measures will be implemented during all activities. This Opinion analyzes the likelihood and magnitude of potential effects, taking into consideration the PDC.

2.5.1.1 Manual and cultural treatments

Manual and cultural treatments will be performed by hand on up to 200 acres per year. Manual removal of invasive weeds is expected to expose bare soils that could result in increased sedimentation to streams. Sediment is a serious stressor for bull trout, and has been shown to disrupt social and feeding behavior, impair feeding efficiency, and reduce growth rates. However, manual and cultural treatments will occur on less than 0.1 percent of the total action area during the 15-year life of the Project (USDA 2017, p. 25). In addition, removal of invasive weeds will be followed by cultural treatments such as seeding, transplanting, and fertilization that would reduce sedimentation and restore or improve treatment areas through the establishment of native vegetation. As specified in the Assessment, fertilizers will be applied according to the Forest and manufacturer's guidelines and, while runoff may occur, nutrient concentrations will not be sufficient enough to enrich streams (USDA 2017, p. 25). Any potential impacts from these activities are expected to be temporary, short-term, and localized, and not expected to interfere with the breeding, feeding, or sheltering behavior of bull trout. Therefore, effects to bull trout from manual and cultural treatments are expected to be insignificant.

2.5.1.2 Biological treatments

Biological treatments will include the release of selective insects, bacteria, or fungi, and will occur on up to 20,000 acres over the 15-year life of the Project. The removal of invasive species may result in increased soil erosion associated with the exposure of bare soils as targeted invasive weeds are eradicated. The effects of sedimentation are described above. While biological treatments have the potential to increase sedimentation, infested riparian areas are already experiencing increased soil erosion associated with invasive vegetation (Lacey *et al.* 1989, pp. 629-630). Additional soil exposure will be a short-term disturbance that is expected to decrease as native vegetation becomes established. In addition, biological agents do not compete for food with aquatic organisms and may even provide additional food sources for fishes where infestations occur adjacent to stream channels. Therefore, the effects to bull trout from the use of biological controls will be insignificant in the short term and may be beneficial in the long term.

2.5.1.3 Chemical treatments

The Forest will utilize chemical treatments in the form of herbicides and associated additives to treat up to 1,775 acres per year across the Wilderness and its boundary. Treatments within 100-foot riparian buffers are limited to 150 acres per year, and treatments within 100-foot riparian buffers of bull trout designated critical habitat are limited to 50 acres per year. As previously discussed, treatment objectives differ whether herbicides are applied in "designated," high-use areas or "dispersed," low-use areas. Although the Assessment does not specify the maximum acreage to be treated within 100 feet of streams in "designated" areas, treatment in "dispersed" areas will not exceed 10 percent of the total annual acres treated within 100 feet of streams (i.e., up to 15 acres per year). While these numbers represent maximum allowable treatment acres per year, the total herbicide applied each year is expected to decrease over time as weed infestations are brought under control. Due to the presence of large, documented weed infestations, most treatments will occur along the Salmon River face drainages and lower tributaries to the Salmon River (i.e., Lower Crooked Creek and Wind River), but treatments will also occur in the upper drainages where smaller infestations have been documented and wherever new infestations

occur. The spraying season will run from April through September, but the majority of spraying is expected to be completed by August 15.

Herbicide preparation requires water to be drawn from Project area streams, and often crews will enter streams in order to draft water. The number and frequency of entries depends on the amount of water needed to treat an area. Water will be drawn primarily from the Salmon River or from the lower drainages of tributaries to the Salmon River, all of which serve as FMO habitat for adult/subadult bull trout, but water may also be drawn infrequently from upper tributary streams that serve as SR habitat. Herbicide treatments begin in May, following bull trout fry emergence and crews will not enter streams after August 15, when bull trout spawning is expected to commence. Therefore, we do not expect drafting to disturb bull trout redds. Instream activities will be a temporary, minor disturbance to adult/subadult bull trout in the area, and we expect any bull trout within the area to flee to nearby suitable habitat. During the day, juvenile bull trout are often found under substrate in deep pools or runs. While we expect crews to target runs as a water source, we do not expect crews to be walking in deep pools or runs, so the likelihood of trampling young is very low. In addition, water is drafted from the upper water column and does not involve movement of channel substrates, so we expect young bull trout to be able to remain under cover structures or move away to alternative hiding areas to avoid drafting disturbance. Because drafting represents an infrequent, short-term disturbance that is not expected to interfere with the breeding, feeding, or sheltering behavior of bull trout, the effects to bull trout from drafting will be insignificant or discountable.

Chemical treatments may result in a temporary increase in soil erosion as invasive weeds are eradicated, exposing bare soils. However, chemical treatments in riparian areas will be limited to spot spraying, wicking, wiping, dripping, painting, or injecting of individual plants and would not result in large areas of bare ground. Any soil exposure will be reduced as new vegetation established. In addition, we expect a sufficient amount of native vegetation to remain in riparian areas following chemical treatments to reduce the amount of sediment transport. Any sediment that reaches streams will be small quantities that represent localized, minor, short-term disturbances to bull trout and is not expected to interfere with breeding, feeding, or sheltering behavior. Therefore, effects to bull trout from sedimentation as a result of chemical treatments will be insignificant.

Chemical treatments are more likely to affect bull trout through potential toxicological effects to individuals than from physical changes to their habitat. The full range of toxicological effects and ecological risks to bull trout are not fully known for all herbicides, formulations, or additives proposed for use during Project implementation. Similarly, a quantitative estimate of the exposure of bull trout to herbicides is not possible because exact treatment locations and amounts of herbicides to be applied each year are not definitively known. Given the incomplete information available, we rely on the risk quotient developed for the Forest to determine the potential exposure risk to aquatic systems (see USDA 2017, p. 26) and extrapolation or inference from published studies of similar chemicals on surrogate fish species to qualify potential effects to bull trout.

