United States Department of the Interior

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Memorandum

To: State Supervisor, Oregon Fish and Wildlife Office, Portland, Oregon

From: Assistant Project Leader, Endangered Species/Land and Water Development Program, Oregon Fish and Wildlife Office, Portland, Oregon

Subject: Intra-Service Formal and Informal Section 7 Consultation for the Oregon Restoration Programs: Coastal, Greenspaces, Jobs in the Woods, Partners for Fish and Wildlife, and Private Stewardship Grants Programs: 2004 to 2009 (ref. no.1-7-F-04-0133)

This document transmits the Fish and Wildlife Service's (Service) biological opinion (BO) based on our review of the Service's Oregon Fish and Wildlife Office (OFWO), Non-Federal Lands Conservation Division's January 16, 2004 biological assessment (BA) for the Coastal, Greenspaces, Jobs in the Woods, Partners for Fish and Wildlife and Private Stewardship Grants Programs (hereafter collectively referred to as the Restoration Program) for a five year period upon signature of this BO. This BO covers the OFWO and suboffices (Bend, Newport, Roseburg and La Grande) and the Willamette Valley National Wildlife Refuge Complex Partners for Fish and Wildlife Program restoration efforts throughout Oregon, excluding those areas of Klamath, Lake, and Jackson counties administered by the Service's Klamath Basin Office (Appendix A). The BA addresses the effects of the Service's Restoration Programs on those Federally listed species in Table 1 for which the Service is responsible under the Endangered Species Act (Act) as amended (16 U.S.C. 1531 et seq.). Since your request for consultation and conferencing on proposed bull trout critical habitat was received the Service has made a final rule. Therefore, the Service is providing formal consultation on designated bull trout critical habitat. The Service is consulting concurrently with NOAA Fisheries concerning listed anadromous fish species and their designated critical habitat.

Table 1. Species addressed in the biological assessment for which the Service has lead Endangered Species Act responsibility, their listing status, and the Service's effects determinations.

Species	**Scientific name**	**Federal Status**	**Determination**
Mammals			
Canada lynx	Felis lynx canadensis	T	NLAA
Columbian white-tailed deer	Odocoileus virginianus leucurus	E	NLAA
Birds			
Marbled murrelet	Brachyramphus marmoratus	T/CH	NLAA
Western snowy plover (coastal)	Charadrius alexandrinus nivosus	T/CH	NLAA
Bald eagle	Haliaeetus leucocephalus	T	NLAA
Brown pelican	Pelecanus occidentalis	E	NLAA
Northern spotted owl	Strix occidentalis caurina	T/CH	NLAA
Fish			
Warner sucker	Catostomus warnerensis	T/CH	LAA
Oregon chub	Oregonichthys crameri	E	LAA
Bull trout	Salvelinus confluentus	T/CH	LAA
Invertebrates			
Vernal pool fairy shrimp	Branchinecta lynchi	T	NLAA
Fender's blue butterfly	Icaricia icarioides fenderi	E	LAA
Oregon silverspot butterfly	Speyeria zerene hippolyta	T/CH	NLAA
Plants			
Willamette daisy	Erigeron decumbens var. decumbens	E	NLAA
Gentner's fritillary	Fritillaria gentneri	E	NLAA
Water howellia	Howellia aquatilis	T	NLAA
Western lily	Lilium occidentale	E	NLAA
Large-flowered meadowfoam	Limnanthes floccosa ssp. grandiflora	E	NLAA
Bradshaw's lomatium	Lomatium bradshawii	E	NLAA
Cook's lomatium	Lomatium cookii	E	NLAA

Kincaid’s lupine	Lupinus sulphureus var. kincaidii	T	NLAA
MacFarlane's four o'clock	Mirabilis macfarlanei	T	NLAA
Rough Popcornflower	Plagiobothrys hirtus	E	NLAA
Nelson's checker-mallow	Sidalcea nelsoniana	T	NLAA
Spalding's catchfly	Silene spaldingii	T	NLAA
Howell's spectacular thelypody	Thelypodium howellii var. spectabilis	T	NLAA

(E) - Endangered (T) - Threatened (CH) - designated Critical Habitat (Prop) - proposed
(NLAA) - May affect, not likely to adversely affect (LAA) - May affect, likely to adversely affect

Consultation History

The Non-Federal Land Conservation Division (NFLCD) requested concurrence with its determinations that the proposed Restoration Programs “may affect, but are not likely to adversely affect” the Canada lynx, Columbian white-tailed deer, marbled murrelet, western snowy plover (Pacific coast population), bald eagle, brown pelican, northern spotted owl, vernal pool fairy shrimp, Oregon silverspot butterfly, Willamette daisy, Gentner's fritillary, Water howellia, Western lily, large-flowered meadowfoam, Bradshaw's lomatium, Cook's lomatium, Kincaid’s lupine, MacFarlane's four o'clock, rough popcornflower, Nelson's checker-mallow, Spalding's catchfly, and Howell's spectacular thelypody and their designated critical habitat as identified in Table 1, and to initiate formal consultation for its “may affect, likely to adversely affect” determinations for the Oregon chub, Warner sucker, bull trout, and Fender’s blue butterfly, in accordance with section 7 of the Act.

A draft BA was initially provided to the Land and Water Development Division and NOAA Fisheries for review May 6, 2003. Informal comments were provided via electronic mail and verbally to Dan Perritt. Meetings were held internally with the Service and with NOAA Fisheries to discuss the proposed action in the draft BA. A final BA was submitted to the Assistant Project Leader, Endangered Species/Land and Water Development Program dated January 16, 2004.

The Service established the Partners for Fish and Wildlife Program in 1987 to provide technical and financial assistance to private landowners interested in restoring or otherwise improving native habitats for fish and wildlife. In Oregon, the Service prepared a programmatic BO November 16, 1998, (USDI FWS 1998a) for the Partners for Fish and Wildlife program. Partners for Fish and Wildlife program activities were consulted on for fiscal years 1998-2002. Activities under the Partners for Fish and Wildlife Program which did not fit the programmatic BO were consulted on individually.

The Coastal Program is a national program which was expanded to Oregon in spring 2002. It is a non-regulatory program that relies on voluntary partnerships. All projects funded under the initial year were reviewed for environmental compliance individually, including section 7 consultation. This BA and BO are the first programmatic consultations for the Coastal Program in Oregon.

The Service's Jobs-In-The-Woods Program was established under the Northwest Economic Adjustment Initiative in 1994 as part of the Northwest Forest Plan. In Oregon, the Service previously consulted programmatically on the Jobs-In-Woods-Program and a BO was completed June 20, 1997. The Programmatic JITW consultation covered projects using FY 96 funds, as well as projects funded in through FY 98. The consultation also stated that the opinion may be amended to include all additional fiscal years in which the JITW Program is funded, as long as the program objectives and goals remain unchanged.

The Greenspaces Program is a congressionally allocated program administered through a partnership between Portland Metro and the Service. Projects funded through the program go to restoration, environmental education, urban ecological studies, and projects designed to reduce the effects of urbanization in the greater Portland metropolitan area. The Greenspaces Program to date has consulted individually on projects. This is the first programmatic consultation for the Greenspaces Program.

The Service's Private Land Stewardship Grants Program is a congressionally established program begun in 2002 with funding from the Land and Water Conservation Fund. The program provides grants and other assistance on a competitive basis to the individuals and groups engaged in local, private, and voluntary conservation efforts that benefit Federal listed, proposed, or candidate species or other at risk species.

This biological opinion is based on information provided in the Coastal, Greenspaces, Jobs in the Woods, and Partners for Fish and Wildlife Programmatic BA (FWS 2003) and supporting reference information; numerous discussions between NFLCD, Service consultation biologists and species experts and NOAA Fisheries personnel, and file information and reference material located at the OFWO. A complete administrative record of this consultation is on file at the OFWO.

BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

The similarity of activities under the Service's Restoration Programs allow for the categorization of these activities under the following eight project categories: (**I**) riparian habitat restoration, (**II**) wetland habitat restoration, (**III**) instream habitat restoration, (**IV**) fish passage improvements, (**V**) upland habitat restoration, (**VI**) coastal and estuarine habitat restoration, (**VII**) road and trail improvements, and (**VIII**) surveys, assessments, and monitoring activities. Actions under each of the project categories are described below. Appendix B provides detailed information on project design standards that will be implemented during the completion of the various restoration activities. The acquisition and use of restoration materials is addressed at the end of the chapter.

The work area for an activity under any project category that may directly or indirectly affect surface water may require the temporary isolation of the area by one or more of the following techniques. These techniques will minimize or eliminate a potential increase in the turbidity of the water source adjacent to the work area. Sediments trapped behind the structure(s) will be removed and the work area will be stabilized before the water source is allowed to re-enter the area.

- Installation of sandbags, straw bales, water bladder, temporary coffer dams or other similar structure.
- Construction of a plastic lined channel adjacent to the work area to by-pass water flows.
- Installation of a metal or plastic culvert to by-pass water flows.
- Pumping the water source around the work area through an appropriately screened intake and discharging it through low velocity output diffuser.

Project Category I - Riparian Habitat Restoration
Activities in this project category will primarily focus on restoring the plant species composition and structural diversity of native riparian plant communities, natural floodplain hydrology, and water quality. Specific restoration activities will consist of the following:

Installation of livestock fencing - Installation of livestock fencing will minimize or eliminate livestock degradation of stream banks and riparian areas. Woody and herbaceous vegetation greater than six inches in height will be manually or mechanically removed along a new fence line. The habitat affected will be limited to the area along a fence line for a width of 25 feet or less. Wooden support poles (four to six inches in diameter) will be either pounded into the ground with heavy equipment[1] or placed in holes dug by hand or with mechanical augers. Metal "T" support posts will be pounded into the ground by hand. Fences will be strung with New Zealand style smooth wire, barbed wire, or a combination of the two wire types. Electric fencing will consist of smooth wire, polytape, or polywire. Perimeter and cross-pasture fencing may be installed to promote rotational grazing. Existing livestock fences may be repaired and/or extended using the same techniques and materials indicated above. An old fence line will be removed if a new fence is installed with a greater buffer width than the old fence.

Installation of livestock watering facilities - Installation of livestock watering facilities will minimize or eliminate the need for direct livestock access to stream channels. Watering facilities may consist of nose pumps, gravity-fed or electric pumping systems, off-channel ponds, and controlled access areas (*e.g.*, hardened ford crossings and water gaps). A water line (PVC or other plastic tubing) will be installed from each watering facility to the water source. This line

[1] "Heavy equipment" refers to farm tractors, excavators, backhoes, bulldozers, front-end loaders, scrapers, graders, compactors, cranes, trenchers, dump trucks, log trucks, and other similar types of construction equipment. Equipment will be supported on metal tracks or rubber tires.

will often be buried 12 to 24 inches below the ground. Heavy equipment will be used to excavate and backfill the trench. A screened foot valve (*i.e.*, water intake) may be installed at the end of a water line and placed in a stream channel, wetland, or off-channel pond, depending on available water sources and type of watering facility.

<u>Installation of livestock crossings</u> - Installation of livestock stream crossings (*e.g.,* culverts, bridges, and hardened ford crossings) will minimize or eliminate livestock degradation of stream banks and riparian areas. Livestock crossings (*e.g.,* culverts, bridges, and hardened ford crossings) will be constructed using culverts, flatbed railroad cars or semi-trailers, or other materials (*e.g.,* wood, steel and/or concrete for bridge construction). A crossing structure will be placed on earthen, rock, or concrete abutments and supported above the bankfull[2] elevation of a stream. A hardened ford crossing will consist of a rock armored area of the stream bank and channel. The stream bank may be graded and shaped to accommodate livestock and minimize erosion. The maximum width of a livestock crossing will be limited to eight feet for a hardened ford and ten feet for other crossing types. Fencing will be installed at crossings to limit livestock access to stream channels. Heavy equipment will be used to complete these activities.

<u>Breaching, removing, and constructing berms and dikes</u> - This restoration activity will allow more natural hydrologic flows to occur in riparian areas and may increase the width of channel migration zones. Existing berms and dikes will be breached or completely removed at specific locations. These activities will be designed not to cause the artificial entrapment[3] of fish and other aquatic species in adjacent areas. Constructed berms and dikes will be used to protect existing infrastructure from restoration activities that will be completed in the immediate project area. The height and width of constructed berms and dikes will depend on site specific conditions and the intent of the project. Heavy equipment will be used to complete these activities. Site preparations may involve the removal of vegetation on and around berms and dikes. Soil disturbances will be primarily limited to the areas where these structures will be altered or constructed. *(Note: Berms and dikes will not be constructed in riparian areas adjacent to fish bearing streams*[4] *that contain federally listed anadromous fish species without a site specific consultation from NOAA Fisheries. This also includes stream reaches that are one-half stream miles above anadromy.)*

<u>Installation of bio-engineered stream bank stabilization structures</u> - Installation of stream bank stabilization structures will minimize or eliminate sedimentation and erosion and improve water quality in adjacent streams. Natural materials (*e.g.,* native vegetation, boulders, and woody

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2 "Bankfull elevation" means the bank height inundated by a 1.5 to 2 year average recurrence interval and may be estimated by morphological features such average bank height, scour lines and vegetation limits.

3 "Artificial entrapment" refers to man-made habitat changes or structures (*e.g.,* isolated ditches, depressions, or other topographical changes) that would not allow the passive surface flow of water to return to a stream channel as water levels recede.

4 "Fish bearing streams" refer to perennial and ephemeral streams that are known to contain one or more native fish species. A stream is assumed "fish bearing" unless a presence/absence or other appropriate survey has been completed to prove otherwise.

debris) will be used to redirect flows in stream channels to minimize stream bank erosion. Structures (*e.g.*, rock barbs, tree revetments, and fascines) will be placed and anchored within the toe and bank areas of stream channels. Similar materials and/or structures may be placed in adjacent floodplains to redirect flows across these areas. Stream banks may also be reshaped or graded and planted with native vegetation to stabilize them. Heavy equipment will be used to complete these activities.

Installation of wildlife habitat structures - Installation of wildlife habitat structures will increase cover, shelter, and nesting habitats for a variety of wildlife species in riparian areas. Various structures will be installed or constructed to enhance habitats for wildlife. These structures may include bat roosting/breeding structures, avian nest boxes and platforms, turtle basking logs, conifer/hardwood snags, and brush piles.

Planting native riparian plant species - Native vegetation will be planted to increase the composition and abundance of riparian plant communities. Native vegetation to be planted will include conifers and hardwood trees, forbs, shrubs, and grasses, and any other vegetation that would have naturally occurred at a project site. Vegetation will be planted by hand, mechanical planters, or broadcasted with hand or mechanical spreaders (*e.g.*, no till seed drill and hydro-seeding with vehicle mounted pressurized equipment). Cottonwood (*Populus spp.*), willows (*Salix spp.*) and other tree species able to propagate readily from cuttings may be bundled and buried into shallow, narrow trenches along stream banks to promote a greater abundance of seedling sprouts. Heavy equipment may be used to excavate and backfill the trenches.

Silvicultural treatments - Silvicultural treatments in riparian areas will be limited to juniper tree removal to improve native vegetative diversity and minimize fuel loading for wildfire control. Selected juniper trees will be removed by pulling smaller trees (*i.e.*, eight inches in diameter or less) from the ground, pushing over larger trees with heavy equipment, and cutting trees with chainsaws. Trees that are removed may be used in soil bio-engineered stabilization and fish habitat structures, remain on-site for nutrient recycling, piled and burned on-site, or transported to appropriate upland disposal sites. Burn sites will not be located in riparian areas[5] and must be at least 100 feet away from perennial and ephemeral stream channels. *(Note: Other types of silvicultural treatments in riparian areas will not be completed without a site specific consultation from NOAA Fisheries, if project sites are adjacent to fish bearing streams that contain federally listed anadromous fish species, and/or the Service, if project sites are adjacent to fish bearing streams that contain non anadromous listed aquatic species. This also includes stream reaches that are one-half stream miles above areas that contain a listed species.)*

Control and removal of invasive/non native plant species - Control and removal of invasive and non native vegetation (*i.e.*, woody and herbaceous species) will improve the composition and abundance of native riparian plant communities. Invasive and non native plant species,

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[5] "Riparian areas" are defined as two site potential tree heights (of native, site potential vegetation) located from the channel migration zone (defined as the area defined by the lateral extent of likely movement along a stream reach as shown by evidence of active stream channel movement over the past 100 years, *e.g.*, alluvial fans or floodplains formed where the channel gradient decreases, the valley abruptly widens, or at the confluence of larger streams).

including aquatic and terrestrial species, will be controlled or removed by manual, mechanical, and biological methods:

- Manual - hand pulling and grubbing with hand tools or cutting and bagging seed heads. Hand-operated power tools, such as chain saws, may also be used.
- Mechanical - excavating, mowing, tilling, discing, plowing, stump grinding, or competitive seedbed preparation.
- Biological - grazing by cattle, sheep and/or goats. The purpose of this method is not complete removal, but to minimize target plant species to a negligible status.

Heavy equipment may be used to gather and pile plant materials. These materials may be chipped or burned on-site, or transported to appropriate upland disposal sites. Determining which method(s) to use for controlling or removing unwanted plant materials (including timing and frequency of use) will be based on, but not limited to, the following factors:

- Physical growth characteristics of target plant species (*i.e.*, rhizomatous vs. tap-rooted, etc.)
- Seed longevity and germination
- Infestation size
- Relationship of the project site to other infestations
- Relationship of the project site to listed and/or proposed species
- Distances to surface waters
- Accessibility for equipment and project personnel
- Use of the area by people (*e.g.*, for recreation, farming, or ranching)
- Effectiveness of treatment on the target plant species
- Overall cost

Due to these various factors, one or more treatment methods may be required in a given area for several years after an initial treatment. Prescribed burns will not be conducted in riparian areas and must be at least 100 feet away from the edge of perennial and ephemeral stream channels.

Stormwater management - Stormwater management activities will help to improve water quality and closely mimic natural hydrology and runoff patterns. Activities will include creating or improving bioswales, removing impervious surfaces and replacing them with pervious surfaces, installing rooftop gardens on built structures, installing street tree wells, naturescaping, removing curbs, disconnecting downspouts, and regrading sites to de-channelize/spread flows and dissipate hydrologic energy. These activities will typically occur in urbanized areas and will de designed not to cause the artificial entrapment of fish and other aquatic species in adjacent areas. Heavy equipment may be used to complete these activities.

Project Category II - Wetland Habitat Restoration
Activities in this project category will primarily focus on restoring the composition and structural diversity of native wetland plant communities, natural wetland hydrology, and wetland functions. Marine, estuarine, riverine, lacustrine, and palustrine wetlands are included in this category. Specific restoration activities will consist of the following:

Installation of livestock fencing - Installation of livestock fencing will minimize or eliminate livestock degradation of wetland areas. Same as described in Project Category I - Riparian Habitat Restoration.

Installation of livestock watering facilities - Installation of livestock watering facilities will minimize or eliminate the need for direct livestock access to wetland areas. Same as described in Project Category I - Riparian Habitat Restoration, except for the following action. A natural spring (wetland) used as water source will be protected from livestock degradation by fencing off the perimeter of the spring and developing a low impact water withdraw system.

Installation of livestock crossings - Installation of livestock stream crossings will minimize or eliminate livestock degradation of wetland areas. Same as described in Project Category I - Riparian Habitat Restoration. Substitute wetland for stream in the description.

Breaching, removing, and constructing berms and dikes - The restoration activity will allow more natural hydrologic flows to occur in wetland habitats. Same as described in Project Category I - Riparian Habitat Restoration. *(Note: Berms and dikes will not be constructed along wetland areas adjacent to fish bearing streams that contain federally listed anadromous fish species without a site specific consultation from NOAA Fisheries. This also includes wetland areas that are one-half stream miles above anadromy.)*

Converting former wetlands and restoring current wetlands - Wetland restoration activities will off-set wetland losses and improve their functions for fish, wildlife, and plants. Wetlands activities may involve the excavation and removal of fill materials, installation of water control structures, backfilling or plugging drainage ditches and tiles, and grading the land to restore former shallow and deep water wetland habitats. These activities will be designed to not cause the artificial entrapment of fish and other aquatic species in adjacent areas. Heavy equipment will be used to complete these activities.

Installation of wildlife habitat structures - Installation of wildlife habitat structures will increase the cover, shelter, and nesting habitat availability for a variety of wildlife species in wetland areas. Same as described in Project Category I - Riparian Habitat Restoration.

Planting native wetland plant species - Native wetland vegetation will be planted to increase the diversity and abundance of existing wetland plant communities. Vegetation to be planted will include conifers and hardwood trees, shrubs, and grasses, sedges, rushes, and any other vegetation that would have naturally occurred at the project site. Planting will be done by manual labor, seed drilling, tilling, installation of vegetated mats, or other appropriate planting techniques.

