United States Department of the Interior
U.S. Fish and Wildlife Service
Idaho Fish and Wildlife Office
1387 S. Vinnell Way, Room 368
Boise, Idaho 83709
Telephone (208) 378-5243
http://www.fws.gov/idaho

Rebecca S. Nourse
Forest Supervisor
Sawtooth National Forest—Supervisor's Office
2647 Kimberly Road East
Twin Falls, Idaho 83301

JUN 21 2012

Subject: Wildfire Management Activities on the Sawtooth National Forest—Fairfield and Ketchum Ranger Districts, and Sawtooth National Recreation Area, Idaho—Biological Opinion
In Reply Refer to: 01EIFW00-2012-F-0104 Internal Use: CONS-100b

Dear Ms. Nourse:

Enclosed are the U.S. Fish and Wildlife Service's (Service) Biological Opinion (Opinion) and concurrence with the Sawtooth National Forest's (Forest) determinations of effect on species listed under the Endangered Species Act (Act) of 1973, as amended, for the Forest's proposed Wildfire Management Activities programmatic action (Program) in the three northern districts of the Forest. In a letter dated January 26, 2012, and received by the Service on January 30, 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, Canada lynx (*Lynx canadensis*), and Ute's ladies'-tresses orchid (*Spiranthes diluvialis*), and requested our concurrence with these determinations. The Forest also determined that the proposed project will not jeopardize the continued existence of the gray wolf (*Canis lupus*), and is not likely to adversely affect the bald eagle (*Haliaeetus leucocephalus*), yellow-billed cuckoo (*Coccyzus americanus*), greater sage-grouse (*Centrocercus urophasianus*), north American wolverine (*Gulo gulo luscus*, inferred from the consultation package), and whitebark pine (*Pinus albicaulis*); the Service acknowledges the determinations for these delisted and candidate species.

The enclosed Opinion and concurrence are based primarily on our review of the proposed action, as described in your January 2012 Biological Assessment (Assessment), and the anticipated effects of the action on listed species, and were prepared in accordance with section 7 of the Act. Our Opinion concludes that the proposed project will not jeopardize the survival and recovery of bull trout. A complete record of this consultation is on file at this office.

<u>Clean Water Act Requirement Language</u>

This Opinion is also intended to address section 7 consultation requirements for the issuance of any project-related permits required under section 404 of the Clean Water Act. Use of this

Opinion and letter to document that the Army Corps of Engineers (COE) has fulfilled its responsibilities under section 7 of the Act is contingent upon the following conditions:

1. The action considered by the COE in their 404 permitting process must be consistent with the proposed project as described in the Assessment such that no detectable difference in the effects of the action on listed species will occur.
2. Any terms applied to the 404 permit must also be consistent with conservation measures and terms and conditions as described in the Assessment and addressed in this letter and Biological Opinion.

Thank you for your continued interest in the conservation of threatened and endangered species. Please contact Pam Druliner (208-378-5348) if you have questions concerning this Opinion.

Sincerely,

Russell L. Holder

for Brian T. Kelly
State Supervisor

Enclosure

cc: NOAA, Salmon (Fealko)
COE, Boise (Phillips)
SNF—SO, Twin Falls (Chatel)
SNF—Fairfield RD, Fairfield (Dettori)
SNF—Ketchum RD, Ketchum (Nelson)
SNF—SNRA, Ketchum (Timm)

BIOLOGICAL OPINION
FOR THE

WILDFIRE MANAGEMENT ACTIVITIES
ON THE SAWTOOTH NATIONAL FOREST
01EFW00-2012-F-0104

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

Russell R. Holden for Bryan T. Kelly

Supervisor ______JUN 2 1 2012______

Date ________________________

Table of Contents

List of Tables

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 Sawtooth National Forest's (Forest) proposed Wildfire Management Activities programmatic action (Program) on bull trout (*Salvelinus confluentus*). In a letter dated January 26, 2012, and received on January 30, the 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 (USFS 2012, entire) 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 also determined the action is not likely to adversely affect bull trout critical habitat, Canada lynx (*Lynx canadensis*), and Ute's ladies'-tresses orchid (*Spiranthes diluvialis*). We are providing concurrence with these determinations.

1.2 Consultation History

The following represent noteworthy events related to the development and completion of the proposed action. Events center on communication/coordination between the Forest and the Service.

August 11, 2006	The Service concluded consultation for the Wildfire Suppression and Wildland Fire Use Management Plan on the Boise and Sawtooth National Forests (14420-2006-I-0822).
October 25, 2010 and January 20, 2011	Preliminary discussions on the revised Wildfire Management Programmatic were discussed at Forest Level 1 meetings.
February 17, 2011	Initial comments on draft proposed action were discussed at a Forest Level 1 meeting.
October 19, 2011	The Service provided comments to the Forest on their draft Assessment for the Wildfire Management Programmatic.
October 25, 2011	Comments on the draft Assessment were reviewed and discussed at the Forest Level 1 meeting.
November 29, 2011	Additional discussion occurred on the draft Assessment at the Forest Level 1 meeting.
December 19, 2011	The Service provided comments to the Forest on the revised draft Assessment.
January 6, 2012	The Service provided final comments to the Forest on the revised draft Assessment.

January 24, 2012	Final discussions on the Assessment took place at the Forest Level 1 meeting. It was agreed that the Assessment could be finalized and forwarded for consultation if final edits were addressed and incorporated.
January 30, 2012	The Service received the final Assessment and request for formal consultation.
June 12, 2012	Draft Opinion forwarded to the Forest for comments; they had none.

1.3 Informal Consultation

1.3.1 Bull Trout Critical Habitat

As part of their wildfire suppression efforts, the Forest proposes to implement numerous activities that may affect Primary Constituent Elements (PCE) of bull trout critical habitat. These activities include the following: fireline construction, water drafting and dipping, burnout operations, road reconstruction, mop-up, and rehabilitation. A summary of these suppression activities can be found in the Proposed Action section of this Opinion; a full description can be found on pages 8 to 22 in the Assessment (USFS 2012).

Service concurrence that the proposed action is not likely to adversely affect bull trout critical habitat relies on information contained in Tables 24 and 25 of the Assessment (USFS 2012) indicating that all effects to PCEs will be either discountable or insignificant. All nine PCEs are presumed to be present in the action area, and could be affected by suppression activities. However, use of effected habitat by bull trout may be sporadic or rare at the time suppression activities would be taking place, depending on whether the critical habitat, and its associated PCEs, was designated as foraging, migration, and overwintering habitat, or as spawning and rearing habitat.

Suppression activities will be subject to specific design criteria that will limit effects to the individual PCEs. Water sources (PCE 1), food base (PCE 3), water temperatures (PCE 5), a natural hydrograph (PCE 7), and nonnative competition (PCE 9) will be minimally affected by suppression activities; effects are expected to be discountable.

Movement (migratory or otherwise) of bull trout within affected streams (PCE 2) may be impaired when drafting water, as temporary damming of streams may be necessary to raise water levels for appropriate drafting conditions, and removal of water volume may impede the ability of bull trout to adequately maneuver through aquatic systems. These activities will be short-term in nature, drafting will only occur in non-fish bearing streams, and streams will not be dewatered; effects to PCE 2 are considered discountable.

Complex aquatic environments (PCE 4) are expected to be only insignificantly effected by suppression activities. Trees or snags felled in riparian conservation areas (RCA) during fireline construction must be left within the RCA to remain available for recruitment as large woody debris. Riparian vegetation and sources of large woody debris will be minimally effected by fire within RCAs, as direct ignition is not permissible; fire burning into RCAs is allowable to meet fire management objectives, and these occurrences are not expected to significantly affect riparian vegetation such that complex aquatic environments would appreciably be altered.

While some suppression activities may negatively affect spawning and rearing habitat (PCE 6) and general water quality (PCE 8), design criteria will minimize the amount of sediment entering aquatic systems, and the potential for contaminant entry will be limited; effects to these PCEs are considered insignificant. Design criteria include the following: operational facilities will be located outside of RCAs; refueling and storage of larger quantities of fuel will occur outside of RCAs; smaller quantities of fuel will generally be located beyond 100 feet of water bodies and should be used in combination with a containment basin or absorbent pad; heavy equipment will not be used to construct fireline within RCAs; fireline construction within RCAs will employ proper erosion control techniques and will be rehabilitated post-fire; explosives will not be used within RCAs; direct ignition and use of accelerants within RCAs will not occur; road reconstruction will include erosion-control structures; and culvert installation/replacement work will only occur in non-fish bearing streams.

1.3.2 Canada Lynx

Service concurrence is based on information provided in the Assessment and the following rationales.

Some fire suppression activities have the potential to affect Canada lynx. The Forest identified the following components of their wildfire management activities that may affect Canada lynx by disturbance: fireline construction and hazard tree felling, water drafting and dipping, back burning, road reconstruction or reopening, and fire camps, helibases, and facilities. Human and equipment presence associated with implementing these activities can create disturbance which may displace individuals. Noise associated with equipment would alert individuals in the vicinity and allow them time to disperse from the area. Fire season is generally between June and November. This is a time period when both adult and juvenile Canada lynx are mobile and, if disturbed, would be able to readily leave an area. Project design features prohibit locating incident bases, camps, helibases/spots, staging areas, and other centers of incident activities within one mile of known lynx dens. Wildfire itself will affect lynx habitat but the discretionary action of suppressing the wildfire has few mechanisms of effects to potential lynx habitat. Suppression activities will be subject to specific design criteria that will limit effects to lynx habitat or if exceeding will trigger emergency consultation with the Service.

As described in the Assessment (Section 6) and based on the historical occurrence of lynx on the Forest and project design features, direct disturbance effects from fire related activities are expected to be temporary, localized, and discountable. Population numbers for lynx on the Forest are not available, and although thought to be present on the Forest, the most recent confirmed sighting of lynx tracks was reported during the winter of 1997 near the Fishhook Creek Drainage and the Alturas Lake Creek drainage. Effects to habitat will be minimized by project design features which limit the use of suppression activities that result in a Lynx Analysis Unit (LAU) exceeding 30 percent unsuitable habitat.

1.3.3 Ute Ladies'-Tresses

Service concurrence that the proposed wildfire suppression management activities are not likely to adversely affect the Ute ladies'-tresses is based upon absence of known occurrences on the Forest. In addition, wildfire suppression management activities incorporate specific mitigation measures that would avoid or minimize disturbance to riparian areas that have modeled Ute ladies'-tresses potential habitat. The following measures were designed to minimize fireline construction and hazard tree felling effects on Botanical Resources.

- The incident Resource Advisor would make fire personnel aware of known locations of listed plant species and noxious plant species infestations, and provide maps and location data to the Incident Commander during an incident. Once a suppression activity decision has been approved, heavy equipment shall not be used to construct firelines within occupied candidate, threatened or endangered plant habitat unless the line officer or designee determines that imminent safety to human life or protection of structures is necessary.
- The use of heavy equipment in occupied endemic plant habitat could result in direct mortality and destruction of habitat for Stanley Basin endemic plant species. The incident Resource Advisor would provide guidance for avoidance of occupied habitat.
- The incident Resource Advisor would document degradation to occupied threatened, endangered, candidate and sensitive plant habitat as a result of the disturbance of heavy equipment.

As described in the Assessment (Section 6), based on the lack of known occurrence of Ute ladies'-tresses on the Forest and project design features that would be incorporated if the plant were to occur on the Forest, effects from fire related activities are expected to be discountable. Effects to potential habitat will be minimized by project design features.

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 Program will apply to all National Forest lands in the northern three Ranger Districts of the Forest (the Fairfield and Ketchum Districts, and the Sawtooth National Recreation Area). Wildfire management activities will occur on Forest lands within seven subbasins (see Table 3 in the Assessment), however, some level of effects are expected to occur across the entire subbasin area. Thus, the action area is defined as the entire area of each effected subbasin where listed fish, wildlife, plants, and designated critical habitat occurs.

2.1.2 Proposed Action

The Program proposes the use of all activities, with the exception of aerial retardant delivery, that could occur during suppression of wildland fires and management of wildland fire use on the Forest. The individual activities may occur at many individual sites across the landscape, on a routine basis or sporadically, and over multiple years. The action is intended to be in effect for a period of 10 years, at which time updates will be made based on monitoring results and changed baseline conditions, and to incorporate any modified or new suppression tactics. Additionally, amendments to the proposed action would be made as new information on fire suppression tactics occur. Any changes would be discussed with the Level 1 teams prior to their implementation to determine if there is a need to reinitiate consultation.

Wildfire Management Tactics include: application of water and chemical fire retardants (excluding aerial retardant drops); construction of fuel breaks around fire perimeters; complete removal of understory and overstory vegetation as a part of fire line construction; road work to aid in the deployment of suppression resources; the establishment and operation of spike and base camps, which could involve tens to thousands of people; burnout operations between firelines and the wildfire; drafting water from stream courses; establishment of helispots and helibases where Jet-A fuel is transported and stored; bucket dipping (or snorkeling) of water from rivers, large streams, and lakes by helicopter; use of gasoline and diesel fuel for pumps, saws, and engines; cleaning/sanitation of equipment; and rehabilitation activities. Individual or multiple conservation measures may be applied to each of these suppression activity subcomponents to minimize or avoid negative effects to listed species. A full description of the action, and pertinent conservation measures, can be found on pages 8 to 22 of the Assessment; a generalized summary is provided below. Additionally, where conservation measures cannot be fully implemented, or where adverse effects to listed species cannot be fully avoided, emergency consultation procedures can be implemented to ensure the appropriate management of the action can occur, and to ensure life and property remain the primary consideration.

2.1.2.1 Camps, Helicopter Landing Sites, and other Operational Facilities

Camps, helibases, staging areas, and helispots are areas used to camp or stage personnel and equipment, and as places to land and park helicopters. Camps vary in size and impacts from coyote camps for two people with minimal equipment and comforts, to large camps for several hundred personnel with multiple facilities and activities. Helicopter bases are areas where helicopters can be fueled, loaded, parked, and maintained. Helispots are areas where personnel and equipment can be loaded or unloaded from a helicopter. Staging areas are generally temporary places where personnel and equipment are placed for rapid deployment on large fires; limited facilities and activities occur in these areas.

Conservation Measures

- Operational facilities other than coyote or spike camps will be located outside of RCAs. Coyote or spike camps will only be allowed within RCAs if there are no other suitable sites that minimize the risk to firefighters.
- Incident bases, camps, helibases, staging areas, helispots, and other centers for incident activities shall be located outside of occupied listed plant habitat.

- Avoid cutting and removing 5- needled pine (whitebark pine) when establishing coyote camps, helispots, staging areas, and other centers for incident activities in upper elevation areas.
- All operational facilities will be located outside RCAs or where use of an existing facility located within the RCA results in less disturbance than establishing a facility outside the RCA.
- Avoid locating incident bases, camps, helibases, staging areas, helispots and other centers for incident activities within a ½ mile of an active bald eagle nest.
- Helicopters and other aircraft shall maintain a minimum flight buffer of ¼ mile horizontally and vertically around active bald eagle nests from February 1 to August 15.
- Avoid locating incident bases, camps, helibases, staging areas, helispots and other centers of incident activities within one mile of known wolf, lynx, or wolverine reproductive dens.
- Fueling of equipment may occur within RCAs if there are no other suitable locations. Refueling or storage of over ten gallons of fuel should occur outside of RCAs. If this is not physically possible, refueling of supplies other than pumps will occur no closer than 100 feet from waterbodies. If drip torches or pumps are fueled in the RCA, or fuel mixtures or other petroleum products are stored in the RCA, a containment basin or absorbent pad of adequate size to contain the potential spill volume will be used.
- Minimize the potential for spread of noxious weeds by avoiding travel or placement of facilities in noxious weed areas, and by managing equipment and rehabilitation efforts to prevent the inadvertent establishment of noxious weeds.

2.1.2.2 Fireline Construction

Firelines are constructed to control the spread of the fire. Fireline construction involves clearing a 5 to 20 foot path (removing all flammable material), wide enough to check the spread of fire, and scraping a line to bare mineral soil, typically 18 inches wide. Most often, hand tools and chainsaws are used for line construction, though dozers, excavators, or explosives may be used. Fuel characteristics, fire behavior, topography, access, and wildfire management strategy dictate the type and size of fireline constructed. In some instances, a wet line using a hose lay with pump and water source or cold trailing the fire's edge may be sufficient. Natural barriers are used whenever possible, including rock outcrops, areas of little or no fuel, and streams, rivers, or lakes. Some felling and burning of hazard snags or trees, and bucking of down logs using hand tools or a chainsaw may be required.

Conservation Measures

- Use of heavy equipment for fireline construction within RCAs is outside the scope of this Program.
- Proper erosion control techniques will be utilized on steep slopes to prevent excessive erosion and resource damage from occurring. Any fireline constructed in RCAs will be rehabilitated.
- Fireline will be constructed using the minimum width and depth needed to safely accomplish the desired task.

- Explosive use will not occur within 300-foot slope distance from the water's edge of any waterbody or 150-foot slope distance from any intermittent stream regardless of the charge weight and buffer implemented.
- Explosives for fireline construction or removal of hazard trees will not be used within ½ mile of active bald eagle nests during the reproductive season (February 1 through August 15). Fireline construction with tools other than with explosives shall not be used within ¼ mile of active bald eagle nests during the reproductive season (February 1 through August 15).
- Explosives for fireline construction and removal of hazard trees outside of RCAs (300 feet from perennial streams) will adhere to the distances and charges stated within Table 4 in the Assessment.
- Heavy equipment shall not be used to construct firelines within occupied ESA listed plant habitat.
- Minimize felling/bucking of trees in RCAs. Trees or snags that are felled within RCAs shall be left intact unless bucking into smaller pieces is required to meet wildfire management objectives or public safety. All material felled/bucked should remain within the RCA.
- Avoid felling of trees within 330 feet of an active bald eagle nest trees.
- Resource Advisors shall identify appropriate spatial and seasonal buffers for fireline construction near occupied listed species' nests or den sites during the breeding season.
- Avoid cutting and removing 5-needle pine (whitebark pine) when constructing fireline.

2.1.2.3 Water Drafting and Dipping

The use of water is the preferred means for managing wildfire. During wildfire management, local water sources such as lakes and streams are generally used. Water is also transported to fires by a water tender/tank truck, fire engine, or by portable pumps with a network of hoses. The pump used varies with the size of the water source, and stream flows. If the water source has inadequate flow for effective pumping, a "porta tank" may be used or occasionally a sump is created. When available, a culvert crossing is generally used to create this sump by blocking flow for a period. A sump may be constructed by hand using native materials, plywood, and/or plastic. These sites are usually (but not always) located in steep, low-order headwater streams. Portable pumps are fueled either by an attached tank or by a portable fuel container. Helicopter bucket drops of water are also used. Buckets range in size from 75 gallons to more than 1,000 gallons, depending on the allowable helicopter payload. Water is dipped (or snorkeled) by helicopters from lakes, rivers, streams, or portable tanks that are located as close to the incident as possible. Dipping (or snorkeling) generally occurs from lakes and large rivers. Sometimes dipping occurs in smaller streams; the size of the stream used is limited by the pool size available.

Conservation Measures

- Water dipping points and criteria for dipping points, shall be identified by the Resource Advisor prior to the fire season for listed fish-bearing streams and occupied listed aquatic plant habitat. Dipping should only occur after coordination with the Resource Advisor.
- During the bull trout spawning period (August 1 to October 30), dipping should not occur in sensitive spawning areas identified in the Sawtooth National Forest's "Fire

Suppression Operation Guidance" map. If dipping does occur, the District Fire Duty Officer will contact an aquatic resource specialist or Resource Advisor by the end of the first operational period of initial attack to identify appropriate dipping and drafting locations which can then be utilized in remaining fire suppression efforts.

- Helicopter bucketing directly from streams will not occur if chemical products are injected into the bucket. Helicopter bucketing can occur only after chemical injection systems have been removed, disconnected, or rinsed clean.
- Deeper and faster-flowing streams and pools should be selected for pump intakes when available.
- Pump intake screens shall have openings not exceeding 3/32-inch diameter and a surface area proportionate to the pump intake capacity. All pumps in waters within the Forest will have these screens attached even if listed fish are not believed to be present.
- Crews will avoid dewatering streams to reduce the possibility of stranding fish. Drafting without screens where listed fish species may occur is outside the scope of this programmatic consultation.
- Cleaning of all drafting and dipping equipment will avoid contamination of waterways or introduction of invasive species.
- Resource Advisors will monitor drafting operations to ensure that pumps stationed within the RCA have containment berms, absorbent pads, and/or other controls sufficient to contain potential chemical spills and prevent delivery to waterbodies and intermittent streams.
- Resource Advisors should be consulted as soon as possible to direct fire crews and helicopter pilots to dip locations where ESA-listed fish are not present.
- Temporary dams will only be allowed on smaller, non-fish bearing streams.
- If dip locations have ESA-listed fish present; the Resource Advisor must evaluate the site and action that occurred in order to determine the potential for adverse effects.
- Avoid drafting operations within ¼ mile of active bald eagle nests.