The risk of adverse effects from chemical treatments depends on the probability of exposing bull trout to toxic concentrations of herbicides (Norris *et al.* 1983, p. 5). The Service does not anticipate significant effects to bull trout resulting from herbicide treatments located greater than 100 feet from streams, as treatments within 100 feet of streams have a greater potential for

delivering herbicides to streams than upland sites. Similarly, the Service does not anticipate significant effects to bull trout in the Salmon River due to the rapid dilution expected from the volume of water in the river, which greatly reduces the probability of exposing subadult/adult bull trout to toxic concentrations of herbicides. Treatments within 100 feet of tributary streams have a greater likelihood of delivering toxic concentrations of herbicides to streams due to their low flow volume, particularly in the late-summer and early fall months, and the highest probability of bull trout presence, including resident and fluvial bull trout, adults, juveniles, eggs, alevins, and fry. Therefore, our analysis of the effects from chemical treatments will focus on those treatments occurring within 100 feet of streams with documented or suspected bull trout spawning and rearing.

Bull trout may be exposed to herbicides via sediment, food, or water. Exposure through sediment occurs following the transport of contaminated sediments to streams and is typically associated with erosion (Norris 1983, p. 8). Erosion is usually the result of forest management, landslides, or streambank erosion. The Wilderness is not actively managed. In addition, the Project includes selective, ground-based herbicide application that does not target landslide or streambank erosion areas. Therefore, the likelihood of contaminated sediments reaching streams through forest management or natural processes is very small, and the effects to bull trout are expected to be discountable.

Bull trout may also be exposed to herbicides through the food chain. Bull trout may consume an aquatic organism that came into contact with an herbicide just before entering the water. The risk of exposure to toxic concentrations of harmful chemicals via this route is reduced because only aquatic-approved glyphosate and 2,4-D are approved for use within 15 feet of water. Alternatively, bull trout may consume an organism that has taken in an herbicide in the water through gill/epithelial tissue (i.e., bioconcentration) or dietary uptake, a process known as bioaccumulation (Katagi 2010, p. 3). Bioaccumulation is a product of the ratio of fat solubility to water solubility where the greater the water solubility of the chemical, the less likely the chemical will be available to accumulate in aquatic organisms. When the level of an herbicide accumulated by an organism is concentrated through two or more trophic levels, the process is referred to as biomagnification. Accumulation to toxic levels requires exposure to sufficient concentration of an herbicide for sufficient durations. Although herbicides may be taken in by bull trout prey during Project implementation, the risk of biomagnification of herbicides is largely eliminated because the herbicides proposed for use are relatively water soluble, so bioaccumulation is not expected for eight of the nine herbicides proposed for use (Norris *et al.* 1991, p. 220). Triclopyr has a low bioaccumulation potential and is rapidly eliminated once exposure has ended. The likelihood that a bull trout would ingest an organism, or enough prey, to be exposed to toxic concentrations of triclopyr is very small; therefore, the effects to bull trout from exposure to herbicides through the food chain is expected to be insignificant or discountable.

Bull trout may be exposed to herbicides in the water. Herbicides may enter a stream through accidental spill, direct spray, spray drift, volatilization, or overland flow or leaching (including mobilization through ephemeral streams and ditches), with each route resulting in a different exposure magnitude and duration depending on the method and rate of application, and the behavior of the chemical in the environment.

Accidental spilling could occur while transporting chemicals from staging areas to treatment areas or during preparation when chemicals are being mixed or transferred from one container to another. The Project includes a number of PDC that will minimize the potential adverse impacts including, but not limited to:

- Maintaining all transportation, storage, or application equipment in a leak-proof condition; triple wrapping and securing to vessels all chemical containers that are being transported by raft;
- Ensuring no storage, mixing, or cleaning equipment occurs within 300-foot riparian habitat conservation areas unless it can be assured that an accidental spill would not be able to contaminate a stream or water body before it could be contained; and
- In no case would mixing, loading, or cleaning occur within 100 feet of live water.

Because of the required PDC, accidental spills are not expected to result in delivery of toxic concentrations of chemicals to streams or other water bodies because of the limited quantity, frequency, and duration of a spill, and the maintenance of the 100-foot buffer (bullet 3 above). Therefore, effects to bull trout from accidental spills are considered insignificant or discountable.

Direct spray has the greatest potential to deliver toxic concentrations of herbicides to streams. Direct delivery is not expected because there is no water application proposed in this action. Only spot applications of aquatically-approved versions of glyphosate and 2,4-D without surfactants would be used within 15 feet of water. Applicators will aim nozzles away from water and no spraying will occur during windy conditions (i.e., wind speeds greater than 5 miles per hour). These restrictions will reduce, but not eliminate the risk of these herbicides reaching the water.

The risk of spray drift occurs when herbicides are picked up on air currents and transported to water. This risk has been minimized because there is no broadcast or aerial spraying under the proposed action. Only ground-based, spot applications (i.e., spot spraying, wicking, wiping, dripping, painting, or injecting individual plants) will be used such that spray nozzles are held no more than 6 inches from target plants, and spraying will not occur during windy conditions. The drift distance is also dependent upon spray droplet size and height of application with drift being minimized by using the coarsest droplet size and lowest application height; however, these prescriptions are not proposed. The specified protective measures will minimize, but not eliminate, the risk of herbicides reaching bull trout habitat.

Herbicides volatilize and drift when they enter a gaseous phase and are transported on air currents with potential delivery to bull trout habitat. Volatility is dependent upon the molecular weight of the herbicide and will increase with increasing temperature and soil moisture (Tu *et al.* 2001, p. 6.8). According to the Assessment, dicamba is the only volatile herbicide proposed for use, and dicamba will not be used within 15 feet of streams (USDA 2017, Table 11, p. 25). This restriction will minimize, but not eliminate, the risk of this herbicide reaching bull trout habitat.