Control and removal of invasive/non native plant species - Control and removal of invasive and non native vegetation will promote the composition and abundance of native wetland plant communities. Same as described in Project Category I - Riparian Habitat Restoration, except for the following action. Prescribed burn areas will not be located in wetland areas and must be at least 100 feet away from the edge of perennial and ephemeral stream channels.

Project Category III - Instream Habitat Restoration

Activities in this project category will primarily focus on improving instream diversity and complexity and natural stream hydrology for fish and other aquatic species. Specific restoration activities will consist of the following:

Installation of wood and boulder instream structures - Installation of structures will improve spawning and rearing habitats for fish and other aquatic species. Installations will consist of weirs, revetments, log jams, and other cover structures designed with large woody debris and/or boulders. Large woody debris includes whole conifer and hardwood trees, logs, and rootwads. Structures will be either non-affixed or affixed[6] depending on the site location and project objectives. Structures may partially or completely span stream channels or be positioned along the stream banks. Sizing requirements for wood and boulder materials will depend on bankfull widths and stream discharge rates, and the local availability of these materials. Heavy equipment and helicopters will be used to complete these activities.

Hydrologic modifications of natural alcoves and side channels - Improvements to natural alcoves and side channels will promote off-channel habitats and refuge areas for fish and other aquatic species. Natural alcoves and side channels will be modified by improving stream flows through these areas. Instream structures will be installed, as necessary, to redirect stream flows and provide habitats for aquatic species. These activities will be designed not to cause the artificial entrapment of fish and other aquatic species. Heavy equipment will be used to complete these activities. *(Note: Alcoves and side channels adjacent to fish bearing streams that contain federally listed anadromous fish species will not be enhanced without a site specific consultation from NOAA Fisheries. This also includes stream reaches that are one-half stream miles above anadromy.)*

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[6] Instream structures that are firmly buried or cabled in a stream channel or bank.

Re-channeling of streams into their historic locations - The re-channelization of streams will restore or enhance their historic form and function that were lost as a result of past artificial channel modifications. Re-channelization activities will include grading and shaping of new channels to obtain natural meander patterns, depth/width ratios, pool/riffle ratios, and substrate composition. Existing stream channels may be backfilled to disconnect them from the new channel. Existing stream flows may also be directed into old channels if they are discernable instead of creating new historic channels. Heavy equipment will be used to complete these activities. *(Note: Re-channelization projects adjacent to fish bearing streams that contain federally listed anadromous fish species will not be completed without a site specific consultation from NOAA Fisheries. This also includes stream reaches that are one-half stream miles above anadromy.)*

Salmon carcass placements - Salmon carcass placements will help to mimic stream enrichment and nutrient recycling. Carcasses will be obtained from State fish hatcheries. They will be placed along and in streams by hand. This activity will be directly or indirectly supervised by a fisheries biologist from the Oregon Department of Fish and Wildlife.

Project Category IV - Fish Passage Improvements

Activities in this project category will primarily focus on improving and restoring fish passage through artificial stream structures to allow fish and other aquatic species access to former spawning and rearing habitats. Specific restoration activities will consist of the following:

Installation and modification of artificial fishways[7] - Installations or modifications of fishways will provide fish passage to habitats beyond man-made barriers (*e.g.*, dams and spillways). Artificial fishways will generally consist of a flume with baffles or a series of stepped pools that slow water velocities and provide adequate water depths to allow fish passage. Examples of fishways include vertical slot fishways, Denil ladders, and Alaskan steep passes. Modifications to fishways may include deepening plunge pools, redirecting water flows to provide proper water levels and flow velocities, installing debris deflectors, providing adequate resting areas inside fishways, maintaining appropriate entrance flows to attract fish, and installing finger traps at the crest of weirs to restrict fish access. Heavy equipment will be used to complete these activities. *(Note: Artificial fishway projects adjacent to fish bearing streams that contain federally listed anadromous fish species will not be completed without a site specific consultation from NOAA Fisheries. This also includes stream reaches that are one-half stream miles above anadromy.)*

Re-engineering of existing irrigation diversions - The re-engineering of irrigation diversions will result in more efficient irrigation systems that will conserve water and improve fish passage and

[7] "Artificial fishway" is defined as any non-culvert related fish passage structure constructed within a stream channel to aid in the passage of juvenile and/or adult fish or other aquatic species. This includes stand alone fishways and those incorporated into approved irrigation diversions. The structure must also be a semipermanent or permanent installation and constructed of wood, rock, concrete, and/or metal. Simple boulder-step pool weirs are not defined as an artificial fishway if they are designed and constructed to meet NOAA Fisheries' fish passage criteria and Oregon Road/Stream Crossing Restoration Guide (Robison *et al.* 1999). A closed or open by-pass fish conveyance (*e.g.*, piped or ditched system) installed within an irrigation diversion is not defined as an artificial fishway if fish are returned to the original stream a short distance downstream of the diversion.

water quality. Designs for irrigation diversions described below will be reviewed and approved by NOAA Fisheries' Engineering staff and the Service before initiating project activities. This includes designs for headgates, headgate/sluice gate combinations, screening, fish passage, diversion dams/structures, and water delivery systems (*i.e.,* open ditch or closed pipe systems). Irrigation diversions may include infiltration galleries, cross vanes, "W" weirs, "A" frame weirs, central pumping stations, and individual pump intakes. Multiple diversions may be consolidated into one permanent diversion or pumping station. Abandoned open ditches and other similar structures will be plugged or backfilled, as appropriate, to prevent fish from swimming or being entrained into them. Heavy equipment will be used to complete these activities. *(Note: Infiltration galleries and lay-flat stanchions will not be constructed in streams that contain federally listed anadromous fish species without a site specific consultation from NOAA Fisheries. This also includes stream reaches that are one-half stream miles above anadromy.)*

<u>External and internal modifications to roadway culverts</u> - The modification of roadway culverts will improve fish passage at road-stream crossings. Culvert modifications may include the installation of internal baffles to redirect or reduce flow velocities and the construction of boulder-step pool weirs to backwater a culvert outlet. Heavy equipment will be used to complete these activities.

<u>Realignment of roadway culverts to stream flows</u> - Realigning culverts to current stream flows will improve fish passage at road-stream crossings and increase protection to streambanks and roadway fills. Misaligned culverts will be excavated and repositioned at the existing road-stream crossing. The existing culvert must be adequately sized for the stream and in good condition to be reinstalled. All culvert installations will be in compliance with NOAA Fisheries' fish passage criteria and Oregon Road/Stream Crossing Restoration Guide. Heavy equipment will be used to complete these activities.

<u>Replacement of undersized roadway culverts with appropriately sized culverts</u> - Replacement of undersized culverts will improve fish passage at road-stream crossings. Culverts determined to be undersized, with respect to current stream conditions, will be replaced with appropriately sized culverts. The existing culvert will be excavated and the stream channel prepared for the installation of the new culvert. All culvert installations will be in compliance with NOAA Fisheries' fish passage criteria and Oregon Road/Stream Crossing Restoration Guide. Grade control structures (*e.g.,* log or boulder weirs) may be constructed upstream and downstream of a culvert within the stream channel to control potential stream channel incision (Castro 2003). The stream channel, up to linear distance of 50 feet upstream or downstream of a culvert, may be altered (*e.g.,* graded, armored, or realigned parallel to the culvert) to allow for improved stream flow into and out of the culvert. This action will provide increased erosion protection to the road-stream crossing and reduce turbulent flows inside the culvert for improved fish passage. Heavy equipment will be used to complete these activities. *(Note: A culvert installation requiring the alteration of a stream channel at a linear distance greater than 50 feet upstream or downstream of a culvert on a fish bearing stream that contain federally listed anadromous fish species will not be completed without a site specific consultation from NOAA Fisheries. This also includes stream reaches that are one-half stream miles above anadromy.)*

Replacement of roadway culverts with bridges - Replacement of culverts with bridges will allow unobstructed fish passage at road-stream crossings. A road-stream crossing determined to be inappropriate for a culvert installation, based on current steam conditions, will be redesigned for a full spanning bridge. Bridges will be constructed from wood, steel, and/or reinforced concrete or flatbed railroad cars. Concrete abutments will be constructed above the bankfull elevation of the stream to support and anchor bridge structures. Grade control structures (*e.g.,* log or boulder weirs) may be constructed upstream and downstream of a bridge within the stream channel to control potential stream channel incision (Castro 2003). Bridge designs will incorporate necessary elements to allow for wildlife movement over or under bridges whenever possible.

Permanent removal of roadway culverts, tide gates, and other artificial fish passage barriers - Permanent removal of culverts, tide gates, and other fish passage barriers will allow unobstructed fish passage at the stream crossing. Culverts, tide gates, and other fish passage barriers (*e.g.,* irrigation dams, water control structures, and old bridge abutments) will be excavated and removed from stream locations. Stream banks will be graded and shaped, as necessary, to minimize or eliminate erosion. Stream channels may also be graded or streambed deposition partially removed to control potential steam channel incision. Permanent culvert removals will primarily be associated with road and trail abandonment and decommissioning projects.

Project Category V - Upland Habitat Restoration

Activities in this project category will primarily focus on restoring the composition and structural diversity of native upland plant communities. Specific restoration activities will consist of the following:

Installation of livestock fencing - Installation of livestock fencing will minimize or eliminate livestock degradation of upland habitats. Same as described in Project Category I - Riparian Habitat Restoration.

Installation of livestock watering facilities - Installation of livestock watering facilities will minimize or eliminate the need for direct livestock access to aquatic habitats. Same as described in Project Category I - Riparian Habitat Restoration.

Installation of bio-engineered stabilization structures - Installation of stabilization structures will minimize or eliminate erosion at site specific locations. These installations will improve the water quality in downslope aquatic habitats. Natural materials (*e.g.,* vegetation, boulders, and woody debris) will be installed to control erosion on unstable slopes and areas developing rills and gullies. Heavy equipment will be used to complete these activities.

Installation of wildlife habitat structures - Installation of wildlife habitat structures will increase the cover, shelter, and nesting habitat availability for a variety of wildlife species in upland areas. Same as described in Project Category I - Riparian Habitat Restoration.

Planting native upland plant species - Native upland vegetation will be planted to increase the diversity and abundance of existing upland plant communities. Native vegetation to be planted will include conifers and hardwood trees, shrubs, and grasses, and any other vegetation that would have naturally occurred at a project site. Vegetation will be planted by hand, mechanical planters, or broadcasted with hand or mechanical spreaders (*e.g.*, no till seed drill and hydro-seeding with vehicle mounted pressurized equipment). Heavy equipment may be used to complete these activities.

Conversion of altered habitats to historic oak savannahs, short and tall grass prairies, or conifer/hardwood forests - Habitat conversions will restore or enhance human-altered habitats to more closely mimic historic habitats. Many of these habitats have been converted in the past for timber, ranching, farming, and industrial/commercial purposes. Non historic vegetation will be removed and replaced in these habitats with historic vegetative species. Planting will be done by manual labor, seed drilling, tilling, or other appropriate planting techniques. Invasive and non native vegetation will be controlled or removed by manual, mechanical, biological methods and prescribed burns.

Silvicultural treatments - Silvicultural treatments in upland areas will improve forest health and reduce fuel loading for wildfire control. Silvicultural treatments will include:

- removing or girdling dominate hardwood or conifer trees.
- removing understory vegetation to release existing hardwood or conifers trees.
- pre-commercial thinning timber stands to reduce hardwood or conifer stocking rates.
- replanting hardwood or conifer seedlings to establish or reestablish timber stands.
- removing ground fuels to reduce fuel loading.

Silvicultural treatments will occur in upland areas based on the following criteria:Treatments will occur in occupied and suitable unsurveyed habitats for federally listed terrestrial species if they do not remove or degrade these habitats.

- Treatments will occur in areas that are at least 500 feet (i.e., measured as a straight line distance from the nearest edge of the timber stand to the stream channel) from a fish bearing stream that contains federally listed aquatic species. The stand must also be on a slope of less then twenty percent to the stream channel.

- Treatments may occur in areas that are at least 250 feet or two site potential tree heights away (*i.e.,* whichever is greater) away from a fish bearing stream that does not contain federally listed fish species. The stand must also be on a slope of less then twenty percent to the stream channel.

- Treatments may occur in areas that are at least 125 feet or two site potential tree heights (*i.e.,* which ever is greater) away from a non-fish bearing stream. The stand must also be on a slope of less then twenty percent to the stream channel.

- If the status of a stream (*i.e.,* whether it contains federally listed species) is unknown, then silvicultural treatments in upland areas must adhere to requirements for a fish bearing stream that contains federally listed aquatic species.

Conifer and hardwood trees felled in forest stands may be removed from the stand, remain on-site for nutrient recycling, or used for other habitat restoration activities (*e.g.,* materials for instream structures). Heavy equipment may be used to complete these activities. *(Note: Silvicultural treatments in upland areas that do not meet the criteria above will not be completed without a site specific consultation from NOAA Fisheries and/or the Service.)*

<u>Control and removal of invasive/non native plant species</u> - Control and removal of invasive and non native vegetation will promote the composition and abundance of native upland plant communities. Same as described in Project Category I - Riparian Habitat Restoration, except for the following action. Prescribed burns will occur in upland areas for control and removal of invasive and non native vegetation. These burns will be used as a site-preparation tool rather than for strict control purposes. Burns will not occur in riparian and wetland areas and will be at least 100 feet away from the edge of perennial and ephemeral stream channels.

<u>Stormwater management</u> - Same as described in Project Category I - Riparian Habitat Restoration.

Project Category VI - Coastal and Estuarine Habitat Restoration
Activities in this project category will primarily focus on restoring the natural diversity and complexity of coastal dune and estuarine habitats. Activities under Wetland Habitat Restoration will also apply in these habitats. Specific restoration activities will consist of the following:

<u>Installation of wood and boulder structures</u> - Installation of structures will increase the complexity and diversity of estuarine habitats and provide spawning and rearing habitats for fish and other aquatic species. Same as described in Project Category III - Instream Habitat Restoration, except for the following action. Structures will be placed in estuaries and streams that drain into them.

Reestablishment of natural coastal dune processes - The reestablishment of coastal dune processes will restore nesting habitat for the western snowy plover. Sand dunes being stabilized by European beach grass (*Ammophila arenaria*) will be bulldozed to remove the grass biomass and lower the elevation of the dunes. Existing drift wood in the project areas will be piled at the high tide mark (*i.e.,* to be removed from the areas under tidal action). Dunes will be lowered to an elevation where ocean tides can complete a wash over of the area to maintain an open beach habitat. Followup activities may need to continue for one to two years after the initial treatment to get the area to be self-maintaining.

Planting native coastal/estuarine plant species - Native coastal and estuarine vegetation will be planted to increase the diversity and abundance of existing plant communities. Same as described in Project Categories I and II - Riparian and Wetland Habitat Restoration.

Installation of wildlife habitat structures - Installation of wildlife habitat structures will increase the cover, shelter, and nesting habitat availability for a variety of wildlife species in coastal and estuarine areas. Same as described in Project Category I - Riparian Habitat Restoration.

Control and removal of invasive/non native plant species - Control and removal of invasive/non native vegetation will promote the composition and abundance of native coastal and estuarine plant communities. Same as described in Project Category I - Riparian Habitat Restoration, except for the following action. Prescribed burns will not occur in riparian and wetland areas and will be at least 100 feet away from the edge of perennial and ephemeral stream channels.

Project Category VII - Road and Trail Improvements

Activities in this project category will primarily focus on sedimentation reduction and erosion control from roads and trails in riparian, wetland, and upland areas. Specific restoration activities will consist of the following:

Closure of roads and trails - This activity will restrict motorized vehicle access on a road or trail by installing a temporary or permanent gate or other type of barrier. Barriers may include large wood, boulders, or ditches dug perpendicular to the road.

Abandonment of roads and trails - This activity will eliminate pedestrian, bike, or motorized vehicle access on a road or trail. Activities will include installing a temporary or permanent gate or other type of barrier, drainage improvements, revegetation, and soil stabilization to prevent sedimentation and erosion.

Decommissioning of roads and trails - This activity will return a road or trail to natural conditions before its construction. Activities will include installing a permanent gate or other type of barrier, removing cross-drainage and stream culverts, contour shaping of the road or trail base, soil stabilization, and tilling compacted surfaces to reestablish native vegetation.

Improvements on roads and trails - This activity will include installing or upgrading road and trail structures (*e.g.,* cross-drainage culverts, water bars, and water dips), road prism shaping, revegetation of fill and cut slopes, removal and stabilization of sidecast materials, and grading or resurfacing roads and trails with gravel, bark chips, or other appropriate materials.

Project Category VIII - Surveys, Assessments, and Monitoring Activities
Activities in this project category will primarily focus on the collection of physical, chemical, and biological information. For activities related to specific restoration projects, the information will be used to develop an adaptive management approach for future restoration activities under Project Categories I-VII. Other field work will be conducted to gather data for habitat conservation efforts and to increase public outreach and education through field studies and observations. Specific activities will consist of the following:

<u>Physical data collection</u> -

- Stream channel morphology.
- Road inventories addressing road conditions and sedimentation concerns.
- Fish passage assessments on road-stream crossings.
- Monitoring the retention of instream structures.
- Water quality monitoring.
- General visual observations and site assessments.

<u>Biological data collection</u> -

- Macroinvertebrate surveys.
- Aquatic surveys, including spawning and juvenile fish surveys.
- Surveys for the presence, abundance, distribution, and composition of flora and fauna.
- Monitoring plant survival and growth.
- General visual observations and site assessments.

<u>Acquisition of Restoration Materials</u>
Although the Service does not have complete control over restoration material acquisition, appropriate steps will be taken to ensure that acquired materials will not affect federally listed species. Steps to be taken include the implementation of Project Standards (Appendix B), written terms and conditions on official project authorizations issued to project cooperators, and follow-up monitoring by the Service personnel during and after construction activities.

Large Wood - Large wood[8] used in restoration activities will be either donated, purchased, or salvaged. Whole trees, logs, and rootwads will be obtained from, but not limited to, local lumber mills, approved silvicultural operations on Federal, State, Tribal, and private lands, roadway projects, and urban development sites. Riparian timber stands will not be harvested to supply large wood to complete a restoration activity. A limited number of appropriately sized (*i.e.*, length and diameter) conifer trees in upland habitats (*e.g.*, ten conifer trees/stream or road mile) may be harvested and incorporated as key structural components in restoration activities. Harvesting of upland conifer trees may occur in habitats where federally listed species may be present; however, these trees will not be harvested if they will remove or degrade occupied or suitable habitats. Down coarse woody debris[9] in riparian and upland habitats may also be incorporated into a restoration activity. However, this material will remain at or near its original location to maintain the natural (or current) characteristics of the local area. Large wood will be obtained during appropriate seasonal periods to minimize or eliminate soil disturbance and compaction.

Boulders - Boulder and other rock materials will be obtained outside of aquatic habitats. Boulders used in restoration activities will be donated, purchased, or salvaged from non-streambed sources (*i.e.*, primarily from established upland quarries on Federal, State, and private lands). Boulders used in aquatic restoration activities will be appropriately sized (*i.e.*, diameter and weight) and of durable composition to meet the intent of an activity and habitat needs for aquatic species. To meet this intent, boulder composition may be different from the native composition at a project site. Boulder composition refers to the formation, mineral makeup, and hardness on the rock material. Boulders will be obtained during appropriate seasonal periods to minimize or eliminate soil disturbance and compaction.

Native Plant Materials - Native vegetation to be planted or seeded will be primarily obtained from Federal, State, local (*e.g.*, City of Portland), and private suppliers and nurseries. However, local native plant species may be collected and transplanted at project sites, depending on their availability from established suppliers and nurseries. Plants purchased from suppliers and nurseries will be selected, as appropriate, for the environmental conditions (*e.g.*, light, hydrology, elevation, and range) present at a project site. Plants may also be salvaged from areas where soil disturbance will be occurring and replanted on the same project site following the completion of construction activities. Tree and shrub species that can be propagated from cuttings (*e.g.*, willows and cottonwoods) may be obtained from local natural stands. The number and type of cuttings collected from a stand will not affect the stand from continuing to provide benefits to the local watershed.

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8 "Large wood" means a tree, log, or rootwad big enough to dissipate stream energy associated with high flows, capture bedload, stabilize streambanks, influence channel characteristics, and otherwise support aquatic habitat function, given the slope and bankfull channel width of the stream in which the wood occurs. See Oregon Department of Forestry and Oregon Department of Fish and Wildlife, *A Guide to Placing Large Wood in Streams*, May 1995 (http://www.nwr.noaa.gov/1salmon/salmesa/4ddocs/lrgwood.pdf).

9 "Coarse woody debris" consists of snags, fallen logs, wind blown trees, and large branches.