2.1.2.4 Burning Out Operations

Burning out is setting a fire inside a control line to consume fuel between the edge of the control line and the wildfire to strengthen the fireline. Burning out removes the danger of flare-ups in unburned fuel near the fireline to prevent spotting across the fireline and facilitate containment. Equipment used to light burnouts include handheld drip torches (filled with a mixture of diesel and gasoline), fusees, flare guns, terra-torches (truck mounted flame throwers), helitorches (helicopters with suspended tanks of gelled fuel and applicators), and aerially applied plastic spheres (filled with potassium permanganate mixed with liquid ethylene glycol) that combust upon delivery to the ground.

Conservation Measures

- Direct ignition within RCAs will not be allowed unless the resource advisor documents that the ignition would not degrade soil, water, riparian, and aquatic conditions. Fire can be allowed to burn into RCAs when necessary to meet wildfire management objectives.
- Application of chemical-filled (glycol and potassium permanganate) plastic spheres called, "ping pong balls" will not occur within 300 feet of fish bearing streams to reduce the chance of chemical contamination and burning along streambanks.

- Direct ignition from streambanks is outside the scope of this programmatic consultation.
- A Resource Advisor should be consulted to determine if burnout operations will extend into occupied listed species' nest or denning sites during the breeding season.
- Use of burnouts that may result in a Lynx Analysis Area (LAU) exceeding 30 percent unsuitable lynx habitat are outside the scope of this programmatic consultation.
- A Resource Advisor should be consulted to determine if burnout operations will extend into occupied listed plant species' habitat and healthy cone bearing stands of 5-needle pines (whitebark pines), and would prescribe mitigations to protect whitebark pine during burn out operations.

2.1.2.5 Road Reconstruction

Roads that have been overgrown, closed or blocked are often reopened for wildfire management. These roads may also be improved if needed to allow for heavy equipment and vehicles.

Conservation Measures

- If closed roads are opened within RCAs, the Resource Advisor shall identify any associated erosional problems and recommend rehabilitation treatments needed to minimize or avoid sediment delivery to water bodies and intermittent streams. Treatments identified by the Resource Advisor will be incorporated in the Rehabilitation Plan.
- All road reconstruction activities shall be discussed beforehand with the Resource Advisor in order to avoid potential adverse effects. Road reconstruction actions will require the use of erosion-control structures to capture any sediment that may be caused through implementation.
- Roads reopened within RCAs that have more than a discountable or insignificant effect to ESA-listed species or their habitats, as determined by the appropriate resource specialists, would be outside the scope of this Program.
- Culvert installation/replacement work will be confined only to crossings on first and second order non-fish bearing streams and waterways and where treatments would have no potential to affect downstream fish bearing streams. All actions will require stream flows to be temporarily diverted around the installation site.
- Culvert installation/replacement and reconstruction of stream crossings within streams and waterways that contain listed fish are outside the scope of this Program.
- All roads that are opened during wildfire management activities shall be returned to pre-fire administrative status once all wildfire management actions and suppression rehabilitation treatments are complete.
- Avoid wildfire management road reconstruction activities within ¼ mile of active bald eagle nests during the nesting season (February 1 through August 15).
- Avoid cutting and removing 5-needle pines (i.e. whitebark pine) when reconstructing road for wildfire management activities.

2.1.2.6 Application of Retardant, Foams, and Surfactants

Aerial application of fire retardant or foam is not covered under this proposed action: aerial application of fire retardant adheres to the national consultation effort. This action does cover ground application of chemical fire retardants. Ground application of chemical fire foams may be used to check the spread of fire around structures and to create a "wetline" for burnouts. Foam generally reaches the wildland fuel in the form of a mist or rain and not as a concentrated mass, except when needed to control fast moving fires in grass or sagebrush habitat.

Conservation Measures

- Hand application of fire suppression chemicals will not be used in areas where there is a potential for direct waterway contamination.
- Injecting chemicals while pumping directly from waterways will not be conducted without appropriate mitigations that prevent foams/surfactants from reaching a waterbody. In cases where chemicals are needed, water will be pumped from a fold-a-tank, or a backflow check valve will be used.
- Release of retardant, foams, additives, and/or surfactants into waterways is outside the scope of this programmatic consultation.
- Aircraft will maintain a ¼ mile buffer of all flight activities around an active bald eagle nest to avoid disturbance of nesting activities.
- Spill containment equipment will be carried on all engines and be readily available at the incident camp.
- Resource Advisors should be knowledgeable of and able to implement the Forest's contingency plans in the event of a chemical spill or contamination.

2.1.2.7 Mop-Up

Once the fire is contained and the spread is stopped, mop-up is started. Often times, this includes cold trailing (a process by which a bare hand is used to feel for heat along the edge of "the black" and throughout the fire, searching for suspect hotspots), falling of burnt out hazard trees along where human safety is at risk, and bucking large logs with remaining heat. When hotspots are found, they are cooled or extinguished with hand tools, soil, and water.

Conservation Measures

- Applicable measures identified above will be employed as appropriate.

2.1.2.8 Rehabilitation Activities

When a fire is close to containment, rehabilitation of the fireline, roads, camps, and other areas used, will be planned and completed as necessary. Actions associated with rehabilitation will be identified in the Incident Action Plan or Suppression Rehabilitation Plan and may include measures such as:

- Construction of water bars and covering the line with debris is usually sufficient on hand lines.
- Bulldozer fire lines usually require extensive rehabilitation, and these areas are usually seeded in addition to having water bars installed and debris placed on the line's footprint.
- All opened roads will be returned to pre-fire condition once wildfire management actions and suppression rehabilitation treatments are complete.

All post-fire activities will be accomplished prior to cessation of normal outdoor activities due to onset of winter/adverse weather conditions.

Conservation Measures

- Rehabilitation measures will be implemented as appropriate where Wildfire Management Tactics have been employed.
- The appropriate resource specialist (i.e. fisheries biologist, hydrologist, botanist, or wildlife biologist) shall be consulted by the Rehabilitation Team when fisheries, hydrological, botanical or wildlife concerns are present.
- The Resource Specialist/Resource Advisor assigned to the wildfire will review the Wildfire Management Tactics and rehabilitation efforts to ensure that they successfully avoided adverse effects to listed species and critical habitat.
- A botanist shall be consulted by the Rehabilitation Team when considering seeding. If seeding is deemed necessary, a Forest Service approved native seed mix should be used.
- A separate Burn Area Emergency Response Team (BAER) may be formed as appropriate for a wildfire, but burn area rehabilitation is not part of the wildfire management action. That team would have to initiate emergency consultation should any BAER actions be recommended that may affect listed species or critical habitat.
- To improve efficiencies and maintain consistency, consultation on BAER activities should attempt to tier to existing programmatic coverage's wherever appropriate.

2.1.2.9 Cleaning/Sanitation of Equipment

Equipment used to draft, dip, store, or deploy water to a wildfire can be exposed to variety of invasive organisms. To prevent the spread of invasive species from contaminated to uncontaminated sources equipment will be sanitized and/or cleaned. Cleaning involves physically removing or washing with water to eradicate mud, plant parts, or other types of debris from equipment and supplies. Sanitation involves creating a solution containing a disinfectant that kills or neutralizes pathogenic organisms and exposing surfaces that may have come in contact with these organisms to the disinfectant. Sanitation generally occurs with cleaning, but cleaning can occur without sanitation.

Conservation Measures

- Known locations of aquatic invasive organisms and noxious weeds will be provided to fire management personnel or others involved with wildfire management activities prior to the fire season by Forest/District specialists; use of these areas will be avoided.
- Engines and helicopters returning from off-forest assignments must clean and sanitize equipment. Suppression actions that do not adhere to equipment cleaning and sanitation specifications mentioned above are outside the scope of this Program.
- Water tenders, engines and helicopters shall not dump water where it could directly or indirectly reach any surface water.
- Avoid sucking organic and bottom material into water intakes when drafting from streams or ponds.
- Minimize driving equipment through or wading across water bodies whenever possible.
- All equipment and vehicles will need to have all plant parts, soil and other materials that may carry noxious weed seeds removed prior to entry onto the Forest or movement from one Forest incident area to another.
- Water tenders, engines and helicopters moving from areas where whirling disease and other invasive aquatic organisms occur, to areas where they are not known, shall clean

and sanitize equipment before moving. Actions that do not adhere to equipment cleaning and sanitation specifications in this section are outside the scope of this Program.

- Cleaning/Sanitation will be conducted in areas where there is no potential to deliver effluent to waterways. Areas will be designated for cleaning/sanitation of heavy equipment to reduce the spread of noxious weeds and unwanted organisms.
- Sanitize all equipment prior to use if it has an unknown sanitizing history as well as after an incident.
- If possible, dispose of sanitation effluent in sanitary sewers. If sanitary sewers are not available, sanitation effluent can be applied to roads in areas where there is no potential to deliver to waterways. Care will be taken to avoid exposing firefighters, the public, or areas outside of the road right-of-way to the sanitation effluent as it is applied.
- Do not dump treated water into any stream or lake, or on areas where it can migrate into any water body.

2.2 Analytical Framework for the 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.

As discussed below under the *Status of the Species*, interim recovery units have been designated for the bull trout for purposes of recovery planning and application of the jeopardy standard. Per Service national policy (U.S. Fish and Wildlife Service 2006, entire), it is important to recognize that the establishment of recovery units does not create a new listed entity. Jeopardy analyses must always consider the impacts of a proposed action on the survival and recovery of the species that is listed. While a proposed Federal action may have significant adverse consequences to one or more recovery units, this would only result in a jeopardy determination if these adverse consequences reduce appreciably the likelihood of both the survival and recovery of the listed entity; in this case, the coterminous U.S. population of the bull trout.

The joint Service and National Marine Fisheries Service (NMFS) *Endangered Species Consultation Handbook* (U.S. Fish and Wildlife Service and NMFS 1998, pp. 4-38), which represents national policy of both agencies, further clarifies the use of recovery units in the jeopardy analysis:

> When an action appreciably impairs or precludes the capacity of a recovery unit 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, include in the biological opinion a description of how the action affects not only the recovery unit's capability, but the relationship of the recovery unit to both the survival and recovery of the listed species as a whole.

The jeopardy analysis in this Opinion conforms to the above analytical framework.

2.3 Status of the Species – Bull Trout

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

2.3.1 Listing Status

The coterminous United States population of the bull trout was listed as threatened on November 1, 1999 (64 FR 58910). The threatened bull trout occurs in the Klamath River Basin of south-central Oregon, the Jarbidge River in Nevada, north to various coastal rivers of Washington to the Puget Sound, east throughout major rivers within the Columbia River Basin to the St. Mary-Belly River, and east of the Continental Divide in northwestern Montana (Cavender 1978, pp. 165-166; Bond 1992, p. 4; Brewin and Brewin 1997, pp. 209-216; Leary and Allendorf 1997, pp. 715-720). The Service completed a 5-year Review in 2008 and concluded that the bull trout should remain listed as threatened (U.S. Fish and Wildlife Service 2008, p. 53).

The bull trout was initially listed as three separate Distinct Population Segments (DPSs) (63 FR 31647, 64 FR 17110). The preamble to the final listing rule for the U.S. coterminous population of the bull trout discusses the consolidation of these DPSs, plus two other population segments, into one listed taxon and the application of the jeopardy standard under Section 7 of the Act relative to this species (64 FR 58930):

> Although this rule consolidates the five bull trout DPSs into one listed taxon, based on conformance with the DPS policy for purposes of consultation under Section 7 of the Act, we intend to retain recognition of each DPS in light of available scientific information relating to their uniqueness and significance. Under this approach, these DPSs will be treated as interim recovery units with respect to application of the jeopardy standard until an approved recovery plan is developed. Formal establishment of bull trout recovery units will occur during the recovery planning process.

Thus, as discussed above under the *Analytical Framework for the Jeopardy Determination*, the Service's jeopardy analysis for the proposed Project will involve consideration of how the Project is likely to affect the Columbia River interim recovery unit for the bull trout based on its uniqueness and significance as described in the DPS final listing rule cited above, which is herein incorporated by reference. However, in accordance with Service national policy, the jeopardy determination is made at the scale of the listed species. In this case, the coterminous U.S. population of the bull trout.

2.3.1.1 Reasons for Listing

Though wide ranging in parts of Oregon, Washington, Idaho, and Montana, bull trout in the interior Columbia River basin presently occur in only about 45 percent of the historical range (Quigley and Arbelbide 1997, p. 1177; Rieman et al. 1997, p. 1119). Declining trends due to the combined effects of habitat degradation and fragmentation, blockage of migratory corridors, poor water quality, angler harvest and poaching, entrainment into diversion channels and dams, and introduced nonnative species (e.g., brook trout, *Salvelinus fontinalis*) have resulted in declines in range-wide bull trout distribution and abundance (Bond 1992, p. 4; Schill 1992, p. 40; Thomas 1992, pp. 9-12; Ziller 1992, p. 28; Rieman and McIntyre 1993, pp. 1-18; Newton and Pribyl 1994, pp. 2, 4, 8-9; Idaho Department of Fish and Game in litt. 1995, pp. 1-3). Several local extirpations have been reported, beginning in the 1950s (Rode 1990, p. 1; Ratliff and Howell 1992, pp. 12-14; Donald and Alger 1993, p. 245; Goetz 1994, p. 1; Newton and Pribyl 1994, p. 2; Berg and Priest 1995, pp. 1-45; Light et al. 1996, pp. 20-38; Buchanan and Gregory 1997, p. 120).

Land and water management activities such as dams and other diversion structures, forest management practices, livestock grazing, agriculture, road construction and maintenance, mining, and urban and rural development continue to degrade bull trout habitat and depress bull trout populations (U.S. Fish and Wildlife Service 2002a, p. 13).

2.3.2 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, pp. 165-169; Bond 1992, pp. 2-3). To the west, the bull trout's current range includes Puget Sound, coastal rivers of British Columbia, Canada, and southeast Alaska (Bond 1992, p. 2-3). East of the Continental Divide bull trout are found in the headwaters of the Saskatchewan River in Alberta and the MacKenzie River system in Alberta and British Columbia (Cavender 1978, pp. 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.

2.3.2.1 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 one to four years before migrating to either a lake (adfluvial), river (fluvial), or, in certain coastal areas, to saltwater (anadromous) where they reach maturity (Fraley and Shepard 1989, p. 1; Goetz 1989, pp. 15-16). Resident and migratory forms often occur together and it is suspected that individual bull trout may give rise to offspring exhibiting both resident and migratory behavior (Rieman and McIntyre 1993, p. 2).

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

Bull trout are found primarily in colder streams, although individual fish are migratory in larger, warmer river systems throughout the range (Fraley and Shepard 1989, pp. 135-137; Rieman and McIntyre 1993, p. 2 and 1995, p. 288; Buchanan and Gregory 1997, pp. 121-122; Rieman et al. 1997, p. 1114). Water temperature above 15°C (59°F) is believed to limit bull trout distribution, which may partially explain the patchy distribution within a watershed (Fraley and Shepard 1989, p. 133; Rieman and McIntyre 1995, pp. 255-296). Spawning areas are often associated with cold water springs, groundwater infiltration, and the coldest streams in a given watershed (Pratt 1992, p. 6; Rieman and McIntyre 1993, p. 7; Rieman et al. 1997, p. 1117). Goetz (1989, pp. 22, 24) suggested optimum water temperatures for rearing of less than 10°C (50°F) and optimum water temperatures for egg incubation of 2 to 4°C (35 to 39°F).

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

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

Bull trout typically spawn from August to November during periods of decreasing water temperatures. Migratory bull trout frequently begin spawning migrations as early as April, and have been known to move upstream as far as 250 kilometers (km) (155 miles (mi)) to spawning grounds (Fraley and Shepard 1989, p. 135). Depending on water temperature, incubation is normally 100 to 145 days (Pratt 1992, p.1) and, after hatching, 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).

2.3.2.2 Population Dynamics

The draft bull trout Recovery Plan (U.S. Fish and Wildlife Service 2002a, pp. 47-48) defined core areas as groups of partially isolated local populations of bull trout with some degree of gene flow occurring between them. Based on this definition, core areas can be considered metapopulations. A metapopulation is an interacting network of local populations with varying frequencies of migration and gene flow among them (Meefe and Carroll 1994, p. 188). In theory, bull trout metapopulations (core areas) can be composed of two or more local populations, but Rieman and Allendorf (2001, p. 763) suggest that for a bull trout metapopulation to function effectively, a minimum of 10 local populations are required. Bull trout core areas with fewer than 5 local populations are at increased risk of local extirpation, core areas with between 5 and 10 local populations are at intermediate risk, and core areas with more than 10 interconnected local populations are at diminished risk (U.S. Fish and Wildlife Service 2002a, pp. 50-51).

The presence of a sufficient number of adult spawners is necessary to ensure persistence of bull trout populations. In order to avoid inbreeding depression, it is estimated that a minimum of 100 spawners are required. Inbreeding can result in increased homozygosity of deleterious recessive alleles which can in turn reduce individual fitness and population viability (Whitesel et al. 2004, p. 36). For persistence in the longer term, adult spawning fish are required in sufficient numbers to reduce the deleterious effects of genetic drift and maintain genetic variation. For bull trout, Rieman and Allendorf (2001, p. 762) estimate that approximately 1,000 spawning adults within any bull trout population are necessary for maintaining genetic variation indefinitely. Many local bull trout populations individually do not support 1,000 spawners, but this threshold may be met by the presence of smaller interconnected local populations within a core area.

For bull trout populations to remain viable (and recover), natural productivity should be sufficient for the populations to replace themselves from generation to generation. A population that consistently fails to replace itself is at an increased risk of extinction. Since estimates of population size are rarely available, the productivity or population growth rate is usually estimated from temporal trends in indices of abundance at a particular life stage. For example, redd counts are often used as an indicator of a spawning adult population. The direction and magnitude of a trend in an index can be used as a surrogate for growth rate.

Survival of bull trout populations is also dependent upon connectivity among local populations. 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. 7). Increased habitat fragmentation reduces the amount of available habitat and increases isolation from other populations of the same species (Saunders et al. 1991, p. 22). Burkey (1989, p. 76) 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 of local populations may be low and probability of extinction high. Migrations also facilitate gene flow among local populations because individuals from different local populations interbreed when some stray and return to nonnatal streams. Local populations that are extirpated by catastrophic events may also become reestablished in this manner.

In summary, based on the works of Rieman and McIntyre (1993, pp. 9-15) and Rieman and Allendorf (2001, pp 756-763), the draft bull trout Recovery Plan identified four elements to consider when assessing long-term viability (extinction risk) of bull trout populations: (1) number of local populations, (2) adult abundance (defined as the number of spawning fish present in a core area in a given year), (3) productivity, or the reproductive rate of the population, and (4) connectivity (as represented by the migratory life history form).

2.3.3 Status and Distribution

As noted above, in recognition of available scientific information relating to their uniqueness and significance, five population segments of the coterminous United States population of the bull trout are considered essential to the survival and recovery of this species and are identified as: (1) Jarbidge River, (2) Klamath River, (3) Coastal-Puget Sound, (4) St. Mary-Belly River, and (5) Columbia River. Each of these segments 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.

A summary of the current status and conservation needs of the bull trout within these units is provided below. A comprehensive discussion of these topics is found in the draft bull trout Recovery Plan (U.S. Fish and Wildlife Service 2002a, entire; 2004a, b; entire).

Central to the survival and recovery of the bull trout is the maintenance of viable core areas (U.S. Fish and Wildlife Service 2002a, p. 54). A core area is defined as a geographic area occupied by one or more local bull trout populations that overlap in their use of rearing, foraging, migratory, and overwintering habitat, and, in some cases, their use of spawning habitat. Each of the population segments listed below consists of one or more core areas. One hundred and twenty one core areas are recognized across the United States range of the bull trout (U.S. Fish and Wildlife Service 2005, p. 9).

A core area assessment conducted by the Service for the 5 year bull trout status review determined that of the 121 core areas comprising the coterminous listing, 43 are at high risk of extirpation, 44 are at risk, 28 are at potential risk, 4 are at low risk and 2 are of unknown status (U.S. Fish and Wildlife Service 2008, p. 29).

2.3.3.1 Jarbidge River

This population segment currently contains a single core area with six local populations. Less than 500 resident and migratory adult bull trout, representing about 50 to 125 spawners, are estimated to occur within the core area. The current condition of the bull trout in this segment is attributed to the effects of livestock grazing, roads, angler harvest, timber harvest, and the introduction of nonnative fishes (U.S. Fish and Wildlife Service 2004a, p. iii). The draft bull trout Recovery Plan identifies the following conservation needs for this segment: (1) maintain the current distribution of the bull trout within the core area, (2) maintain stable or increasing trends in abundance of both resident and migratory bull trout in the core area, (3) restore and maintain suitable habitat conditions for all life history stages and forms, and (4) conserve genetic diversity and increase natural opportunities for genetic exchange between resident and migratory forms of the bull trout. An estimated 270 to 1,000 spawning fish per year are needed to provide for the persistence and viability of the core area and to support both resident and migratory adult bull trout (U.S. Fish and Wildlife Service 2004a, p. 62-63). Currently this core area is at high risk of extirpation (U.S. Fish and Wildlife Service 2005, p. 9).