Herbicides may be delivered to surface waters by overland flow (including mobilization through ephemeral streams and ditches) or leaching when precipitation occurs within a few days of herbicide application (Tu *et al.* 2001, p. 6.9). The amount of herbicide introduced to a stream depends on the level of precipitation and is also dependent upon a number of factors, including soil half-life (persistence of an herbicide in the soil), sorption (the tendency of an herbicide to bind to soil particles), and water solubility (the amount of herbicide that will dissolve in a known

amount of water). In the Assessment, herbicides were rated on their movement potential based on these factors (USDA 2017, Table 13, p. 28-29). Of the herbicides proposed for use within 100 feet of streams, clopyralid, dicamba, and picloram have a very high movement rating; metsulfuron methyl has a high rating; aminopyralid, imazipic, triclopyr, and 2,4-D amine have a moderate rating; and glyphosate, which has a high sorption coefficient, has a very low movement rating (Table 5). Chlorsulfuron will not be used within 100 feet of streams, and Sulfometuron methyl (Oust) will not be used within 300 feet of streams. The risk of herbicides reaching water is minimized because herbicide application is not permitted when heavy precipitation is occurring or is imminent (i.e., when precipitation has occurred within the previous 48 hours, is occurring, or is expected to occur within 48 hours) and by the riparian use restrictions described in Table 4. While these measures will minimize the risk of delivery, if heavy precipitation does occur within a few days of treatment, some herbicide may be introduced into bull trout habitat (Wood 2001, pp. 22-23).

Table 5. Herbicide movement potential rating[1] (excerpted from USDA 2017, Table 13). Refer to the Assessment for reference citations.

Chemical Evaluated	Soil Half Life (Days)	Sorption Coefficient (soil Koc)	Herbicide Movement Rating
Aminopyralid	103	1.05-24.3	Moderate
Chlorsulfuron	40	13-54	High
Clopyralid	40	6	Very High
Dicamba	7-90	2	Very High
Glyphosate Rodeo	47	24,000	Very Low
Imazapic	7-150	112	Moderate
Metsulfuron Methyl	30-120	35	High
Picloram	90-513	16	Very High
Sulfometuron methyl	15-33	61-122	Moderate
Triclopyr -TEA	30-46	20	Moderate
2,4-D Amine	10	100	Moderate

[1] Derived from Vogue *et al.* (1994). This database relies heavily on the SCS/ARS/CES Pesticide Properties Database for Environmental Decision Making (Wauchope *et al.*, 1992).

Exposure to herbicides, whether acute or chronic, may result in lethal (mortality) or sublethal (behavioral or physiological changes) effects depending on the toxicity of the particular herbicide or herbicide/ additive mixture, concentration of herbicide in the water, and duration of exposure. Most of the herbicides proposed for use are rated as being of low aquatic concern (Table 6). Level of aquatic concern is based on a risk quotient (safety factor/estimated

environmental concentration (EEC)) that explains the relationship between the EEC of an herbicide in the system (based on the application rate and modeled landscape features) and the concentration of an herbicide deemed safe for aquatic organisms (i.e., the "safety factor," or lethal concentration (LC)50/20; LC50 refers to the concentration at which mortality is expected in 50 percent of the population). The risk quotient (safety factor/EEC) assigns the following ratings: low concern for values greater than 10, moderate concern for values between 1 and 10, and high concern for values less than 1. Based on the risk quotient, Picloram is of moderate to high concern, triclopyr is of moderate concern, and the remaining herbicides are of low aquatic concern. Picloram will not be applied within 50 feet of streams, will be applied infrequently within 100 feet of streams, and will not be applied in any areas adjacent to bull trout critical habitat after July 15, during spawning season (USDA 2017, p. 13). Triclopyr (of moderate concern) will not be applied within 15 feet of streams. Only aquatically-approved herbicides will be used within 15 feet of water, including glyphosate formulations without surfactants (e.g., Rodeo, Aqua Neat, Aquamaster, and Glyphos Aquatic) and aquatic labeled 2,4-D (i.e., Weedar). These restrictions will further reduce, but not eliminate, the likelihood of chemicals of moderate and high concern reaching bull trout-occupied streams.

Despite the use of some herbicides with high and very high movement ratings (Table 5), numerous PDC are expected to reduce the amount of herbicide or herbicide mixture reaching surface waters. We expect any events where herbicides are introduced to waters to be infrequent and localized. Any herbicides delivered to streams are expected to be rapidly diluted as the herbicide moves downstream from the entry point (Norris *et al.* 1983, pp. 6-7) reducing concentrations to well below the safety factor (LC50/20, described above). Based on this, we do not anticipate lethal effects as a result of Project implementation; however, sublethal effects may occur. While the Project contains numerous PDC and other restrictions intended to limit bull trout exposure to toxic concentrations of herbicides, we cannot discount the possibility that herbicides will reach bull trout-occupied streams and that bull trout present in the contaminated areas will be exposed to toxic concentration of chemicals. While exposure to herbicides is unlikely to result in direct mortality of bull trout, we expect herbicide exposure to result in sublethal effects that may cause significant interference with the breeding, feeding, and sheltering behavior of bull trout, and may result in delayed mortality.

In general, there is a paucity of information concerning sublethal effects for the herbicides proposed for use. The Assessment (USDA 2017, pp. 29-44) provides some information regarding sublethal effects. A Service review of recent literature provides very little additional information. We examined documented sublethal effects for eight of the nine herbicides proposed for use within 100 feet of streams. Exposure has been shown to result in behavioral changes, including lethargy, loss of equilibrium, or altered schooling behavior; decreased capture efficiency; reduced reproductive fitness; decreased growth; decreased hatching and fry survival; hypersensitivity; and physiological stresses. We could find very little information regarding sublethal effects of dicamba. The Assessment reports that fish may react to dicamba within the first 24 hours following exposure with very little reaction afterwards, likely due to mechanisms for rapid elimination (USDA 2017, p. 39). Glyphosate, one of the most extensively tested herbicides, is considered non-toxic to fish; however, olfactory impairment was documented in juvenile coho at 1.0 milligrams/liter (mg/L) in one laboratory study, but the effect did not persistent once exposure was removed (Tierney *et al.* 2006, p. 2815).

Table 6. Aquatic Toxicology Profile of Herbicides Proposed for Use. Rainbow trout were the species used in all testing. Excerpted from the Assessment, Table 12, p. 27. Refer to the Assessment for reference citations.