Pressure Treated Wood Products - Pressured treated wood products[10] containing water or oil-borne preservatives may be incorporated into restoration activities under appropriate project categories. However, these wood products will not be placed in areas where they will be in constant contact with standing or moving water or placed over water where they will be exposed to mechanical abrasion or leachate may enter aquatic habitats. These products will typically be used for livestock fence installations (*e.g.,* fence support poles). Treated wood products will be required to have been manufactured using American Wood-Preservers Association best management practices to ensure proper preservative application and drying of the wood product before use. Wood products of unknown origin or method of treatment will not be used in a restoration activity under any project category. Subject to the above conditions, natural decay resistant wood (*e.g.,* cedar products), metal, concrete, rock, or plastic materials will be used in place of treated materials. *(Note: Use of pressure treated wood products that do not meet the criteria above will not be incorporated into any restoration activity without a site specific consultation from NOAA Fisheries and/or the Service, as appropriate.)*

Conservation Measures of the Proposed Action

Project Design Standards

Project Design Standards (Project Standards) include both general conditions and specific techniques and guidance that will be implemented as part of the proposed action to avoid or minimize adverse effects of project activities. Appendix B includes these standards as provided in the BA.

Project Design Criteria

Project Design Criteria (PDC) are specific conservation measures designed to minimize or eliminate the likelihood of adverse affects to federally listed species based on an individual species' life history. These PDC are separated by habitat and disturbance.

Habitat PDC are designed to avoid or minimize adverse affects which may result in harm to a listed species. "Harm" is defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavior patterns such as breeding, feeding, or sheltering. These criteria are also designed not to have an adverse affect on designated critical habitat and should provide beneficial effects to the constituent elements supporting critical habitat.

Disturbance PDC are designed to avoid or minimize disturbance of a listed species which may rise to the level of harassment. "Harassment" is defined by the Service as actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering.

[10] "Treated wood" means lumber, pilings, and other wood products preserved with alkaline copper quaternary (ACQ), ammoniacal copper arsenate (ACA), ammoniacal copper zinc arsenate (ACZA), copper naphthenate, chromated copper arsenate (CCA), pentachlorophenol, or creosote.

Mammals

Canada lynx

Habitat - Restoration activities[11] that reduce vegetative habitat and cover will not occur in snowshoe hare habitat. Snowshoe hare habitat is considered areas where live limb (*e.g.,* trees and shrubs) can be reached by hares at snow depth.

Disturbance - Restoration activities (*i.e.,* above local ambient noise and visual activity levels) will not occur within 0.25 miles of lynx denning habitat from May 1 to August 31.

Columbian white-tailed deer

Habitat - "Wildlife friendly" livestock fencing (e.g., USDI BLM 1989) will be constructed in areas where Columbia white-tailed deer occur.

Disturbance - Project personnel will be instructed to reduce vehicle speeds around project sites where Columbian white-tailed deer occur to avoid vehicle-deer collisions. Project personnel will also be instructed not to approach adults or fawns at any time. Restoration activities (*i.e.*, above local ambient noise and visual activity levels) will not occur in fawning areas from June 1 to July 15.

Birds

Marbled murrelet

Habitat - Restoration activities that remove or degrade suitable marbled murrelet habitat will not occur within murrelet zones 1 and 2 or zones A and B on the Siskiyou National Forest.

Disturbance - For project sites located within 500 feet of occupied or unsurveyed suitable habitat, restoration activities (*i.e.*, above local ambient noise and visual activity levels) will not occur during the critical nesting period from April 1 to August 5, and will only occur during daylight hours between two hours after sunrise to two hours before sunset from August 6 to September 15. Service standards being developed for harassment thresholds to murrelets are shown in Table 2. A greater disturbance threshold will be required on Service funded projects in order to be more conservative in potential murrelet disturbances.

Table 2. Harassment distance thresholds from various activities for marbled murrelets.

[11] "Restoration activities" includes all actions under Project Categories I-VIII, unless otherwise specified.

Type of Activity	Distance at which murrelets may flush or abort a feeding attempt
Use of an impact pile driver, jackhammer, or rock drill	300 feet
Use of a helicopter or single engine airplane	360 feet
Use of heavy equipment	300 feet
Use of chainsaws	300 feet
Visual activity	300 feet

Western snowy plover

Habitat - Restoration activities that remove or degrade suitable western snowy plover habitat will not occur. Ground disturbing activities on coastal dunes will occur during the fall and winter months before the critical nesting period (*i.e.*, March 15 to September 15).

Disturbance - Restoration activities under Project Categories I-VII will not occur within 0.25 miles of a known occupied beach during the critical nesting period. Project cooperators will coordinate with local plover monitoring biologists to identify occupied beaches. Project personnel must take appropriate measures not to attract potential avian or mammalian predators to project sites. These include eliminating human-introduced food sources, properly disposing of organic waste, and not planting vegetation that could be potential cover or perches for predators near suitable habitat. Survey, assessment, and monitoring activities (Project Category VIII) during the critical nesting period will only be conducted by qualified biologist(s) covered under a current 10(a)(1)(A) permit or other valid ESA coverage (*e.g.,* working as an agent of the state under Oregon Department of Fish and Wildlife's Cooperative Agreement).

Bald eagle

Habitat - Restoration activities that remove or degrade suitable bald eagle habitat will not occur.

Disturbance - The most recent bald eagle survey data from the Oregon Cooperative Fish and Wildlife Research Unit, Oregon State University, will be consulted to determine project proximity to known bald eagle nests. Restoration activities (*i.e.*, above local ambient noise and visual activity levels) will not occur within 0.25 miles (or 0.5 miles line-of-site) from an occupied nest during the critical nesting period from January 1 to September 1 or known winter roost areas from October 31 to April 30.

Brown pelican

Disturbance - Restoration activities (*i.e.*, above local ambient noise and visual activity levels) will not occur within 0.25 miles from a known brown pelican roost site.

Northern spotted owl

Habitat - Restoration activities that remove or degrade suitable northern spotted owl habitat will not occur.

Disturbance - For project sites located within 400 feet of occupied or unsurveyed suitable habitat, restoration activities (*i.e.*, above local ambient noise and visual activity levels) will not occur during the critical nesting period from March 1 to July 15, (or specific provincial critical nesting period), unless a qualified biologist confirms known owls are not nesting. Service standards being developed for disturbances to owls are shown in Table 3. A greater avoidance distance will be required on Service funded projects in order to be more conservative in potential owl disturbances.

Table 3. Harassment distance thresholds from various activities for northern spotted owls.

Type of Activity	Distance at which owls may flush or abort a feeding attempt
Use of an impact pile driver, jackhammer, or rock drill	180 feet
Use of a helicopter or single engine airplane	360 feet
Use of heavy equipment	105 feet
Use of chainsaws	195 feet

<u>Inland Fish</u>

Warner Sucker, Oregon Chub, and Bull Trout

Habitat - Aquatic restoration activities will follow the Oregon guidelines for the timing of in-water work for each affected stream reach, unless the Oregon Department of Fish and Wildlife approves an extension based on current year site specific conditions.

Disturbance - Survey, assessment, and monitoring activities (Project Category VIII) requiring the physical capture and handling of these species will only be conducted by qualified biologist(s) covered under a current section 10(a)(1)(A) permit or other valid ESA coverage.

<u>Invertebrates</u>

Vernal pool fairy shrimp

Habitat - For project sites located in or adjacent to a vernal pool, restoration activities will not disrupt the impermeable, sub-surface soil layer or cause the movement of soils that could be deposited into the vernal pool. Project personnel will avoid traveling through the wetted portions of a vernal pool.

Fenders blue butterfly

Habitat - Surveys will be conducted for Fender's blue butterfly during the mid-May to early July flight period on any project sites that support or may support Kincaid's, spur, or sickle-keeled lupine within the Willamette Valley.

<u>Mechanical</u> - Mechanical activities, occurring in occupied habitat, will be conducted when lupine and nectar plants have completed seed production and the butterflies are in diapause (*i.e.*, August 15 to February 28). Maintenance activities include: mowing, line trimming, grubbing, girdling trees, and chain saw removal of woody species. No more than 75 percent of the occupied habitat at any given site will be mowed. Untreated strips of occupied habitat, approximately twelve meters wide, will be evenly distributed throughout the mowed portions of a site. The center of a mowed area will be within 100 meters of untreated occupied habitat, which can serve as a recolonization source. Mowers will be set at a height so that the blades gouge no more than five percent of the ground.

Early spring mowing (*i.e.*, March 1 to May 15) may be used for management purposes in unoccupied habitat. Mowers will be set at a height to avoid harming low-stature native plants and gouging the ground. Mowing will not occur during this time if Kincaid's lupine is present in the unoccupied habitat.

<u>Prescribed burns</u> - In the fall (*i.e.*, September 1 to November 30), prescribed burns may be performed to discourage woody plant growth, remove accumulated leaf litter and duff, and encourage the spread of native prairie grasses and forbs. The annual burn unit (ABU) will be determined based on the individual site conditions and population sizes.

The ABU for sites supporting 100 or more adult Fender's may be a maximum of one-third of the occupied habitat. The ABU for sites with less than 100 adult Fender's may be a maximum of one-quarter of the occupied habitat. The center of the ABU will be within 100 meters of unburned occupied habitat, which can serve as a recolonization source. Once burned, a unit will not be re-burned for at least three years, to allow butterfly populations to rebuild. The use of fire for habitat maintenance inherently increases the risk of accidentally impacting more habitat than originally intended. In order to ensure the maximum allowable ABU will not be exceeded, project cooperators will plan to burn approximately five percent less than the annual maximum.

In order to reduce the potential fuel load, the removal of large woody plants will occur prior to burning, when feasible. Ignition of burn areas will be by hand, using propane, fusees, or drip torches. Fire control/suppression will be accomplished with the use of pre-burn hose lays, wet-lining, or fire retardant foam. Vehicles would not be operated in the areas of listed species. Additionally, where patch size allows, butterfly refugia within burn units will be protected with a fire break and/or watering down prior to a burn.

When using controlled fire as a management technique, additional consideration of subsequent annual treatments for the ABU will be necessary. That is, the year following a burn, management of that unit will be limited to manual techniques and herbicide applications. Additionally, during a burn year, management activities will also be limited for adjacent units of the site. That is, mowing will not occur on a site that is scheduled to be burned, in order to limit the maximum affected area to approximately one-third of the site.

Disturbance - Survey, assessment, and monitoring activities (Project Category VIII) requiring the physical capture and handling of this species will only be conducted by qualified biologist(s) covered under a current 10(a)(1)(A) permit or other valid ESA coverage.

Oregon silverspot butterfly

Habitat - Surveys will be conducted for Oregon silverspot butterfly within its range during the late July to early September flight period on any project sites that support or may support the western blue violet. Manual, mechanical, and biological activities (see descriptions under control and removal of invasive/non native plant species: Project Category I - Riparian Habitat Restoration [Chapter 3]) will not occur in habitats that are occupied by the butterfly or contain the violet. These activities will only occur in areas outside of these identified habitats.

Disturbance - Survey, assessment, and monitoring activities (Project Category VIII) requiring the physical capture and handling of this species will only be conducted by qualified biologist(s) covered under a current 10(a)(1)(A) permit or other valid ESA coverage.

<u>Plants</u>

Habitat - Surveys will be conducted during the appropriate flowering period if a project site is known to be in a suitable habitat or soil type. Surveys will be conducted by a botanist or qualified biologist (*i.e.*, recognized by the Service with appropriate botanical expertise) following standardized protocol for the specific plant. Project cooperators will coordinate with a Service botanist or qualified biologist for all proposed project sites containing listed plant species. They will decide whether to proceed with a project or develop alternatives to the project to minimize or eliminate affects to the plants.
<u>Mechanical</u> - Project sites occupied by listed plants species may be mowed to control or removal woody vegetation or invasive or non native vegetation when listed plants are dormant and seeds have been dispersed. Mowing activities will require the use of low ground impact equipment. Mowers will be set at a height so that blades gouge no more

than five percent of the ground. All equipment will be cleaned of invasive and non native plant materials before entering an occupied site to prevent the dispersal of seeds or other reproductive plant parts.

Prescribed burns - Prescribed burns will not be conducted on project sites occupied by Willamette daisy, Gentner's fritillary, Water howellia, Western lily, Large-flowered meadowfoam, Cook's lomatium, Macfarlane's four o'clock, Rough popcornflower, Spalding's catchfly, and Howell's spectacular thelypody because relatively little is known about the effects of fire on them. If adequate information is gathered to support the use of prescribed burns to benefit these plant species, the Service consultation may be amended to include prescribed burns as a conservation and recovery technique.

Prescribed burns may be conducted on project sites occupied by Bradshaw's lomatium, Kincaid's lupine, and Nelson's checkermallow when these plants are dormant and seeds have been dispersed. Burns will be conducted for control and removal of invasive and non native plant species and to mimic natural fire regimes. Individual sites will not be burned more than once every two years.

A site specific consultation with the Service will be required for all activities involving the relocation or destruction of listed plant species. Survey, assessment, and monitoring activities (Project Category VIII) requiring the physical collection and handling of listed plant species will only be conducted by qualified botanist(s) or biologist(s) covered under a current 10(a)(1)(A) permit or other valid ESA coverage.

INFORMAL CONSULTATION

The Service concurs with the NFLCD's determinations of "may affect, is not likely to adversely affect" the Canada lynx, Columbian white-tailed deer, marbled murrelet, western snowy plover (Pacific coast population), bald eagle, brown pelican, northern spotted owl, vernal pool fairy shrimp, Oregon silverspot butterfly, Willamette daisy, Gentner's fritillary, Water howellia, Western lily, large-flowered meadowfoam, Bradshaw's lomatium, Cook's lomatium, Kincaid's lupine, MacFarlane's four o'clock, rough popcornflower, Nelson's checker-mallow, Spalding's catchfly, and Howell's spectacular thelypody and their designated critical habitat (Table 1) based on the following summarized information available to the Service and presented in the BA:

(1) because the goal of the Restoration Program is to restore native habitats to benefit native fish and wildlife species, including listed species, long-term adverse effects to listed species habitat are not anticipated; (2) by following the Project Standards listed in Appendix B, short-term impacts to riparian and upland habitats supporting the above listed species are limited to those that are insignificant, discountable or beneficial; (3) by following the PDCs, projects are unlikely to result in harassment to the listed bird and mammal species during critical nesting, fawning or denning periods; (4) surveys will be conducted for plants and invertebrates species in suitable habitat, other than Fender's blue butterfly, prior to project initiation and occupied habitat will be avoided; (5) no primary constituent elements of designated critical habitat for marbled murrelet, northern spotted owl, western snowy plover (Pacific coast population),or Oregon silverspot butterfly will be adversely effected by the proposed action; and (6) most of the proposed actions may affect, but are not likely to adversely affect, Kincaid's lupine. Mowing, burning, and other weed removal activities that occur after the plants have senesced for the season should not result in adverse impacts to Kincaid's lupine. The prevalence of lupine in sites historically disturbed by plowing indicates the species is resistant to disturbance.

FORMAL CONSULTATION

STATUS OF THE SPECIES

Warner sucker (*Catostomus warnerensis*)

<u>Background</u>
Detailed description of the Warner sucker taxonomy, ecology, and life history can be found in the final rule to designate the Warner sucker as threatened (USDI FWS 1985); the draft Recovery Plan for the Threatened and Rare native Fish of the Warner Basin and Alkali Subbasin (USDI FWS 1997); and the final rule designating critical habitat for the Warner sucker (USDI FWS 1985).

<u>Current and Historic Range</u>
The probable historic range of the Warner sucker includes the main Warner Lakes (Pelican, Crump, and Hart), and other accessible standing or flowing water in the Warner Valley, as well as the low to moderate gradient reaches of the tributaries which drain into the Valley. The tributaries include Deep Creek, up to the falls west of Adel, the Honey Creek drainage, and the Twentymile Creek drainage. In Twelvemile Creek, a tributary to Twentymile Creek, the historic range of the sucker extended through Nevada and back into Oregon, but probably not as high as the California reach of the stream.

Early collection records document the occurrence of the Warner sucker from Deep Creek up to the falls about 5 kilometers (3.1 miles) west of Adel, the sloughs south of Deep Creek, and Honey Creek (Snyder 1908). Andreasen (1975) reported that long-time residents of the Valley described large runs of suckers in the Honey Creek drainage, even far up into the canyon area.

Between 1977 and 1991, eight studies examined the range and distribution of the Warner sucker throughout the Warner Valley (Kobetich 1977, Swenson 1978, Coombs et al. 1979, Coombs and Bond 1980, Hayes 1980, White et al. 1990, Williams et al. 1990, White et al. 1991). These surveys have shown that when adequate water is present, Warner suckers may inhabit all the lakes, sloughs, and potholes in the Warner Valley. The documented range of the sucker extended as far north into the ephemeral lakes as Flagstaff Lake during high water in the early 1980's, and again in the 1990's (Allen et al. 1996). The sucker population of Hart Lake was intensively sampled to salvage individuals before the lake went dry in 1992.

Stream resident populations are found in Honey Creek, Snyder Creek, Twentymile Creek and Twelvemile Creek. Intermittent streams in the drainages may support small numbers of migratory suckers in high water years. No stream resident suckers have been found in Deep Creek since 1983 (Smith et al. 1984, Allen et al. 1994), although a lake resident female apparently trying to migrate to stream spawning habitats was captured and released in 1990 (White et al. 1990). The known upstream limit of the Warner sucker in Twelvemile Creek is through the Nevada reach and back into Oregon (Allen et al. 1994). However, the distribution appears to be discontinuous and centered around low gradient areas that form deep pools with protective cover. In the lower Twentymile Slough area on the east side of the Warner Valley, White et al. (1990) collected adult and young suckers throughout the slough and Greaser

Reservoir. This area dried up in 1991, but because of its marshy character, may be important sucker habitat during high flows. Larval, young-of-year (YOY), juvenile and adult suckers captured immediately below Greaser Dam suggest either a slough resident population, or lake resident suckers migrating up the Twentymile Slough channel from Crump Lake to spawn (White et al. 1990, Allen et al. 1996)

Habitat Relationships

Spawning Habitat

Spawning usually occurs in April and May in streams, although variations in water temperature and stream flows may result in either earlier or later spawning. Temperature and flow cues appear to trigger spawning, with most spawning taking place at 14-20 degrees Celsius (57-68 degrees Fahrenheit) when stream flows are relatively high. Suckers spawn in sand or gravel beds in slow pools (White et al. 1990, 1991, Kennedy and North 1993). Allen et al. (1996) surmise that spawning aggregations in Hart Lake are triggered more by rising stream temperatures than by peak discharge events in Honey Creek.

Tait and Mulkey (1993b) found YOY were abundant in the upper Honey Creek drainage, suggesting this area may be important spawning habitat and a source of recruitment for lake recolonization. The warm, constant temperatures of Source Springs at the headwaters of Snyder Creek (a tributary of Honey Creek) may provide an especially important rearing or spawning site (Coombs and Bond 1980).

In years when access to stream spawning areas is limited by low flow or by physical in-stream blockages (such as beaver dams or diversion structures), suckers may attempt to spawn on gravel beds along the lake shorelines. In 1990, suckers were observed digging nests in 40+ centimeters (16+ inches) of water on the east shore of Hart Lake at a time when access to Honey Creek was blocked by extremely low flows (White et al. 1990).

Larval and Juvenile Habitat

Larvae are found in shallow backwater pools or on stream margins where there is no current, often among or near macrophytes. YOY are often found over deep, still water from midwater to the surface, but also move into faster flowing areas near the heads of pools (Coombs et al. 1979).

Larvae venture near higher flows during the daytime to feed on planktonic organisms but avoid the mid-channel water current at night. This aversion to downstream drift may indicate that spawning habitat is also used as rearing grounds during the first few months of life (Kennedy and North 1993). None of the studies conducted thus far have succeeded in capturing suckers younger than 2 years old in the lakes, and it has been suggested that they do not migrate down from the streams for 2 to 3 years (Coombs et al. 1979). The absence of young suckers in the lakes, even in years following spawning in the lakes, could be due to predation by introduced fishes (White et al. 1991).

Juvenile suckers (1 to 2 years old) are usually found at the bottom of deep pools or in other habitats that are relatively cool and permanent such as near springs. As with adults, juveniles prefer areas of the streams which are protected from the main flow (Coombs et al. 1979). Larval and juvenile mortality over a 2-month period during the summer has been estimated at 98 percent and 89 percent, respectively, although accurate larval fish counts were hampered by dense macrophyte cover (Tait and Mulkey 1993b).