2.3.3.2 Klamath River

This population segment currently contains three core areas and 12 local populations. The current abundance, distribution, and range of the bull trout in the Klamath River Basin are greatly reduced from historical levels due to habitat loss and degradation caused by reduced water quality, timber harvest, livestock grazing, water diversions, roads, and the introduction of nonnative fishes. Bull trout populations in this unit face a high risk of extirpation (U.S. Fish and Wildlife Service 2002b, p. iv). The draft bull trout Recovery Plan (U.S. Fish and Wildlife Service 2002b, p. v) identifies the following conservation needs for this unit: (1) maintain the current distribution of the bull trout and restore distribution in previously occupied areas, (2) maintain stable or increasing trends in bull trout abundance, (3) restore and maintain suitable habitat conditions for all life history stages and strategies, and (4) conserve genetic diversity and provide the opportunity for genetic exchange among appropriate core area populations. Eight to 15 new local populations and an increase in population size from about 3,250 adults currently to 8,250 adults are needed to provide for the persistence and viability of the three core areas (U.S. Fish and Wildlife Service 2002b, p. vi).

2.3.3.3 Coastal-Puget Sound

Bull trout in the Coastal-Puget Sound population segment exhibit anadromous, adfluvial, fluvial, and resident life history patterns. The anadromous life history form is unique to this unit. This population segment currently contains 14 core areas and 67 local populations (U.S. Fish and Wildlife Service 2004b, p. iv; 2004c, pp. iii-iv). Bull trout are distributed throughout most of the large rivers and associated tributary systems within this unit. With limited exceptions, bull trout continue to be present in nearly all major watersheds where they likely occurred historically within this unit. Generally, bull trout distribution has contracted and abundance has declined, especially in the southeastern part of the unit. The current condition of the bull trout in this population segment is attributed to the adverse effects of dams, forest management practices (e.g., timber harvest and associated road building activities), agricultural practices (e.g., diking, water control structures, draining of wetlands, channelization, and the removal of riparian vegetation), livestock grazing, roads, mining, urbanization, angler harvest, and the introduction of nonnative species. The draft bull trout Recovery Plan (U.S. Fish and Wildlife Service 2004b, pp. ix-x) identifies the following conservation needs for this unit: (1) maintain or expand the current distribution of bull trout within existing core areas, (2) increase bull trout abundance to about 16,500 adults across all core areas, and (3) maintain or increase connectivity between local populations within each core area.

2.3.3.4 St. Mary-Belly River

This population segment currently contains six core areas and nine local populations (U.S. Fish and Wildlife Service 2002c, p. v). Currently, bull trout are widely distributed in the St. Mary River drainage and occur in nearly all of the waters that were inhabited historically. Bull trout are found only in a 1.2-mile reach of the North Fork Belly River within the United States. Redd count surveys of the North Fork Belly River documented an increase from 27 redds in 1995 to 119 redds in 1999. This increase was attributed primarily to protection from angler harvest (U.S. Fish and Wildlife Service 2002c, p. 37). The current condition of the bull trout in this population segment is primarily attributed to the effects of dams, water diversions, roads, mining, and the introduction of nonnative fishes (U.S. Fish and Wildlife Service 2002c, p. vi). The draft bull trout Recovery Plan (U.S. Fish and Wildlife Service 2002c, pp. v-ix) identifies the following conservation needs for this unit: (1) maintain the current distribution of the bull trout and restore distribution in previously occupied areas, (2) maintain stable or increasing trends in bull trout abundance, (3) maintain and restore suitable habitat conditions for all life history stages and forms, (4) conserve genetic diversity and provide the opportunity for genetic exchange, and (5) establish good working relations with Canadian interests because local bull trout populations in this unit are comprised mostly of migratory fish whose habitat is mainly in Canada.

2.3.3.5 Columbia River

The Columbia River population segment includes bull trout residing in portions of Oregon, Washington, Idaho, and Montana. Bull trout are estimated to have occupied about 60 percent of the Columbia River Basin, and presently occur in 45 percent of the estimated historical range (Quigley and Arbelbide 1997, p. 1177). This population segment currently contains 97 core areas and 527 local populations. About 65 percent of these core areas and local populations occur in Idaho and northwestern Montana.

The condition of the bull trout populations within these core areas varies from poor to good, but generally all have been subject to the combined effects of habitat degradation, fragmentation and alterations associated with one or more of the following activities: dewatering, road construction and maintenance, mining and grazing, blockage of migratory corridors by dams or other diversion structures, poor water quality, incidental angler harvest, entrainment into diversion channels, and introduced nonnative species.

The Service has determined that of the total 97 core areas in this population segment, 38 are at high risk of extirpation, 35 are at risk, 20 are at potential risk, 2 are at low risk, and 2 are at unknown risk (U.S. Fish and Wildlife Service 2005, pp. 1-94).

The draft bull trout Recovery Plan (U.S. Fish and Wildlife Service 2002a, p. v) identifies the following conservation needs for this population segment: (1) maintain or expand the current distribution of the bull trout within core areas, (2) maintain stable or increasing trends in bull trout abundance, (3) maintain and restore suitable habitat conditions for all bull trout life history stages and strategies, and (4) conserve genetic diversity and provide opportunities for genetic exchange.

2.3.3.5.1 Columbia River Recovery/Management Units

Achieving recovery goals within each management unit is critical to recovering the Columbia River population segment. Recovering bull trout in each management unit would maintain the overall distribution of bull trout in their native range. Individual core areas are the foundation of management units and conserving core areas and their habitats within management units preserves the genotypic and phenotypic diversity that will allow bull trout access to diverse habitats and reduce the risk of extinction from stochastic events. The continued survival and recovery of each individual core area is critical to the persistence of management units and their role in the recovery of a population segment (U.S. Fish and Wildlife Service 2002a, p. 54).

The draft bull trout Recovery Plan (U.S. Fish and Wildlife Service 2002a, p. 2) identified 22 recovery units within the Columbia River population segment. These units are now referred to as management units. Management units are groupings of bull trout with historical or current gene flow within them and were designated to place the scope of bull trout recovery on smaller spatial scales than the larger population segments. The action area is encompassed by the Salmon River and Southwest Idaho management units.

2.3.3.5.1.1 Salmon River Management Unit

The Salmon River Management Unit includes the entire Salmon River Basin in Idaho upstream of its confluence with the Snake River to the headwaters in the Sawtooth Valley. This mountainous basin covers one of the largest areas in the Columbia River Basin. The Salmon River Basin is considered a management unit because bull trout likely functioned as a unit historically with the large mainstem rivers providing connectivity between subbasins and their associated bull trout populations (U.S. Fish and Wildlife Service 2002d, p. 1). Large dams are absent on the mainstem rivers, thus supporting the contention that bull trout populations remain connected (U.S. Fish and Wildlife Service 2002d, p. 23). Bull trout are distributed throughout much of the mainstem Salmon River and associated tributary systems within this management unit, and exhibit adfluvial, fluvial, and resident life history forms. Bull trout spawning occurs in the higher elevation stream reaches throughout this unit. Within the Salmon River Management Unit, 10 core areas contain 125 local populations (U.S. Fish and Wildlife Service 2002d, pp. 3-6). For this management unit, only the Upper Salmon River Core Area is contained within the action area.

Upper Salmon River Core Area

This area encompasses the fourth field Hydrologic Unit that extends from the mouth of the Pahsimeroi River to the headwaters in the Sawtooth Mountains, including the mainstem Salmon River and its tributaries. The area covers 2,410 square miles and contains 3,251 miles of stream. Eighty nine percent of this core area is in public ownership, and most of this public land is managed by the Federal government. Eighteen local populations have been identified in this core area (U.S. Fish and Wildlife Service 2002d, p. 7). This core area is considered at a diminished risk for stochastic events based on the number of local populations in existence (U.S. Fish and Wildlife Service 2002d, p. 63). Adult abundance in this core area is estimated to be greater than 5,000 individuals; it is not at risk for inbreeding or genetic drift (U.S. Fish and

Wildlife Service 2002d, p. 65). Migratory bull trout exist in all or nearly all local populations in the Upper Salmon Core Area; it is considered at a diminished risk regarding functional connectivity (U.S. Fish and Wildlife Service 2002d, p. 66). The Service's Five Year Status Review (U.S. Fish and Wildlife Service 2008, p. 34) concluded that the Upper Salmon River Core Area was at risk of extirpation based on population abundance, distribution, and trend; threats were considered moderate but imminent.

2.3.3.5.1.2 Southwest Idaho Management Unit

The Southwest Idaho Management Unit encompasses the entire Boise, Payette, and Weiser River drainages. Historically, it was believed that bull trout were able to move freely between all three river systems; however, today bull trout occupy areas in the basins that are upstream of impassible dams or uninhabitable areas (U.S. Fish and Wildlife Service 2002e, p. 1). The basins were included in a single recovery unit because they likely functioned as a unit historically; however, each basin is currently treated as a subunit. For this management unit, only the Boise River and Payette River Subunits are contained within the action area.

Boise River Subunit

The Boise River Subunit includes the entire Boise River watershed, however, bull trout are only known to exist above Lucky Peak Dam. Within the Boise River Subunit, 3 core areas exist with a total of 31 local populations. The Arrowrock Core Area encompasses the Boise River watersheds upstream of Arrowrock Dam, including the North Fork Boise River, Middle Fork Boise River, and the lower South Fork Boise River. The Anderson Ranch Core Area includes the South Fork Boise River above Anderson Ranch Dam. The action area does not include the Lucky Peak Core Area. Migratory and resident bull trout occur in both the Arrowrock and Anderson Ranch Core Areas (U.S. Fish and Wildlife Service 2002e, p. 32).

Arrowrock Core Area

There are 15 known local populations in the Arrowrock Core Area (U.S. Fish and Wildlife Service 2002e, p. 33) and are considered at a diminished risk from stochastic events (U.S. Fish and Wildlife Service 2002e, p. 48). Populations in this core area exhibit resident, fluvial (North Fork, Middle Fork, and lower South Fork Boise Rivers), and adfluvial (Arrowrock Reservoir) life history patterns. Migratory bull trout exist in all or nearly all local populations in the Arrowrock Core Area, and are considered at a diminished risk regarding functional connectivity (U.S. Fish and Wildlife Service 2002e, p. 50). The Service's Five Year Status Review (U.S. Fish and Wildlife Service 2008, p. 34) concluded that the Arrowrock Core Area was at risk of extirpation based on population abundance, distribution, and trend; threats were considered moderate but imminent. Only the headwater sections of the North Fork and Middle Fork Boise Rivers are contained within the action area.

Anderson Ranch Core Area

There are 15 known local populations in the Anderson Ranch Core Area (U.S. Fish and Wildlife Service 2002e, p. 33), however, recent information suggests that three additional local populations are likely present (Assessment, p. 70). Populations exhibit resident, fluvial (South Fork Boise River), and adfluvial (Anderson Ranch Reservoir) life history patterns. Because of the number of local populations present, this core area is considered at a diminished risk from stochastic events (U.S. Fish and Wildlife Service 2002e, p. 48). Migratory bull trout exist in all or nearly all local populations in the Anderson Ranch Core Area, and are considered at a diminished risk regarding functional connectivity (U.S. Fish and Wildlife Service 2002e, p. 50). The Service's Five Year Status Review (U.S. Fish and Wildlife Service 2008, p. 34) concluded that the Anderson Ranch Core Area was at risk of extirpation based on population abundance, distribution, and trend; threats were considered substantial and imminent. The majority of this core area within the action area is found in the headwater sections of the South Fork Boise River.

Payette River Subunit

Five core areas exist within the Payette River Subunit, with a total of 18 local populations. The action area only encompasses the Upper South Fork Payette River Core Area, located predominantly within the headwater reaches of the Sawtooth Wilderness. While bull trout may be able to interact between the Middle Fork and Upper South Fork Payette River Core Areas, a waterfall on the South Fork Payette River may act as a barrier (U.S. Fish and Wildlife Service 2002e, p. 8); all the other core areas within this subunit are effectively disconnected due to dams or inhospitable habitat conditions.

Upper South Fork Payette River Core Area

There are nine known local populations in the Upper South Fork Payette River Core Area (U.S. Fish and Wildlife Service 2002e, p. 34); the core area is considered at an intermediate risk from stochastic events (U.S. Fish and Wildlife Service 2002e, p. 48). Migratory bull trout may exist in some local populations within the Upper South Fork Payette River Core Area, but the population is considered at an intermediate risk regarding functional connectivity (U.S. Fish and Wildlife Service 2002e, p. 50). The Service's Five Year Status Review (U.S. Fish and Wildlife Service 2008, p. 35) concluded that the Upper South Fork Payette River Core Area was at risk of extirpation based on population abundance, distribution, and trend; threats were considered moderate and imminent.

2.3.4 Previous Consultations and Conservation Efforts

2.3.4.1 Consultations

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 sums to 137 biological opinions. The summation has not been updated since 2003. Of these, 124 biological opinions (91 percent) applied to activities affecting bull trout in the Columbia Basin population segment, 12 biological opinions (9 percent) applied to activities affecting bull trout in the Coastal-Puget Sound population segment, 7 biological opinions (5 percent) applied to activities affecting bull trout in the Klamath Basin population segment, and one biological opinion (< 1 percent) applied to activities affecting the Jarbidge and St. Mary-Belly population segments (Note: these percentages do not add to 100, because several biological opinions applied to more than one population segment). The geographic scale of these consultations varied from individual actions (e.g., construction of a bridge or pipeline) within one basin to multiple-project actions occurring across several basins.

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.

2.3.4.2 Regulatory Mechanisms

The implementation and effectiveness of regulatory mechanisms vary across the coterminous range. Forest practices rules for Montana, Idaho, Oregon, Washington, and Nevada include streamside management zones that benefit bull trout when implemented.

2.3.4.3 State Conservation Measures

State agencies are specifically addressing bull trout through the following initiatives:

- Washington Bull Trout and Dolly Varden Management Plan developed in 2000.
- Montana Bull Trout Restoration Plan (Bull Trout Restoration Team appointed in 1994, and plan completed in 2000).
- Oregon Native Fish Conservation Policy (developed in 2004).
- Nevada Species Management Plan for Bull Trout (developed in 2005).
- State of Idaho Bull Trout Conservation Plan (developed in 1996). The watershed advisory group drafted 21 problem assessments throughout Idaho which address all 59 key watersheds. To date, a conservation plan has been completed for one of the 21 key watersheds (Pend Oreille).

2.3.4.4 Habitat Conservation Plans

Habitat Conservation Plans (HCP) have resulted in land management practices that exceed State regulatory requirements. Habitat conservation plans addressing bull trout cover approximately 472 stream miles of aquatic habitat, or approximately 2.6 percent of the Key Recovery Habitat across Montana, Idaho, Oregon, Washington, and Nevada. These HCPs include: Plum Creek Native Fish HCP, Washington Department of Natural Resources HCP, City of Seattle Cedar River Watershed HCP, Tacoma Water HCP, and Green Diamond HCP.

2.3.4.5 Federal Land Management Plans

PACFISH is the "Interim Strategy for Managing Anadromous Fish-Producing Watersheds and includes Federal lands in Western Oregon and Washington, Idaho, and Portions of California." INFISH is the "Interim Strategy for Managing Fish-Producing Watersheds in Eastern Oregon and Washington, Idaho, Western Montana, and Portions of Nevada." Each strategy amended Forest Service Land and Resource Management Plans and Bureau of Land Management Resource Management Plans. Together PACFISH and INFISH cover thousands of miles of waterways within 16 million acres and provide a system for reducing effects from land management activities to aquatic resources through riparian management goals, landscape scale interim riparian management objectives, Riparian Habitat Conservation Areas (RHCAs), riparian standards, watershed analysis, and the designation of Key and Priority watersheds. These interim strategies have been in place since 1992 and are part of the management plans for Bureau of Land Management and Forest Service lands.

The Interior Columbia Basin Ecosystem Management Plan (ICBEMP) is the strategy that replaces the PACFISH and INFISH interim strategies when federal land management plans are revised. The Southwest Idaho Land and Resource Management Plan (LRMP) is the first LRMP under the strategy and provides measures that protect and restore soil, water, riparian and aquatic resources during project implementation while providing flexibility to address both short- and long-term social and economic goals on 6.6 million acres of National Forest lands. This plan includes a long-term Aquatic Conservation Strategy that focuses restoration funding in priority subwatersheds identified as important to achieving Endangered Species Act, Tribal, and Clean Water Act goals. The Southwest Idaho LRMP replaces the interim PACFISH/INFISH strategies and adds additional conservation elements, specifically, providing an ecosystem management foundation, a prioritization for restoration integrated across multiple scales, and adaptable active, passive and conservation management strategies that address both protection and restoration of habitat and 303(d) stream segments.

The Southeast Oregon Resource Management Plan (SEORMP) and Record of Decision is the second LRMP under the ICBEMP strategy which describes the long-term (20+ years) plan for managing the public lands within the Malheur and Jordan Resource Areas of the Vale District. The SEORMP is a general resource management plan for 4.6 million acres of Bureau of Land Management administered public lands primarily in Malheur County with some acreage in Grant and Harney Counties, Oregon. The SEORMP contains resource objectives, land use allocations, management actions and direction needed to achieve program goals. Under the plan, riparian areas, floodplains, and wetlands will be managed to restore, protect, or improve their natural functions relating to water storage, groundwater recharge, water quality, and fish and wildlife values.

The Northwest Forest Plan covers 24.5 million acres in Washington, Oregon, and northern California. The Aquatic Conservation Strategy (ACS) is a component of the Northwest Forest Plan. It was developed to restore and maintain the ecological health of watersheds and the aquatic ecosystems. The four main components of the ACS (Riparian Reserves, Watershed Analysis, Key Watersheds, and Watershed Restoration) are designed to operate together to maintain and restore the productivity and resiliency of riparian and aquatic ecosystems.

It is the objective of the Forest Service and the Bureau of Land Management to manage and maintain habitat and, where feasible, to restore habitats that are degraded. These plans provide for the protection of areas that could contribute to the recovery of fish and, overall, improve riparian habitat and water quality throughout the basin. These objectives are accomplished through such activities as closing and rehabilitating roads, replacing culverts, changing grazing and logging practices, and re-planting native vegetation along streams and rivers.

2.3.4.6 Conservation Needs

The recovery planning process for the bull trout (U.S. Fish and Wildlife Service 2002a, p. 49) has identified the following conservation needs (goals) for bull trout recovery: (1) maintain the current distribution of bull trout within core areas as described in recovery unit chapters, (2) maintain stable or increasing trends in abundance of bull trout as defined for individual recovery units, (3) restore and maintain suitable habitat conditions for all bull trout life history stages and strategies, and (4) conserve genetic diversity and provide opportunity for genetic exchange.

The draft bull trout Recovery Plan (U.S. Fish and Wildlife Service 2002a, p. 62) identifies the following tasks needed for achieving recovery: (1) protect, restore, and maintain suitable habitat conditions for bull trout, (2) prevent and reduce negative effects of nonnative fishes, such as brook trout, and other nonnative taxa on bull trout, (3) establish fisheries management goals and objectives compatible with bull trout recovery, (4) characterize, conserve, and monitor genetic diversity and gene flow among local populations of bull trout, (5) 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, (6) use all available conservation programs and regulations to protect and conserve bull trout and bull trout habitats, (7) assess the implementation of bull trout recovery by management units, and (8) revise management unit plans based on evaluations.

Another threat now facing bull trout is warming temperature regimes associated with global climate change. Because air temperature affects water temperature, species at the southern margin of their range that are associated with cold water patches, such as bull trout, may become restricted to smaller, more disjunct patches or become extirpated as the climate warms (Rieman et al. 2007, p. 1560). Rieman et al. (2007, pp. 1558, 1562) concluded that climate is a primary determining factor in bull trout distribution. Some populations already at high risk, such as the Jarbidge, may require "aggressive measures in habitat conservation or restoration" to persist (Rieman et al. 2007, p. 1560). Conservation and restoration measures that would benefit bull trout include protecting high quality habitat, reconnecting watersheds, restoring flood plains, and increasing site-specific habitat features important for bull trout, such as deep pools or large woody debris (Kinsella 2005, entire).

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.

Because this programmatic action takes place across the entire northern portion of the Forest, baseline descriptions in the action area must be described at a broader level. It is unknown where or when a fire may take place on the Forest where suppression actions are needed, thus it is not realistic to describe environmental baseline conditions at each 7th field Hydrologic Unit. Rather, baseline conditions are described more generally at the 5th and 6th field Hydrologic Units within and immediately adjacent to the boundaries of the Sawtooth National Forest in the action area.