Active Ingredient and Product Name	Typical Application Rate (lb ae/ac)[1]	Max Label Application Rate (lb ae/ac)	EEC (ppm)[2]	Toxicity 96-hour LC_{50} (mg/L)[3]	Safety Factor 1/20 LC_{50} (mg/L)[4]	Risk Quotient & Level of Concern[5]
Aminopyralid[6] (Milestone)	.078-.11	.11	.3-1.5	100	2.44	40 Low
Chlorsulfuron (Telar DF)	.01-.02	.02	0.052	250	12.5	240 Low
Clopyralid (Transline)	0.1-0.5	0.5	0.184	102	20	28 Low
Dicamba[7] (Banvel)	0.5-2.0	2.0	1.47	1,00	50	34 Low
Glyphosate (Rodeo)	.5-2.25	5.5	2.02	1,000	50	25 Low
Imazapic (Plateau)	0.09-0.16	0.19	0.276	100	5.0	18 Low
Metsulfuron-methyl (Escort)	.01-.02.	.03	0.046	150	7.5	163 Low
Picloram (Tordon 22K)	0.25-0.5	1.0	0.368	19.3	0.965	2[8] Moderate-High[8]
Triclopyr[9] (Garlon 3A)	1-2	2.0	3.309	117	5.85	1.7 Moderate
Sulfometuron – methyl (Oust)	0.045	0.38		148	7.4	160 Low
2,4-D amine (Weedar 64 or Amine 4)	1-2	4.0	1.103	250	12.5	11 Low

[1]Application rates are based upon typical and maximum label raters unless otherwise noted.
[2] Estimated Environmental Concentration - Hazard Evaluation Division, Standard Evaluation Procedure – Ecological Risk Assessment (Urban and Cook 1986).
[3] Rainbow Trout LC_{50} values from Herbicide Handbook, Seventh Edition (Ahrens 1994) and individual FS Pesticide Fact Sheets and Risk Assessments.
[4] Safety Factor – A divisor applied to the toxicity value to establish a concentration below which risk is acceptable (as determined by EPA). For endangered aquatic species, EPA uses 1/20 of the LC_{50} value.
[5]The Risk Quotient and Level of Concern for a mixture of herbicides would reflect the values associated with the mixture's most toxic component.
[6] The 96-hour LC_{50} differs from Table 11 in that Table 11 is based on the 24-hour LC_{50}
[7] Dicamba application rates are 1 lb per acre for broadcast applications and ≤ 2 lb per acre per year on a treatment area, per label requirements for rangeland uses. LC_{50} value from Dicamba Pesticide Fact Sheet (SERA 1995).
[8] Risk Quotient values for Picloram reflect the range of LC50 toxicity value of 5.5 to 19.3 mg/L identified by various observers. Level of Concern would be Moderate for LC50 values above 7.3 mg/L, including the midpoint value of 12.4 mg/L. Level of Concern would be high based upon LC50 values from 5.5 to 7.3 mg/L.
[9] Triclopyr application rates and LC50 value from Triclopyr Pesticide Fact Sheet (SERA 1995).

In summary, we expect some level of effects to bull trout related to treatment portions of the Project and, while increased sedimentation from manual, biological, or chemical controls or disturbance during herbicide preparation may result in insignificant or discountable effects, bull trout are more likely to be injured or harmed through toxicological effects to individuals rather than disturbance to their physical environment. Bull trout may be exposed to chemicals through sediment, the food chain, or water, but we expect water will be the primary exposure pathway. Most of the herbicides proposed for use are of low aquatic concern, and numerous project design criteria reduce the potential for herbicides to reach streams. Based on the acute toxicity of herbicides proposed for use and the modeled EECs, acute, lethal effects are not anticipated, but sublethal effects may occur that are expected to result in behavioral or physiological stresses that disrupt the feeding, breeding, or sheltering behavior of bull trout. Therefore, we anticipate adverse effects in the form of injury or harm to bull trout as a result of exposure to herbicides applied during Project implementation. We expect these effects to be infrequent, localized, and of short duration, but adverse effects will likely be detectable at individual sites in bull trout-occupied streams. However, it is unlikely that these effects would be discernable at a local population scale or at the scale of any of the three core areas that comprise the action area.

2.5.2 Effects of Interrelated or Interdependent Actions

The Service is unaware of any interrelated or interdependent actions associated with this project.

2.6 Cumulative Effects

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

The Service is not aware of non-federal plans proposed within the action area that will cumulatively affect bull trout.

2.7 Conclusion

The Service has reviewed the current status of the bull trout, the environmental baseline in the action area, effects of the proposed action, and cumulative effects, and it is the Service's conclusion that the proposed Gospel Hump Wilderness Invasive Plants Management Project is not likely to jeopardize the continued existence of the coterminous U.S. population of the bull trout. The Service's rationale is presented below.

The Service concludes that implementation of the treatment elements of the Project near streams and within riparian areas occupied by bull trout are likely to result in adverse effects to bull trout resulting from introduction of herbicides to streams. Adverse effects in the form of sublethal injury or harm are likely to be localized in nature, minimally present in riparian areas, and dispersed throughout the 13 subwatersheds and their associated riparian corridors. As described in the *Effects of the Proposed Action* section, direct mortality to bull trout as a result of chemical

contamination is unlikely to result due to the low risk to aquatic organisms posed by most of the herbicides proposed for use, the restricted use of chemicals in riparian areas, and mandatory PDC that will minimize the risk and extent to which chemicals may enter streams. However, sublethal effects are likely to occur in areas where herbicides have the potential to enter streams and persist until such time as the herbicides degrade or concentrations are diluted below the level of toxic effects. Because effects are expected to be infrequent and widespread, and exposure is expected to be short duration and of low severity, the Service finds the level of impact is unlikely to appreciably reduce the viability of any bull trout population in the action area.

For the above reasons, the Service concludes that the anticipated level of effects caused by the proposed Project over the 15-year term of the action, taking into account the environmental baseline, is likely to be compatible with sustaining the viability of the three bull trout core areas, and the local populations of bull trout within those core areas.