Adult Habitat
White et al. (1991) found in qualitative surveys that, in general, adult suckers used stretches of stream where the gradient was sufficiently low to allow the formation of long (166.6 feet (50 meters) or longer) pools. These pools tended to have: undercut banks; large beds of aquatic macrophytes (usually greater than 70 percent of substrate covered); root wads or boulders; a surface to bottom temperature differential of at least 2 degrees Celsius (at low flows); a maximum depth greater than 1.5 meters (5 feet); and overhanging vegetation (often *Salix* spp.). About 45 percent of these pools were beaver ponds, although there were many beaver ponds in which suckers were not observed. Suckers were also found in smaller or shallower pools or pools without some of the above mentioned features. However, they were only found in such places when a larger pool was within approximately 0.4 kilometer (0.25 mile) upstream or downstream of the site.

Submersed and floating vascular macrophytes are often a major component of sucker-inhabited pools, providing cover and harboring planktonic crustaceans which make up most of the YOY sucker diet. Rock substrates such as large gravel and boulders are important in providing surfaces for epilithic (living on the surface of stones, rocks, or pebbles) organisms upon which adult stream resident suckers feed, and finer gravels or sand are used for spawning. Siltation of sucker stream habitat increases the area of soft stream bed necessary for macrophyte growth, but embeds the rock substrates utilized by adult suckers for foraging and spawning. Embeddedness, or the degree to which hard substrates are covered with silt, has been negatively correlated with total sucker density (Tait and Mulkey 1993).

Habitat use by lake resident suckers appears to be similar to that of stream resident suckers in that adult suckers are generally found in the deepest available water where food is plentiful. Not surprisingly, this describes much of the habitat available in Hart, Crump, and Pelican Lakes, as well as the ephemeral lakes north of Hart Lake. Most of these lakes are shallow and of uniform depth (the deepest is Hart Lake at 3.4 meters (11.3 feet) maximum depth), and all have mud bottoms that provide the suckers with abundant food in the form of invertebrates, algae, and organic matter.

Population Dynamics
A population estimate of Warner suckers in streams was conducted in 1993 on the Honey Creek and Twentymile Creek drainages (Tait and Mulkey 1993b). Approximately 20 percent of available stream habitat in the Honey Creek drainage was sampled. The population sampled within Honey Creek was estimated at 77 adults, 172 juveniles, and 4,616 YOY. Approximately 60 percent of the available stream habitat in the Twentymile Creek drainage was also sampled. Estimates were 2,563 adults, 2,794 juveniles, and 4,435 YOY.

As of 1996, the Hart Lake Warner sucker population was estimated at 493 spawning individuals (with 95 percent confidence intervals of 439-563; Allen et al. 1996). Although this is the only quantified population estimate of Warner suckers ever made for Hart Lake, it is likely well below the abundances found in Hart Lake prior to the drought.

In 1997, Bosse et al documented the continued existence but reduced numbers of Warner suckers in the Warner Lakes. A decline in the number of suckers as a catch per unit effort had declined 75% over the 1996 results. The reduction in sucker numbers was offset by a shrp increase in the percentage composition of introduced game fish, especially white crappie and brown bullhead.

Hartzell and Popper completed the most recent study in 2001. As with the 1997 work, this study indicated the loss of Warner suckers and an increase of introduced fish. The greatest number of suckers captured was in Hart Lake (96%) with only a few captured in the other Warner Lakes, including Crump. Suckers represented a greater percentage of the catch in relation to introduced and other native fish compared to the efforts of 1997 although a smaller number of sucker were captured. This was the first year since 1991 that native fish made up a smaller percentage of the catch than introduced fish.

A common phenomenon among fishes is phenotypic plasticity (the ability of different individuals of the same species to have different appearances despite identical genotypes) induced by changes in environmental factors (Wooton 1990, Barlow 1995). This is most easily seen by a difference in the size of the same species living in different but contiguous, and at times sympatric, habitats for a portion of their lives (Healey and Prince 1995, Wood 1995). The Warner Basin provides two generally continuous aquatic habitat types; a temporally more stable stream environment and a temporally less stable lake environment (e.g., lakes dried in 1992). Representatives of a species occupying this continuum form a metapopulation. Observations indicate that Warner suckers and Warner Valley redband trout grow larger in the lakes than they do in streams (White et al. 1990). The smaller stream morph and the larger lake morph are examples of phenotypic plasticity within metapopulations of the Warner sucker and the Warner Valley redband trout. Expressions of these two morphs in both the Warner sucker and the Warner Valley redband trout might be as simple as each species being opportunistic. When lake habitat is available, the stream morph migrates downstream and grows to become a lake morph. These lake morphs can migrate upstream to spawn or become resident populations while the lake habitat is available. Presumably, when the lake habitat dries up the lake morph is lost but the stream morph persists. When the lakes refill, the stream morph can reinvade the lakes to again become lake morphs. The lake habitat represents a less stable but more productive environment that the metapopulations of Warner suckers and Warner Valley redband trout use on an opportunistic basis. The exact nature of the relationship between lake and stream morphs remains poorly understood and not well studied.

Monitoring

The objectives of implementation monitoring are to determine if a given standard or requirement is being properly applied on the ground as intended and documented. Monitoring sites were chosen in 1994 that accurately portray riparian or stream channel conditions for each pasture following grazing actions. BLM personnel measure residual herbaceous stubble heights, and stream temperatures in all allotments at the end of the growing season in October. Most years, stream temperatures are measured June through October. Riparian score cards are being established to determine riparian site potential. These descriptions will form the basis of future monitoring and goal determination.

A long term monitoring report was submitted to the USFWS in March 2001. This report summarized the results from several years of stream survey, photo point, temperature and macroinvertebrate monitoring in Warner sucker habitats. The report also presented a recent grazing history.

Consultations Regarding Warner sucker

Since the listing of Warner suckers as threatened in 1985, the BLM has completed numerous consultations on agency actions affecting the species. Table 4 lists the years and subject of the consultations completed to date.

Table 4. Section 7 consultations regarding effects to Warner sucker from various actions.

Year	Subject	Number
1985	Habitat Management Plan for the Warner Sucker	1-1-86-F-15
1987	Fort Bidwell-Adel County Road Realignment	1-1-87-F-15
1990	Warner Wetlands Habitat Management Plan	1-7-90-F-251
1993	Relocation of Twentymile Stream Gauge	1-7-93-I-554
1994	Lakeview BLM Grazing Program	1-7-94-F-197, 219, 227, 228, 242, 277
1995	Reinitiation of consultation on Grazing Program	1-7-95-F-136
1996	Noxious Weed Control Program	1-7-96-I-250
1996	Reinitiation of consultation on Grazing Program	1-7-96-F-117 Xref:1-7-F-136
1997	Informal consultation on guided fishing activities	No number
1997	Reinitiation of consultation on Grazing Program and consultation on a number of small non-grazing projects	1-7-97-F-168
1999	Reinitiation of consultation on Grazing Program	1-7-99-F-155 Xref: 1-7-97-F-168
1999	Informal consultation on Long Canyon Prescribed Fire	1-7-99-I-407
1999	Grazing permit renewal	Concurrence
2000	Reinitiation of consultation on Grazing Program	1-7-00-F-331 Xref: 1-7-97-F-168
2001	Reinitiation of consultation on Grazing Program	1-7-02-F-538

In 1994, Lakeview RA BLM determined that ongoing site-specific livestock grazing actions were likely to adversely affect Warner suckers in the Warner Valley Watersheds and has, to date, consulted under recurring BOs with USFWS. Present grazing prescriptions and monitoring protocols are in concordance with biological opinions issued by the Service, and results of grazing monitoring appear annually in reports to USFWS. Consultation has been reinitiated due to changes in the action, changes due to new information and for failure to comply with terms and conditions of the BO.

Improved Federal Land Management

The Federal agencies responsible for management of the habitat in the Warner Basin have consulted on activities that might impact the Warner sucker. On May 21, 1995, the BLM, Forest Service (FS), National Marine Fisheries Service (NMFS) and the Service signed the Streamlining/Consultation Guidelines (streamlining: Streamlining Consultation Procedures Under section 7 of the ESA) to improve communication and efficiency between agencies. In the Warner Basin, the outcome of streamlining has been regular meetings between the Federal agencies conducting and reviewing land management actions that may affect Warner suckers. These meetings have greatly improved the communication among agencies and have afforded all involved a much better understanding of issues throughout the entire watershed. As a result of close coordination, the FS and BLM have modified many land management practices thus reducing negative impacts, and in many cases, bringing about habitat improvements to Warner suckers and redband trout.

Current Conservation Efforts

Salvage, Refuge Populations, and Captive Propagation

In early 1991, the threat of a fifth consecutive drought year prompted the agencies responsible for managing the Warner sucker to plan a salvage operation to establish a refuge population of suckers at the Service's Dexter National Fish Hatchery and Technology Center (Dexter) in New Mexico. Salvage operations consisted primarily of intensive trap netting in Hart Lake to collect suckers, then transportation of the captured fish to a temporary holding facility (a series of five small earth ponds linked by a 200 meter (666.6 foot) ditch) at ODFW's Summer Lake Wildlife Management Area. The suckers were held at Summer Lake Wildlife Management Area for five months until September 1991, when 75 adults were recaptured and transported to Dexter.

While being held at Summer Lake Wildlife Management Area, the suckers from Hart Lake spawned successfully, leaving an estimated 250+ young in the Summer Lake Wildlife Management Area holding ponds after the adults were taken to Dexter. The young suckers did well in the ponds, growing approximately 85 millimeters (3.3 inches) during their first summer and reaching sexual maturity at the age of only two years. Sucker larvae were observed in the ponds during the summer of 1993, just over two years after the original wild suckers from Hart Lake were held there. Approximately 30 of the two year-old suckers were captured and released in Hart Lake in September 1993. In June 1994, over 100 10-17.5 centimeter (4-7 inch) Warner suckers were observed in the Summer Lake Wildlife Management Area ponds. In 1996, nine adult fish were observed in these ponds along with about 20 larvae.

The suckers taken to Dexter were reduced from 75 to 46 individuals between September 1991 and March 1993, largely due to *Lernaea* (anchor worm) infestation. In March 1993, the 46 survivors (12 males and 34 females) appeared ready to spawn, but the females did not produce any eggs. Between March 1993 and March 1994, *Lernaea* further reduced the population to 20 individuals (5 males and 15 females) (B. Jensen, USFWS, pers. comm., 1994). In May 1994, the five males and seven of the females spawned, producing a total of approximately 175,000 eggs. However, for reasons that are not clear, none of the eggs were successfully fertilized. The remaining 20 fish at Dexter died in 1995 (B. Jensen, pers. comm., 1995). In November of 1995, approximately 65 more suckers from Summer Lake Wildlife Management Area were transferred to Dexter for spawning purposes but as yet no attempts to spawn these fish have occurred.

Fish Passage Improvements
In 1991, the BLM installed a modified steep-pass Denil fish passage facility on the Dyke diversion on lower Twentymile Creek. The Dyke diversion structure is a 1.2 meter (4 feet) high irrigation diversion that was impassable to suckers and trout before the fishway was installed. It blocked all migration of fishes from the lower Twentymile Creek, Twentymile Slough and Greaser Reservoir populations from moving upstream to spawning or other habitats above the structure. To date, no suckers have been observed or captured passing the structure, but red band trout have been observed and captured in upstream migrant traps. Hopefully, the fishway will re-establish a migration corridor, and allow access to high quality spawning and rearing habitats.

An evaluation of fish passage alternatives has been done for diversions on Honey Creek which identifies the eight dams and diversions on the lower part of the creek that are barriers to fish migration (Campbell-Craven Environmental Consultants 1994). In May 1994, a fish passage structure was tested on Honey Creek. It consisted of a removable fishway and screen. The ladder immediately provided passage for a small redband trout. These structures were removed by ODFW shortly after their installation due to design flaws that did not pass allocated water.

Oregon Chub (*Oregonichthys crameri*)

Background
Detailed accounts of the taxonomy, ecology, and life history of the Oregon chub can be found in the final rule designating the species as endangered (USDI FWS 1993), the annual progress reports for Oregon chub investigations (Scheere et al. 2001, 2002, 2003) and the Recovery Plan for the Oregon Chub (USDI FWS 1998).

Oregon chub are found in slack water off-channel habitats such as beaver ponds, oxbows, side channels, backwater sloughs, low gradient tributaries, and flooded marshes. These habitats usually have little or no water flow, silty and organic substrate, and considerable aquatic vegetation as cover for hiding and spawning (Pearsons 1989, Markle et al. 1991, Scheerer and McDonald 2000). The average depth of Oregon chub habitats is typically less than two meters (six ft) and the summer temperatures typically exceed 16oC (61oF). Adult Oregon chub seek dense vegetation for cover and frequently travel in the mid-water column in beaver channels or along the margins of aquatic plant beds. Larval chub congregate in near shore areas in the upper layers of the water column in shallow areas (Pearsons 1989, Scheerer 1997). Juvenile Oregon chub venture farther from shore into deeper areas of the water column (Pearsons 1989). In the winter months, Oregon chub can be found buried in the detritus or concealed in aquatic vegetation (Pearsons 1989). Fish of similar size classes school and feed together. In the early spring, Oregon chub are most active in the warmer, shallow areas of the ponds.

Current and Historical Range
The Oregon chub *(Oregonichthys crameri)* is a small minnow (Family: Cyprinidae) endemic to the Willamette River drainage of western Oregon (Markle et al. 1991). This species was formerly distributed throughout the Willamette River Valley in off-channel habitats such as

beaver ponds, oxbows, side channels, backwater sloughs, low gradient tributaries, and flooded marshes (Snyder 1908). Historical records show Oregon chub were found as far downstream as Oregon City and as far upstream as Oakridge. Records of Oregon chub collections exist for the Clackamas River, Molalla River, Mill Creek, South Santiam River, North Santiam River, Luckiamute River, Long Tom River, McKenzie River, Calapooia River, Muddy Creek, Mary's River, Coast Fork Willamette River, Middle Fork Willamette River, and the mainstem Willamette River (Markle et al. 1991, Scheerer and McDonald 2000).

Based on a 1987 survey (Markle et al. 1989) and compilation of all known historical records, at the time of the petition for listing in 1991, viable populations of the Oregon chub occurred in the following locations: Dexter Reservoir, Shady Dell Pond, Buckhead Creek near Lookout Point Reservoir, Elijah Bristow State Park, William L. Finley National Wildlife Refuge, Greens Bridge, and East Fork Minnow Pond. These locations represented a small fraction - estimated as two percent based on stream miles - of the species' formerly extensive distribution within the Willamette River drainage.

Population Status and Trends

At present, Oregon chub occur at approximately 27 locations in the North and South Santiam River, McKenzie River, Middle Fork Willamette River, Coast Fork, and several tributaries to the mainstem Willamette River downstream of the Coast Fork Willamette/Middle Fork Willamette confluence (Scheerer et al. 2003). The Oregon Department of Fish and Wildlife has reintroduced Oregon chub at a number of sites within the Willamette Basin; seven currently sustain a population. In 2002, only nine populations of Oregon chub were larger than 1,000 fish, and eight populations numbered fewer than 100 individuals (Scheerer et al. 2003). Oregon chub appear to have been extirpated from at least nine locations at which they were detected in the 1990s (Scheerer et al. 2003).

Of the known Oregon chub populations, the sites with the highest diversity of native fish, amphibian, and reptile species have the largest populations of Oregon chub (Scheerer and McDonald 2000). Beavers (Castor canadensis) appear to be especially important in creating and maintaining habitats that support these diverse native species assemblages (Scheerer and Apke 1998).

McKenzie Subbasin

Historical records show that Oregon chub were collected in the McKenzie River subbasin, but until recently, no extant populations were known from the basin. In October 2001, Oregon chub were introduced into Russell Pond in the Mohawk drainage on private land under the terms of a Safe Harbor Agreement among the landowner, the Service and ODFW (Scheerer et al. 2002). The current estimated population in Russell Pond is 470 chub (Scheerer et al. 2003). A population of Oregon chub was discovered in April 2002 in Shetzline Pond, a small man-made pond near Marcola in the Mohawk drainage. The population estimate was 120 (Scheerer et al. 2003). ODFW is seeking funds to expand the wetland to create more habitat for the chub. Neither of these two populations in the Mohawk drainage is affected by flows in the mainstem McKenzie.

In 2002, a population of Oregon chub was found in side channels of the McKenzie River just east of Springfield in an area called Big Island, upstream of the confluence with Cedar Creek (Scheerer et al. 2003). The population was estimated at 940 chub. This site is connected to the mainstem McKenzie.

North Santiam Subbasin

Oregon chub are currently known to persist at about five sites in the North Santiam River subbasin: Geren Island, Santiam Conservation Easement, Green's Bridge Backwater, Pioneer Park Backwater, and at I-5 Backwater, which is downstream of the confluence of the North and South Santiam Rivers (Scheerer et al. 2003). Oregon chub populations in the North Santiam have been declining in recent years; no chub were detected at two sites (Stayton Public Works Pond and Gray Slough) in 2002, which had small populations of the fish in 2000 and 2001 (Scheerer et al. 2003). Only two populations in this subbasin have more than 100 fish (Geren Island and I-5 Backwater). Many of the sites in the North Santiam subbasin (e.g., Geren Island, Santiam Conservation Easement sloughs) have seen chub populations decline as non-native fishes invaded the habitats (Scheerer et al. 1998).

The largest Oregon chub population in the subbasin is at Geren Island, in the ponds and channels of the City of Salem's municipal water treatment facility. Oregon chub were first detected there in 1996. At the time, the population was the largest known, with over 8,000 Oregon chub. Since 1996, the population has declined precipitously to fewer than 800 chub in 2002; the cause of the decline is unknown, but may be associated with the proliferation of non-native fishes, which appear to have entered the ponds in the 1996 floods. The water treatment ponds at Geren Island are connected to the North Santiam by means of intake structures; the North Pond, which supports most of the Oregon chub at Geren Island, appears to have a hydrological connection to the North Santiam. River level is closely correlated to the water level in the North Pond; as river levels drop, pond level drops and the temperature rises (Scheerer and McDonald 2000). When releases from Big Cliff Dam fall below 2,000 cfs, water levels in the North Pond drop below optimum levels (Scheerer and McDonald 2000). The City of Salem is preparing a Habitat Conservation Plan for Oregon chub at the facility. A number of conservation measures to protect the chub are already in place, including screening and monitoring for chub in the sand filters.

All of the other known Oregon chub populations in this subbasin are in backwater sloughs connected to the river, and are potentially affected by changes in flow levels in the river. Non-native fish appear to have invaded the Santiam Conservation Easement sloughs and Green's Bridge Backwater in the 1996 floods (Scheerer and McDonald 2000).

South Santiam Subbasin

There are two introduced populations of Oregon chub in the South Santiam subbasin. In 1999, ODFW introduced Oregon chub into Foster Pullout Pond, on the north shore of Foster Reservoir. The spring-fed pond is perched above the full-pool reservoir level; it is free of any other fish species, and contains a diverse assemblage of native amphibians, western pond turtles (Clemmys marmorata marmorata), and bull frogs (Rana catesbiana) (Scheerer and McDonald 2000). The population was estimated at 320 fish in 2002 (Scheerer et al. 2003).

Fifteen Oregon chub were introduced into Menear's Bend Pond in 2000. The site is a small series of beaver ponds on USACE land upstream of Foster Reservoir on a small unnamed tributary to the South Santiam River; 29 chub were captured at the site in 2002 (Scheerer et al. 2003). Water levels were very low at this pond in 2001, which may have contributed to the low numbers.

Middle Fork Willamette Subbasin

The Middle Fork Willamette River Subbasin supports the largest number of Oregon chub populations, as well as the most abundant populations. Oregon chub are currently know to persist at 13 locations in the subbasin: Fall Creek Spillway Pond, East Fork Minnow Creek Pond, Elijah Bristow State Park (two sites), Hospital Pond, Buckhead Creek Enhancement Ponds, Shady Dell Pond, Dexter Reservoir Alcoves (two sites), Oakridge Slough, Wicopee Pond, Rattlesnake Creek, and Barnhard Slough. Reintroductions have been conducted at four sites (i.e., Fall Creek Spillway, Wicopee, East Ferrin and West Ferrin). Surveys by ODFW between 1992 and 2002 have found Oregon chub populations in the Middle Fork Willamette River to be generally stable or increasing in abundance (Scheerer et al. 2002).

The Buckhead Creek Enhancement Ponds consist of three shallow, off-channel ponds with surface areas of 300-500 m2 each. The ponds were created by the WNF in 1998 to increase the amount of off-channel habitat available to Oregon chub in the Middle Fork Willamette drainage. The ponds are connected to Buckhead Creek in high flow events, but are not affected by flows in the Middle Fork. In 2001, surveys detected 1,230 chub in the middle pond, 200 chub in the lower pond, and no chub in the upper pond (Scheerer et al. 2002).