2.4.1 Status of the Bull Trout in the Action Area

Upper Salmon Subbasin; Upper Salmon River Core Area

Biological Condition of Bull Trout

Sawtooth Valley - Both resident and migratory (fluvial and adfluvial) bull trout are present in the Sawtooth Valley. The Alturas Lake inlet has adfluvial bull trout and one of the largest local populations in the Sawtooth Valley. All bull trout patches have been sampled in the last four years. Inventories have shown that two local populations (Pettit Lake Creek and Upper Salmon River) do not currently support bull trout reproduction; however, Pettit Lake provides important summer forage and overwintering habitat for migratory bull trout. A few resident or offspring from migratory lineage of bull trout were found in 2004 in Champion Creek and in 2007 in Hell Roaring Lake by Idaho Department of Fish and Game (IDFG) that have not been previously designated as local populations. Bull trout have not been found in other patches suggesting they currently do not support reproducing populations.

Although the five occupied patches are well dispersed, extinction risks for this metric are still believed to be moderate within this subpopulation. This is due to the high abundance of brook trout within Hellroaring, Alturas Lake, and Champion Creeks that are causing lower densities of juvenile bull trout. Juvenile bull trout may not even be present if it were not for migratory adults sustaining reproduction within each of these patches.

Valley Creek - All bull trout patches (headwaters of Valley, E.F. Valley, Meadow, Elk, Stanley Lake, Stanley, Crooked, Iron, Goat, and Meadow Creeks) have been sampled in the last four years. Sampling has found that only two patches (headwaters of Valley and E.F. Valley Creek) are occupied by reproducing bull trout populations. Wandering subadults or migratory adult bull trout have occasionally been found in the lower Elk, Iron, Stanley, and Crooked Creek patches. However, juvenile bull trout (<150 mm) have not been found in these streams suggesting reproducing populations are not present. The risk of extinction in Valley Creek is high because only two of the 10 patches are occupied by juvenile bull trout and the spatial arrangement is clumped in the headwaters of Valley Creek. Populations that are in close proximity to one another are more likely to respond to the same environmental variations (e.g., floods, droughts, etc.) and may be affected in a similar manner. If populations within a metapopulation fluctuate together their ability to persist amid environmental changes decreases.

Lower and Upper Canyon –All bull trout patches have been sampled in the last four years. Sampling has found that juvenile bull trout occupy all patches identified as local populations in the draft recovery plan. However, bull trout were not found in the additional patches due to many having barriers near their confluences with the Salmon River. Occupied patches support large amounts of habitat and are well dispersed. This implies that extinction risks for this metric are lower within this subpopulation because there are multiple occupied patches and are well dispersed making them less likely to respond to similar disturbances (e.g., floods, droughts, etc.).

East Fork Salmon River – Both resident and migratory/fluvial life forms are thought to be present. All patches have been sampled in the last four years. Sampling has found that juvenile bull trout occupy all patches except Wickiup and Big Lake Creeks. High densities of bull trout have been documented in tributaries to the East Fork Salmon River in Big Boulder, Herd, and Warms Spring Creeks. Occupied patches support large amounts of habitat and are well dispersed. This implies that extinction risks for this metric are lower within this subpopulation because there are multiple occupied patches and are well dispersed making them less likely to respond to similar disturbances (e.g., floods, droughts, etc.).

Middle/North Fork Boise Subbasin; Arrowrock Core Area

Biological Condition of Bull Trout

Historically this subbasin supported steelhead and Chinook salmon (fall and summer). The abundance, diversity, and migration of bull trout have been affected by dams, habitat modifications and introduced species. Resident and migratory bull trout occur throughout the Middle Fork and North Fork Boise River subbasins, but have been isolated from the Snake River by Diversion Dam built in 1908 and then later Arrowrock Dam. The Atlanta Dam located on the Middle Fork Boise River a short distance downstream of the town of Atlanta also completely blocked migratory bull trout from upstream habitat until a fish ladder was constructed in 1999. However, there have been many problems with the operator not taking care of the fish ladder as there have been debris and gravel blockage problems that are preventing the fish ladder from working at best efficiency.

Arrowrock and Lucky Peak dams have had adverse effects on bull trout inhabiting the Middle Fork and North Fork Boise River. The dams have no provisions for either upstream or downstream fish passage, and have eliminated access to lower portions of the Boise River basin by migratory fish. However, Arrowrock Reservoir has allowed the expression of bull trout adfluvial life forms.

The abundance, diversity, and migration of bull trout have been affected by dams, habitat modifications, and introduced species. Competition and hybridization with brook trout is a concern in parts of the subbasin. Brook trout have been documented in the North Fork Boise River drainage, in Meadow Creek, French Creek, lower Crooked River, Beaver Creek, Edna Creek, Pikes Fork Creek, upper Crooked River, lower Bear River, and Bear Creek. Brook trout have been documented from the extreme upper portion of the Middle Fork Boise River drainage, such as in Long Gulch, upper Smith Creek and the upper Middle Fork Boise River upstream of Atlanta.

South Fork Boise Subbasin; Anderson Ranch Core Area

Biological Condition of Bull Trout

Historically this subbasin supported steelhead and Chinook salmon (fall and summer). It encompasses the Anderson Ranch core area and part of the Arrowrock core area. The abundance, diversity, and migration of the other native salmonids, such as bull trout, have been affected by habitat modifications and introduced species. Bull trout have been isolated from other subbasins by Arrowrock, Anderson Ranch, and Lucky Peak Dams. Resident and migratory forms persist. Reservoir habitat created by the dams has allowed the expression of adfluvial forms.

The mainstem of the South Fork Boise River and larger tributaries (Big Smoky and Little Smoky Creeks) harbor adult and subadult fluvial (i.e., large-river dwelling) bull trout year-around and serve as a migratory corridor for adult and advanced juvenile fluvial and adfluvial (lake-dwelling) bull trout during the spring and fall. Bull trout are also present in several tributary streams (Boardman, Deadwood, Skeleton, Big Peak Creeks, etc.). The mainstem of the river and the lower reaches of many of the tributaries are not considered to be spawning or early (i.e., first year) rearing habitat due to warm summer water temperatures.

In addition, some subadult fluvial and adfluvial bull trout (typically 175-300 mm in length) are known to "wander" into habitat which may not be suitable for spawning or early rearing (as opposed to migration to or from spawning and/or early rearing habitat) and may exist for short or long periods in streams reaches that otherwise would be unoccupied or used only as a migratory corridor (Personal communication, Bruce Rieman, Fisheries Research Biologist, Rocky Mountain Research Station). These wandering subadult fish have been occasionally found in Salt Creek, Little Smoky Creek below the Five Points Creek confluence, and Little Smoky Creek near the mouth of Stovepipe Creek, and the lower few hundred meters of Carrie Creek. However, there does not appear to be any evidence that a reproducing bull trout population exists in the Little Smoky watershed.

In the South Fork Boise River drainage, brook trout occur in lower and middle Fall Creek, Salt Creek, Little Smoky Creek, Lick Creek, Five Points Creek, and Paradise Creek, and they likely occur in other areas. Brook trout in the upper South Fork Boise River are thought to have originated from fish introduced in alpine lakes and stocked streams by State and Federal resource agencies and private individuals during the 1940's and 1950's. Bull trout x brook trout hybrids have been observed in this core area.

Bull trout populations are "functioning at risk" in the subbasin due to: (1) the presence of brook trout which increases the risk of hybridization, (2) watershed/habitat impacts from roads, grazing, dispersed and developed recreation, etc. causing lower survival, and (3) scarcity of strong local populations making the overall population less resilient to natural and managed disturbances.

South Fork Payette Subbasin; Upper South Fork Payette River Core Area

Biological Condition of Bull Trout

Historically this subbasin supported steelhead and Chinook salmon (fall and summer). Bull trout still occur throughout the South Fork Payette River subbasin, but have been isolated from the Snake River by Black Canyon Dam. Deadwood Dam, constructed in 1931, currently prevents upstream migration of bull trout from the South Fork Payette River and the lower Deadwood River. Deadwood dam also represents the boundary between two bull trout core areas in the Southwest Basin Recovery Unit, with populations upstream of the dam falling in the Deadwood River core area (not within the action area) and populations below the dam falling in the Upper South Fork Payette River core area. Bull trout in this core area are primarily resident. Migratory adults (>300mm) are very rarely captured using backpack electrofishing gear in spawning/early rearing habitats (> 1600 m elevation). The loss of the migratory component is contributing to the current depressed bull trout population condition in the core area.

Currently the Sawtooth National Forest supports bull trout in two patches (Baron Creek and Trail Creek) in the Sawtooth Wilderness. Bull trout were found following single pass electrofishing in the Trail Creek patch and snorkeling in the Baron Creek patch in 2004. Despite relatively cold stream temperatures, bull trout were not observed during snorkeling surveys in Goat Creek above or below a 30 ft. falls one-half mile above the South Fork Payette River confluence. The headwaters of the Upper South Fork Payette were sampled in 2008. However, no bull trout were detected above a natural waterfall just above the confluence with Lake Creek. Bull trout may occur in the mainstem of the South Fork Payette River; however, 2007 snorkel surveys did not detect them. Competition and hybridization with brook trout is a concern because brook trout were introduced into alpine lakes in the Sawtooth Wilderness and bull trout x brook trout hybrids have been captured during recent surveys. The present status of the species here is functioning at risk, with generally depressed local populations throughout the lower portion of the South Fork Payette River and relatively strong local populations scattered in the upper South Fork Payette River. Physical barriers and overall poor habitat condition, due to sediment, have contributed to the depression of the population.

2.4.2 Factors Affecting the Bull Trout in the Action Area

Upper Salmon Subbasin; Upper Salmon River Core Area

Condition of Select Physical Indicators

Water Quality - Surface water quality varies throughout the subbasin and is dependent on land uses, local geology, and discharge. Most surface water originates in the high mountainous areas above the principal rivers and is of high quality near the source. Localized areas have accelerated sediment impacts, increased water temperatures, stream channel and flow alteration from roads, developed and dispersed recreation, livestock grazing, and irrigation diversions.

Twelve subwatersheds on the Sawtooth NRA have impaired assessment units under Section 303(d) of the Clean Water Act based on the 2008 Idaho Department of Environmental Quality (IDEQ) designations. Pollutants of concern include sediment/siltation, elevated water temperatures, nutrients, and/or habitat impairment. Water quality is generally functioning appropriately in most of the Sawtooth National Recreation Area, with the exception of 12 subwatersheds that are functioning at risk (see Table 17 in the Assessment).

Habitat Access – There are numerous culverts and diversions across the Sawtooth National Recreation Area. The majority of these occur in Valley Creek and the Sawtooth Valley, with localized areas being impacted in the Upper/Lower Canyon and East Fork Salmon. Road crossing inventories were completed in 2003 and 2007, and assessments of some diversions completed in 2005. Based on the road crossing assessment, several culverts are year-round barriers to juvenile and adult fish in Hanna, Job, Stanley, Smiley, Fisher, Twin, Mays, Vat, Cabin, Upper and Lower Harden, Muley, and Holman Creeks, and the headwaters of the Salmon River.

Several culverts are also are partial barriers to fish passage. These represent culverts where certain life stages (i.e., juvenile) of fish cannot pass under specific flow conditions (e.g., high flows due to velocity) and specific times of the year. Partial barrier culverts occur in Elk, Trap, Pole, Warm Springs, Beaver, and Meadow Creeks.

Irrigation diversions are widespread on private and public land particularly within the Valley Creek drainage and on the east side of the Sawtooth Valley. Though many diversion related threats have been addressed in recent years, the physical, legal, and political complexity surrounding this important western commodity (water) leaves many yet to be tackled. Private diversions on private or public land remove water to such an extent that a suite of direct and indirect effects can occur in some or all years. Most of these structural diversion related threats have been identified, and some have been addressed. However, it is recognized that in some streams it may be impossible to achieve conservation goals with technical or mechanical approaches alone (e.g. pipes, screens, headgates, ladders).

Many subwatersheds are considered to be functioning at risk or unacceptable risk because of the cumulative effect of the actions and conditions described above. However, wilderness and roadless areas are functioning appropriately.

Watershed and Habitat Conditions - Watershed and habitat conditions are influenced by actions on both Federal and non-Federal land. Conditions in this subbasin have been influenced by livestock grazing, irrigation, residential development, recreation, road construction and maintenance, and timber harvest. These actions have resulted in sediment delivery to streams, altered riparian vegetation, loss potential wood sources, altered stream channels and flows and elimination of connectivity and access.

Livestock use has altered habitats within most local populations within the core area. The greatest impacts persist from the extreme intensity of historical sheep grazing (peaking approximately 100 years ago), and the mid-1900s shift to intensive cattle grazing in many areas. These uses removed vegetative cover from ridgetop areas, greatly accelerated erosion and runoff rates, and altered vegetative composition and resiliency in riparian bottoms. As a result, over the decades, effects to stream habitats compounded as headwater floods and sediments frequently overwhelmed altered and unstable riparian bottoms. Streams widened or were incised through meadows, and complex habitats were exposed and simplified. Since these effects were comprehensively recognized and addressed (beginning in the 1980s), grazing objectives have been revised and historic landscape functions have slowly begun to return to most habitats. The most common areas where grazing challenges remain are the East Fork Salmon River, a portion of the Sawtooth Valley, and Valley Creek.

As with livestock, effects from the intensive mining activities of the past persist. No active mines currently operate with the Sawtooth National Recreation Area, and all new mineral entry is prohibited by the organic act that created it in 1972. Nevertheless, valid claims remain, and effects from past uses remain evident within local populations, including within the headwater tributaries of the Salmon River, Fourth of July, Slate, Big Boulder, Germania, and West Pass Creeks. The most prominent of these are the mill sites located within the Slate and Big Boulder Creek drainages.

Legacy transportation networks, principally secondary public and private roadways on the landscape (but also some highway and trail segments), continue to influence local populations within the core area. Few of these are associated with past timber harvest, as is more commonplace elsewhere in the central Idaho. Rather, the majority of these roadways, on both public and private lands, have been established over the decades for general access objectives of necessity or convenience. Most were not initially designed and, instead, followed the course of least resistance – typically on or near the canyon bottoms adjacent to the stream. The existence of these roadways, and their maintenance and protection, in such tenuous locations, results in chronic impacts to some local populations. However, several routes remain and the effects persist, including segments in the upper East Fork Salmon River, Big Boulder, West Pass, Iron, and Fourth of July Creeks. Overall watershed and habitat conditions are functioning at risk for the above reasons.

Table 1. Baseline condition for select physical indicators on the 49 subwatersheds in the Upper Salmon River subbasin on the Sawtooth National Forest

Indicator	# of Subwatersheds in a Functioning Appropriate Condition	# of Subwatersheds in a Functioning at Risk Condition	# of Subwatersheds in a Functioning at an Unacceptable Risk Condition
Sediment and /Turbidity	6	39	4
Chemical Contamination/Nutrients	31	18	0
Habitat Access	11	21	17
Substrate Embeddedness	5	39	5
Large Woody Debris	41	8	0
Streambank Condition	12	35	2
Change in Peak/Base Flows	22	17	10
Riparian Conservation Areas	9	38	2

Middle/North Fork Boise Subbasin; Arrowrock Core Area

Condition of Select Physical Indicators

Water Quality - Water quality varies throughout the subbasin. Streams and rivers with little or no disturbance have excellent water quality. Water quality has been reduced in streams and rivers where land-disturbing activities (mining, logging, road building) have taken place. Some waters are contaminated with heavy metals that are potentially a health risk, especially for aquatic species. The Kirby Dam breach in 1992 released a large amount of both natural and mining related sediment that was stored behind the impoundment into the Middle Fork Boise River below the community of Atlanta, Idaho.

Most historic placer mining occurred in the Middle Fork Boise River near the Atlanta and Featherville-Rocky Bar areas. Less extensive mining activity was conducted in the North Fork Boise River and some of its tributaries. The Atlanta mining district was a major producer of gold; large dredge piles and tailings are still evident (materials mined were largely quartz with arsenopyrite (iron-arsenic-sulfide) and gold. Other old mines in the Boise River basin include an antimony mine near Swanholm Peak, and small gold and silver mines in Black Warrior Creek, Little Queens River, and other watersheds. Water quality is considered to be functioning at risk because of sediment and mining related effects.

Habitat Access - Physical barriers and overall poor habitat condition, due to sediment, have contributed to the depression of the population. Bull trout are doing well in the upper basin where disturbance is low, and they are depressed in the lower basin where effects to habitat are greater. The U.S. Forest Service has conducted an inventory of culverts in some watersheds within the Boise River basin, including the Arrowrock core area. Because of the high numbers of culverts in some areas, such as in the extreme example of the 500 to 600 culverts in the Beaver Creek, Edna Creek, and Pikes Fork watersheds, it is likely that numerous undocumented barriers exist in other areas. Culverts thought to be fish barriers have been documented in the Beaver Creek and Owl Creek watersheds in the North Fork Boise River drainage, and Swanholm Creek, Cottonwood Creek, and Roaring River watersheds in the Middle Fork Boise River. The overall effects of barriers have likely been a reduction in habitat available to migratory bull trout and reduced interaction of individuals from various portions of the basin (i.e., reproduction and genetic exchange).

Atlanta Dam completely blocked access to migratory bull trout since the early 1900s, preventing migratory fish from using the upper Middle Fork Boise River watershed. Upstream of Atlanta Dam, bull trout occur in the upper Yuba River. Idaho Department of Fish and Game constructed a fish ladder that began operating in 1999 and two migratory sized bull trout have been documented upstream of the dam. Studies are inconclusive that fish using the ladder are providing genetic material to ensure the long term persistence of bull trout upstream of the dam in the Yuba River. Impacts to habitat in the drainage have a high likelihood of impacting bull trout that are upstream of the dam.

Watershed and Habitat Condition - The Middle Fork/North Fork Boise River subbasin originates in the Sawtooth Wilderness and drains southwest into Arrowrock Reservoir. Watershed conditions are largely influenced by actions on Federal land and recent wildfires. Mining, livestock grazing, recreation, road management, and timber harvest have influenced conditions in this subbasin. These actions and wildfires have resulted in sediment delivery to streams, altered riparian vegetation, and loss of potential wood sources, altered stream channels, and disrupted connectivity. In some locations, impacts have increased sedimentation and nutrient levels. High levels of natural sediment from erodible granitic parent material exacerbate these impacts. Several large uncharacteristic wildfires have occurred throughout the subbasin with extensive landslides and debris torrents damaging several subwatersheds. Overall, watershed conditions are functioning at risk.

Table 2. Baseline condition for select physical indicators on the six subwatersheds in the Middle Fork/North Fork Boise River subbasin on the Sawtooth National Forest

Indicator	# of Subwatersheds in a Functioning Appropriate Condition	# of Subwatersheds in a Functioning at Risk Condition	# of Subwatersheds in a Functioning at an Unacceptable Risk Condition
Sediment and /Turbidity	5	1	0
Chemical Contamination/Nutrients	4	2	0
Habitat Access	6	0	0
Substrate Embeddedness	5	1	0
Large Woody Debris	4	2	0
Streambank Condition	5	1	0
Change in Peak/Base Flows	5	1	0
Riparian Conservation Areas	4	2	0

South Fork Boise Subbasin; Anderson Ranch Core Area

Condition of Select Physical Indicators

Water Quality - Water quality varies throughout the South Fork Boise River from headwater streams with excellent water quality to impaired streams impacted by grazing, mining, logging, and road building. High levels of natural sediment exacerbate these impacts in many areas. Some waters are contaminated with heavy metals that are potentially a health risk, especially for aquatic species.

Eight subwatersheds (e.g. Kelley Creek, Big Water-Virginia, Little Smoky Creek, etc.) on the Sawtooth National Forest have impaired assessment units under Section 303(d) of the Clean

Water Act based on the 2008 IDEQ designations. Overall, water quality is considered to be functioning at risk overall because of sediment input.

Watershed and Habitat Conditions - Watershed conditions in this subbasin are largely influenced by actions on Federal land. Mining, livestock grazing, recreation, road management, and timber harvest have influenced conditions in this subbasin. These actions have resulted in sediment delivery to streams, altered riparian vegetation, loss of potential wood sources, altered stream channels, lack of pools and off-channel habitat, and disrupted connectivity. In some locations, impacts have increased sedimentation and nutrient levels. Hydraulic dredge areas with the extensive gravel piles and ponds exist on Little Smoky Creek and on the Feather River near Featherville. Livestock grazing has occurred in the South Fork Boise River drainage for more than 100 years and has had negative effects on aquatic resources (i.e., through reduced riparian vegetation, and increases in sedimentation, stream bank instability, water temperatures). Grazing impacts have been apparent in the past in the Little Smoky Creek watershed, but annual grazing reports demonstrate improving conditions in this drainage. Overall, watershed conditions are functioning at risk, with some individual indicators functioning at unacceptable risk in relation to bull trout and their habitat needs.

Habitat Access – Anderson Ranch Dam, on the South Fork Boise River, blocks access of bull trout residing in the lower South Fork Boise River, including Rattlesnake Creek, to the upper portion of the South Fork Boise River basin.