2.8 Incidental Take Statement

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

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

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

2.8.1 Form and Amount or Extent of Take Anticipated

Based on the results presented in the *Effects of the Action* section analysis above, the Service finds that the incidental take of the bull trout is likely to occur in the form of injury or harm caused by sublethal effects of herbicide exposure.

Because the proposed action applies to a broad geographic area (approximately 205,539 acres, comprised mostly of wilderness Forest lands) and specific information regarding the exact location of all current or newly established invasive plant infestations, timing and type of all

proposed treatments, site-specific features affecting herbicide movement and environmental fate, and presence or absence of bull trout in each stream reach is not available, the Service is unable to estimate a specific amount of incidental take. As discussed in the *Effects of the Action* section above, although the Service finds that take would occur infrequently and be spread across the three bull trout core areas, the potential for take cannot be eliminated. Because the available information is insufficient for the Service to quantify the amount of take anticipated, we describe the expected extent of take as the acreage treated within 100 feet of water.

The Service does not expect all herbicide application within 100 feet of water to result in take of bull trout, but herbicide application near water has the greatest potential for unintentional introduction of herbicide into water. Numerous mandatory PDC will be implemented as part of the proposed action, greatly reducing the potential for take of bull trout. Consequently, the Service anticipated the total take will be low over the 15-year life of the Project.

As described in the *Description of the Proposed Action*, a maximum of 1,775 acres could be treated across the action area each year with chemical control methods. Of this, up to 150 acres may be treated within 100 feet of water, and up to 50 acres of this may occur within 100 feet of bull trout designated critical habitat. In addition, the Forest proposes that treatments in dispersed, remote, low-use areas would not exceed more than 10 percent of the total acres treated within 100 feet of water (i.e., 15 acres). Based on the Forest estimates, the extent of incidental take is limited to no more than 150 acres per year of herbicide application within 100 feet of water, no more than 50 acres of the 150 acres of herbicide application within 100 feet of bull trout critical habitat, and no more than 15 acres of the 150 acres of herbicide application within 100 feet of water in dispersed areas. If the Forest treats more than 150 acres within 100 feet of water in any given year, more than 50 acres within 100 feet of bull trout critical habitat, or more than 15 acres of herbicide application within 100 feet of water in dispersed areas, the extent of take is exceeded and reinitiation of the consultation is required. Further, because the analysis of effects anticipates potential delayed mortality as a result of sublethal effects of herbicides, but no direct mortality, reinitiation is required should direct mortality of any bull trout result from the implementation of the proposed action.

2.8.2 Effect of the Take

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

2.8.3 Reasonable and Prudent Measures

The Service finds that compliance with the proposed invasive management program, including full implementation of PDC and BMPs as outlined in the Assessment, is essential to minimizing the impacts of incidental take of the bull trout in the action area.

The Service also finds that the following reasonable and prudent measures (RPMs) are necessary and appropriate to minimize the impacts of the incidental take of bull trout that is reasonably certain to be caused by the proposed action.

1. Minimize the total quantity of herbicides applied in a single watershed in a given year.
2. Minimize the potential for spray drift.

3. Minimize potential effects from Picloram.
4. Minimize effects to bull trout in spawning and rearing habitat.

2.8.4 Terms and Conditions

To meet RPM #1:

- Total acres treated with chemical controls in any given subwatershed will not exceed the Maximum Annual Treatable Acres identified in Appendix E (Maximum Annual Sprayable Acreage for Each Herbicide with No Observable Effect, or Equivalent) of this Opinion.
- Herbicide applications should treat the minimum acreage necessary for the control of invasive species.

To meet RPM #2:

- Utilize the largest appropriate droplet size for herbicides within 15 feet of water.

To meet RPM #3:

- Treatment of Picloram or mixtures containing Picloram will not exceed the Maximum Acres to be treated in a subwatershed identified in Appendix D (Herbicide Risk Assessment for Picloram) of this Opinion.
- Picloram will not be used in areas with shallow water tables (less than 6 feet), dry draws, ditches, or ephemeral streams that run into bull trout critical habitat.

To meet RPM #4:

- After August 15, crews will not enter streams that are designated bull trout spawning and rearing habitat.
- Crews will not interrupt spawning bull trout while drafting water from streams.

2.8.5 Reporting and Monitoring Requirement

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

- Prior to each treatment season, the Forest will provide the Service their annual plan of operations that includes an estimate of the number of acres to be treated with chemical controls within 100 feet of streams, summarized by subwatershed.
- Following each season, the Forest will provide the Service with a report of the actual acreage sprayed within 100 feet of streams, summarized by subwatershed. The final report will be submitted by December of the following year.
- During Project implementation, the Forest will notify the Service immediately in the event of accidental spillage or unintentional introduction of herbicides to streams that may result in the direct mortality of bull trout.

Reports can be submitted electronically to Katherine Sarensen (katherine_sarensen@fws.gov) or mailed to this office.

2.9 Conservation Recommendations

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

1. The Forest should transport the minimum amount of herbicide necessary to treat a given area.
2. The Forest should conduct surveys, including redd surveys and eDNA, to improve our understanding of bull trout presence and distribution within the Gospel Hump Wilderness.
3. The Forest should develop projects to improve instream habitat in degraded bull trout critical habitat streams within the South Fork Clearwater Core Area.
4. The Forest should develop programs and to address threats and promote the recovery of bull trout populations in the South Fork Clearwater Core Area.
5. The Forest should explore opportunities to restore overwintering habitats in the South Fork Clearwater River.
6. The Forest should identify suitable areas for recovery actions that identify and address potential barriers (physical and thermal) that may restrict bull trout migration between spawning and rearing and overwintering habitats as climate change progresses.

2.10 Reinitiation Notice

This concludes formal consultation on the Gospel Hump Wilderness Invasive Plant Management project. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been maintained (or is authorized by law) and if:

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

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4. APPENDICES

4.1 Appendix A- Project Design Criteria (PDCs)

Excerpted from the Assessment (USDA 2017; Table 8, pp. 11-13).