Shady Dell Pond is on a small tributary to the Middle Fork between Hills Creek and Lookout Point. The population in 2002 was estimated at 2,420 Oregon chub (Scheerer et al. 2003). There is not likely to be any effect of flow regime in the Middle Fork on chub habitat in Shady Dell Pond.

The Oregon chub habitat at Oakridge Slough has connections to the Middle Fork Willamette River at both upstream and downstream ends. There may also be a subsurface connection to the river. Surveys in 2002 found just 9 Oregon chub at the site (Scheerer et al. 2003).

Barnhard Slough is downstream of Oakridge on the Middle Fork, between Hills Creek and Lookout Point Reservoirs. Only two chub were found at the site in 2002 (Scheerer et al. 2003). The slough is a backwater area with upstream and downstream connections to the Middle Fork, and may also be affected by the flow regime in the Middle Fork via subsurface connections.

Hospital Pond is a 1-acre pond created when Lookout Point reservoir fills and backs water into a depression above Forest Road 5821 (County Road 360) through a culvert. The pond elevation is maintained at the existing reservoir elevation. The pond also receives water from a spring that appears to be associated with nearby Hospital Creek; the inflow is reported to be perennial and was estimated to be a few cubic feet per second in March 2001. When full, the pond is approximately 16 ft deep, with shallower areas around the margins and a large bench at elevation 922 ft. Typically, the reservoir and pond fill in late May and water elevations begin to drop in early to mid-July, depending on downstream water needs and inflow.

In the winter, when Lookout Point is lowered to provide flood storage, the water in Hospital Pond is maintained at the top of the culvert (elevation 917 ft) by a small check dam below the culvert outflow. Surface acreage is much reduced, but the pond depth is maintained at approximately eight feet at it deepest point throughout the winter.

Since 2001, USACE has been attempting to protect the Oregon chub spawning habitat in Hospital Pond by decoupling the water level in Hospital Pond from the level in Lookout Point Reservoir. The goal is to allow Lookout Point to be drafted to meet downstream flow objectives without regard to chub spawning needs in the pond. So far, several projects have had some beneficial effect on the pond, but have not completely succeeded in making Hospital Pond's hydrology independent of the reservoir.

Since 1993, ODFW has conducted surveys for Oregon chub at Hospital Pond. The population has ranged from a low of 690 individuals in 1993 to a high of 3,160 individuals in 1996, and is thought to be stable at around 3,000 fish (Scheerer et al. 2002). The population was estimated at 2,130 individuals in the 2002 survey (Scheerer et al. 2003). Data from ODFW have shown that in years when the reservoir does not fill, Oregon chub reproduction in Hospital Pond fails because the benches which provide spawning habitat are not submerged. The reservoir did not fill in 1992 and 1994, which resulted in year class failures (Scheerer and McDonald 2000). A diversity of other native fishes have been collected in Hospital Pond [sculpins (Cottus sp.), dace (Rhinichthys sp.), redside shiner (Richardsonius balteatus), Northern pikeminnow (Ptychocheilus oregonensis) and largescale sucker (Catostomus macrocheilus)], but no non-native species have been found in the pond.

The Oregon chub at Hospital Pond are consistently larger in size than other populations in the vicinity, despite lower than average water temperatures (Scheerer and McDonald 2000), suggesting that this population may be genetically unique, or that the pond is unusually productive. Preservation of this population is a high priority for the resource agencies involved in chub recovery.

Oregon chub have been found in alcoves and ponds on the south side of Dexter Reservoir. These sites are connected to the reservoir by culverts; water levels in the coves fluctuate with the height of the reservoir, and may vary by as much as five feet in elevation in a day. As the reservoir is drawn down for flood control in winter, or only partially filled in the spring and summer, these coves become inhospitable to chub. The survival of chub in the main body of the reservoir is probably very low since food, vegetative cover and other refugia are practically non-existent. Introduced predators, and lack of cover and breeding habitat combine to create a hostile environment for chub in the reservoir.

The Oregon chub population in East Fork Minnow Creek Pond numbered 3,270 in 2002 (Scheerer et al. 2003). The site is a beaver pond near Lookout Point Reservoir; it is not affected by changing reservoir levels, as the pond is perched above the level of the full pool, and the culvert that connects Minnow Creek with the reservoir is impassable to the upstream movement of fish from the reservoir (Scheerer and McDonald 2000).

There is a very small population of Oregon chub in Rattlesnake Creek (only two chub were found in 2002)(Scheerer et al. 2003). Rattlesnake Creek is a tributary that enters the Middle Fork below Dexter Dam; flow regime in the Middle Fork has no effect on chub habitat in this population.

Oregon chub have been found in several ponds at Elijah Bristow State Park on the Middle Fork Willamette River below Dexter Dam. The populations in Berry Slough and the Northeast Backwater do not appear to be directly affected by flows in the Middle Fork, although there may be a subsurface connection. These populations have been stable or increasing; surveys in 2002 estimated 4,910 chub in Berry Slough, and 940 chub in the Northeast Backwater (Scheerer et al. 2003). A small number of chub were found in the gravel pits at the park about five years ago; these ponds appear to be very sensitive to the flow levels in the Middle Fork Willamette River. In 2001, releases from Dexter fell below 1100 cfs, which resulted in the water level in one of the chub ponds falling to less than 0.25 m. The Corps worked closely with ODFW and the Service to monitor the water levels in the chub ponds as flows from Dexter dropped, but these populations appear to have been extirpated (Scheerer et al. 2002).

Recent surveys of the introduced populations in the Middle Fork Subbasin found robust populations in Fall Creek Spillway Pond (6,370 chub) and Wicopee Pond (2,410 chub)(Scheerer et al. 2003). The Fall Creek Spillway Pond was formed by a beaver dam that blocks the spillway overflow channel, and has been in existence for over 10 years. The pond has high quality habitat (Scheerer and McDonald 2000).

Wicopee Pond was the site of a 1988 introduction of 50 Oregon chub. The pond is a former borrow pit adjacent to Salt Creek in the Middle Fork Willamette drainage. Few chub were found between 1992 and 1999, but in 2000, the population increased dramatically to over 4,000 individual (Scheerer et al. 2003).

Not all introductions have fared as well as Fall Creek Spillway Pond and Wicopee Pond. East Ferrin Pond and West Ferrin Ponds were treated with Rotenone to remove non-native fishes in 1993. In 1994, Oregon chub were introduced to the ponds. West Ferrin Pond did not succeed as a reintroduction site, and no chub have been found in the pond. East Ferrin Pond had a population of approximately 7,200 Oregon chub in 1997; surveys in 2000 and 2001 found no chub in the pond, and the population is presumed to be extirpated (Scheerer et al. 2002). The decline of chub in East Ferrin Pond occurred in concert with the increase of largemouth bass, a non-native predatory fish at the site, which illustrates the threat of non-native fishes to Oregon chub (Scheerer and McDonald 2000).

Coast Fork Willamette Subbasin

Oregon chub are known from two sites in the Coast Fork subbasin. Surveys in 1992 and 1993 found very low numbers of chub in poor quality habitat in Camas Swale; subsequent surveys have failed to detect any chub at all (Scheerer and McDonald 2000). In April 2002, surveys by the Oregon Department of Transportation and ODFW found a few Oregon chub in side channels of the mainstem Coast Fork at RM 16, upstream of Camas Swale. The habitat at the site is influenced by releases out of both Dorena and Cottage Grove Reservoirs. The site has abundant non-native fishes.

Upper Mainstem Willamette River Subbasin
Oregon chub occur at three sites in the Upper Mainstem Willamette subbasin: Gray Swamp and Display Pond in the Muddy Creek drainage at William L. Finley National Wildlife Refuge, and the Dunn Wetland Ponds in the Beaver Creek drainage. The population at Gray Creek Swamp has been declining for the last three years; in 2002, the population was estimated at 290 (Scheerer et al. 2003). The Display Pond population is the result of an introduction in 1998; numbers of chub there have decreased from 1,750 fish in 2000 to 500 in 2002 (Scheerer et al. 2003). In 1997, Oregon chub were introduced into the Dunn Wetland Ponds in the Beaver Creek drainage, with the permission of the private landowner (Scheerer et al. 1998). The project included a large wetland restorations and construction of a spring-fed pond (Scheerer et al. 2003). In 2002, this was the most abundant population in the Willamette Valley; the estimated number of Oregon chub in the wetlands was 19,270 (Scheerer et al. 2003).

Threats
A variety of factors are likely responsible for the decline of the Oregon chub. These include habitat loss and alteration; the proliferation of non-native fish and amphibians; accidental chemical spills; runoff from herbicide or pesticide application on farms and timberlands or along roadways, railways, and power line rights-of way; the application of rotenone to manage sport fisheries; desiccation of habitats; unauthorized water withdrawals, diversions, or fill and removal activities; sedimentation resulting from timber harvest in the watershed, and possibly the demographic risks that result from a fragmented distribution of small, isolated populations (USFWS 1998).

The decline of Oregon chub has been correlated with the construction of dams. Based on the date of last capture at a site, Pearsons (1989) estimated that the most severe decline occurred during the 1950s and 1960s. Ten of the 13 dams that make up the Willamette Valley flood control system were completed between 1953 and 1969 (USACE 2000). Other structural changes along the Willamette River corridor such as revetment and channelization, diking and drainage, and the removal of floodplain vegetation have eliminated or altered the slack water habitats of the Oregon chub (Willamette Basin Task Force 1969, Hjort et al. 1984, Sedell and Froggatt 1984, Li et al. 1987). Channel confinement, isolation of the Willamette River from the majority of its floodplain, and elimination or degradation of both seasonal and permanent wetland habitats within the floodplain began as early as 1872 and, for example, has reduced the 25 kilometer (15.5 mile) reach between Harrisburg and the McKenzie River confluence from over 250 kilometers (155 miles) of shoreline in 1854 to less than 64 kilometers (40 miles) currently (Sedell and Froggatt 1984, Sedell et al. 1990).

The establishment and expansion of non-native species in Oregon have contributed to the decline of the Oregon chub and limits the species' ability to expand beyond its current range. Many species of non-native fish have been introduced to, and are common throughout, the Willamette Valley, including largemouth bass (Micropterus salmoides), smallmouth bass (Micropterus dolomieui), crappie (Pomoxis sp.), bluegill (Lepomis macrochirus), and western mosquitofish (Gambusia affinis). The bullfrog (Rana catesbiana), a non-native amphibian, also occurs in the valley and breeds in habitats preferred by the Oregon chub (Willamette Basin Task Force 1969, Hjort et al. 1984, Li et al. 1984, Scheerer et al. 1992). The period of severe decline of the

Oregon chub does not coincide well with the initial dates of introduction of nonindigenous species. However, many sites formerly inhabited by the Oregon chub are now occupied by non-native species (Markle et al. 1991). Currently, 25 sites are known to contain Oregon chub; over half of these sites are also inhabited by non-native fishes or amphibians (Scheerer and McDonald 2000). Since 1995, non-native fish have been discovered for the first time in six locations containing Oregon chub; the Oregon chub populations have subsequently declined or remained in low abundance in all of these sites. The 1996 flooding in the Santiam River was probably responsible for three of these movements of non-native fish. The other three sites, located in the Middle Fork Willamette River drainage, were likely the result of unauthorized introductions or spread of non-native fish from reservoirs (Scheerer and Jones 1997). Because all remaining population sites are easily accessible, there also continues to be a potential for unauthorized introductions of non-native species, particularly mosquitofish and game fishes such as bass and walleye (Stizostedion vitreum).

Many of the known extant populations of Oregon chub occur near rail, highway, and power transmission corridors and within public park and campground facilities. These populations are threatened by chemical spills from overturned truck or rail tankers; runoff or accidental spills of vegetation control chemicals; overflow from chemical toilets in campgrounds; sedimentation of shallow habitats from construction activities; and changes in water level or flow conditions from construction, diversions, or natural desiccation (USFWS 1998). In the early 1990s, a train derailment on the railroad line that parallels the Middle Fork Willamette River spilled methanol near the Minnow Pond population of Oregon chub; the methanol burned and did not contaminate the chub's habitat, yet this incident illustrates the risk to Oregon chub populations along transportation corridors (USFWS 2003b). Oregon chub populations near agricultural areas are subject to poor water quality as a result of runoff laden with sediment, pesticides, and nutrients. Logging in the watershed can result in increased sedimentation and herbicide runoff.

<u>Population dynamics</u>

The current pattern of distribution and abundance of Oregon chub populations reflects the fundamental alteration in the natural processes under which the species evolved. Sites with Oregon chub can be categorized as having high or low connectivity to the Willamette and its tributaries; those sites with low connectivity tend to have large populations of chub and fewer species of non-native fish (Scheerer et al. 2002). Thus, Oregon chub now thrive only in habitats that are isolated and bear little resemblance to the species' dynamic natural environment. Efforts to restore floodplain function and connectivity may facilitate the introduction of non-native fishes into isolated habitats, which could have devastating effects to populations of Oregon chub (Scheerer 2002).

Bull trout (Salvelinus confluentus)

<u>Background</u>

Detail accounts of life history, taxonomy and behavior can be found in the final rule listing the Columbia River and Klamath River populations of bull trout as threatened (USDI FWS 1998), the final rule designating critical habitat for the bull trout (USDI FWS 2004), and the Status of Oregon's Bull Trout; Distribution, Life History, Limiting Factors, management Considerations, and Status (Buchanan et al. 1997).

Historic Range

The historical range of the bull trout includes major river basins in the Pacific Northwest at about 41 to 60 degrees North latitude, from the southern limits in the McCloud River in northern California and the Jarbidge River in Nevada to the headwaters of the Yukon River in the Northwest Territories, Canada (Cavender 1978, Bond 1992). To the west, the bull trout's range includes Puget Sound, various coastal rivers of British Columbia, Canada, and southeast Alaska (Bond 1992). Bull trout occur in portions of the Columbia River and tributaries within the basin, including its headwaters in Montana and Canada. Bull trout also occur in the Klamath River basin of south-central Oregon. East of the Continental Divide, bull trout are found in the headwaters of the Saskatchewan River in Alberta and Montana and in the MacKenzie River system in Alberta and British Columbia, Canada, (Cavender 1978, Brewin *et al.* 1997).

Distinct Population Segments (DPS) and Population Units

Population units of bull trout exist in which all fish share an evolutionary legacy and which are significant from an evolutionary perspective (Spruell *et al.* 1999). These population units can range from a local population to multiple populations, and theoretically should represent a DPS. Although such population units are difficult to characterize, genetic data have provided useful information on bull trout population structure. For example, genetic differences between the Klamath River and Columbia River populations of bull trout were revealed in 1993 (Leary *et al.* 1993). The boundaries of the five listed DPSs of bull trout are based largely on this 1993 information.

Since the bull trout was listed, additional genetic analyses have suggested that its populations may be organized on a finer scale than previously thought. Data have revealed genetic differences between coastal populations of bull trout, which includes the lower Columbia River and Fraser River, and inland populations in the upper Columbia River and Fraser River drainages (Williams *et al.* 1997, Taylor *et al.* 1999). There is also an apparent genetic differentiation between inland populations within the Columbia River basin. This differentiation occurs between the (a) mid-Columbia River (John Day, Umatilla) and lower Snake River (Walla Walla, Clearwater, Grande Ronde, Imnaha rivers, etc.) populations and the (b) upper Columbia River (Methow, Clark Fork, Flathead River, etc.) and upper Snake River (Boise River, Malheur River, Jarbidge River, etc.) populations (Spruell *et al.* 2003). Genetic data indicate that bull trout inhabiting the Deschutes River drainage of Oregon are derived from coastal populations and not from inland populations in the Columbia River basin (Leary *et al.* 1993, Williams *et al.* 1997, Spruell and Allendorf 1997, Taylor *et al.* 1999, Spruell *et al.* 2003). In general, evidence since the time of listing suggests a need to further evaluate the distinct population segment structure of bull trout DPSs.

Habitat Relationships

Bull trout have more specific habitat requirements than most other salmonids (Rieman and McIntyre 1993). Habitat components that influence the species' distribution and abundance include water temperature, cover, channel form and stability, valley form, spawning and rearing substrate, and availability of migratory corridors (Fraley and Shepard 1989; Goetz 1989; Hoelscher and Bjornn 1989; Sedell and Everest 1991; Howell and Buchanan 1992; Pratt 1992; Rieman and McIntyre 1993, 1995; Rich 1996; Watson and Hillman 1997). Watson and Hillman

(1997) concluded that watersheds must have specific physical characteristics to provide the habitat requirements necessary for bull trout to successfully spawn and rear and that these specific characteristics are not necessarily present throughout these watersheds. Because bull trout exhibit a patchy distribution, even in pristine habitats (Rieman and McIntyre 1993), individuals of this species should not be expected to simultaneously occupy all available habitats (Rieman *et al.*1997a).

Bull trout are found primarily in cold streams, although individual fish are found in larger, warmer river systems throughout the Columbia River basin (Fraley and Shepard 1989; Rieman and McIntyre 1993, 1995; Buchanan and Gregory 1997; Rieman *et al.* 1997a). Water temperature above 15 degrees Celsius (59 degrees Fahrenheit) is believed to limit bull trout distribution, a limitation that may partially explain the patchy distribution within a watershed (Fraley and Shepard 1989, Rieman and McIntyre 1995).

Spawning areas are often associated with cold-water springs, groundwater infiltration, and the streams with the coldest summer water temperatures in a given watershed (Pratt 1992, Rieman and McIntyre 1993, Rieman *et al.* 1997a, Baxter *et al.* 1999). Water temperatures during spawning generally range from 5 to 9 degrees Celsius (41 to 48 degrees Fahrenheit) (Goetz 1989). The requirement for cold water during egg incubation has generally limited the spawning distribution of bull trout to high elevations in areas where the summer climate is warm. Rieman and McIntyre (1995) found in the Boise River Basin that no juvenile bull trout were present in streams below 1613 m (5000 feet). Similarly, in the Sprague River basin of south-central Oregon, Ziller (1992) found in four streams with bull trout that "numbers of bull trout increased and numbers of other trout species decreased as elevation increased. In those streams, bull trout were only found at elevations above 1774 m [5500 feet]."

Goetz (1989) suggested optimum water temperatures for rearing bull trout of about 7 to 8 degrees Celsius (44 to 46 degrees Fahrenheit) and for egg incubation of 2 to 4 degrees Celsius (35 to 39 degrees Fahrenheit). For Granite Creek, Idaho, Bonneau and Scarnecchia (1996) observed that juvenile bull trout selected the coldest water [8 to 9 degrees Celsius (46 to 48 degrees Fahrenheit), within a temperature gradient of 8 to 15 degrees Celsius (46 to 60 degrees Fahrenheit)] available in a plunge pool.

In Nevada, adult bull trout have been collected at sites with a water temperature of 17.2 degrees Celsius (63 degrees Fahrenheit) in the West Fork of the Jarbidge River (S. Werdon, *pers. comm.*, 1998) and have been observed in Dave Creek where maximum daily water temperatures were 17.1 to 17.5 degrees Celsius (62.8 to 63.6 degrees Fahrenheit) (Werdon, *in litt.* 2001). In the Little Lost River, Idaho, bull trout have been collected in water having temperatures up to 20 degrees Celsius (68 degrees Fahrenheit); however, these fish made up less than 50 percent of all salmonids when maximum summer water temperature exceeded 15 degrees Celsius (59 degrees Fahrenheit) and less than 10 percent of all salmonids when temperature exceeded 17 degrees Celsius (63 degrees Fahrenheit)(Gamett 1999).

All life-history stages of bull trout are associated with complex forms of cover, including large woody debris, undercut banks, boulders, and pools (Fraley and Shepard 1989, Goetz 1989, Hoelscher and Bjornn 1989, Sedell and Everest 1991, Pratt 1992, Thomas 1992, Rich 1996, Sexauer and James 1997, Watson and Hillman 1997). Jakober (1995) observed bull trout overwintering in deep beaver ponds or pools containing large woody debris in the Bitterroot River drainage, Montana, and suggested that, because of the need to avoid anchor ice in order to survive, suitable winter habitat may be more restricted than summer habitat. Maintaining bull trout habitat requires stability of stream channels and of flow (Rieman and McIntyre 1993). Juvenile and adult bull trout frequently inhabit side channels, stream margins, and pools with suitable cover (Sexauer and James 1997). These areas are sensitive to activities that directly or indirectly affect stream channel stability and alter natural flow patterns. For example, altered stream flow in the fall may disrupt bull trout during the spawning period, and channel instability may decrease survival of eggs and young juveniles in the gravel from winter through spring (Fraley and Shepard 1989, Pratt 1992, Pratt and Huston 1993).