In 2003 and 2004 culvert inventories were completed on all fish bearing streams within the South Fork Boise subbasin; a total of 71 culverts received a full assessment. Of these 64 culverts (90 percent) are barriers to juvenile salmonids and 56 (79 percent) are barriers to adult salmonids. Only four (6 percent) of the 71 culverts inventoried are passable to fish. The majority of the habitat blocked in the South Fork Boise subbasin occurs in the Little Smoky, Feather-Grouse, Anderson Ranch Reservoir, Little Camas Creek, Rock-Cayuse, and Willow Creek 5th field hydrologic units. The overall effects of barriers have likely been a reduction in habitat available to migratory bull trout and reduced interaction of individuals from various portions of the basin (e.g., reproduction and genetic exchange).

Water withdrawals also have reduced flows for passage during August and September in Big Water Gulch. Streams that support bull trout in the South Fork Boise have very few roads and culvert crossings.

Table 3. Baseline condition for select physical indicators on the thirty subwatersheds in the South Fork Boise River subbasin on the Sawtooth National Forest

Indicator	# of Subwatersheds in a Functioning Appropriate Condition	# of Subwatersheds in a Functioning at Risk Condition	# of Subwatersheds in a Functioning at an Unacceptable Risk Condition
Sediment and /Turbidity	3	13	14
Chemical Contamination/Nutrients	28	2	0
Habitat Access	19	4	7
Substrate Embeddedness	2	15	13
Large Woody Debris	21	8	1
Streambank Condition	15	14	1
Change in Peak/Base Flows	29	1	0
Riparian Conservation Areas	15	15	0

South Fork Payette Subbasin; Upper South Fork Payette River Core Area

Condition of Select Physical Indicators

Water Quality – Many areas have localized impacts from roads, timber harvest, livestock grazing, and recreation use that have increased sedimentation. High levels of natural sediment in the area exacerbate these impacts. Water quality is considered to be functioning at risk overall because of sediment input. Historic and present land use has increased erosion rates and sediment yield, and caused excess sedimentation of the South Fork Boise River.

No impaired assessment units occur on the Sawtooth National Forest under Section 303(d) of the Clean Water Act based on the 2008 IDEQ designations. On the Boise National Forest, several assessment units are listed as impaired for increased sediment. The Total Maximum Daily Load (TMDL) plan associated with this subbasin was completed in July 2005.

Habitat Access - Although every local bull trout population in this core area is associated with an inventoried roadless area or wilderness, almost 50 percent of these populations are affected by passage barriers at road crossings on the Boise National Forest. The 2003-2004 inventory results indicate that there are 13 aquatic organism passage (AOP) barriers on the Boise National Forest that block access to a total of 22.6 miles (36.4 km) of stream habitat within 5 local population watersheds. There are no AOP barriers on the Sawtooth National Forest.

Watershed and Habitat Conditions - Watershed conditions are largely influenced by actions on Federal land. Livestock grazing, recreation, road management, and timber harvest have influenced conditions in this subbasin. These actions have resulted in sediment delivery to streams, altered riparian vegetation, reduced potential wood sources, altered stream channels, and disrupted connectivity. Extensive uncharacteristic wildfires have occurred with numerous landslides and debris torrents damaging several subwatersheds. High levels of natural sediment from erodible granitic parent material intensify these impacts.

Habitat in Canyon Creek is mostly functioning acceptably because it occurs primarily within wilderness and roadless areas. Habitat in Clear Creek, middle sections of the South Fork Payette, Fivemile, and Eightmile Creeks generally appears to be functioning at risk. Habitats within the Whitehawk subwatershed appear to be functioning at risk or unacceptable risk. Primary causes appear to be road-related barriers, sedimentation, and limited large woody debris. Whitehawk, Scott, Clear, and Warm Springs Creeks have problems with stream sedimentation from roads, the lack of large woody debris, large pools and refugia. In the South Fork Payette River core area, roads and stream crossings are the most common factors influencing bull trout, with the lower South Fork Payette River and Clear Creek having the most degraded conditions. Many of the riparian areas show disturbance from timber harvest, road construction, and dispersed recreation.

The majority of drainages on the Forest occur in the Sawtooth Wilderness where management action are limited to disperse camping and hiking trails. These have had only localized impacts on stream and riparian conditions. Sediment levels are believed to be elevated above the functioning appropriately matrix criteria but mainly due to natural sediment from erodible granitic parent material. Wildfire in the last decade may still be causing lingering affects to stream flows, although ground cover is rapidly recovering. Although extensive data are not available at this time, focal habitats within the Upper South Fork Payette River appear to be functioning acceptably.

Table 4. Baseline condition for select physical indicators on the five subwatersheds in the South Fork Payette River subbasin on the Sawtooth National Forest

Indicator	# of Subwatersheds in a Functioning Appropriate Condition	# of Subwatersheds in a Functioning at Risk Condition	# of Subwatersheds in a Functioning at an Unacceptable Risk Condition
Sediment and /Turbidity	2	3	0
Chemical Contamination/Nutrients	4	1	0
Habitat Access	5	0	0
Substrate Embeddedness	2	3	0
Large Woody Debris	4	1	0
Streambank Condition	5	0	0
Change in Peak/Base Flows	3	2	0
Riparian Conservation Areas	3	2	0

Summary of Factors Affecting Bull Trout in the Action Area

Factors affecting critical habitat are similar to those described above under the species. The Assessment summarizes information regarding the condition of the habitat in the action area and the factors that have influenced the species. In summary, the baseline indicates that of the select pathways and indicators most are functioning at risk. Forest lands contained within wilderness areas often have a higher proportion of habitat condition indicators functioning appropriately, while areas contained in historic mining districts have a higher proportion of indicators functioning at risk or functioning at unacceptable risk. Indicators having the highest likelihood of functioning at risk or unacceptable risk include those associated with sediment-related impacts, roaded conditions, and water diversions.

Changes in hydrology and temperature caused by changing climate have the potential to negatively impact aquatic ecosystems in Idaho, with salmonid fishes being especially sensitive. Average annual temperature increases due to increased carbon dioxide are affecting snowpack, peak runoff, and base flows of streams and rivers (Mote et al. 2003, p. 45). Increases in water temperature may cause a shift in the thermal suitability of aquatic habitats (Poff et al. 2002, p. iii). For species that require colder water temperatures to survive and reproduce, warmer temperatures could lead to significant decreases in available suitable habitat. Increased frequency and severity of flood flows during winter can affect incubating eggs and alevins in the streambed and over-wintering juvenile fish. Eggs of fall spawning fish, such as bull trout, may suffer high levels of mortality when exposed to increased flood flows (Independent Scientific Advisory Board 2007, p. iv). Relative to this action and given the above climatic discussion, it is likely that fire-related impacts to the landscape, exacerbated by climate change, will continue to alter aquatic conditions (e.g., fire-induced sediment laden runoff, earlier and increased peak runoff, and decreased base flows) in such a manner that reduces habitat suitability for salmonids.

2.5 Effects of the Proposed Action on Bull Trout

Effects of the action considers 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

While effects to bull trout resulting from wildfire management activities are dependent on the type of activities taking place, effects can generally be captured in a few work types – those that cause ground disturbances, those that effect water volume, and those that effect water quality. Even within these three broad categories, there is significant overlap among the effects that could reasonably occur under the various wildfire management activity types.

2.5.1.1 Ground Disturbing Activities

Of the wildfire management activity types identified in section 2.1.2, ground disturbing activities are likely to result from the following: (1) Fireline Construction, (2) Road Reconstruction, (3) Camps, Helicopter Landing Sites, and other Operational Facilities, and (4) Burning Out Operations. These activities occur in upland areas (inclusive of riparian conservation areas), and impact bull trout via reductions in vegetation or via the introduction of sediment into live water.

Effects to Aquatic Resources

Firelines may be constructed with hand tools, heavy equipment, or explosives. The construction of firelines can cause direct and indirect effects to watershed conditions. Fireline construction removes vegetation; displaces, compacts, and causes erosion of soils; and can increase overland flow resulting in degraded water quality. Soil compaction is dependent upon soil type, soil moisture content, and the number of times an area is traversed. The amount of area disturbed is also dependent upon the size and type of equipment used to create the line. Larger equipment generally causes more compaction and can clear larger areas of vegetation. Manual construction of firelines with hand crews that are well trained generally causes less disturbance by controlling the width of the line.

Roads that have been overgrown, closed or blocked may be reopened and temporarily improved to allow equipment and vehicle access for firefighting purposes. This can lead to increased sedimentation from roadbed reconstruction (e.g., sidecasting soils into streams, ground/surface water interception, and installation of temporary stream crossings) and loss of vegetation adjacent to and in the road. Road reconstruction can also affect streams by changing the runoff characteristics of watersheds.

Fire camps, helibases, and other operational facilities are normally located in large flat areas with road access. These facilities can result in land disturbance from compacted soils, clearing of vegetation, and introduction of contaminants. Bare, compacted soils exposed to rainfall and runoff from these facilities can cause surface erosion, and location of fire camps within RCAs can introduce contaminants (e.g., soaps, detergents, and bleach) into nearby waterbodies.

Burning out operations have the potential to adversely affect aquatic resources by reducing vegetative cover in the RCA, disturbing the soil, increasing stream temperatures, degrading water quality, and generally damaging habitat features and conditions in and near stream habitat. Fires in riparian areas can affect aquatic ecosystems by altering vegetation which influences erosion and sediment transport, water infiltration and routing, quantity of nutrients entering streams, the amount of shade, and the input of large woody debris into streams. The extent of impact of fire is generally related to the intensity and severity of the burn.

To reduce the potential of adverse effects occurring from burn out operations, direct ignition within RCAs will not be allowed unless the resource advisor documents that the ignition would not degrade soil, water, riparian, and aquatic conditions. Fire can be allowed to burn into RCAs when necessary to meet wildfire management objectives. Consistent application of this design feature during burning out operations should reduce fire intensity immediately adjacent to streams, thus minimizing the chances of creating hydrophobic soils and consumption of soil's organic material. Effects from fire ignitions should also be minimized by having Resource Advisors on site to inform fire crews of resource issues and needs, and by preventing wildfire management ignitions within RCAs where critical resources are present. Most burning out operations implemented under this programmatic are intended to be surface fires which are the lowest fire intensity, while natural fires in the Intermountain Region can span the entire range of intensities.

Effects to Sediment/Turbidity/Substrate Embeddedness

Increased erosion and sedimentation can occur from wildfire management activities. Firelines can channel water which can accelerate erosion and increase the risk of mass failure if constructed on landslide prone areas. The effects on hydrologic processes and sediment erosion generally increase with the steepness of the terrain. Fireline construction can cause non-point sediment sources to streams depending on their proximity to the stream channel.

Design criteria will help to reduce the potential for sediment to enter waterways. Fireline construction will not occur on slopes where excessive erosion could be delivered to water bodies and cause resource damage. Proper erosion control techniques will be utilized on steep slopes to minimize excessive erosion from occurring. Firelines will be constructed in a way that will minimize the collection, concentration, and possible delivery of sediments to nearby waterways (e.g., minimum width and depth, no use of heavy equipment in RCAs), and erosion control measures (e.g., water bars and cutout drains) will be installed as soon as feasible (generally within one week from fireline construction) to reduce the potential for erosion problems. Water bars and cutout drains will help redirect runoff, minimizing the chances of sediment entering waterways. Construction of water bars and the use of other erosion control methods are necessary to limit the distance sediment travels from the fireline. Since installation of these erosion control structures may be delayed by several days to a week during periods of active wildfire management, some erosion could occur. Effects would be greatest if a rain event occurred before erosion control structures were installed. These effects should be minimal since the likelihood of rain events is uncommon during peak fire season which occurs during the drier months of the summer and early fall. If sediment does enter waterways, it is expected to be an immeasurable amount compared to sediment coming off adjacent burned hillslopes and will not adversely affect habitat and listed species.

Bare, compacted soils on roads exposed to rainfall and runoff are a potential source of surface erosion. Roads and ditches form pathways for sediment transport to stream channels (Chamberlin et al. 1991, p. 193). Once in streams, fine sediments may be deposited in slow water areas and behind obstructions, locally altering fish habitat conditions. In particular, fine sediment has been shown to fill the interstitial spaces among larger streambed particles, which can eliminate the living space for various microorganisms, aquatic macroinvertebrates, and juvenile fish.

Potential problems associated with excessive sediment have long been recognized in a variety of salmonid species and at all life stages. The Service knows of no positive effects to salmonids from increased sediment; while the potential negative impacts of increased suspended sediment on bull trout and other salmonids have been well documented (e.g., Bakke et al. 2002, p.1; Newcombe and MacDonald 1991, pp. 72-73; Newcombe and Jensen 1996, p. 700-715, Bash et al. 2001, p. 24). Social (Berg and Northcote 1985, p. 1410) and feeding behavior can be disrupted by increased levels of suspended sediment. Fish may avoid high concentrations of suspended sediments altogether (Hicks et al. 1991, p. 483-485). Even small elevations in suspended sediment may reduce feeding efficiency and growth rates of some salmonids (Sigler et al. 1984, p. 142). Based on their experiments with juvenile rainbow trout (*Oncorhynchus mykiss)*, Suttle et al. (2004, p. 973) concluded that "fine sediment deposition, even at low concentrations, can decrease growth and survival of juvenile salmonids." They found "no threshold below which fine-sediment addition is harmless."

Increased sediment and suspended solids have the potential to affect primary production and benthic invertebrate abundance, due to reductions in photosynthesis within murky waters. Thus, food availability for fish may be reduced as sediment levels increase (Cordone and Kelley 1961, pp. 189-190; Lloyd et al. 1987, p. 18; Henley et al. 2000, pp. 129-133). Sediment can also reduce health of in-stream plants, reducing cover for fish making them more vulnerable to predation (Waters 1995, pp. 111-116). Pools, which are an essential habitat type, can be filled by sediment and degraded or lost (Megahan 1982, p. 114).

Sediment introduced into streams does not just adversely affect fish at an individual physical level but can adversely affect fish populations. Deposition of silt on spawning beds can fill interstitial spaces in spawning areas with sediment (Phillips et al. 1975, p. 461; Myers and Swanson 1996, p. 245; Wood and Armitage 1997, p. 203) impeding water flow, reducing dissolved oxygen levels, and restricting waste removal which reduces the survival of fish embryos (Chapman 1988, pp. 1-5; Bjornn and Reiser 1991, p. 98).

Effects from road reconstruction would be greatest when stream crossings are installed, and if a rain event occurred shortly after reconstruction before erosion control structures could be installed. To minimize sediment during crossing installations/replacement, the following measures will be employed: (1) work will be confined only to crossings on first and second order non-fish bearing streams and waterways and where treatments would have no potential to affect downstream fish bearing streams, (2) stream flows will be temporarily diverted around the installation site, and (3) erosion-control structures (e.g., wattles, weed free straw bales, etc.) are required. Even with these measures, short turbidity/sediment increases may occur up to 600 feet downstream of the crossing when stream flows are reintroduced into the channel. However, these increases are expected to have discountable effects to fish and their habitat given their headwater locations and general distance from fish bearing streams.

Effects from rain events on roads should be minimal since these events are uncommon during peak fire season when precipitation is usually low. If sediment is produced from roads, design criteria should help to minimize effects from sediment to an insignificant level by employing the following measures: (1) discussing methods and potential impacts with a Resource Advisor prior to initiating road reconstruction activities, (2) before the road is reopened, a Resource Advisor will identify any erosion problems, mitigate sediment sources through the use of erosion-control structures (e.g., wattles, weed free straw bales, etc.), and identify rehabilitation treatments to minimize or avoid sediment delivery to waterbodies, and (3) Requiring the agency administrator to ensure rehabilitation is completed by the Incident Management Team to ensure all roads are returned to pre-fire administrative status once all wildfire management actions and suppression rehabilitation treatments are complete. Effects to bull trout from road reconstruction are expected to be insignificant.

Fire camps, helibases, and other operational facilities can result in land disturbance from compacted soils, clearing of vegetation, and introduction of contaminants. Disturbance to riparian vegetation and soils will be minimized to insignificant levels by: (1) locating facilities outside of RCAs unless there are no other suitable sites or where use of an existing facility within the RCA results in less disturbance than establishing a new facility outside the RCA, (2) Coordination with a Resource Advisor who will work with the agency administrator and incident teams to locate camps away from environmentally sensitive areas and ensure appropriate mitigation measure are in place, and (3) following pack it in/pack it out practices and the standard sanitation procedures found in the Forest Health and Safety Handbook. Operational facilities (other than coyote and spike camps or existing facilities) located within an RCA are outside the scope of this programmatic action. Where such actions may affect ESA-listed species or their habitats, the Forest Service shall initiate emergency consultation. Project design features will minimize potential effects to sediment, turbidity, and substrate embeddedness watershed condition indicators to an insignificant level.

Effects to Large Woody Debris

Tree felling is another component of wildfire management. Both small diameter understory and large diameter overstory trees are felled to construct firelines, helispots, and safety zones. Cutting trees within RCAs could reduce future wood recruitment into streams. Design criteria will help to reduce the effects on fish habitat by: (1) only using explosives to remove hazard trees outside of RCAs, (2) avoiding the construction of helispots within RCAs, and (3) leaving cut snags/trees intact unless required to meet wildfire management or safety objectives. Any bucking and stacking of felled trees that may result in a potential change to how woody debris functions in the RCA or in-stream are outside the scope of this programmatic consultation. Successful implementation of these design criteria should result in only localized effects to wood recruitment and larger sizes of cut snags and trees near streams, and would not result in adverse effects to this habitat indicator.

Effects to Riparian Areas

Fireline construction can remove riparian vegetation and trees within RCAs reducing stream shade. Design criteria will help to reduce the effects on fish habitat through: (1) coordination with Resource Advisors who can identify areas of concern; (2) keeping a fireline's footprint to the minimum necessary to meet fire suppression objectives, and (3) not allowing heavy equipment to construct firelines within RCAs. Effects to stream temperature from tree cutting in riparian areas is expected to be limited to localized areas in close proximity to firelines, helispots, safety zones, and structures. This should result in negligible or discountable effects to stream temperature, especially when compared to the loss of stream shade that wildfires can cause.

Fires in riparian areas can affect aquatic ecosystems by altering vegetation which influences erosion and sediment transport, water infiltration and routing, quantity of nutrients entering streams, the amount of shade, and the input of large woody debris into streams (Wissmar et al. 1994; Spence et al. 1996). The extent of impact of fire is generally related to the intensity and severity of the burn. In high-intensity fires, the organic material that holds soil together is consumed; this increases the soil's susceptibility for erosion. The soil can also become hydrophobic, thereby reducing its water infiltration capabilities and increasing surface runoff (Spence et al. 1996).

Direct ignition within RCAs will not be allowed unless the resource advisor documents that the ignition would not degrade soil, water, riparian, and aquatic conditions. Fire can be allowed to burn into RCAs when necessary to meet wildfire management objectives. Direct ignition from streambanks is outside the scope of this action if listed species can be affected; if direct ignition is required to meet wildfire management objectives, the Forest Service shall initiate emergency consultation. Consistent application of this design feature during burning out operations should reduce fire intensity immediately adjacent to streams, thus minimizing the chances of creating hydrophobic soils and the consumption of soil organic material. Effects from fire ignitions should also be minimized by having Resource Advisors on site to inform fire crews of resource issues and needs, and by preventing wildfire management ignitions within RCAs where critical resources are present. Burning out within RCAs can reduce the chances of a higher-intensity fire, which would otherwise cause more resource damage. Further, burning out is generally utilized as a tool to control overall fire size or to protect valuable resources. Controlling overall fire size is expected to minimize negative effects to soil and aquatic resources.

Reopening roads within RCAs will remove vegetation adjacent to the road and along the roadbed. The amount of riparian vegetation disturbed should be minimized through coordination with a Resource Advisor. Disturbed riparian vegetation caused by road reopening will in time recover, as all roads must be returned to pre-fire administrative status. This may involve blocking the newly reopened access to motorized use, de-compacting the road's surface, re-contouring the roadbed, and planting with native species where adequate seed sources are not available. If substantial amounts of road within RCAs need to be reopened then these actions would be outside the scope of this programmatic action and would require the Forest Service to initiate emergency consultation.

Fire camps, helibases, and other operational facilities are normally located in large flat areas with road access. Project design features limit disturbance to riparian areas and soils by: (1) locating facilities outside of RCAs unless there are no other suitable sites or where use of an existing facility within the RCA results in less disturbance than establishing a new facility outside the RCA, (2) coordination with a Resource Advisor who will work with the agency administrator and incident teams to locate camps away from environmentally sensitive areas and ensure appropriate mitigation measures are in place, and (3) following pack it in/pack it out practices and the standard sanitation procedures found in the Forest Health and Safety Handbook. Operational facilities (other than coyote and spike camps or existing facilities) located within an RCA are outside the scope of this programmatic consultation.

Effects to Habitat Access

Stream culvert installation/replacement may be necessary during wildfire management. However, these actions will not affect fish passage since installation/replacement can only occur in non-fish bearing streams. Any installation/replacement within waterways that contain listed fish is outside the scope of this consultation.