Design Criteria	Objective, Effectiveness, and Basis for Rating
Herbicide Use	
(H1) Operators would calibrate spray equipment at regular intervals (approximately after every 80 to 160 hours of use) to ensure proper rates of herbicide applications, using standard methods.	Control Application Rates; Moderate effectiveness (Logical –check equipment); Monitor –equipment for wear
(H2) Herbicides would be used in accordance with label instructions and restrictions. Application will be done or supervised by licensed applicators.	Ensure responsible application of herbicide; Moderate effectiveness Monitor –Daily Pesticide Application Record or similar database.
(H3) Herbicide applicators would carry spill containment equipment, as described and in the Herbicide Emergency Spill Plan, and be familiar with and carry an Herbicide Emergency Spill Plan. A spill cleanup kit would be available at temporary storage sites and with all transportations (vehicles, raft, plane, mules) carrying herbicides.	Ensure responsible application of herbicide; High effectiveness (Professional experience)
(H4) Equipment used for transportation, storage, or application of herbicides would be maintained in leak proof condition. When transporting chemicals on raft, chemical containers would be triple wrapped and secured to the raft.	Prevent spillage that may come into contact with humans or may directly enter surface waters. High Effectiveness, Practical experience.
(H5) Chemicals would not be used over live water (streams, ponds, springs, etc.), including water standing or running in ditch lines	Prevent contact with open water. High effectiveness. Logic.
(H6) Procedures for mixing, loading, and disposal of herbicides and a spill plan would be followed. All herbicide storage, mixing, and post-application equipment cleaning would be completed outside of riparian habitat conservation areas (RHCAs). If no other alternative is available, mixing and loading operations would take place in an area where an accidental spill would not contaminate a stream or body of water before it could be contained. In no case would mixing, loading, or cleaning occur within 100 feet of live water. Drafting equipment used for filling herbicide spray tanks would be equipped with appropriate back-siphoning prevention devices.	Avoid impact to sensitive plants and non-target aquatic species. High effectiveness Professional experience.
(H7) No spraying of herbicides would occur from a boat/raft.	Prevent contact with open water. High effectiveness. Logic.
(H8) No spraying of herbicides would occur during rain or when rain is imminent (within or anticipated to occur within 48 hours).	Prevent contact with open water. High effectiveness. Logic.

Design Criteria	**Objective, Effectiveness, and Basis for Rating**
(H9) Additional herbicides may be considered for use within the project area in the future. Changes in application distances of Picloram to water may be needed to spot treat new invaders closer than 50 feet to water. Additional consultation would occur for these circumstances before treatments are implemented.	Assure product safety. High effectiveness. EPA Studies.
(H10) In public recreation areas (such as developed campgrounds, and trailheads) treated areas would be posted until the area is safe to re-enter.	Inform public and reduce exposure; High effectiveness (Logical – prevent exposure)
(H11) The Annual Plan of Operations for herbicide application would be reviewed by an interdisciplinary team that includes, at a minimum, hydrology and or fisheries biology, botany, and wildlife biology skills. The review would take place prior to implementation to ensure the protection of native flora and fauna and to ensure that herbicide thresholds are not exceeded.	Provide for annual, pre-application oversight. High effectiveness. Coordination.
Surfactants	
(H12) Use of surfactants would occur as previously described, using only the surfactants previously described, and according to the allowable distances to live water.	Protect Aquatic Resources; High effectiveness Prior testing.
Dyes	
(H13) Water-soluble colorants, such as Hi-Light® blue dye, would be used within 100 feet of water and other situations as needed to enable applicators and inspectors to better see where herbicides has been applied.	Safe handling of herbicide; High effectiveness (Logical – visible)
Biological Controls	
(B1) Biological agents would not be released until screened for host specificity and approved by the USDA Animal Plant Health Inspection Service.	Minimize injury to non-target species; Highly effective (Logical – tested prior to approval)
Adjacent Land	
(L1) In cooperation with federal, state, county agencies and private landowners, weeds on non-Forest Service land may be treated when adjacent to national forest lands within the project boundary. Decisions regarding the treatment methods would be negotiated between the Forest Service and the other owner/agency.	Prevent weeds from spreading onto FS land; Moderate effectiveness (Professional experience); Monitor results in weeds database
Aquatic	
(A1) Herbicides would not be used to control weeds within a 100-foot radius of any potable water spring development within the project area.	Protect aquatic resources and ground water; High effectiveness Application standards.
(A2) No ester formulations of herbicides would be used (i.e., 2,4-D ester, triclopyr-BEE), due to relatively high fish toxicity.	Protect aquatic resources; High effectiveness. Avoids potentially harmful exposure.

Design Criteria	**Objective, Effectiveness, and Basis for Rating**
(A3) Use of herbicides and surfactants within 100' of surface water or wetlands would adhere to distances and conditions outlined in Table 3 and 7	Protect aquatic resources and ground water; High effectiveness. Practical experience.
(A4) No herbicides would be used within 15 feet, Picloram would not be used within 50 feet of any stream for any reason, and would generally not be used within a 100-ft buffer unless other herbicides are not considered effective in controlling certain weed species, such as leafy spurge or rush skeletonweed. Application of Picloram would not occur within 100' of designated critical habitat after July 15th	
Soils	
(S1) At maximum of 1.0 pounds/acre of Picloram, application would occur as spot treatments only, not exceeding more than 50 percent of any treated acre).	

4.2 Appendix B- Annual Implementation and Effectiveness Monitoring Plan

Excerpted from the Assessment (USDA 2017; Table 9, pp. 13-15).