Preferred bull trout spawning habitat consists of low-gradient stream reaches with loose, clean gravel (Fraley and Shepard 1989). In the Swan River, Montana, abundance of bull trout redds was positively correlated with the extent of bounded alluvial valley reaches, which are likely areas of groundwater to surface water exchange (Baxter *et al.* 1999). Survival of bull trout embryos planted in stream areas of groundwater upwelling used by bull trout for spawning were significantly higher than embryos planted in areas of surface-water recharge not used by bull trout for spawning (Baxter and McPhail 1999). Pratt (1992) indicated that increases in fine sediment reduce egg survival and emergence.

Migratory corridors link seasonal habitats for all bull trout life-history forms. For example, in Montana, migratory bull trout make extensive migrations in the Flathead River system (Fraley and Shepard 1989), and resident bull trout in tributaries of the Bitterroot River move downstream to overwinter in tributary pools (Jakober 1995). The ability to migrate is important to the persistence of bull trout (Rieman and McIntyre 1993, M. Gilpin, *in litt.* 1997, Rieman *et al.* 1997a). Migrations facilitate gene flow among local populations when individuals from different local populations interbreed, or stray, to non-natal streams. Local bull trout populations that are extirpated by catastrophic events may also become re-established by migrants.

<u>Threats</u>

Bull trout distribution, abundance, and habitat quality have declined rangewide (Bond 1992, Schill 1992, Thomas 1992, Ziller 1992, Rieman and McIntyre 1993, Newton and Pribyl 1994, IDFG *in litt.* 1995, McPhail and Baxter 1996). These declines result from the combined effects of habitat degradation and fragmentation, the blockage of migratory corridors; poor water quality, angler harvest and poaching, entrainment (process by which aquatic organisms are pulled through a diversion or other device) into diversion channels and dams, and introduced nonnative species. Specific land and water management activities that depress bull trout populations and degrade habitat include dams and other diversion structures, forest management practices, livestock grazing, agriculture, agricultural diversions, road construction and maintenance, mining, and urban and rural development (Beschta *et al.* 1987, Chamberlain *et al.* 1991, Furniss *et al.* 1991, Meehan 1991, Nehlsen *et al.* 1991, Sedell and Everest 1991, Craig and Wissmar 1993, Henjum *et al.* 1994, McIntosh *et al.* 1994, Wissmar *et al.* 1994, MBTSG 1995a-e, 1996a-f; Light *et al.* 1996, USDA and USDI 1995, 1996, 1997; Frissell 1997)

Population Dynamics

Although bull trout are widely distributed over a large geographic area, they exhibit a patchy distribution, even in pristine habitats (Rieman and McIntyre 1993). Increased habitat fragmentation reduces the amount of available habitat and increases isolation from other populations of the same species (Saunders *et al.* 1991). Burkey (1989) concluded that when species are isolated by fragmented habitats, low rates of population growth are typical in local populations and their probability of extinction is directly related to the degree of isolation and fragmentation. Without sufficient immigration, growth for local populations may be low and probability of extinction high (Burkey 1989, 1995).

Metapopulation concepts of conservation biology theory have been suggested relative to the distribution and characteristics of bull trout, although empirical evidence is relatively scant (Rieman and McIntyre 1993, Dunham and Rieman 1999, Rieman and Dunham 2000). A metapopulation is an interacting network of local populations with varying frequencies of migration and gene flow among them (Meffe and Carroll 1994). For inland bull trout, metapopulation theory is likely most applicable at the watershed scale where habitat consists of discrete patches or collections of habitat capable of supporting local populations; local populations are for the most part independent and represent discrete reproductive units; and long-term, low-rate dispersal patterns among component populations influences the persistence of at least some of the local populations (Rieman and Dunham 2000). Ideally, multiple local populations distributed throughout a watershed provide a mechanism for spreading risk because the simultaneous loss of all local populations is unlikely. However, habitat alteration, primarily through the construction of impoundments, dams, and water diversions has fragmented habitats, eliminated migratory corridors, and in many cases isolated bull trout in the headwaters of tributaries (Rieman *et al.* 1997a, Dunham and Rieman 1999, Spruell *et al.* 1999, Rieman and Dunham 2000). Accordingly, human-induced factors as well as natural factors affecting bull trout distribution have likely limited the expression of the metapopulation concept for bull trout to patches of habitat within the overall distribution of the species (Dunham and Rieman 1999). However, despite the theoretical fit, the relatively recent and brief time period during which bull trout investigations have taken place does not provide certainty as to whether a metapopulation dynamic is occurring (e.g., a balance between local extirpations and recolonizations) across the range of bull trout or whether the persistence of bull trout in large or closely interconnected habitat patches (Dunham and Rieman 1999) is simply reflective of a general deterministic trend towards extinction of the species where the larger or interconnected patches are relics of historically wider distribution (Rieman and Dunham 2000). Recent research (Whiteley *et al.* 2003) does, however, provide stronger genetic evidence for the presence of a metapopulation process for bull trout, at least in the Boise River basin of Idaho.

Ongoing Conservation Actions

Federal Conservation Actions

Federal conservation actions include: (1) the development of a draft *Bull Trout Recovery Plan*; (2) ongoing implementation of the *Interim Strategy for Managing Anadromous Fish-producing Watersheds in Eastern Oregon and Washington, Idaho, and Portions of California* (PACFISH; USDA and USDI 1995) and the *Interim Strategy for Managing Fish-producing Watersheds in Eastern Oregon and Washington, Idaho, Western Montana and Portions of Nevada* (INFISH; USDA 1995); (3) ongoing implementation of the Northwest Forest Plan; (4) ongoing implementation of the Northwest Power and Conservation Council Fish and Wildlife Program targeting subbasin planning; (5) ongoing implementation of the Federal Caucus Fish and Wildlife Plan; and, (6) ongoing implementation of Department of Agriculture Conservation Reserve Programs.

State Conservation Actions
Since 1990, the State of Oregon has taken several actions to address the conservation of bull trout, including: (1) Establishing bull trout working groups in the Klamath, Deschutes, Hood, Willamette, Odell Lake, Umatilla and Walla Walla, John Day, Malheur, and Pine Creek river basins for the purpose of developing bull trout conservation strategies; (2) establishment of more restrictive harvest regulations in 1990; (3) reduced stocking of hatchery-reared rainbow trout and brook trout into areas where bull trout occur; (4) angler outreach and education efforts are also being implemented in river basins occupied by bull trout; (5) research to further examine life history, genetics, habitat needs, and limiting factors of bull trout in Oregon; (6) reintroduction of bull trout fry from the McKenzie River watershed to the adjacent Middle Fork of the Willamette River, which is historical unoccupied, isolated habitat; (7) the Oregon Department of Environmental Quality (DEQ) established a water temperature standard such that surface water temperatures may not exceed 10 degrees Celsius (50 degrees Fahrenheit) in waters that support or are necessary to maintain the viability of bull trout in the State (Oregon 1996); and, (8) expansion of the Oregon Plan for Salmon and Watersheds (Oregon 1997) to include all at-risk wild salmonids throughout the State.

<u>Conservation Needs</u>
Conservation needs reflect those biological and physical requirements of a species for its long-term survival and recovery. Based on the best available scientific information (Rieman and McIntyre 1993, MBTSG 1998, Hard 1995, Healey and Prince 1995, Rieman and Allendorf 2001), the conservation needs of the bull trout are to: (1) Maintain and restore multiple, interconnected populations in diverse habitats across the range of each DPS; (2) Preserve the diversity of life-history strategies (e.g., resident and migratory forms, emigration age, spawning frequency, local habitat adaptations); (3) Maintain genetic and phenotypic diversity across the range of each DPS; and, (4) Protect populations from catastrophic fires across the range of each DPS. Each of these needs is described below in more detail.

Maintain and Restore Multiple, Interconnected Populations in Diverse Habitats Across the Range of Each DPS
Multiple local populations distributed and interconnected throughout a watershed provide a mechanism for spreading risk from stochastic events (Rieman and McIntyre 1993, Hard 1995, Healey and Prince 1995, Spruell *et al.* 1999, Rieman and Allendorf 2001). Current patterns in bull trout distribution and other empirical evidence, when interpreted in view of emerging conservation theory, indicate that further declines and local extinctions are likely (Rieman *et al.* 1997a, Dunham and Rieman 1999, Rieman and Allendorf 2001, Spruell *et al.* 2003). Based in part on guidance from Rieman and McIntyre (1993), bull trout core areas with fewer than five local populations are at increased risk of extirpation; core areas with between 5 to 10 local populations are at intermediate risk of extirpation; and core areas which have more than 10 interconnected local populations are at diminished risk of extirpation.

Maintaining and restoring connectivity between existing populations of bull trout is important for the persistence of the species (Rieman and McIntyre 1993). Migration and occasional spawning between populations increases genetic variability and strengthens population variability (Rieman and McIntyre 1993). Migratory corridors allow individuals access to unoccupied but suitable habitats, foraging areas, and refuges from disturbances (Saunders *et al.* 1991).

Because bull trout in the coterminous United States are distributed over a wide geographic area consisting of various environmental conditions, and because they exhibit considerable genetic differentiation among populations, the occurrence of local adaptation is expected to be extensive. Some readily observable examples of differentiation between populations include external morphology and behavior (e.g., size and coloration of individuals; timing of spawning and migratory forays). Conserving many populations across the range of the species is crucial to adequately protect genetic and phenotypic diversity of bull trout (Leary *et al.* 1993, Rieman and McIntyre 1993, Hard 1995, Healey and Prince 1995, Spruell *et al.* 1999, Taylor *et al.*1999, Rieman and Allendorf 2001). Changes in habitats and prevailing environmental conditions are increasingly likely to result in extinction of bull trout if genetic and phenotypic diversity is lost.

Preserve the Diversity of Life-history Strategies

The bull trout has multiple life history strategies, including migratory forms, throughout its range (Rieman and McIntyre 1993). Migratory forms appear to develop when habitat conditions allow movement between spawning and rearing streams and larger rivers or lakes where foraging opportunities may be enhanced (Frissell 1997). For example, multiple life history forms (e.g., resident and fluvial) and multiple migration patterns have been noted in the Grande Ronde River (Baxter 2002). Parts of this river system have retained habitat conditions that allow free movement between spawning and rearing areas and the mainstem of the Snake River. Such multiple life history strategies help to maintain the stability and persistence of bull trout populations to environmental changes. Benefits to migratory bull trout include greater growth in the more productive waters of larger streams and lakes, greater fecundity resulting in increased reproductive potential, and dispersing the population across space and time so that spawning streams may be recolonized should local populations suffer a catastrophic loss (Frissell 1997, Rieman and McIntyre 1993, MBTSG 1998).

Maintain the Genetic Diversity and Evolutionary Potential of Bull Trout Populations

When the long-term persistence of a species, taxon, or phylogenetic lineage is considered, it is necessary to consider the amount of genetic variation necessary to uphold evolutionary potential which is needed for that taxon to adapt to a changing environment. Effective population size provides a standardized measure of the amount of genetic variation that is likely to be transmitted between generations within a population. Effective population size is a theoretical concept that allows one to predict potential future losses of genetic variation within a population due to small population size and genetic drift. Individuals within populations with very small effective population sizes are also subject to inbreeding depression because most individuals within small populations share one or more immediate ancestors (parents, grandparents, etc.) after only a few generations and will be closely related.

The effective population size parameter (N_e) incorporates relevant demographic information that determines the evolutionary consequences of members in a population contributing to future generations (Wright 1931). When prioritizing populations for conservation, N_e is an important parameter because it is inversely related to the rate of loss of genetic diversity and the rate of increase in inbreeding in a population that is finite, but otherwise randomly mating (Waples 2002). Within a population, the census number of sexually mature adults per generation (N) and N_e are the same when the following conditions are met: constant and large population size, variance in reproductive success is binomial (number of progeny per parent follows a Poisson distribution), and sex ratio is equal. Because most populations do not conform to these conditions, the N_e to N ratio is usually below 1.0 (Frankham 1995), and the N_e to N ratio is thought to be between 0.15 and 0.27 in bull trout populations based on computer modeling (Rieman and Allendorf 2001).

A N_e of 50 or more is recommended to avoid the immediate effects of inbreeding and should be considered a minimum requirement for the short-term conservation of populations (Franklin 1980, Soulé 1987). Increased homozygosity of deleterious recessive alleles is thought to be the main mechanism by which inbreeding depression decreases the fitness of individuals within local populations (Allendorf and Ryman 2002). Deleterious recessive alleles are introduced into the genome via random mutations, and natural selection is slow to purge them because they are usually found in the heterozygous form where they are not detrimental. When populations become small, heterozygosity decreases at the rate of $1/(2\ N_e)$ per generation which in turn causes an increase in the frequency of homozygosity of the deleterious recessive alleles. Hedrick and Kalinowski (2000) provide a review of studies demonstrating inbreeding depression in wild populations.

Effective population sizes of 500 to 5000 have been recommended for the retention of evolutionary potential (Franklin and Frankham 1998, Lynch and Lande 1998). Populations of this size are able to retain additive genetic variation for fitness related traits gained via mutation (Franklin 1980).

Bull trout specific benchmarks have been developed concerning the minimum N_e necessary to maintain genetic variation important for short-term fitness and long-term evolutionary potential. These benchmarks are based on the results of a generalized, age-structured, simulation model, VORTEX (Miller and Lacy 1999), used to relate effective population size to the number of adult bull trout spawning annually under a range of life histories and environmental conditions (Rieman and Allendorf 2001). In this study, the authors estimated N_e for bull trout to be between 0.5 and 1.0 times the mean number of adults spawning annually. Rieman and Allendorf (2001) concluded that an average of 100 (i.e., 100 x 0.5 = 50) adults spawning each year would be required to minimize risks of inbreeding in a population and 1000 adults (i.e., 1000 x 0.5 = 500) is necessary to maintain genetic variation important for long-term evolutionary potential. This latter value of 1000 spawners may also be reached with a collection of local populations among which gene flow occurs.

The combination of resident forms completing their entire life cycle within a stream and the homing behavior of the migratory forms returning to the streams where they hatched to spawn promotes reproductive isolation among local bull trout populations. This reproductive isolation creates the opportunity for genetic differentiation and local adaptations to occur. Nevertheless, within a core area local populations are usually connected through low rates of migration. This connection of local populations, linked by migration, is termed a metapopulation (Hanski and Gilpin 1997). Within a metapopulation, evolution primarily occurs at the local population level (i.e., it is the main demographic and genetic unit of concern). However, when longer time frames are considered (e.g., 10 plus generations), metapopulations become important. For example, metapopulations allow for the reintroduction of lost alleles and recolonization of extinct local breeding populations. Migration and gene flow among local populations ensures that the alleles within a metapopulation will be present in most local breeding populations and can be acted upon by natural selection (Allendorf 1983).

Maintain Phenotypic Diversity
Healy and Prince (1995) reported that, because phenotypic diversity is a consequence of the genotype interacting with the habitat, the conservation of phenotypic diversity is achieved through conservation of the sub-population within its habitat. They further note that adaptive variation among salmonids has been observed to occur under relatively short time frames (e.g., changes in genetic composition of salmonids raised in hatcheries; rapid emergence of divergent phenotypes for salmonids introduced to new environments). Healy and Prince (1995) conclude that while the loss of a few sub-populations within an ecosystem might have only a small effect on overall genetic diversity, the effect on phenotypic diversity and, potentially, overall population viability could be substantial. This concept of preserving variation in phenotypic traits that is determined by both genetic and environmental (i.e., local habitat) factors has also been identified by Hard (1995) as an important component in maintaining intraspecific adaptability (i.e., phenotypic plasticity) and ecological diversity within a genotype. He argues that adaptive processes are not entirely encompassed by the interpretation of molecular genetic data; in other words, phenotypic and genetic variation in adaptive traits may exist without detectable variation at the molecular genetic level, particularly for neutral genetic markers. Therefore, the effective conservation of genetic diversity necessarily involves consideration of the conservation of biological units smaller than taxonomic species (or DPSs). Reflecting this theme, the maintenance of local sub-populations has been specifically emphasized as a mechanism for the conservation of bull trout (Rieman and McIntyre 1993, Taylor *et al* 1999).

Fender’s blue butterfly (*Icaricia icarioides fenderi*)

Background
A detailed account of the taxonomy, life history and ecology of the Fender’s blue butterfly can be found in the final rule listing the species as endangered (65 FR 3875).

Current and Historical Range
Fender’s blue butterfly is a Willamette Valley endemic subspecies that was considered to be extinct until rediscovered by Dr. Paul Hammond in 1989 in McDonald Forest, Benton County, Oregon. The historical distribution of Fender’s blue butterfly is not precisely known, due to the limited information collected on this species prior to its description in 1931. Recent surveys have determined that Fender’s blue butterfly is confined to 33 habitat patches in Yamhill, Polk, Benton, and Lane counties, Oregon. One population at Willow Creek Nature Conservacy preserve in Eugene, Lane County, Oregon is found in wet Deschampsia-type prairie, while the

remaining sites are generally found on drier upland prairies characterized by fescue species. The Willow Creek aggregate of populations is the largest of the south valley sites.

<u>Habitat Relationships</u>

Fender's blue butterfly is known to use Kincaid's lupine as its primary larval food plant but is also known to use spur lupine *(Lupinus laxiflorus = L. arbustus)* and sickle-keeled lupine *(L. albicaulis*) as secondary host plants. Female Fender's blue butterfly lay their eggs on lupine foliage in late May or early June; and larvae emerge to feed on foliage during late June. In July, larvae crawl to the base of the plant and enter diapause. From this point until the larvae emerge and begin feeding on foliage again the following April, the larvae remain at the base of the senescent plant, or in the litter immediately adjacent to the lupine stem. Fender's density has been positively correlated with the number of Kincaid's lupine flowering racemes, and more recently, to nectar production in native flowering species used as nectar sources by Fender's. Survivorship of larvae to adult butterflies has been estimated at 0.025-0.060 percent (Schultz and Crone 1998).

Recent research (Schultz and Dlugosh in litt. 1999) indicates that native wildflowers in the Willamette Valley prairies provide more nectar than nonnative flowers for adult butterflies, and that Fender's blue butterfly population density is positively correlated with the density of native wildflowers. In Lane County, key native flowers include: wild onion, (*Allium amplectans*), cat's ear mariposa lily (*Calachortus tolmiei*), common camas (*Camassia quamash*), Oregon sunshine (*Eriophyllum lanatum*), and rose checkermallow (*Sidalcea virgata)* (Schultz and Dlugosh in litt. 1999). Tall oatgrass (*Arrenatherum elatius*) and other non-native grasses can out-compete these native forb species (Hammond 1996). The abundance of exotic grasses can effectively preclude butterflies from using a Kincaid's lupine patch (Hammond 1996).

Habitat Connectivity

Anecdotal evidence indicates that under ideal conditions adult Fender's blue butterflies may disperse as far as 5-6 km (3.1 to 3.7 mi) from their natal lupine patches (Hammond and Wilson 1992; and Schultz 1994). According to Schultz (1997), adult dispersal of this magnitude is not likely anymore. Schultz (1997) found that the butterflies are generally found within 10 m (32.8 ft) of lupine patches, although they might disperse more than 2 km (1.2 mi) between lupine patches. Hammond (1998) reports recolonization of a site by Fender's blue butterfly from a distance of approximately 3 km (1.9 mi). Schultz (1997) further theorizes that Fender's blue originally would have had a high probability of dispersing between patches, which were historically located an average of 0.5 km (0.3 mi) apart. Current distribution of lupine patches range well beyond this distance, and barriers to migration between close sites may be present.

Today, remnant upland prairie acreage is extremely fragmented and remaining Fender's blue butterfly populations so small that migration processes are not expected to maintain the population over time. Extirpation of remaining small populations is expected from localized events and low genetic diversity of very small populations. The low availability of host lupine patches and fragmentation of habitat are seen today as the major ecological factors limiting reproduction, dispersal, and subsequent colonization of new habitat (Hammond 1994, Hammond and Wilson 1993 &1992, Schultz 1997, Schultz and Dugosch 1999).

Kincaid's lupine
Kincaid's lupine is a perennial forb generally associated with native fescue upland prairies that are characterized by heavier soils, with mesic to slightly xeric soil moisture levels. At the southern limit of its range, the subspecies occurs on well-developed soils adjacent to serpentine outcrops where the plant is often found under scattered oaks (Kuykendall and Kaye 1993). Kincaid's lupine is thought to have historically colonized areas along the edge of oak woodlands in upland prairies. Schultz (1997) theorizes that lupine patches were historically distributed no greater than 0.5 km (0.3 mi) apart, allowing dispersal of Fender's blue butterfly between lupine patches.

There are 38 known sites for Fender's blue butterfly across its range in the Willamette Valley totaling approximately 463 acres (Table 5). Of this total area, approximately 25 sites (66 percent) and 242 acres (52 percent of the total area) have Kincaid's lupine as at least a co-dominant host plant. The remaining 13 sites (34 percent) comprise approximately 221 acres (48 percent of the total area).

Table 5. Known Fender's blue butterfly sites and habitat by host plant.