Effects to Peak/Base Flows

Re-opened roads may alter natural drainage patterns or encounter plugged relief culverts and ditch lines. Road reconstruction can temporarily improve hillslope drainage by installing drainage dips, reconstructing ditch lines, and installing cross drain culverts. This can redirect flows into their original stream course, or on to forest soils reducing the magnitude of flows before they reach a stream. How much drainage improves depends on the number of cross drains installed/replaced, the road's grade and shape, and the amount of surface/groundwater encountered. Design criteria should help to minimize effects to an insignificant level by: (1) discussing all road reconstruction activities before they begin with a Resource Advisor in order to avoid potential adverse effects, (2) requiring a Resource Advisor identify any drainage problems and mitigate these problems through proper drainage installation once a road is reopened, and (3) requiring the agency administrator ensure that rehabilitation is addressed by the Incident Management Team to ensure all roads are returned to pre-fire administrative status once all wildfire management actions and suppression rehabilitation treatments are complete. Effects to Peak/Base Flow indicator from road reconstruction is expected to be insignificant.

Effects to Bull Trout from Disturbance

Explosives (i.e. pentaerythritol tetranitrate, diammonium phosphate, ammonium nitrate with a sensitizer) are a low-cost alternative to hand fireline construction (Backer et al. 2004, p. 945). Blasting in or near water produces post-detonation compression shock waves which can damage the swimbladder of fish and can also cause damage to incubating eggs and alter behavior of fish. The degree of damage is related to the type of explosive, size and pattern of the charge(s), method of detonation, distance from the point of detonation, water depth if in water, and species of fish (Wright and Hopky 1998, p. 2). The use of explosives near fish habitat may also result in the physical and/or chemical alteration of that habitat.

According to Bishaie (1961, p. 292) and Rasmussen (1967, p. 16) swim-up fry will die if exposed to shock wave pressures exceeding 2.8 psi. Studies by Alaska Department of Fish and Game found no mortality was observed at a psi of 2.7 for chum and coho salmon (Bird and Roberson 1984, p. 2). Studies by Smirnov (1954) found significant egg mortality resulting from ground vibrations at 2 inches per second (ips). Alaska DNR and Canadian fisheries do not allow explosives that will result in a peak particle velocity (ground vibration) exceeding 0.5 ips in spawning beds during incubation (Wright and Hopky 1998, pp. 3-4). The rationale for using 0.5 ips level is because it is below (one-fourth) the ground vibration peak velocities observed for mortality in incubating eggs. This standard will be applied until more research is available to define a more appropriate level.

Explosives for fireline construction outside of RCAs will adhere to the distances and pounds stated within Table 4 in section 2.9.3 of the Assessment. Meeting these standards will protect habitat and listed species from the adverse effects described above. Use of explosives within 300' of perennial and 150' of intermittent streams is outside the scope of this programmatic action.

Summary of Effects From Ground Disturbing Activities

While many pathways of effect related to aquatic resources are possible via the implementation of ground disturbing activities associated with wildfire management actions, based on the specific conservation measures included as part of the action, these actions would result in only insignificant or discountable effects to bull trout or associated aquatic habitats. The majority of effects to bull trout would center on sediment entry into stream systems and vegetation impacts within riparian conservation areas. No adverse effects to bull trout are expected as a result of these ground disturbing activities.

2.5.1.2 Water Volume Reduction Activities

Water drafting and dipping are the predominant wildfire management activities that would result in reductions of water volume or would impact bull trout via the mechanism in which water is removed. Helicopters may acquire water from lakes, rivers, and large streams with available pool size and safety considerations determining feasible dip sites. Water is acquired by either dipping with a suspended bucket or drafting water with a snorkel which pumps water directly from the source into an on-ship tank. These activities have the potential to affect the Chemical Contamination/nutrients, Habitat Access, and Peak/Base Flows watershed condition indicators as well as cause direct disturbance to bull trout.

Effects to Aquatic Resources

During wildfire management, water sources such as lakes and streams are used by helicopter buckets, water tender and/or tank truck, and fire engines. If the water source has inadequate flow for effective pumping, a "porta tank" may be used. When available, culvert crossings can be used to create a sump by blocking flow with native materials, plywood, and/or plastic. Water drafting and dipping management actions have the potential to: reduce stream flow; create temporary passage barriers; cause fish to become stranded or stress them by pushing them into shallower areas; introduce residual chemicals and/or aquatic invasive species from contaminated equipment; cause disturbance to fish by placement of screens, hoses, and dropping of buckets; entrain juvenile fish from improperly screened pumps; and disturb or harass fish as aerial buckets are dropped. Conservation measures described in Section 2.1.2 and incorporated into the project description will minimize many of these potential adverse to insignificant levels.

Chemical Contamination/Nutrients

Use of portable pumps and other equipment within RCAs could introduce fuel and other lubricants into waterbodies. Effects from these will be minimized by: (1) refueling/storing over ten gallons of fuel outside of RCAs, (2) refueling supplies other than pumps no closer than 100 feet from waterbodies, and (3) having containment berms, basin, and/or absorbent pads in place in case of a spill or leakage from equipment.

Potential effects to water quality and fish in the vicinity of equipment that retains residual retardant and foam chemicals should be reduced by design criteria. Specifically, helicopter bucketing directly from streams will not occur if chemical products are injected into the bucket. Helicopter bucketing can occur only after chemical injection systems have been removed, disconnected, or rinsed clean. Injecting chemicals while pumping from waterways will not be conducted without appropriate mitigation. In cases where chemicals are needed, water will be pumped from a fold-a-tank, or a backflow check valve will be used. Cleaning of all drafting and dipping equipment will avoid contamination of waterways or introduction of invasive species. Resource Advisors will monitor drafting operations to ensure that pumps stationed within the RCA have containment berms, absorbent pads, and/or other controls sufficient to contain potential chemical spills and prevent delivery to waterbodies and intermittent streams.

Successful implementation of these design criteria will minimize potential effects to bull trout and the watershed condition indicators from potential fuel or lubricants and contamination from dipping and drafting equipment to an insignificant level.

Effects to Habitat Access

Habitat access may be temporarily blocked when flow is backwatered to create a deeper site from which to draft water. Often, deeper scour pools or culverts with large plunge pools are selected. Creation of small, temporary dams in fish bearing streams is problematic because access can be reduced until the dam is removed. Temporary structures are most likely to be installed from mid-July to early October during peak fire season. Installation of these structures could delay upstream movement of bull trout until they are removed. Fish encountering a barrier will likely spend energy trying to find a way around the dam. If unsuccessful, fish may move into any available deeper habitat below or near the structure. Some fish may try to move upstream again at a later time, while others that expended too much energy may remain in deeper habitat below the structure. Fish that are too tired to move or that remain in shallower habitat with less cover may be more susceptible to predation.

To address these effects, temporary dams will only be allowed on smaller, non-fish bearing streams. Maps showing fish bearing streams to be avoided will be provided to the fire organization each spring. Resource advisors will also be available to address site specific questions. Dams created on fish bearing streams would be beyond the scope of the programmatic consultation. Resource advisors will direct fire staff to deeper and faster-flowing streams and pools where the potential conflict with listed species is less and they will monitor drafting operations to ensure dams are not in place for extend periods of time. Design criteria will reduce the effects to habitat access to insignificant levels.

Effects to Peak/Base Flows

Helicopters may draft/dip 75 to more than 1,000 gallons per dip. Helicopters typically use the mainstem rivers or larger streams in the action area, with bucket sizes restricted by available pool size and helicopter clearances necessary to ensure safe operation. Waterbodies used for drafting typically range from approximately 100 cubic feet per second (cfs) up to 1,000 cfs, or approximately 748 to 7,481 gallons per second. Smaller streams are typically unsafe or lack appropriate areas to use. Intermittently removing 75 to 1,000 gallons from such sites will have insignificant effects on the quantity of water in the action area, even when multiple dips occur in an operational period. Because an insignificant quantity of water will be removed, ESA-listed species will not experience any significant reductions in food drift, habitat quantity, or habitat quality. In addition, effects should be minimized to an insignificant level by: (1) drafting will be limited to only preapproved sites, as identified by the annual "Fire Suppression Operation Guidance" map, in areas where Chinook salmon and bull trout spawning occurs, (2) Resource Advisors directing fire staff to deeper and faster-flowing streams and pools to avoid stranding fish, and (3) not drafting from streams with low flows to avoid stream dewatering and stranding of fish.

<u>Effects to Bull Trout from Disturbance</u>

The use of portable pumps, engines, or water tenders could result in disturbance to bull trout through disruption of essential feeding, breeding, or sheltering of juvenile and adult fish, as well as entrainment of juvenile fish.

Helicopters typically bucket water from ponds, lakes, and rivers that are near the wildfire. Suitable dip sites are picked based on safety criteria for the helicopter crew, and on water depth, area, and size. When suitable sites are not available, a helicopter can dip from portable holding and mixing tanks. Past fires on the Sawtooth National Forest have shown that larger, deeper pools within the South Fork, North Fork, and Middle Fork Boise River, and Salmon River are typically used for dipping from mid-July to mid-September. Juvenile and adult bull trout may be present during these times. However, warm summer water temperatures within these rivers likely limits each species distribution to cooler, more stratified deeper pools.

Helicopter bucket or snorkel operations may harass fish but the risk of capture is usually discountable. The risk of capturing fish is proportional to the size of the stream, the size of the bucket, and the fright and/or flight responses of the fish encountered (Sicking 2003, p.2). Sicking (2003) indicated it is unlikely that fish would be scooped up within the bucket while collecting water. A study conducted on the Boise National Forest concluded that there is little potential of capturing salmonids in lakes, reservoirs, and ponds by helicopter dipping (Jimenez and Burton 2001, p. 35). However, flow conditions in rivers and streams could affect the potential for fish to drift into buckets or affect their ability to disperse (Jimenez and Burton 2001, p. 34). River sites most suitable for bucketing operations are deeper, slower, mid-channel areas where smaller fish with poorer swimming ability are unlikely to be encountered and larger fish tend to be near the bottom (Sicking 2003, p. 3).

Rotor wash and splash from the bucket may displace fish from the dip site, causing stress to the fish. Most concern would be within rivers that lack deeper water habitat. In very large pools, fish could move to a different location without being forced out of the pool. However, in smaller pools fish could be displaced into less optimal habitat. Such displacement can result in physical and behavioral responses including adverse changes in feeding, metabolic rates, osmoregulatory processes, avoidance behavior, and immune system functions and disease. Stress-induced behavior changes in fish may lead to a higher risk of predation. Along with alterations in avoidance behavior, cover-seeking time was found to increase for juvenile Chinook salmon when exposed to multiple acute handling stressors (Sigismondi and Weber 1988, p. 196), potentially exacerbating the potential for increased predation. Feeding activity of salmonids was also found to decrease when exposed to several stressors (Price and Schreck 2003, p. 910). Concentrations of plasma cortisol, glucose, and lactate were found to be increased in fish that were subjected to multiple stressors and pre-stress levels did not return for 6-24 hours. These physiological changes correlated with a poor ability to avoid predators (Mesa 1994, p. 792). Mesa (1994) showed that juvenile salmonids were capable of avoiding predators within one hour of being subjected to multiple acute stressors even though physiological homeostasis may be altered for up to 24 hours.

Proposed design criteria (Section 2.1.2) will minimize many of the above effects. Specifically dip sites should not occur during the Chinook and bull trout spawning periods (August 1 to October 30) in sensitive spawning areas identified in the Sawtooth National Forest's "Fire Suppression Operation Guidance" map, unless safety, loss of human life, or protection of structures is at imminent risk. If dipping does occur in these sites, the District Fire Duty Officer will contact an aquatic resource specialist or Resource Advisor by the end of the first operational period of initial attack. Although this is a proactive approach it does not eliminate the potential for multiple dips to occur during critical life stages. In addition, it is possible that dipping could occur for 10-12 hours before an aquatic resource specialist or Resource Advisor is notified. While the number of dips and their location cannot be predicted, it is possible that dozens to hundreds of dips could occur. It is assumed that the potential for adverse effects increases as exposure increases, especially in river sections with marginal cool, deep water habitat.

Effects to bull trout from dipping will also be minimized by the seasonality of fire management activities and by their life history patterns. Bull trout should not be present in large numbers in the rivers due to the warmer water temperatures and because most bull trout will have migrated upstream. Schoby and Curet (2007, p. 1) using radio telemetry found that adfluvial and fluvial bull trout generally begin migrations within the Salmon River toward spawning tributaries in April and May and enter spawning tributaries between June 7 and July 20. Partridge et al. (2000) radio-tagged 57 adult bull trout in the South Fork Boise River and tracked their movements into spawning streams via fixed-wing aircraft. Bull trout migrated out of Anderson Ranch reservoir in May and typically entered spawning tributaries by the end of June, roughly corresponding to the descending limb of peak runoff. Bull trout remained in tributary streams until late August and early September with most finding their way back to the reservoir by the end of November. Although it's possible for some adult or sub-adult bull trout to be disturbed from dipping, most spawning fish and juveniles will be within tributary streams where dipping will not take place.

However, even with conservation measures in place to reduce potential effects to bull trout from dipping, and given the seasonality of fire management activities along with bull trout life history patterns, the potential for adverse effects to bull trout are not reduced to insignificant or discountable levels. Too many variables, including timing of fires, variability in site conditions, dipping that may occur during initial response, and other uncertainties, exist that can lead to adverse effects to bull trout. Exposed fish occupying these sites will experience an unknown range of the previously described adverse effects from harassment, increased stress, to flight-induced predation.

Effects from entrainment into pumps or impingement pump screens should be minimized by requiring all pump intakes to not have openings exceeding 3/32-inch diameter and a surface area proportionate to the pump intake capacity unless safety, loss of human life, or protection of structures is at imminent risk. Drafting without screens where listed fish species may occur is outside the scope of this programmatic consultation.

Aquatic Nuisance Species

The use of tanker trucks, water buckets, and other equipment used to draft or collect water can spread unwanted aquatic organisms. Aquatic organisms that are known to occur on the Forest are purple loosestrife (*Lythrum salicaria*), Eurasian watermilfoil (*Myriophyllum spicatum*), and whirling disease (*Myxobolus cerebralis*). The Upper Salmon and Big Wood River subbasins and the South Fork Boise River between Anderson Ranch Dam and Arrowrock Reservoir have been identified positive for whirling disease. These identified infestations underscore the necessity of sanitizing all holding tanks, tenders, and other equipment used to collect/draft water. Other areas on the Sawtooth National Forest will be identified yearly, by map, to notify fire crews of where unwanted aquatic organisms exist.

Conservation measures will minimize the threat of spreading aquatic nuisance species by requiring the following: (1) engines and helicopters returning from off-forest assignments must be clean and sanitized before resuming work on the Forest, (2) removing all visible signs of mud and debris before equipment is used between different water bodies, (3) water tenders, engines and helicopters must not dump water between separate waterbodies or where it could otherwise reach waterbodies in order to prevent the spread of potential aquatic organisms/diseases, (4) minimizing driving equipment or wading through waterways wherever possible, (5) avoid sucking organic and bottom material into water intakes when drafting from streams or ponds, and 6) water tenders, engines and helicopters moving from areas where whirling disease and other invasive aquatic organisms occur, to areas where they are not known, shall clean and sanitize equipment before moving. Actions that do not adhere to equipment cleaning and sanitation specifications in this section are outside the scope of this consultation.

2.5.1.3 Water Quality Reduction Activities

While the majority of activities identified in section 2.5.1.1 may ultimately impact water quality, the pathway would be more indirect in nature and center on predominantly sediment related effects. Program activities that have the potential to more directly impact water quality via chemical contamination include the following: (1) Application of Retardant, Foams, and Surfactants, (2) Mop-up, and (3) Cleaning/Sanitation of Equipment.

Chemical Contamination/Nutrients

Foam may be applied by engines and portable pumps to protect structures. Foaming agents approved for use for the Forest Service are Ansul Silv-Ex, Fire-Trol FireFoam 103 and 103B, Phos-Chek WD 881, Fire-Trol FireFoam 104, Angus ForExpan S, Pyrocap B-136, Fire Choke, Phos-Chek WD 881-C, Phos-Chek Anchor Point, National Foam KnockDown, Summit FlameOut, Angus Hi-Combat A, Buckeye Platinum Class A Foam, and Chemguard First Class.

The use of foaming agents carries the risk that they may be introduced into waterways (lakes, ponds, rivers, or streams). Direct or indirect introduction of these materials into waterways could result in various levels of toxicity to ESA-listed species. The degree and rate of mixing and dilution of chemicals over time and space determines the level of toxicity.

Fire suppressant foams contain wetting agents that enhance the extinguishing ability of water by increasing its retention on fuel sources and/or reducing its evaporation. They are generally composed of anionic surfactants, foam stabilizers, inhibiting agents, and solvents. Buhl and Hamilton (1998) conducted a study that looked at the toxicity of three fire retardants (Fire-Trol

GTS-R, Fire-Trol LCG-R, and Phos-Chek D75-F) and two fire suppressant foams (Phos-Check WD-881 and Ansul Silv-EX) to early life stages of Chinook salmon. Foam suppressants are more toxic to each life stage of both Chinook salmon and rainbow trout (swim up fry, 90 days post-hatch juveniles, 60 days post-hatch juveniles, embryo larvae, and eyed egg) than fire retardants (Buhl and Hamilton 1998, p. 1590). Foam suppressants are also more toxic to trout at lower concentrations than fire retardants (http://www.cerc.usgs.gov/FRS_Webs/Yankton/fire.htm). Foams and surfactants are sometimes attached to portable pump setups to increase the effectiveness of the water treatment.

Operational procedures include a one way valve on the discharge side of the pump to keep water with foam and surfactants from flowing backwards into the waterway and all hose lays are emptied before disconnecting at the pump. Using these procedures, the risks for introduction of these materials into a waterway are discountable.

Drift of foam is possible since it is very light. Foams are applied from engines and portable pumps. Flexible hoses are used to move around structures and apply foam within a few feet of a structure's surface. Therefore, the risk of drift is often greatly reduced. Surface run-off is possible depending on how wet the foam is applied. Foam quickly settles to the ground around the target structure and does not typically move from the site. However, it is possible that some foam can be carried into a waterbody by runoff if a rain event occurred after application. How much would move is dependent on the soil type (rock, sand, soils with high or low organic matter, etc) and vegetative buffer between the structure and stream.

Design criteria in this BA should minimize foam from entering waterbodies and cause negligible or discountable effects to ESA listed fish species by: (1) not using chemicals where there is a potential for direct waterway contamination, (2) avoiding application within RCAs, and (3) having spill containment equipment available on all engines. The only exception would be when safety, human life, or structures are at imminent risk. Application of fire foams to waterways is outside the scope of this programmatic consultation.

Vehicles and personnel supporting burn out operations can contaminate soils and nearby waterbodies when equipment is refueled or from leaks in poorly maintained equipment. Aerial application of chemical-filled (glycol and potassium permanganate) plastic spheres called, "ping pong balls" can also cause chemical contamination. Effects will be minimized by: (1) only fueling of equipment within RCAs if there are no other suitable locations, (2) refueling or storing over ten gallons of fuel outside of RCAs, (3) refueling of supplies other than pumps will occur no closer than 100 feet from waterbodies when refueling outside RCAs is not possible, (4) using the appropriate containment devices and absorbent pads to capture the potential spill volume, (5) not applying "ping pong balls" within 300 feet of fish bearing streams, and (6) consulting with the Resource Advisor on appropriate mitigation needs to help further minimize any potential contamination.

The introduction of contaminates (i.e. soaps, detergents etc.) from washing facilities will be minimized to insignificant levels or discountable by: (1) using designated washing stations located on gravel or well-drained soils, where there is no potential to deliver effluent to waterways away from the site, (2) not dumping treated water into any stream or lake, or on areas where it can migrate into any water body, and (3) disposing of effluents in sanitary sewers where available or applying it to roads where there is no potential to deliver to waterways.

Refueling of helicopters, vehicles and heavy equipment will occur with containment equipment and a spill response plan in place. Wherever possible, storage of petroleum products and refueling will occur outside of RCAs. The use of containment devices, absorbent pads, and a developed spill plan will help reduce the risk of fuel and petroleum products from getting into streams and other waterways if an accident were to occur. If refueling or storage of petroleum products is necessary within RCAs, these operations will be conducted no closer than 100 feet from waterways. Consultation with the Resource Advisor on appropriate mitigation needs for each situation will help further minimize any potential contamination.

The following table summarizes potential effects to pathways and indicators and is adapted from the Assessment, pp. 149-155.