Monitoring Item	Objectives	Methodology and Documentation	Adaptive Response Options	Persons Assigned
1. Periodic Effectiveness of Herbicide Treatments	Determine whether treatments are meeting the eradication, reduction or containment objectives for the species and site	a) Follow established FACTS[1] protocols for evaluating and documenting treatment success or failure such as estimating and recording changes of infestation size and density (increases, reduction or static) b) Establish line or belt transects in both permanent and opportunistic plots (as appropriate) on sample representative sites using a combination of frequency plots and target plant mortality measurements c) Supplement with photo points as needed d) Integrate with Forest Plan monitoring requirements	If treatment effectiveness on a site is substandard then adjust treatment timing, application rate, herbicide or adjuvant to achieve improved results	a) Field Verification: Field crew supervisors or designated field specialist b) Data review, ground-truthing and treatment evaluation: Forest Weed Specialists and Forest Weed Program Managers
2. Impacts to Wilderness Character	Insure that social encounters and other annual	Use annual monitoring methods for the composite wilderness resource described in Appendices A & B of	Non-compliance determinations with the primary cause tied to IWM actions will	Field work: Wilderness Rangers Information review and

Monitoring Item	Objectives	Methodology and Documentation	Adaptive Response Options	Persons Assigned
	impacts to wilderness character from invasive plant management activities fall within the acceptability guidelines	the Wilderness General Management Direction (GMD). Standardized methods include wilderness ranger hitch reports for social encounters, campsite inventory data, etc.	trigger adjustments in timing, duration or quantity of invasive plant treatment, monitoring or mapping activities	evaluation: Forest Wilderness Program Managers
3. Compliance with Allowable Herbicide Limits by 12th Code Subwatershed	Maintain herbicide application quantities at or below the allowable thresholds by subwatershed name / number (see Table 16)	a) Review annual herbicide application plans of operation for Forest Service and contract crews prior to each field season b) Sample check the application records, aggregated by watershed, through the FACTS database at the end of each field season	Adjust annual plans of operation as needed to comply with the watershed threshold limits.	Forest Weed Program Managers and Contracting Officer Representatives
4. Performance Issues and New Issues	Oversight tracking and review of the IWM program	a) Surface issues at the annual fall closeout meeting of wilderness rangers and program managers b) Review and resolve issues at the fall annual GHW managers / line officers meeting c) Apprise and discuss findings / decisions with Forest Supervisors	Modify implementation practices or priorities to address issues, exploit opportunities or solve problems	Wilderness Rangers, Program Managers and District Rangers

Monitoring Item	Objectives	Methodology and Documentation	Adaptive Response Options	Persons Assigned
		at the spring GHW Line Officers meeting		
5. Design Criteria Compliance	Insure that IWM activities adhere to the standards and requirements of the project area design criteria	a) Early season review and refresher training of F.S. crews and contractors in requirements of design criteria b) Reminder checks and reviews on compliance awareness during pre-hitch briefings throughout the operational season c) Provide printed copies of the design criteria to Forest Service crews and contractors at the beginning of field season	a) Modify IWM activities to meet the design criteria requirements b) Improve training or supervision c) Adjust personnel assignments	a) Field oversight: Forest crew leaders, Contract Inspectors, Contracting Officer Representatives and, as appropriate, Resource Specialists b) Training and general oversight: Forest Weed Program Managers

[1] FACTS (Forest Service Activity Tracking System) is a monitoring system, developed in 2004, for all levels of the Forest Service and certain management activities such as invasive species treatments and inventory.

4.3 Appendix C- Long-term Effectiveness and Trend Monitoring Plan

Excerpted from the Assessment (USDA 2017; Table 10 pp. 15-17).

Monitoring Item	**Objectives**	**Methodology and Documentation**	**Adaptive Response Options**	**Persons Assigned Monitoring Responsibilities**
1. Herbicide Resistance	Track and document patterns of target weed escapes such as patches that persist annually in treated areas and/or show irregular shapes	a) Use FACTS database (standard procedure) to field verify and document infestation site characteristics, treatment type and responses. b) Identify target species and herbicides at high risk for resistance development c) Establish photo points on sites suspected of resistance development	a) Develop alternative herbicide use or herbicide rotation plan b) Control target plant populations suspected of resistance before seeds are produced c) Selectively suspend herbicide treatments to avoid worsening the resistance trend	a) Field inspections: Field crew supervisors b) Data review, ground-truthing and resistance determination: Forest Weed Specialists and Forest Weed Program Managers
2. Plant Community Succession and Composition on *Herbicide* Treated Sites	Determine trends in plant species composition and density towards stable or increasing native / desirable plants on sample representative sites receiving herbicide treatment such as trail corridors, administrative sites, burned areas and pioneering invasive plant colonies in early infestation watersheds. Evaluate the degree of achievement of the watershed category objectives as described in the Environmental Analysis.	a) Establish a selective, limited number of baseline representative sites to monitor with permanent plots. Apply standardized frequency, nested frequency, density or other sampling protocols. b) Remeasure on a 2 to 5 year schedule as dictated by funding availability and program priorities. c) Document findings in Forest Plan Monitoring Reports or a GHW	a) Alter herbicide prescription if target species treatment results do not achieve objectives b) Initiate appropriate level of revegetation with native ecotype species in Wilderness if chemical treatments create vegetative voids c) Selectively suspend herbicide treatments if results do not achieve objectives	Forest Weed Specialists

Monitoring Item	**Objectives**	**Methodology and Documentation**	**Adaptive Response Options**	**Persons Assigned Monitoring Responsibilities**
		IWM Strategic Plan revision / update		
3. Biological Control Agent Establishment	Determine establishment success or failure of biocontrol agents	Population sampling at 2 to 3 year intervals	a) Increase numbers or size of releases b) Suspend releases in cases of failure or when successful establishment is achieved	Forest Weed Specialists
4. Plant Community Succession and Composition on *Biocontrol* Treated Sites	Determine trends in plant species composition and density towards stable or increasing native / desirable plants on sample representative sites receiving biocontrol treatment such as spotted knapweed or other invasive dominant polygons, trail corridors, administrative sites, burned areas and established or pioneering invasive plant colonies in advanced or early infestation watersheds. Evaluate the degree of achievement of the watershed category objectives as described in the Environmental Analysis.	a) Establish a selective, limited number of baseline representative sites to monitor with permanent plots. Apply standardized frequency, nested frequency, density or other sampling protocols. b) Remeasure on a 2 to 5 year schedule as dictated by funding availability and program priorities. c) Document findings in Forest Plan Monitoring Reports or a GHW IWM Strategic Plan revision / update	a) Augment release size or numbers of original species b) Include other biocontrol agents based on available empirical or research results c) Initiate appropriate limited level of revegetation with native ecotype species in Wilderness if biocontrol treatments create vegetative voids d) Suspend biocontrol releases if results are not achieving objectives	Forest Weed Specialists
5. Prevention Practices and Information / Education Program	Determine the level of understanding, acceptance and implementation of prevention practices by users and F.S. personnel	Field contacts and informal interviews of user groups, individuals, outfitters, etc.	a) Modify signing or other educational tools to optimize message retention and improve practices	Field interviews and reports: wilderness rangers, IWM crews and contractors Report and Program Evaluation: Forest