Host Plant(s)	**Sites**	**Acres**	**Percent of Area**
Kincaid's lupine	25	121	26%
Kincaid's lupine + Spurred lupine	1	121	26%
Sickle-keeled lupine	4	21	4.5%
Spurred lupine	7	198	43%
Unknown sp. (Cardwell Hill site)	1	2	0.4%
Total	**38**	**463**	**99.9%**

Population Dynamics
Censuses of Fender's blue butterfly were started in 1991; most of the 22 census units have been surveyed every year since 1993 (Fitzpatrick and Schultz 2001, Hammond 2001, 1998, 1996 and 1994, Hammond and Wilson 1993, Schultz 1994-1998). Appendix B shows the results of these surveys.

Total range-wide population numbers (once most sites were monitored) of Fender's blues have ranged from a low of 1,384 in 1998 to a high in 2000 of 3,492. Although population size appears to have increased between 1998 and 2000, this could be a result of poor weather conditions in 1998, and thus poor flight conditions, and it could also be an artifact of increasing survey effort at these sites. However, some of this increase may be attributed to habitat enhancement activities such as tree and shrub removal from lupine sites.

The USFWS is currently developing a recovery plan for the suite of listed species associated with Willamette Valley prairie habitat, including Fender's blue butterfly.

ENVIRONMENTAL BASELINE (status within the action area)

For the Oregon chub, Fender's blue butterfly and Warner sucker their baseline within the action area is essentially the same as that discussed in the Status of the Species section because the action area encompasses the entire species range.

Bull trout

John Day River Basin

Encompassing most of the John Day River basin (excluding that portion of the South Fork which lies beyond the waterfall), the John Day River CHU is located in the southwest portion of the Blue Mountains ecological province. The John Day River is the fourth largest drainage basin in Oregon, consisting of a mainstem, north, middle, and south forks. The 20,979 square kilometer (8,100 square mile) river basin contains more than 804 kilometers (500 miles) of streams in the mainstem and its three forks. The John Day River is one of the longest free-flowing streams in the continental United States. The mainstem, middle and north forks originate in the Blue Mountains, and the south fork originates in the Ochoco Mountains. The mainstem originates southeast of Prairie City and flows west through John Day to Dayville where it is joined by the south fork. Downstream from Dayville, the river turns north through Picture Gorge and continues on to Kimberly, where it joins with the north fork. The John Day River then flows west from Kimberly for approximately 64 kilometers (40 miles) before turning to the north to the Columbia River confluence at River kilometer 351 (River Mile 218) at an elevation of approximately 61 meters (200 feet) (Oregon Water Resource Department 1986). The lower John Day River from Service Creek downstream to Tumwater Falls is included in the Oregon Scenic Waterways and National Wild and Scenic River systems.

The John Day River basin is comprised of about 62 percent private, 30 percent U.S. Forest Service, and 7 percent Bureau of Land Management, lands. The State of Oregon manages most of the remaining (less than 1 percent) of the John Day River basin, mostly as wildlife management areas near Bridge Creek and Murderers Creek. Over 95 percent of the basin is zoned for agriculture and forestry uses (Oregon Department of Fish and Wildlife 1990). Most of the land within the John Day River basin is ceded territory to the Confederated Tribes of the Warm Springs Reservation. Part of the North Fork John Day River subbasin is land ceded to the Confederated Tribes of the Umatilla Indian Reservation (Buchanan *et al.* 1997).

Historically, bull trout occurred throughout the upper John Day Basin. Within the John Day River basin, historic bull trout distribution likely included seasonal use of the entire mainstem and larger tributaries. Bull trout from the John Day Basin were known to migrate to and from the Columbia River (Buchanan et al. 1997). The John Day watershed presently contains three bull trout subpopulations: one in the Upper John Day River, a second in the Middle Fork John Day River, and a third in the North Fork John Day River. Bull trout distribution is limited primarily to headwaters of the Upper Mainstem, North Fork, and Middle Fork John Day River tributaries, with seasonal use of the entire North Fork John Day River, and suspected seasonal use of the John Day River downstream to the vicinity of the town of John Day (Ratliff and Howell 1992, Buchanan et al. 1997). Elevated water temperature and reduced streamflow due to water diversions in the main stem river and larger tributaries typically act as a barrier to migration during summer and early fall (Buchanan et al. 1997), isolating the subpopulations.

Elevated water temperatures are likely the result of changes in riparian habitat, land management activities such as livestock grazing, logging and salvage of timber and road building (USDA 1998a. Natural lightning fires that burned vast areas also affected bull trout habitat by indirectly increasing sedimentation and water temperatures and by loss of riparian and other vegetation (USDA 1998b. Fires in 1996 burned 80,000 acres in the North Fork and Middle Fork John Day sub-basins (USDA 1998; ODFW 1997).

Aquatic inventory information collected from 1990 through 1992 indicates that summer distribution of bull trout is limited to twenty-five percent of the stream area in which, bull trout were suspected to occur (40 of 165 miles), based on prior information on species presence (Buchanan et al. 1997). Creel survey information (Claire and Gray 1993) for the John Day drainage indicates a reduction in the percentage of bull trout taken versus other trout species from approximately 22 percent during the period from 1961-1970 to 4.5 percent from 1981-1992. However, changes in the fishing regulations in 1980 reduced legal limits for trout from ten fish per day to five fish per day (Buchanan et al. 1997), which should not affect relative proportions but could affect fishing effort. In 1993, Oregon Department of Fish and Wildlife prohibited angling harvest of bull trout in the John Day Basin.

Although, in the past, bull trout occurred throughout the John Day River subbasin, they were probably never as abundant as other salmonids in the subbasin. It is certain that they were more abundant and more widely distributed than they are today. Currently, the U.S. Fish and Wildlife Service considers there to be three core areas in the John Day River subbasin: the North Fork John Day River Core Area, the Middle Fork John Day River Core Area, and the Upper Mainstem John Day River Core Area (USFWS 2003a)

Currently, there are three subpopulations recognized in the basin (Buchanan et al. 1997): the upper John Day basin including tributary streams; the North Fork John Day River including tributary streams; and the Middle Fork John Day and its tributary. The three subpopulation areas all flow together with no physical barriers between them, except for barriers as a seasonal consequence of low flow and high stream temperatures during summer that may limit the seasonal distribution of individuals.

North Fork John Day River

Based on distribution information contained in Buchanan *et al.* (1997), and professional judgment of the John Day River Recovery Unit Team, six local populations have been identified in the North Fork John Day River subbasin: (1) upper North Fork John Day River (Crawfish, Baldy, Cunningham, Trail, Onion, and Crane creeks as well as the North Fork John Day River upstream of Granite Creek; (2) upper Granite Creek including Bull Run, Deep, Boulder, and Boundary creeks and the upper mainstem Granite Creek); (3) Clear/Lightning creek including Salmon Creek, (4) Clear Creek below the Pete Mann ditch (including Lightning Creek below the ditch), (5) Desolation Creek (includes South Fork Desolation Creek below the falls and North Fork Desolation Creek), and (6) South Fork Desolation Creek above the falls.

Based upon inventories conducted in 1992, bull trout distribution in the North Fork John Day River and tributaries is limited to 18 percent of the previously known range (Claire and Gray

1993). Although no specific potential populations are identified, bull trout recovery could be enhanced by the reintroduction of bull trout to areas in streams above many natural, and man made barriers (*e.g.*, Cunningham Creek, Lightning Creek, etc.).

There are concerns regarding habitat conditions resulting mainly from timber harvest, mining and the road system. All of these activities produce and input large amounts of sediment into the system which affects water quality, and substrate. Further, these activities have altered stream channels causing loss of shade, which causes increased water temperatures, and produces thermal barriers to migration. Many streams have been channelized and become less complex lowering their value as habitat.

There are also concerns over the presence of brook trout, which compete for forage, and interbreed with bull trout.

Middle Fork John Day River

Distribution information for the Middle Fork John Day River indicates that three local populations currently exist within this drainage. Local populations include (7) Clear Creek, (8) Granite Boulder Creek, and (9) Big Creek (Buchanan *et al.* 1997). The Malheur National Forest (1998a) identifies (A) Vinegar Creek, (B) upper Big Boulder Creek, (C) Butte Creek, (D) Davis Creek and (E) the upper Middle Fork John Day River as potential habitat for bull trout local populations (potential local populations).

Current distribution in the Middle Fork John Day River is based on isolated sightings with the primary distribution restricted to tributaries and limited to 22 percent of stream miles previously known to support bull trout (Claire and Gray 1993, Buchanan *et al.* 1997). Biological assessments for the Middle Fork John Day River subbasin (Malheur National Forest 1998a and 1999a) and Prairie City Ranger District (Malheur National Forest 1998b) provide detailed descriptions of baseline habitat conditions. Summer distribution of bull trout, based on the 1990 and 1992 Oregon Department of Fish and Wildlife Aquatic Inventory Project, indicated bull trout occupy approximately 16 miles of stream in the Middle Fork John Day River watershed, including: 8.8 kilometers (5.5 miles) in Big Creek, 4 kilometers (2.5 miles) in Deadwood Creek (a tributary to Big Creek), 6.4 kilometers (4 miles) in Granite Boulder Creek; and 6.4 kilometers (4 miles) in Clear Creek. Bull trout migration from these tributary streams during the summer is highly unlikely due to high water temperatures and habitat modifications in the mainstem. Aquatic inventory surveys conducted by the Oregon Department of Fish and Wildlife in 1990 and 1991 detected 60 bull trout in the Middle Fork John Day River basin; two fish were measured at 260 millimeters (10 inches) and 360 millimeters (14 inches), all others were less than 210 millimeters (8 inches) in length (Buchanan *et al.* 1997). In the 1999 and 2000 surveys of Clear Creek, eight redds were observed each year (Malheur National Forest 2001).

Bull trout in the Middle Fork John Day River persist at low abundance levels. In 1999, population surveys were conducted in Clear Creek, Big Creek, Deadwood Creek, and Granite Boulder Creek to estimate abundance. Total numbers of bull trout consisting of primarily juvenile and subadult fish, were estimated to be 1,950 individuals in Big Creek, 640 individuals in Clear Creek, and 368 individuals in Granite Boulder Creek (Hemmingsen 1999).

There are concerns regarding habitat conditions resulting mainly from timber harvest, livestock grazing, mining and the road system. All of these activities produce and input large amounts of sediment into the system which affects water quality, and substrate. Further, these activities have altered stream channels causing loss of shade, which causes increased water temperatures, and produces thermal barriers to migration. Many streams have been channelized and become less complex lowering their value as habitat. Historic livestock grazing has altered the plant composition in many areas causing loss of stream shade and natural regugia.

Upper Mainstem John Day River

Based on distribution information contained in Buchanan *et al.* (1997), and professional judgment of the John Day River Recovery Unit Team, two bull trout local populations were identified in the upper mainstem John Day River. The (10) upper John Day River local population (includes a portion of the mainstem John Day River, Deardorff Creek, Reynolds Creek, Rail Creek, Roberts Creek, and Call Creek) and the (11) Indian Creek local population occurs above the flow barrier (Buchanan *et al.* 1997).

Three potential local populations have also been identified. These include (F) Pine Creek, (G) Canyon Creek, and (H) Strawberry Creek have been listed as areas that possess habitat which would be suitable for bull trout.

Spawning surveys of bull trout habitat in tributary streams to the mainstem John Day River showed few fish spawning in this stream. The 1999 and 2000 surveys were done on portions of Call Creek, Deardorff Creek, John Day River, Rail Creek, Reynolds Creek, and Roberts Creek. Only Deardorff Creek was surveyed for two consecutive years. The number of redds observed in Deardorff Creek were twelve the first year and ten the second year (Malheur National Forest 2001).

There are concerns regarding habitat conditions resulting mainly from timber harvest, livestock grazing, and the road system. All of these activities produce and input large amounts of sediment into the system which affects water quality, and substrate. Further, these activities have altered stream channels causing loss of shade, which causes increased water temperatures, and produces thermal barriers to migration. Many streams have been channelized and become less complex lowering their value as habitat. Historic livestock grazing has altered the plant composition in many areas causing loss of stream shade and natural regugia.

There are also concerns over the presence of brook trout, which compete for forage, and interbreed with bull trout, and other non-native fish, such as bass that may act as predators on, or compete with bull trout.

Hood River Basin

The Hood River is one of 22 recovery units proposed for bull trout in the Columbia River Distinct Population Segment. Designation of the Hood River Recovery Unit is based in part on the designation of bull trout in the Hood River Basin as a Gene Conservation Group by Oregon Department of Fish and Wildlife (ODFW 1995). The delineation of the Gene Conservation Group is supported by the genetic analysis conducted by Spruell and Allendorf (1997). There is one core area designated for the Hood River Recovery Unit, the Hood River Core Area.

The Hood River was further defined to include the Sandy River Basin as core habitat. Bull trout have only recently been discovered in the Sandy River, which is adjacent to the Hood River Basin, and there is insufficient information at present to determine the source of bull trout observed in the Sandy River, or define any local populations and their respective core areas. The northwestern limit of the Hood River Recovery Unit extends to Bonneville Dam on the Columbia River. However, records of bull trout in the Bonneville reservoir, at Bonneville Dam, and immediately downstream of the dam indicate the possibility that bull trout from Hood River may be foraging and/or overwintering in the Columbia River. Further, three records of bull trout in the Sandy River indicate additional possibilities: (1) the Sandy River watershed supports a population of bull trout; or (2) bull trout foraging and/or overwintering in the Columbia River, possibly from the Hood River population, may occasionally be entering the Sandy River or other tributaries downstream of the Hood River Recovery Unit boundaries.

The U.S. Fish and Wildlife Service identified two subpopulations of bull trout in the Hood River basin within the Middle Fork Hood River drainage: (1) Laurance Lake (upstream of Clear Branch Dam) and (2) Hood River (downstream of Clear Branch Dam and including tributaries). Historically, bull trout distribution included primarily the mainstem, Middle Fork and tributaries, and a short reach of the West Fork; and bull trout likely used the Columbia River for juvenile rearing and adult foraging (Buchanan *et al.* 1997). Punchbowl Falls is suspected to be a natural barrier to fish migration in the West Fork of Hood River during low flows; at the time of listing, only one bull trout had been captured at this location (Pribyl *et al.* 1996; Buchanan *et al.* 1997). Resident and migratory life history forms were identified above and below the Clear Branch Dam, and the total number of mature fish were believed to be below 300 individuals basin-wide (Buchanan *et al.* 1997).

Snorkel surveys of the Laurance Lake subpopulation detected 50 to 301 total bull trout annually from 1992 through 1996, including juveniles (Buchanan *et al.* 1997). Although upstream passage was recently provided by a trap at Clear Branch Dam, at the time of listing the Service considered this subpopulation isolated until information was available on trap effectiveness; the trap has subsequently been found to be ineffective. The Service considered this subpopulation at risk of stochastic extirpation due to its inability to be naturally reestablished, existence of a single spawning area, and low abundance.

Bull trout in the Middle Fork Hood River subpopulation are believed to spawn in Compass Creek and the Middle Fork Hood River (Buchanan *et al.* 1997). Nineteen fish with fork length greater than 200 millimeters (7.9 inches) were collected during surveys of Compass Creek in 1995 (Buchanan *et al.* 1997).

The U.S. Fish and Wildlife Service did not consider the Sandy River as bull trout habitat at the time of listing. At that time, there were no recent or historical accounts of bull trout occurring in the Sandy River. Since the listing, bull trout have been sighted three times in the Sandy River.

Current bull trout distribution in the Hood River basin occurs in five major areas within the basin: the Hood River, the East and West Fork of Hood River, the Middle Fork Hood River, and the Clear Branch of Hood River. Currently, bull trout are consistently found in only three of these areas, the Hood River, the Middle Fork Hood River, and the Clear Branch of Hood River. Bull trout distribution in the East and West Forks of Hood River are based on isolated, infrequent sightings. Historical distribution is believed to approximate current distribution based on existing knowledge. A comprehensive population assessment is not available, but at present the total number of adult bull trout in the recovery unit is believed to be less than 300.

The Clear Branch local population is located above Clear Branch Dam, and includes bull trout in Laurance Lake and Pinnacle Creek. Most, if not all, of the current spawning activity occurs in Clear Branch upstream of Laurance Lake. The Hood River local population includes Clear Branch downstream of the dam, Bear, Coe, Compass, Tony, and Eliot Creeks, West Fork of Hood River and potentially Evans Creek and the East Fork Hood River.

Although confirmation is lacking for the East Fork Hood River and the number of observations is limited for the West Fork of Hood River, bull trout would not have been precluded from using these tributaries historically, at least on a seasonal basis. Based on professional opinion, bull trout are believed to have occurred in the East Fork historically (USDA 96a). Analyses of East Fork tributary streams and stream segments for suitable bull trout habitat is not available at present. Bull trout are known from the West Fork of Hood River from two sightings, and U.S. Forest Service (1996b) identifies streams with suitable bull trout habitat based on temperature observations. Based on existing information, use of East and West Fork mainstems and tributaries appears to be for foraging, migration, and overwintering. According to Buchanan *et al.* (1997), William Stanley from the Middle Fork Irrigation District observed a bull trout in Evans Creek, a tributary to the East Fork Hood River, in the early 1990's. Subsequent survey of the area by a fisheries biologist did not yield any further detections (Buchanan *et al.* 1997). Small numbers of additional sightings are documented for the East Fork tributaries on Evans Creek and at the mouth of Wisehart Creek, again attributed to William Stanley (USDA 96a). Bull trout in Evans Creek and the East Fork Hood River may be traveling through the irrigation canal which runs from Eliot Branch (a tributary to the Middle Fork Hood River known to contain bull trout) (USDA 1996a), they may be attracted to Evans Creek from downstream, due to the addition of Eliot Branch water (USFWS 2002f).

There are two records of bull trout occurrence in the West Fork of Hood River. The earliest available documentation is from 1963 of one fish in the trap at Punchbowl Falls fish ladder (USDA 1996b, Buchanan *et al.* 1997). Another bull trout was captured at the mouth of Lake Branch, a tributary to the West Fork of Hood River, in the fall of 1997 by the Oregon Department of Fish and Wildlife.

The mainstem Hood River is formed by the confluence of the Middle Fork and the East Fork. At present, this section of river is believed to be used primarily for foraging, migration, and overwintering. Migrations include journeys into the Columbia River of unknown extent, however, at least two bull trout tagged at the Powerdale Dam trap have been recovered in 1994 and 2000 at or near Drano Lake on the opposite side of the Columbia River in Washington State (Pribyl *et al.* 1996; ODFW, *in litt.* 2001) and another tagged in 1994 was captured in 1995, 11 kilometers downstream of the confluence of the Hood and Columbia Rivers (Buchanan *et al.* 1997). Overwintering in the mainstem Hood River is suspected because untagged adult bull trout have been observed at several locations within the Hood River Basin (USDA 1996a) indicating they have not crossed the Powerdale Dam and upstream trap. There are no known spawning locations on the mainstem Hood River, and primary information on bull trout use of the mainstem is the trap data from Powerdale Dam.

Prior to 1992, trap counts at Powerdale Dam were not consistent due to counting at only one of the two ladders, or the ladders themselves being inoperable (USDA 1996a). Numbers of bull trout counted during this period range from a high of 12 in 1967, to a low of zero in 1970, and average five fish annually over the nine-year period (USDA 1996a). Bull trout have been trapped at the Powerdale Dam fish trap continuously since 1992 (Buchanan *et al.* 1997). Numbers trapped range from a high of 28 fish in 1999 to 2 fish in 1993 (USFWS 2002f).

There are concerns regarding PCEs 1, 2, 3, 4 and 7 resulting mainly from timber harvest, and the road system. Both of these activities produce and input large amounts of sediment into the system which affects water quality, and substrate. Further, these activities have altered stream channels causing loss of shade, which causes increased water temperatures, and produces thermal barriers to migration. Many streams have been channelized and become less complex lowering their value as habitat.

Klamath River Basin

The Klamath River Basin includes three distinct watersheds: the Upper Klamath Lake watershed, the Sycan River watershed, and the upper Sprague River watershed. These watersheds were included in a single recovery unit because bull trout probably functioned as a single unit historically.

The Klamath River and its tributaries flow through a total of seven counties, two in southern Oregon (Klamath and Josephine Counties) and five in northwestern California (Warner, Siskiyou, Trinity, Humboldt, and Del Norte Counties), before reaching the Pacific Ocean. The Klamath River basin consists of approximately 10 million acres and has its headwaters in south-central Oregon (ODFW 1997). Elevations vary from 840 meters (2,755 feet) in the Klamath River canyon at the state line to 2,894 meters (9,495 feet) on Mt. McLoughlin in the Cascades and 2,549 meters (8,364 feet) on Gearhart Mountain at the eastern edge of the basin. Most of the drainage tributaries funnel through Upper Klamath Lake, elevation 1,261 meters (4,140 feet), before spilling into Link River and Lake Ewauna at the head of the Klamath River (ODFW 1997).