Table 5. Fisheries matrix of pathways and indicators affected by project for the entire action area

Pathways and Indicators [a, b]	Effects of the Action(s)
Population Characteristics	
Subpopulation Size	Fish can also be disturbed through water dipping and drafting. A study conducted on the Boise National Forest concluded that there is little potential of capturing salmonids in lakes, reservoirs, and ponds by helicopter dipping. Rotor wash from the helicopter causes fish to disperse from the dipping site and reduces the chance of capture. Rotor wash and splash from the bucket will most likely displace fish from the dip site, thereby increasing stress. Most concern would be within rivers where deeper water habitat is more limited. It is assumed that in very large pools, fish could move to a different location without being forced out of the pool. However, in smaller pools fish could be displaced into less optimal habitat. Such displacement can result in physical and behavioral responses including adverse changes in feeding, metabolic rates, osmoregulatory processes, avoidance behavior, and immune system functions and disease. Stress-induced behavior changes in fish may lead to a higher risk of predation. Design criteria should minimize many of the above effects. Specifically dip sites should not occur during the Chinook and bull trout spawning periods (August 1 to October 30) in sensitive spawning areas identified in the Sawtooth National Forest's "Fire Suppression Operation Guidance" map, unless safety, loss of human life, or protection of structures is at imminent risk. If dipping does occur in these sites, the District Fire Duty Officer will contact an aquatic resource specialist or Resource Advisor by the end of the first operational period of initial attack. Although this is a proactive approach it does not eliminate the potential for multiple dips to occur during critical life stages. It is possible that dipping could occur for 10-12 hours before an aquatic resource specialist or Resource Advisor is notified. While the number of dips and their location cannot be predicted, it is possible that dozens to hundreds of dips could occur. It is assumed that the potential for adverse effects increases as exposure increases, especially in river sections with marginal cool, deep water habitat. Although it's possible for some adult or sub-adult bull trout to be adversely affected from dipping, most spawning fish and juveniles will be within tributary streams where dipping will not take place. Schoby and Curet (2007) using radio

Pathways and Indicators [a, b]	Effects of the Action(s)
	telemetry found that adfluvial and fluvial bull trout generally begin migrations within the Salmon River toward spawning tributaries in April and May and enter spawning tributaries between June 7 and July 20. Partridge et al. (2000) found that Bull trout migrated out of Anderson Ranch reservoir in May and typically entering spawning tributaries by the end of June and remained in tributary streams until late August and early September with most finding their way back to the reservoir by the end of November. The use of explosives can also cause disturbance to bull trout, but project design criteria will limit the potential. Disturbance from explosives should not occur as they are not allowed within RCAs and must adhere to the distances and charge weight restrictions stated in the Assessment, Table 4. Meeting these standards will protect habitat and listed species from the adverse effects described above. Use of explosives within 300' of perennial and 150' of intermittent streams is outside the scope of this programmatic action.
Growth and Survival	Temporary sediment increases may occur. However, increases are expected to have discountable potential to affect habitat, survival and growth due to proposed project design criteria. Design criteria that prevent invasive species contamination effectively maintain current growth conditions. Effects to fish habitat and redds from reducing summer baseflows should be minimized to an insignificant level by design criteria that prevent the spread of invasive species and whirling disease.
Life History	Habitat access can be temporary blocked when flow is backwatered to create a deeper site to draft water. Design criteria should help to minimize these effects to an insignificant level.
Persistence and Genetic Integrity	Design criteria should help to minimize effects to connectivity by Resource Advisors directing drafting sites to deeper and faster-flowing streams and pools instead of building small coffer dams at road crossings. Fire suppression actions will not increase the hybridization risks and the lack of take prevents the loss of genetically unique traits from even individual fish.
Water Quality	
Temperature	Disturbances to riparian vegetation can occur from burning out operations, fireline construction, road reconstruction, and fire infrastructure (i.e. camps, helispots, etc.) within RCAs. Effective implementation of design criteria should result in insignificant or discountable effects to stream temperature.
Sediment	Increased erosion and turbidity can occur from burning out operations, fireline construction, road reconstruction, stream crossing replacements, and fire infrastructure (i.e. camps, helispots, etc.) within RCAs. Effects would be greatest if rain events occurred before erosion control structures could be installed on reconstructed roads and firelines. However, these effects should be discountable since the likelihood of rain events is uncommon during drier fire season months. Design criteria (i.e. minimum fireline width and depth, no use of heavy equipment in RCAs, crossing replacement only on first and second order non-fish bearing streams; diversion of streamflows around the crossing replacement site; requiring the use of erosion-control structures, etc.) will also reduce the potential for sediment to enter waterways. Even with these design criteria, short term turbidity increases may occur downstream of stream crossings. However, these increases are expected to have discountable potential to affect fish and their habitat given their headwater locations and general distance from fish bearing streams. If sediment enters waterways from other actions, it is expected to be an

Pathways and Indicators [a, b]	Effects of the Action(s)
	immeasurable amount and thus insignificant.
Chemical Contamination/ Nutrients	Fire suppression activities can impact water quality when foaming agents are used to protect structures, portable pumps and other equipment are refueled and maintained within RCAs, dipping and drafting equipment retains residual chemicals, and cleaning agents (i.e. soaps, detergents etc.) from washing facilities are carried by runoff or dumped near waterbodies. Successful implementation of design criteria should result in negligible or discountable effects to water quality.
Habitat Access	
Physical Barriers	Habitat access can be temporary blocked when flow is backwatered to create a deeper site to draft water. Deeper scour pools are preferred by fire crews because they need to rapidly access water and often do not have material to backwater a site. Culverts with plunge pools are often selected. Creation of small, temporary dams in fish bearing streams is problematic because access can be reduced until the dam is removed. Temporary structures are most likely to be installed from mid-July to early October during peak fire season. Installation of these structures could delay upstream movement of juveniles, and adult Chinook and bull trout until they are removed. Fish encountering a barrier will likely spend energy trying to find a way around the dam. If unsuccessful, fish may move into any available deeper habitat below or near the structure. Some fish may try to move upstream again at a later time, while others that expended too much energy may remain in deeper habitat below the structure. Fish that are too tired to move or that remain in shallower habitat with less cover may be more prone to predation. To address these effects, temporary dams will only be allowed on smaller, non-fish bearing streams. Maps showing fish bearing streams to be avoided will be provided to the fire organization each spring. Resource advisors will also be available to address site specific questions. Dams created on fish bearing streams would be beyond the scope of the programmatic consultation. Additional design criteria should result in insignificant effects when Resource Advisors direct fire staff to deeper and faster-flowing streams and pools where the potential conflict with listed species is less and by Resource Advisors monitoring drafting operations to ensure dams are not in place for extend periods of time. Stream culvert installation/replacement may be necessary during wildfire management. However, these actions will not affect fish passage since installation/replacement can only occur in headwater non-fish bearing streams. Any installation/replacement within waterways that contain listed fish is outside the scope of this consultation.
Habitat Elements	
Substrate Embeddedness	Same discussion as sediment
Large Woody Debris (LWD)	Disturbance to trees and snags can occur from burning out operations, fireline construction, and road reconstruction within RCAs. Successful implementation of design criteria should result in only localized effects to wood recruitment and larger sizes of cut snags and trees near streams.

Pathways and Indicators [a, b]	Effects of the Action(s)
Pool Frequency and Quality	Increases in sediment may result in insignificant and temporary decreases to downstream pool quality. Pool frequency will not be affected.
Off Channel Habitat	There will be no change in off-channel habitat from the proposed activities.
Refugia	Resource Advisors are expected to identify aquatic refugia to the incident management team and assure that appropriate Wildfire Management Tactics are used in areas where there is potential to affect listed species/habitats.
Channel Condition and Dynamics	
Width/Depth Ratio	Reduction in streamside vegetation due to burning out in RCAs may lead to localized bank erosion, but these effects will have negligible effects to width/depth ratios. Design criteria will reduce fire intensity and maintain streambank root structure minimizing this effect.
Stream Bank Condition	Reduction in streamside vegetation due to burning out in RCAs may lead to localized bank erosion, but these effects will have negligible effects to fish habitat.
Floodplain Connectivity	There will be no change in floodplain connectivity from the proposed action.
Flow/ Hydrology	
Changes in Peak/Base Flows	Changes to peak and baseflows can occur from reopened roads, fireline construction, burn out operations, and water drafting. Road reconstruction can temporarily improve hillslope drainage by installing drainage dips, reconstructing ditchlines, and installing cross drain culverts. This can redirect flows into their original stream course, or on to forest soils reducing the magnitude of flows before they reach a stream. Burning out operations are designed to produce low-intensity fire behavior, which is not normally associated with canopy modification. Drafting water during low streamflows can reduce habitat depth and area. Effects to peak flows should be minimizes by: (1) discussing all road reconstruction activities before they begin with a Resource Advisor, (2) once a road is reopened any encountered drainage problems will be mitigated through proper drainage installation, (3) the agency administrator is ensuring that all roads are returned to pre-fire administrative status, (4) ensuring waterbars are placed on steeper firelines, and (5) not allowing direct ignitions for burnout operations within RCAs. Effects to summer baseflows should be minimized to insignificant levels by: (1) drafting from only preapproved sites as identified by the annual "Fire Suppression Operation Guidance" map within areas where Chinook salmon and bull trout spawning occurs, (2) Resource Advisors directing fire staff to deeper and faster-flowing streams and pools to avoid stranding fish, and (3) not drafting from streams with low flows to avoid stream dewatering and standing of fish. Careful implementation of project design features will minimize potential effects to peak/base flows from project activities to an insignificant level.

Pathways and Indicators [a, b]	**Effects of the Action(s)**
Drainage Network Increase	There will be no change in active channel length.
Watershed Conditions	
Road/Density/ Location	Wildfire management-related road reconstruction will temporarily increase road density. However these roads will be rehabilitated to pre-fire status following wildfire management actions. Rehabilitation will include eliminating any encountered drainage problems and ensuring that all roads are returned to pre-fire administrative status.
Distrubance History	Burning out operations are designed to produce low-intensity fire behavior, which is not normally associated with canopy modification, nor will it modify disturbance history.
Riparian Conservation Areas	Disturbance to riparian vegetation can occur from burning out operations, fireline construction, road reconstruction, stream crossing replacements, and fire infrastructure (i.e. camps, helispots, etc.) within RCAs. Design criteria will reduce the effects to RCAs through: (1) coordination with Resource Advisors who can identify areas of concern, (2) keeping a fireline's footprint to the minimum necessary to meet fire suppression objectives, (3) not allowing heavy equipment to construct firelines in RCAs, (4) preventing burnout ignitions within RCAs, and (5) the agency administrator is ensuring that all roads are returned to pre-fire administrative status. If roads reopened within RCAs that have more than a discountable or insignificant effect to ESA-listed species or their habitats, as determined by the appropriate resource specialists, then these actions would be outside the scope of this consultation.
Disturbance Regime	Low intensity fire behavior associated with burning out operations is not expected to increase the occurrence of catastrophic wildfire, debris torrents, scour events, or other disturbances. Wildfire management access via RCA roads is a temporary disturbance. These roads will be rehabilitated to pre-fire status following wildfire management actions.
Integration of Species and Habitat Conditions	Fire suppression actions can impact fish through increases in sediment, removal of streamside canopy, reducing woody debris, temporarily blocking habitat, degrading water quality, and introduction of aquatic invasive species. Fish can also be disturbed through water dipping and drafting, and use of explosives. Successful implementation of design criteria should result in negligible or discountable effects to matrix biological and physical indicators, and not reduce a habitat's or fish species' ability sustain itself overtime.

a Matrix checklist adapted from U.S. Fish and Wildlife Service 1998, endorsed by Sawtooth Level I, March 18, 1999.

b Evaluated against local criteria where appropriate and available (see IV.C)

2.5.2 Effects of Interrelated or Interdependent Actions

Interrelated actions are those that are a part of a larger action and depend on the larger action for their justification. Interdependent actions are those actions that have no independent utility apart from the action under consideration. The Service did not identify any other potentially interrelated or interdependent actions associated with the proposed action.

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.

Private and state activities and management programs may affect bull trout or their habitat in some parts of the action area, where federally managed lands occur adjacent to State or privately owned land. There may be continuation of effects associated with ongoing activities that include timber harvest, grazing and management of domestic livestock, road construction and maintenance, recreation, agriculture, water diversions, and residential development. Population growth and associated demands for agricultural, commercial, or residential development are expected to affect available habitat quality and quantity for bull trout in the future. It is likely that future non-federal actions are likely to continue over the next 10 years at similar intensities as in recent years and these actions will cumulatively affect bull trout. The Service anticipates that majority of cumulative effects related to State and private activities will occur within bull trout forage, migratory, and overwintering habitats where the greatest concentration of non-federal lands occur.

Illegal and inadvertent harvest of bull trout is considered a cumulative effect. Harvest can occur through both misidentification and deliberate catch. Schmetterling and Long (1999, p. 1) found that only 44 percent of the anglers they interviewed in Montana could successfully identify bull trout. Being aggressive piscivores, bull trout readily take lures or bait (Ratliff and Howell 1992, pp. 15-16). Spawning bull trout are particularly vulnerable to harvest because the fish are easily observed during autumn low flow conditions. Spawning bull trout are particularly vulnerable to harvest because the fish are easily observed during autumn low flow conditions. Hooking mortality rates range from 4 percent for non-anadromous salmonids with the use of artificial lures and flies (Schill and Scarpella 1997, p. 1) to a 60 percent worst-case scenario for bull trout taken with bait (Cochnauer et. al. 2001, p. 21). Thus, even in cases where bull trout are released after being caught, some mortality can be expected. An additional cumulative effect to bull trout is global climate change. Warming of the global climate seems quite certain. Changes have already been observed in many species' ranges consistent with changes in climate (Independent Scientific Advisory Board 2007, p. iii; Hansen et al. 2001, p. 767). Global climate change threatens bull trout throughout its range in the coterminous United States. Downscaled regional climate models for the Columbia River basin predict a general air temperature warming of 1.0 to 2.5 °C (1.8 to 4.5 °F) or more by 2050 (Rieman et al. 2007, p. 1552). This predicted temperature trend may have important effects on the regional distribution and local extent of habitats available to salmonids (Rieman et al. 2007, p. 1552), although the relationship between changes in air temperature and water temperature are not well understood. Bull trout spawning and early rearing areas are currently largely constrained by low fall and winter water temperatures that define the spatial structuring of local populations or habitat patches across larger river basins; habitat patches represent networks of thermally suitable habitat that may lie in adjacent watersheds and are disconnected (or fragmented) by intervening stream segments of seasonally unsuitable habitat or by actual physical barriers (Rieman et al. 2007, p. 1553).

With a warming climate, thermally suitable bull trout spawning and rearing areas are predicted to shrink during warm seasons, in some cases very dramatically, becoming even more isolated from one another under moderate climate change scenarios (Rieman et al. 2007, pp. 1558–1562; Porter and Nelitz 2009, pp. 5–7). Climate change will likely interact with other stressors, such as habitat loss and fragmentation (Rieman et al. 2007, pp. 1558–1560; Porter and Nelitz 2009, p. 3); invasions of nonnative fish (Rahel et al. 2008, pp. 552–553); diseases and parasites (McCullough et al. 2009, p. 104); predators and competitors (McMahon et al. 2007, pp. 1313–1323; Rahel et al. 2008, pp. 552–553); and flow alteration (McCullough et al. 2009, pp. 106–108), rendering some current spawning, rearing, and migratory habitats marginal or wholly unsuitable. Over a period of decades, climate change may directly threaten the integrity of the essential physical or biological features of bull trout.

2.7 Conclusion – Bull Trout

The Service has reviewed the current status of the bull trout, the environmental baseline in the action area, effects of the proposed action, and cumulative effects, and it is our conclusion that the proposed action is not likely to jeopardize the species continued existence. The Service concludes that direct adverse effects to adult, subadult and juvenile bull trout in the action area will occur across the Action Area. Effects will be limited to short-term disturbance, feeding rate reduction, increased predation risk, and physiological stress resulting from water drafting and dipping activities. Spawning bull trout, eggs, or alevins are not expected to be affected by program activities. The Service does not expect the numbers, distribution, and reproduction of bull trout in the action area, the Salmon River or the Southwest Idaho Rivers Management Units or their core areas, or in the Columbia Basin population segment will be changed as a result of this proposal. Program impacts will not reduce appreciably the likelihood of both the survival and recovery of bull trout. Therefore, although the proposed action may have some adverse effects to small numbers of bull trout, these effects are not likely to cause a measurable response to bull trout at the local population, core area, management unit, or coterminous U.S. scales. It is the Service's biological opinion that the proposed Program will not jeopardize the coterminous population of bull trout.

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

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

The Forest Service has a continuing duty to regulate the activity covered by this incidental take statement. If the Forest Service 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 Service 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

Adult, subadult and juvenile bull trout, if present, are likely to be harassed and/or harmed during dipping and drafting operations at occupied sites. Although individual fish responses are expected to vary widely, most fish are expected to reach suitable refugia quickly and exhibit only minor levels of harassment. Fewer fish, both juveniles and adults, may be more severely affected in some situations. For example, some juvenile fish will be at an increased risk of predation while fleeing dip sites, either due to dulled senses brought on by helicopter induced stress or due to increased predator exposure if flight response distance is longer (i.e., distance to safety). Migrating adults will likely only exhibit a minor behavioral modification as they are pushed out of pool habitats and continue their upstream or downstream movements unharmed. Harassment of bull trout will be minimized by conservation measures included in the proposed action and because most dip sites will be located in the larger river systems outside bull trout spawning areas. Additionally bull trout are less likely to occupy those river systems during summer months when river temperatures are elevated. Effects are therefore expected to be widely scattered, infrequent, and may or may not overlap spatially and temporally with bull trout occupation.

It is difficult for us to anticipate the exact number of individual bull trout that will be taken as a result of wildfire management actions. Fish density varies widely across individual habitat sites, between days, and across years and habitat conditions, and thus severity of effects when fish are disturbed also vary widely. Similarly, there is no way to predict the number or severity of fires that may occur in the next 10 years and the amount of water dipping or drafting needed in response, particularly given the cumulative effect that climate change may have on the action area. In addition, there is no way for personnel to quantify how many fish are affected at a given dip site, how long they are affected, or what their ultimate fate is. These uncertainties make it impossible to quantitatively identify the amount of take that will occur as a result of implementing the proposed action.

Therefore, to address take associated with harassment of bull trout through water dipping and drafting we will use the extent of upstream and downstream disturbance as a surrogate. We anticipate that all adult, subadult, and juvenile bull trout within the water body area disturbed by equipment (such as rotor wash, noise, equipment entering the water, etc.) are subject to take in the form of harassment from direct exposure to disturbance. Take from water dipping and drafting is only expected to last during daylight hours and in the first operational period. We expect no bull trout mortality will occur as result of Program implementation, and no lethal take is authorized. This Incidental Take Statement is valid for 10 years from the signature date of this Opinion.

If incidental take anticipated by this document (i.e. harassment to bull trout within the disturbance area during water drafting and dipping) is exceeded, the Forest will immediately contact the Service to determine if consultation should be reinitiated.

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. The proposed action is not expected to reduce the reproduction, status, and distribution of bull trout in the action area, and will not appreciably reduce the likelihood of survival and recovery of the Columbia River Distinct Population Segment (DPS). The Columbia River DPS comprises 22 management units including the Salmon River Management Unit and the Southwest Idaho Rivers Management Unit. Within the Salmon River Management Unit, 10 core areas contain 125 local populations. Within the Southwest Idaho Rivers Management Unit, the Boise River Subunit, which has three core areas and 31 local populations, and Payette River Subunit, which has five core areas and 18 local populations, are contained within the action area. While wildfire management activities could occur in any of these core areas or local populations over the next 10 years, the Service does not anticipate appreciable changes in numbers and distribution of bull trout within the action area.

2.8.3 Reasonable and Prudent Measures

The Service concludes that the following reasonable and prudent measures are necessary and appropriate to minimize the take of bull trout caused by the proposed action.

1. Minimize the potential for adverse effects to occur as a result of helicopter dipping and drafting activities associated with wildfire suppression.
2. Ensure completion of a monitoring and reporting program to confirm that the proposed action is implemented as described and to ensure incidental take is not exceeded.

2.8.4 Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the Act, the Forest Service and Bureau of Land Management must comply with the following terms and conditions, which implement the reasonable and prudent measures described above:

1. To implement RMP #1 the Sawtooth National Forest shall:
    a. Ensure all described conservation measures and monitoring of suppression activities, as described in the Assessment and Section 2.1.2 of this Opinion, are followed.
    b. Annually update the Sawtooth National Forest's Operational Guidance for water dipping points and criteria for dipping points in fish-bearing streams.
2. To implement RPM #2 the Sawtooth National Forest shall ensure that:

a. The Resource Advisors monitor implementation of wildfire management activities described within this consultation and provide reports to the Level 1 Team for all wildfire management activities that may affect listed species or their habitats.

1. A general summary of all initial attack actions will be provided to the Level 1 Team at the end of the fire season.
2. All extended attack reports shall provide the number and location of all helicopter dip/snorkel sites that were used within habitat occupied by bull trout, or within designated critical habitat. The report will also include what time-frame they occurred, what species were either documented or present at each, and what mitigations were employed to either reduce or avoid impacts to bull trout.
3. All reports shall be submitted to the Level 1 Team by December 1 of each year.

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)].

1. The action agency shall provide a monitoring report as described above under Term and Condition #2 to the Level 1 Team by December 1 of each year.
2. Notify the Service within 24 hours upon locating dead, injured, or sick bull trout not anticipated by this Opinion as a result of wildfire management activities. Seek alternative sites for continuation of activities that are necessary for wildfire management or implement additional conservation measures to minimize adverse effects to bull trout.
3. During project implementation promptly notify the Service of any emergency or unanticipated situations arising that may be detrimental for bull trout relative to the proposed activity.