Monitoring Item	**Objectives**	**Methodology and Documentation**	**Adaptive Response Options**	**Persons Assigned Monitoring Responsibilities**
			b) Develop partnerships	Weed Program Managers

4.4 Appendix D- Herbicide Risk Assessment for Picloram

Excerpted from the Assessment (Appendix A, Table 5, p. 63). Refer to the Assessment for reference citations.

Subbasin	HUC 6	Subwatershed Name (HUC 6)	Watershed (acres)	Average Low Flow Qlow (cfs)	Worst Case Capacity (pounds)	Maximum Probable Concentration LC50/20 (ppm)	Application Rate (pounds/ acre)	Delivery Ratio	Maximum Acres to be treated in HUC 6 (acres)
				J	C= J*62.43*T T = 21,600 sec.	M	R	D	A = (M * C)/ (1000000*R*D)
Salmon River, South Fork Clearwater River	170602070902	Big Creek	17,984	2.8	3,778,766	0.29	1.0	2%	55
	170602070903	Lake Creek	28,890	4.6	6,162,033	0.29	1.0	2%	89
	170602070904	Lower Crooked Creek	20,065	3.1	4,230,560	0.29	1.0	2%	61
	170602071001	Meadow Creek	17,795	4.0	5,401,832	0.29	1.0	2%	78
	170602071002	Anchor Creek-Wind River	23,700	3.7	5,023,524	0.29	1.0	2%	73
	170602071103	Bull Creek-Salmon River	28,063	4.4	5,980,088	0.29	1.0	2%	87
	170602071104	Sheep Creek	35,011	6.4	8,662,397	0.29	1.0	2%	126
	170602071105	Bear Creek-Salmon River	17,455	2.7	3,664,039	0.29	1.0	2%	53
	170602090303	Upper Slate Creek	10,652	2.6	3,501,289	0.29	1.0	2%	51
	170603050503	Tenmile Creek	34,331	6.6	8,895,538	0.29	1.0	2%	129
	170603050504	Twentymile Creek	14,570	2.7	3,674,171	0.29	1.0	2%	53
	170603050601	Upper Johns Creek	30,779	5.9	7,947,731	0.29	1.0	2%	115
								TOTAL	970

4.5 Appendix E- Maximum Annual Treated Acres with No Observable Effect, or Equivalent

Excerpted from the Assessment (Table 17, p. 49).

			Aminopyralid	Chlor-sulfuron	Clopyralid	Dicamba	Glyphosate Rodeo	Imazapic	Methsulfuron Methyl	Picloram	Sulfometuron Methyl	Triclopyr-TEA	2,4-D
Maximum Chemical Application Rate (lbs./acre)			0.11	0.02	0.5	2.0	2	0.2	0.03	1.0	0.045	2	2
Median Lethal Concentration (LC50 - ppm)			100	250	100	100	1000	100	150	0.8-26	150	199	250
NOEL or NOEC (ppm)			75	32	20			100	4.7	0.55	120	104	10
Median Lethal Concentration/20 (LC50/20 - ppm)			5	2	5	5	50	5.0	7.5	0.4	7.5	10	12
Subwatershed Name (HUC 6)	**Watershed (acres)**	**Currently Infested Acres**	**Maximum Annual Treatable Acres**										
Big Creek	17,984	0	8,588	18,894	1,889	642	1,587	630	47,235	55	2,362	945	945
Lake Creek	28,890	0	14,005	30,810	3,081	1,048	2,588	1,027	77,025	89	3,851	1,541	1,541
Lower Crooked Creek	20,065	1,320	9,615	21,153	2,115	719	1,777	705	52,882	61	2,644	1,058	1,058
Meadow Creek	17,795	104	12,277	27,009	2,701	918	2,269	900	67,523	78	3,376	1,350	1,350
Anchor Creek-Wind River	23,700	513	11,417	25,118	2,512	854	2,110	837	62,794	73	3,140	1,256	1,256
Bull Creek-Salmon River	28,063	304	13,591	29,900	2,990	1,017	2,512	997	74,751	87	3,738	1,495	1,495
Sheep Creek	35,011	762	19,687	43,312	4,331	1,473	3,638	1,444	108,280	126	5,414	2,166	2,166
Bear Creek-Salmon River	17,455	473	8,327	18,320	1,832	623	1,539	611	45,800	53	2,290	916	916
Upper Slate Creek	10,652	94	7,957	17,506	1,751	595	1,471	584	43,766	51	2,188	875	875
Tenmile Creek	34,331	0	20,217	44,478	4,448	1,512	3,736	1,483	111,194	129	5,560	2,224	2,224
Twentymile Creek	14,570	0	8,350	18,371	1,837	625	1,543	612	45,927	53	2,296	919	919

			Aminopyralid	Chlor-sulfuron	Clopyralid	Dicamba	Glyphosate Rodeo	Imazapic	Methsulfuron Methyl	Picloram	Sulfometuron Methyl	Triclopyr-TEA	2,4-D
Upper Johns Creek	30,779	0	18,063	39,739	3,974	1,351	3,338	1,325	99,347	115	4,967	1,987	1,987
Gospel Creek	15,201	213	8,723	19,191	1,919	653	1,612	640	47,979	56	2,399	960	960