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.

- Consider the use of wildfire management as a tool to meet land use plan vegetation objectives and to help restore riparian conservation areas.

- Continue to promote recovery of bull trout in the action area by identifying habitat restoration opportunities and implementing these actions in the near term.

2.10 Reinitiation Notice

This concludes formal consultation on the Sawtooth National Forest's Wildfire Management Activities. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been maintained (or is authorized by law) and if:

1. The amount or extent of incidental take is exceeded.
2. New information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this Opinion.
3. The agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this Opinion.
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.

3. LITERATURE CITED

3.1 Published Literature

Bakke, P.D., B. Peck, and S. Hager. (2002). Geomorphic controls on sedimentation impacts. Eos. Trans. AGU, 83(47), Fall Meet. Suppl., Abstract H11C-0847, 2002. Poster presented at AGU 2002 Fall Meeting, San Francisco, California. Fish and Wildlife Service, Western Washington Fish and Wildlife Office, Lacey, Washington.

Backer, D.M., S.E. Jensen, and G.R. McPherson. 2004. Impacts of Fire-Suppression Activities on Natural Communities. Conservation Biology. Vol. 18, Nov. 4, pp. 937-946. August 2004.

Bash, J., C. Berman, and S. Bolton. 2001. Effects of turbidity and suspended solids on salmonids. Center for Berg, R.K. and E.K. Priest. 1995. Appendix Table 1: A list of stream and lake fishery surveys conducted by U.S. Forest Service and Montana Fish, Wildlife and Parks fishery biologists in the Clark Fork River Drainage upstream of the confluence of the Flathead River from the 1950s to the present. Montana Fish, Wildlife, and Parks, Job Progress Report, Project F-78-R-1, Helena, Montana.

Berg, L. and T.G. Northcote. 1985. Changes in territorial, gill-flaring, and feeding behavior in juvenile coho salmon (*Oncorhyncus kisutch*) following short-term pulses of suspended sediment. Canadian Journal of Fisheries and Aquatic Sciences. 42(8):1410-1417.

Berg, R.K. and E.K. Priest. 1995. Appendix Table 1: A list of stream and lake fishery surveys conducted by U.S. Forest Service and Montana Fish, Wildlife and Parks fishery biologists in the Clark Fork River Drainage upstream of the confluence of the Flathead River from the 1950s to the present. Montana Fish, Wildlife, and Parks, Job Progress Report, Project F-78-R-1, Helena, Montana.

Bird, F.H., and K. Roberson. 1984. Keystone Canyon Blasting Study. Alaska Department of Fish and Game. Pp. 25.

Bishaie, H.M. 1961. The Effect of Pressure on the Survival and Distribution of Larval and Young Fish. Zoology Department. Faculty of Science, Cairo University, Egypt. Pp. 292-311.

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

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

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

Brewin, P.A. and M.K. Brewin. 1997. Distribution maps for bull trout in Alberta. Pages 206-216 in Mackay, W.C., M.K. Brewin and M. Monita, editors. Friends of the Bull Trout Conference Proceedings.

Buchanan, D. M. and S. V. Gregory. 1997. Development of water temperature standards to protect and restore habitat for bull trout and other cold water species in Oregon. Pages 1-8 in Mackay, W.C., M.K. Brewin and M. Monita, editors. Friends of the Bull Trout Conference Proceedings.

Buhl. K.J. and S. J. Hamilton. 1998. Acute Toxicity of Fire-Retardant and Foam-Suppressant Chemicals to Early Life Stages of Chinook Salmon (Oncorhynchus Tshawytscha). Environmental Toxicology and Chemistry. Vol. 17, No. 8. pp. 1589-1599.

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

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

Chamberlin, T.W., R.D. Harr, and F.H. Everest. 1991. Timber harvesting, silviculture, and watershed processes. American Fisheries Society Special Publication 19: 181-206.

Chapman, D. W. 1988. Critical review of variables used to define effects of fines in redds of large salmonids. Transactions of the American Fisheries Society 117(l):1-21.

Cochnauer, T., E. Schriever, and D. Schiff. 2001. Idaho Department of Fish and Game Regional Fisheries Management Investigations: North Fork Clearwater River Bull Trout, Project 9. F-73-R-22.

Cordone, A. J., and D. W. Kelley. 1961. The influences of inorganic sediment on the aquatic life of streams. California Fish and Game 47: 189-228.

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

Dunham, J.B. and B.E. Rieman. 1999. Metapopulation structure of bull trout: influences of physical, biotic, and geometrical landscape characteristics. Ecological Applications 9(2):642-655.

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

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

Goetz, F. 1994. Distribution and juvenile ecology of bull trout (*Salvelinus confluentus*) in the Cascade Mountains. M.S. Thesis, Oregon State University, Corvallis, Oregon.

Hansen, A.J., R.P. Neilson, V.H. Dale, C.H. Flather, L.R. Iverson, D.J. Currie, S. Shafer, R. Cook, and P.J. Bartlein. 2001. Global Change in Forests: Responses of Species, Communities, and Biomes. BioScience 51(9):765-779.

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

Hicks, B. J., et al. 1991. Response of salmonids to habitat change. *In* Meehan, W.R., editor. Influences Of Forest And Rangeland Management On Salmonid Fishes and Their Habitats. American Fisheries Society Special Publication 19. 483-518. Hogen, D. 2001. Spatial and temporal distribution of bull trout, *Salvelinus confluentus*, in the upper East Fork South Fork Salmon River watershed, Idaho. Challenge cost share agreement No. 12-CCS-99-003. Moscow, Idaho. 84 pp.

Idaho Department of Fish and Game, in litt. 1995. List of stream extirpations for bull trout in Idaho.

Independent Scientific Advisory Board (ISAB). 2007. Climate Change Impacts on Columbia River Basin Fish and Wildlife. Portland, Oregon. 136 pp.

Jakober, M. 1995. Autumn and winter movement and habitat use of resident bull trout and westslope cutthroat trout in Montana. M.S. Thesis, Montana State University, Bozeman, Montana.

Jimenez, J. and T.A. Burton. 2001. Are helibuckets scooping more than just water? Fire Management Today 61(1): 34-36.

Kinsella, S.R. 2005. Weathering the Change – Helping Trout in the West Survive the Impacts of Global Warming. Available at: www.montanatu.org/issuesandprojects/climatechange.pdf (last accessed January 11, 2011)

Leary, R.F., F.W. Allendorf, and S.H. Forbes. 1993. Conservation genetics of bull trout in the Columbia and Klamath River drainages. Conservation Biology 7(4):856-865.

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

Leathe, S.A. and P. Graham. 1982. Flathead Lake fish food habits study. E.P.A. through Steering Committee for the Flathead River Basin Environmental Impact Study.

Light, J., L. Herger and M. Robinson. 1996. Upper Klamath Basin bull trout conservation strategy, a conceptual framework for recovery. Part One. The Klamath Basin Bull Trout Working Group.

Lloyd, D.S., J.P. Koenings, and J.D. LaPerriere. 1987. Effects of turbidity in fresh waters of Alaska. North American Journal of Fisheries 7:18-33.

McCullough, D.A., J.M. Bartholow, H.I. Jager, R.L. Beschta, E.F. Cheslak, M.L. Deas, J.L. Ebersole, J.S. Foott, S.L. Johnson, K.R. Marine, M.G. Mesa, J.H. Petersen, Y. Souchon, K.F. Tiffan, and W.A. Wurtsbaugh. 2009. Research in thermal biology: burning questions for coldwater stream fishes. Reviews in Fisheries Science 17(1):90-115.

McMahon, T.E., A.V. Zale, F.T. Barrows, J.H. Selong, and R.J. Danehy. 2007. Temperature and competition between bull trout and brook trout: a test of the elevation refuge hypothesis. Transactions of the American Fisheries Society 136:1313-1326.

Meefe, G.K. and C.R. Carroll. 1994. Principles of conservation biology. Sinauer Associates, Inc. Sunderland, Massachusetts.

Megahan, W.F. 1982. "Channel sediment storage behind obstruction in forested drainage basins draining the granitic bedrock of the Idaho Batholith", in Sediment Budges and Routing in Forested Drainage Basins, USDA Forest Service General Technical Report, PNW-GTR-141, 114-121.

Mesa, M.G. 1994. Effects of Multiple Acute Stressors on Predator Avoidance Ability and Physiology of Juvenile Chinook Salmon. Transactions of the American Fisheries Society. Vol. 123, pp. 786-793.Montana Bull Trout Scientific Group (MBTSG). 1998. The Relationship Between Land Management Activities and Habitat Requirements of Bull Trout. Helena, Montana. 78 pp. + vi.

Mote, P.W., E.A. Parson, A.F. Hamlet, K.N. Ideker, W.S. Keeton, D.P. Lettenmaier, N.J. Mantua, E.L. Miles, D.W. Peterson, D.L. Peterson, R. Slaughter, and A.K. Snover. 2003. Preparing for climatic change: The water, salmon, and forests of the Pacific Northwest. *Climatic Change* 61:45-88.

Myers, T.J. and S. Swanson. 1996 Long term aquatic habitat restoration: Mahogany Creek, Nevada, as a case study. Journal of the American Water Research Association 32: 241-252.

Neff, J.M. 1985. Polycyclic aromatic hydrocarbons. In: Fundamentals of aquatic toxicology, G.M. Rand, and S.R. Petrocelli (eds.), pp. 416-454. Hemisphere Publishing, Washington, D.C.

Newcombe, C.P. and J.O.T. Jensen. 1996. Channel suspended sediments and fisheries: a synthesis for quantitative assessment of risk and impact. North American Journal of Fisheries Management 16: 693-727.

Newcombe, C.P. and D.D. MacDonald. 1991. Effects of Suspended Sediments on Aquatic Ecosystems. North American Journal of Fisheries Management 11:72-82.

Newton, J.A. and S. Pribyl. 1994. Bull trout population summary: Lower Deschutes River Subbasin. Oregon Department of Fish and Wildlife, The Dalles, Oregon.

Partridge, F., K. Frank, and C. Warren. 2000. Southwest Idaho bull trout restoration (South Fork Boise River) Completion Report. Idaho Department of Fish and Game, Threatened and Endangered Species Report, Project E-21-1, Section 6,Endangered Species Act, August 2000, Boise, Idaho.

Phillips, R., R. Laritz, E. Claire, and J. Moring. 1975. Some effects of gravel mixtures on emergence of coho salmon and steelhead trout fry. Transactions of the American Fisheries Society 104 (3): 461-466.

Poff, N. L., M. M. Brinson, and J. W. Day, Jr. 2002. Aquatic ecosystems & global climate change: Potential impacts on inland freshwater and coastal wetland ecosystems in the United States. Pew Center on Global Climate Change.

Porter, M. and M. Nelitz. 2009. A future outlook on the effects of climate change on bull trout (Salvelinus confluentus) habitats in the Cariboo-Chilcotin. Prepared by ESSA Technologies Ltd. for Fraser Salmon and Watersheds Program, British Columbia. Ministry of Environment, and Pacific Fisheries Resource Conservation Council. Available at: http://www.thinksalmon.com/reports/BullTroutHabitatOutlook_090314.pdf. (Last accessed April 29, 2011).

Pratt, K.L. 1992. A review of bull trout life history. Pages 5-9 in Howell, P. J. and D. V. Buchanan, editors. Proceedings of the Gearhart Mountain Bull Trout Workshop. Oregon Chapter of the American Fisheries Society, Corvallis, Oregon.

Price, C.S., and C.B. Schreck. 2003. Stress and Saltwater-entry Behavior of Juvenile Chinook Salmon (Oncorhynchus tshawytscha): Conflicts in Physiological Motivation. Canadian Journal of Fisheries Aquatic Science. Vol. 60, pp. 910-918.

Quigley, T.M. and J.J. Arbelbide. 1997. An assessment of ecosystem components in the Interior Columbia Basin and portions of the Klamath and Great basins. Vol. III. 1174-1185pp.

Rahel, F.J., B. Bierewagen, and Y. Taniguchi. 2008. Managing aquatic species of conservation concern in the face of climate change and invasive species. Conservation Biology 22(3):551-561.

Rasmussen, B. 1967. The Effects of Underwater Explosions on Marine Life. Bergen, Norway. 17 pp.

Ratliff, D. E. and P. J. Howell. 1992. The Status of Bull Trout Populations in Oregon. Pages 10-17 in Howell, P.J. and D.V. Buchanan, editors. Proceedings of the Gearhart Mountain Bull Trout Workshop. Oregon Chapter of the American Fisheries Society, Corvallis, Oregon.

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

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

Rieman, B.E. and J.D. McIntyre. 1993. Demographic and habitat requirements for conservation of bull trout. General Technical Report INT-302, Intermountain Research Station, U.S. Department of Agriculture, Forest Service, Boise, Idaho.

Rieman, B.E. and J.D. McIntyre. 1995. Occurrence of bull trout in naturally fragmented habitat patches of varied size. Transactions of the American Fisheries Society 124 (3): 285-296.

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

Rieman, B.E., D.C. Lee and R.F. Thurow. 1997. Distribution, status and likely future trends of bull trout within the Columbia River and Klamath basins.

Rieman, B.E., J.T. Peterson, and D.L. Meyers. 2006. Have brook trout (*Salvelinus fontinalis*) displaced bull trout (*Salvelinus confluentus*) along longitudinal gradients in central Idaho streams? Canadian Journal of Fisheries and Aquatic Sciences 63:63-78.

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

Robins, C.R., R.M. Bailey, C.E. Bond, J.R. Brooker, E.H. Lachner, R.N. Lea and W.B. Scott. 1980. A list of common and scientific names of fishes from the United States and Canada. American Fisheries Society Special Publication 12, Bethesda, Maryland.

Rode, M. 1990. Bull trout, *Salvelinus confluentus* Suckley, in the McCloud River: status and recovery recommendations. Administrative Report Number 90-15. California Department of Fish and Game, Sacramento, California.

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

Schill, D.J. 1992. River and stream investigations. Idaho Department of Fish and Game.

Schill, D.J. and R.L. Scarpella. 1997. Barbed hook restrictions in catch-and-release trout fisheries: a social issue. North American Journal of Fisheries Management 17(4): 873-881.

Schmetterling, D.A. and M.H. Long. 1999. Montana anglers' inability to identify bull trout and other salmonids. Fisheries 24: 24-27.

Schoby, P.S. and T. Curet, 2007. Seasonal Migrations of Bull Trout, Westslope Cutthroat Trout, and Rainbow Trout in the Upper Salmon River Basin, Idaho. Idaho Department of Fish and Game Report, Project 07-12, Boise, Idaho.

Sexauer, H.M. and P.W. James. 1997. Microhabitat use by juvenile trout in four streams located in the Eastern Cascades, Washington. Pages 361-370 in Mackay, W.C., M.K. Brown and M. Monita, editors. Friends of the Bull Trout Conference Proceedings.

Sicking, S.P. 2003. Anadromous Fish Strainers for Use in Wildland Drafting Operations. USDA Forest Service, San Dimas Technology and Development Center, San Dimas, CA. 32 pp.

Sigismond. L.A., and L.J. Weber. 1988. Changes in Avoidance Response Time of Juvenile Chinook Salmon Exposed to Multiple Acute Handling Stresses. Transactions of the American Fisheries Society. Vol. 117, pp. 196-201.

Sigler, J.W., T.C. Bjornn, and F.H. Everest. 1984. Effects of chronic turbidity on density and growth of steelheads and coho salmon. Transactions of American Fisheries Society 113:142-150.

Smirnov, A.I. 1955. The Effects of Mechanical Agitation at Different Periods of Development on the Eggs of Autumn Chum Salmon. Dokl. Adad. Nauk. SSSR, 105 (4): 873-876.

Spence, B.C., G.A. Lomnicky, R.M. Hughes, and R.P. Novitzki. 1996. An Ecosystem Approach to Salmonid Conservation. TR-4501-96-6507. Man Tech Environmental Research Corporation, Corvallis, Oregon.

Suttle, K.B., M.E. Power, J.M. Levine, and C. McNeely. 2004. How fine sediment in riverbeds impairs growth and survival of juvenile salmonids. Ecological Applications 14(4):969-974.

Thomas, G. 1992. Status of bull trout in Montana. Report prepared for Montana Department of Fish, Wildlife and Parks, Helena, Montana.

U.S. Fish and Wildlife Service. 2002a. Chapter 1, Introduction. 137pp. In: Bull Trout (*Salvelinus confluentus*) Draft Recovery Plan. U.S. U.S. Fish and Wildlife Service, Portland, Oregon.

U.S. Fish and Wildlife Service. 2002b. Chapter 2, Klamath River Recovery Unit, Oregon. 82pp. In: Bull Trout (*Salvelinus confluentus*) Draft Recovery Plan. U.S. Fish and Wildlife Service, Portland, Oregon.

U.S. Fish and Wildlife Service. 2002c. Chapter 25, St. Mary-Belly River Recovery Unit, Montana. 134 pp. In: Bull Trout (*Salvelinus confluentus*) Draft Recovery Plan. U.S. Fish and Wildlife Service, Portland, Oregon.

U.S. Fish and Wildlife Service. 2002d. Chapter 17, Salmon River Recovery Unit, Idaho. 194 pp. In: Bull Trout (*Salvelinus confluentus*) Draft Recovery Plan. U.S. Fish and Wildlife Service, Portland, Oregon.

U.S. Fish and Wildlife Service. 2002e. Chapter 18, Southwest Idaho Recovery Unit, Idaho. 110 pp. In: Bull Trout (*Salvelinus confluentus*) Draft Recovery Plan. U.S. Fish and Wildlife Service, Portland, Oregon.

U.S. Fish and Wildlife Service. 2004a. Draft Recovery Plan for the Jarbidge River Distinct Population Segment of Bull Trout (*Salvelinus confluentus*). U.S. Fish and Wildlife Service, Portland, Oregon. 132 + xiii pp.

U.S. Fish and Wildlife Service. 2004b. Draft Recovery Plan for the Coastal-Puget Sound Distinct Population Segment of Bull Trout (*Salvelinus confluentus*). Volume I (of II): Puget Sound Management Unit. Portland, Oregon. 389 + xvii pp.

U.S. Fish and Wildlife Service. 2004c. Draft Recovery Plan for the Coastal-Puget Sound Distinct Population Segment of Bull Trout (*Salvelinus confluentus*). Volume II (of II): Olympic Peninsula Management Unit. Portland, Oregon. 277 + xvi pp.

U.S. Fish and Wildlife Service. 2005. Bull Trout Core Area Conservation Status Assessment. U.S. Fish and Wildlife Service, Portland, Oregon. 95pp. plus appendices.

U.S. Fish and Wildlife Service. 2006. Recovery Units and Jeopardy Determinations under Section 7 of the Endangered Species Act. Director Memorandum: FWS/AES/DCHRS/024358. March 6, 2006.

U.S. Fish and Wildlife Service. 2008. Bull Trout (*Salvelinus confluentus*) 5-Year Review: Summary and Evaluation. 53pp.

U.S. Fish and Wildlife Service and NMFS (National Marine Fisheries Service). 1998. Endangered Species Consultation Handbook. 351pp.

U.S. Forest Service. 2005. Population Viability Assessment Upper South Fork Clearwater River: Spring Chinook, Snake River Steelhead Trout, Westslope Cutthroat Trout, Columbia River Bull Trout, and Pacific Lamprey. Nez Perce National Forest, Grangeville, Idaho. 43 pp.

U.S. Forest Service. 2012. Biological Assessment/Biological Evaluation of the Effects to Threatened, Endangered, and Proposed & Sensitive Species: Programmatic for Wildfire Activities on the Sawtooth National Forest. Sawtooth National Forest, Twin Falls, Idaho. 217 pp.

Waters, T. F. 1995. Sediment in streams: sources, biological effects, and control. American Fisheries Society Monograph 7: 61-117.

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

Whitesel, T.A., J. Brostrom, T. Cummings, J. Delavergne, W. Fredenberg, H. Schaller, P. Wilson, and G. Zydlewski. 2004. Bull Trout Recovery Planning: A review of the science associated with population structure and size. Science Team Report #2004-01. U.S. Fish and Wildlife Service, Regional Office, Portland, Oregon.

Wissmar, R.C., J.E. Smith, B.A. McIntosh, H.W. Li, G.H. Reeves, J.R. Sedell. 1994. Ecological health of river basins in forested regions of eastern Washington and Oregon. Eastside Forest Ecosystem Health Assessment. 3. United States Department of Agriculture, Forest Service.

Wood, P.J. and P.D. Armitage. 1997. Biological effects of fine sediment in the lotic environment. Environmental Management, 21:203 -217.

Wright, D.G., and G.E. Hopky. 1998. Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters. Canadian Technical Report of Fisheries and Aquatic Sciences 2107.

Ziller, J.S. 1992. Distribution and relative abundance of bull trout in the Sprague River Subbasin, Oregon. Pages 18-29 in Howell, P.J. and D.V. Buchanan, editors. Proceedings of the Gearhart Mountain Bull Trout Workshop. Oregon Chapter of the American Fisheries Society, Corvallis, Oregon.