The Upper Klamath Lake core area is comprised of the lake and its immediate major and minor tributaries. The lake is the collection point for most of drainage tributaries, with a surface area of

37,260 hectares (92,000 acres). It is classified as hypereutrophic (or highly productive) (ODFW 1997). This core area incorporates the Upper Klamath Lake drainage, including waters draining from Crater Lake National Park south of Scott Peak and from the area west of and including the Williamson River below Klamath Marsh. Also included is the west side of the Winema National Forest from Crater Lake National Park south into the Spencer Creek and Varney Creek drainages on the west side of Klamath Lake.

This core area includes three existing local bull trout populations: Threemile Creek, Sun Creek, and Lost Creek. Sun Creek, in Crater Lake National Park, currently supports the largest local population in the Upper Klamath Lake core area. Major tributaries are the Williamson and Wood Rivers. Numerous small streams that are spring fed and surface water fed originate along the rim of the basin.

Since bull trout became listed as threatened in the Klamath River basin in 1997, the extent of known bull trout-occupied habitat has been expanded slightly, from seven to nine existing populations. A local population of bull trout has been established in Lost Creek in Crater Lake National Park (Klamath Lake core area), and bull trout have been rediscovered in Coyote Creek (Sycan River core area), a local population formerly thought to have been extirpated. Additionally, several extensions of existing populations have also been discovered.

The Recovery Unit Team expressed concern over several of the PCEs within the Klamath River CHU. These include: PCE 1, 2, 3, and 4 due to the combination of effects from road building, timber harvest, irrigation, and historic livestock grazing. Also PCEs 8 and 9 from the introduction of brown trout, lake trout, brook trout, and large mouth bass within the basin. PCE 7 is of concern because of dewatering by irrigation, and passage problems at dams throughout the basin.

Upper Klamath Lake

As recently as the 1970s, bull trout were documented in Cherry and Sevenmile Creeks (Ratliff and Howell 1992; Light *et al*. 1996), although bull trout in both streams are thought to be extirpated. Surveys in 1990, 1991, and 1997 failed to detect any bull trout in Cherry Creek (OCAFS 1993; Buchanan *et al*. 1997), and bull trout are also believed to be extirpated from Sevenmile Creek (Ratliff and Howell 1992; Buchanan *et al*. 1997). Bull trout have not been documented from the Wood River since 1938 (Dambacher *et al*. 1992).

In 1996, the Threemile Creek local population was estimated to be approximately fifty fish in a 1.4-kilometer (0.84-mile) reach (Buchanan *et al*. 1997) entirely within the upper drainage within Winema National Forest lands. Brook trout co-occurred with bull trout for 0.3 kilometer (0.18 mile) of this 1.4-kilometer (0.84-mile) reach (Buchanan *et al*. 1997).

In 2000, the results of an intensive snorkel survey of Threemile Creek indicated a population of at least 91 bull trout (KBBTWG, *in litt.*, 2000) in a 3.9 kilometer (2.4-mile) stretch. Recently, the Oregon Department of Fish and Wildlife during a survey of private lands below the Westside Road did not encounter any bull trout and only a low incidence of redband trout (USFWS 2002).

The Sun Creek local population was estimated to be 133 adult bull trout (105 spawners) in 1989 (OCAFS 1993) in a 6.2-kilometer (3.9-mile) reach of Sun Creek, which is entirely within Crater Lake National Park (Buktenica 1997). During 1992 to 1994, annual estimates of bull trout abundance ranged from 120 to 260 fish (Buktenica 1997). In 2000, bull trout abundance was 635 fish for the 14.5 kilometers (8.7 miles) of stream within the National Park boundaries (USFWS 2002). In 1999, 119 bull trout were transplanted into Lost Creek in Crater Lake National Park to insure against loss of the original genetic stock during efforts to remove nonnative salmonids from Sun Creek.

Sycan Marsh

Long Creek, a tributary of the Sycan River, has the only sizable population of bull trout in the Sycan River drainage. Buchanan *et al*. (1997) considered bull trout in the upper Sycan River to be "probably extinct". Several reports mention bull trout captured in the upper Sycan River as late as 1994 (Buchanan *et al*. 1997). Bull trout are thought to be locally extirpated in Calahan Creek, Sycan River, and the South Fork Sycan River (Ratliff and Howell 1992; Ziller 1992; Light *et al*. 1996; Buchanan *et al*. 1997). The most recent capture of a bull trout hybrid in Calahan Creek occurred in 1993 (Light *et al*. 1996).

In 1998, presence/absence surveys discovered bull trout in Coyote Creek, where the fish was previously thought to be locally extirpated. Two bull trout and two bull trout x brook trout hybrids were observed (USFWS 2002). Because of the close proximity of Coyote Creek to Long Creek and because of the interconnectivity of canals and the Sycan Marsh, these fish probably originated from the Long Creek population.

In 1991, the Long Creek local population was estimated at 842 fish, with a spawning-size abundance of 362 adults (OCAFS 1993). In 1994, biologists estimated 855 bull trout in Long Creek. In 1995, the estimated bull trout population declined approximately 50 percent (approximately 400 fish) (Buchanan *et al*. 1997). Sampling in the 1990's indicated increasing numbers and multiple age classes of brook trout co-occurring with bull trout (Light *et al*. 1996). Population surveys in 2000 (KBBTWG, *in litt.,* 2000) led to estimates of 491 bull trout in the upper 3.4 kilometers (2.1 miles) of Long Creek. Population estimates are not available for the reaches below river kilometer 21.2 (river mile 13.2).

Prior to 1999, bull trout inhabited only the upper 3.4 kilometers (2.1 miles) of Long Creek. Buchanan *et al*. (1997) reported that Long Creek bull trout distribution had been reduced to the upper 1.3 kilometers (0.8 mile) of the drainage, a reduction in range of 1.5 kilometers (0.9 mile) since 1994. Presence/absence surveys in 1999 and 2000 indicated that bull trout are distributed in Long Creek upstream of the Sycan Marsh upstream for 23.2 kilometers (13.9 miles) (KBBTWG, *in litt.,* 2000). Within the Long Creek watershed, fish occupying the upper 2.8 kilometers (1.7 miles) are within the Fremont National Forest, while those within the lower reaches are on private land (U.S. Timberlands, Inc.) (Light *et al*. 1996).

Until 1998, only resident bull trout were thought to occur in Long Creek, although the capture of a 510-millimeter (20-inch) bull trout (Light et al. 1996) indicated the possible persistence of fluvial or adfluvial life history forms. In 1998, the observation of large fish up to 425 millimeters

(16.7 inches) during presence/absence surveys and brook trout removal efforts further support the possible persistence of fluvial or adfluvial forms (USFWS 2002). In 1998, presence/absence surveys also found bull trout in downstream reaches of Long Creek that were previously thought to be uninhabited. Because downstream reaches of Long Creek and portions of the Sycan Marsh have not been surveyed or have been inadequately surveyed, bull trout distribution within this area may be more extensive than previously suspected. For example, bull trout were last documented in Coyote Creek in 1987 (Ziller 1992) and until recently were thought to be locally extirpated in this stream. During 14 presence/absence surveys in 1998, however, bull trout were rediscovered in this stream (USFWS 2002). In 1999 and 2000, radio telemetry studies indicated that larger bull trout use lower Long Creek and parts of the Sycan Marsh during portions of the year (USFWS 2002), suggesting possible persistence of migratory forms in the Sycan Marsh.

Upper Sprague River

At the time of listing, only five streams within the Sprague River (Boulder, Dixon, Brownsworth, Deming, and Leonard Creeks) were occupied by bull trout. During presence/absence surveys in 1998, three bull trout were observed in Sheepy Creek, an area where the fish were previously thought to be locally extirpated (USFWS 2002). All of these streams originate in the Gearhart Mountain Wilderness Area within the Fremont National Forest. Bull trout summer distribution in Boulder and Dixon Creeks is 9.0 kilometers (5.6 miles) within the upper portions of these streams (total combined stream length approximately 11 kilometers [6.8 miles]). Bull trout co-exist with brown trout for 0.4 kilometers (.25 mile) of this 9.0-kilometer (5.6-mile) reach (Buchanan *et al*. 1997). Because of the proximity of Boulder and Dixon Creeks, the bull trout in these two streams are considered a single population. Previous population estimates placed bull trout abundance in Boulder and Dixon Creeks at 219 individuals. Presence/absence surveys in 1998 failed to detect any bull trout in Boulder Creek.

Because bull trout can range downstream in Boulder and Dixon Creeks to the confluence with the North Fork Sprague River, this area of the North Fork Sprague River may be occupied by bull trout during part of the year (Light *et al*. 1996). Observations of large (greater than 400 millimeter [15.7 inches]) bull trout during presence/absence surveys in 1997 (USFWS 2002) and an angler report (USFWS 2002) of a bull trout greater than 355 millimeters (14 inches) in 2000 indicate that fluvial fish may still persist in the North Fork Sprague River. Unlike for the Upper Klamath Lake and Sycan River core areas, no recent extirpations of local bull trout populations have been reported in the Upper Sprague River core area.

The largest population of bull trout in the Klamath River basin, approximately 1,200 fish, inhabit Deming Creek. Summer distribution in Deming Creek is 6.4 kilometers (3.8 miles) within this 17.3-kilometer (10.7-mile) stream (Buchanan *et al*. 1997). Deming Creek bull trout naturally occur with resident redband trout (Buchanan *et al*. 1997). During the summer, bull trout distribution does not extend below a water diversion structure at river kilometer 15.6 (river mile 9.4) where nearly all water is diverted. Deming Creek flows become subsurface flows approximately 0.6 kilometer (1.0 mile) below the diversion.

In summary, the current abundance, distribution, and range of bull trout in the upper Klamath River basin are greatly reduced from historical levels. In the Klamath River basin, nine local populations of bull trout persist in only 82.2 kilometers (51.1 miles) of waters in three core areas. In the Upper Klamath Lake core area, bull trout are limited to 25.9 kilometers (16.1 miles) in Threemile, Sun, and Lost Creeks. In the Sycan River core area, bull trout inhabit 23.2 kilometers (14.4 miles) in Long Creek and appear to persist in part of the Sycan Marsh. In the Upper Sprague River core area, bull trout are limited to 33.1 kilometers (20.6 miles) in Deming, Leonard, Boulder, Dixon, Brownsworth, and Sheepy Creeks and in the North Fork Sprague River. Since the 1970's, bull trout have been extirpated from Cherry and Sevenmile Creeks and are thought to be extirpated from Calahan Creek, the lower Sycan River, and the South Fork Sycan River. Klamath Basin bull trout are threatened because local populations: 1) consist primarily of resident forms, 2) currently survive in fragmented and degraded habitats, 3) are at low numbers and have low reproductive potential, 4) are subject to interspecific competition and predation from brook and brown trout, and 5) hybridize with brook trout (Light *et al*.1996).

The Upper Sprague River currently supports five local populations of bull trout considered essential to the conservation of the species: Boulder/Dixon Creek; Sheepy Creek; Deming Creek; Brownsworth Creek; and Leonard Creek. A remnant fluvial population exists in the North Fork of the Sprague River (USFWS 2002). To fully achieve recovery of bull trout in the Klamath Basin, the Draft Recovery Plan (USFWS 2002) calls for a total of 7 to 10 local populations in the Upper Sprague River.

Malheur River Basin

The Malheur River is situated in the Malheur Basin in eastern Oregon. It is bordered on the south by the Owyhee River Basin, on the north by the Burnt River and John Day River Basins, on the west by the Malheur Lakes Basin, and by the Snake River to the east, which it enters near Ontario, Oregon. The basin includes portions of four counties; 62 percent occurs in Malheur County, 27 percent in Harney County, and small areas in Grant and Baker Counties (Malheur-Owyhee Watershed Council 1999).

From its headwaters in the Strawberry Range, at the southern terminus of the Blue Mountains, the Malheur River flows southeasterly for 105 kilometers (65 miles), turning north for 12 kilometers (19 miles), then east near the town of Juntura and continuing east to northeast to its confluence with the Snake River near the town of Ontario, a total distance of approximately 306 kilometers (190 miles) (Malheur-Owyhee Watershed Council 1999). Major tributaries include the South Fork Malheur River, which enters from the west at river kilometer 191 (river mile 119) near Riverside; the North Fork Malheur River, which enters at river kilometer 154 (river mile 96) near Juntura; Bully Creek, which enters at river kilometer 34 (river mile 21); and Willow Creek, which enters at river kilometer 32 (river mile 30). The latter three tributaries all enter the mainstem Malheur River from the north. The most important of the tributaries in terms of bull trout is the North Fork Malheur River, which also originates in the Strawberry Range and flows south to its confluence with the mainstem Malheur. Total drainage area of the Malheur River Basin is 11,940 square kilometers (5,000 square miles) (Malheur-Owyhee Watershed Council 1999). Elevations in the basin range from the highest point on Graham Mountain at 2,613 meters (8,570 feet) to 610 meters (2,000 feet) at the mouth of the Malheur River (Hanson *et al.* 1990).

Public ownership accounts for approximately 66 percent of the land in the basin, most of it (47 percent) managed by the U.S. Bureau of Land Management, while 13 percent is managed by the Malheur National Forest and 6 percent is State-owned land. The remainder of the basin is in private or tribal ownership. Special management areas on the Malheur National Forest important to bull trout include the Strawberry Wilderness Area in the upper Malheur River, the Monument Rock Wilderness Area in the North Fork Malheur River watershed, and the Wild and Scenic corridor in the North Fork Malheur River. In 2000, the Burns Paiute Tribe acquired 712 hectares (1,760 acres) in Logan Valley. The property encompasses approximately 11 kilometers (7 miles) of waterways, including portions of McCoy Creek, Big Creek, Lake Creek, Frazier Creek, and Malheur River (L. Schwabe, Burns Paiute Tribe, pers. comm. 2002).

There are two local bull trout populations, the upper Malheur (a) and North Fork Malheur (b), containing four streams with potential habitat where additional habitat essential to the conservation of bull trout will be established following restoration (Bosonberg Creek, McCoy Creek, Corral Basin Creek, and the Little Malheur River) these streams were also identified as essential to recovery in the Draft Recovery Plan (USFWS 2002).

Buchanan *et al*. (1997) classified bull trout in the North Fork Malheur River as “of special concern” and in the Upper Malheur River as at “high risk” of extinction. Categories of increasing extinction risk ranged from “low risk of extinction” to “probably extinct”. Placement in each category was determined based on relative abundance, the severity of factors suppressing the population (for example, habitat conditions and presence of brook trout), and the potential of the population to recover to a healthy condition (Ratliff and Howell 1992). The category “of special concern” falls between a “low” and “moderate” risk level.

Bull trout are found in the North Fork Malheur River subbasin and in the upper Malheur River mainstem and tributaries upstream of the town of Drewsey. They are considered two distinct local populations because of their geographic isolation from construction of dams without fish passage on the mainstem Malheur River and North Fork Malheur Rivers.

A list of those streams that are included in the bull trout Proposed Critical Habitat for this CHU is available in the proposed rule, which was published on November 29, 2002 (FR 67 71236).

The Recovery Unit Team expressed concern over several threats to fish and habitat within the Malheur River. These include: repeated use of rotenone in past years; the combination of effects from road building, timber harvest, irrigation, and historic livestock grazing and dewatering by irrigation, passage problems at two dams in the basin, and from the introduction of brook trout and crappie within the basin.

North Fork Malheur River

Spawning and rearing takes place in the mainstem and tributaries upstream of Crane Crossing in the North Fork Malheur River. Results from studies of radio-tagged fish (18 tagged in Beulah Reservoir in 1999) showed that bull trout moved upstream from overwintering areas in Beulah Reservoir into the river from mid-April until late May in 1999 (Schwabe et al. 2000), and in 2000, some were observed in the river by mid-March (Schwabe et al. 2001). By June tagged fish were well distributed in the North Fork Malheur between Beulah Reservoir and the spawning areas. By early August the majority of tagged fish had moved upstream of Crane Creek confluence at river mile 42.8 (river kilometer 69) and some had moved into spawning tributaries by mid-July. The peak for migration into spawning tributaries occurred by mid to late-August. The peak in adult downstream migration from spawning tributaries occurred in late September and bull trout returned to the reservoir between late October and mid-December (Schwabe *et al.* 2000 and 2001).

Spawning surveys were initiated in the North Fork Malheur subbasin in 1992 in streams with known or suspected bull trout populations (Buchanan *et al.* 1997). Based on data collected since 1992, bull trout spawning begins in late August and peaks in September. Redds have been observed as late as November (Schwabe *et al.* 2000). Spawning has been documented in the mainstem North Fork Malheur upstream of the mouth of Deadhorse Creek and in the following tributaries: Horseshoe Creek, Swamp Creek, Sheep Creek, Elk Creek, Crane Creek, and Little Crane Creek. Bull trout have been observed in Cow Creek during spawning surveys, but no redds have been found (Schwabe *et al.* 2000).

Subadult rearing and adult foraging occurs from the headwaters of the North Fork Malheur River down to, and in, Beulah Reservoir. In August of 1997, an interagency team of biologists snorkel surveyed the North Fork Malheur River from the confluence of the North Fork and Little Malheur Rivers upstream to the National Forest boundary. They documented bull trout rearing down to the confluence of the Little Malheur River. Sizes of bull trout ranged from 50 to 400 millimeters (2 to 16 inches) in length with the majority in the 100 to 200 millimeter (4 to 8 inch) size range. The largest bull trout observed was in the 300 to 400 millimeter (12 to 16 inch) size range (USFWS 2002). Trapping of subadult bull trout during 1998 and 1999 using a rotary screw trap and passive integrated transponder (PIT) tags showed bull trout migrating downstream from spawning and rearing areas (upstream of Crane Creek) in the North Fork Malheur River. During the period the trap was operated (June to October) two peaks in migration were observed, the largest in June, and another smaller one in September. The smallest bull trout trapped in Beulah Reservoir during 1998 and 1999 measured 220 millimeters, or 8 to 9 inches in length (Schawbe *et al.* 2000). Most radio-tagged bull trout overwintered in Beulah Reservoir. Some bull trout exit Beulah Reservoir during flood control operations, as well as during the irrigation season and are lost to the population above the dam. The extent of use and survival of bull trout in the mainstem Malheur River downstream of Agency Dam is unknown. During the 1999 study, five bull trout were fitted with radio tags and released below the dam. Most of the radio-tagged bull trout stayed within 1.5 kilometers (1 mile) of the dam during the study period (Schwabe *et al.* 2000).

Redd surveys are used to track bull trout trends in abundance in the Malheur River Basin. A general upward trend in redd numbers has been observed since 1992 Survey areas and timing have been standardized since 1996, so these data represent the most accurate estimate of trend available (Tinneswood and Perkins 2001).

In 2000, surveyors observed 29 redds with 2 or more bull trout on them, or 19 percent of the total redds counted (151). The number of bull trout observed on a single redd ranged from one to five, or approximately 2.4 bull trout per redd (Tinneswood and Perkins 2001). This represents the maximum bull trout per redd ratio recorded for the North Fork Malheur River local population. In 2001, when fewer redds and bull trout were counted, the ratio was closer to 2.0 (USFWS 2002). These ratios along with redd counts for the period 1996 to 2001 were used to estimate abundance of adult bull trout in the North Fork Malheur. An estimate of 4,132 bull trout age at least one year old for the North Fork Malheur River is based on population sampling completed in 1991 and 1992 using a multiple pass removal method (Buchanan *et al.* 1997).

Upper Malheur River

Bull trout spawning and juvenile rearing occurs in the Upper Malheur River and tributaries upstream of the confluence of Big Creek. Streams where redds have been identified include Snowshoe Creek, Meadow Fork Big Creek, Lake Creek, Summit Creek, and Big Creek, although brook trout may account for some of the redds.

Timing of bull trout spawning in the Upper Malheur population is similar to what has been observed in the North Fork Malheur population with the peak occurring in mid-September. Data collected in 1999 showed that 40 percent of the redds were counted prior to September 15th. These redds were assumed to be bull trout redds as they occurred in streams where most of the bull trout were also observed, although brook trout were present during surveys (Schwabe *et al* 2000).

Subadult rearing and adult foraging occurs downstream to approximately river kilometer 286 (river mile 178) in the vicinity of Hog Flat, based on limited historical and recent radio-telemetry documentation (Schwabe *et al.* 2001), and one radio-tagged fish was tracked to near the mouth of Wolf Creek in the spring of 2002 (USFWS 2002). It is possible, although not documented, that fish forage as far downstream as Warm Springs Reservoir during winter.

A general upward trend in redds counted in the Upper Malheur River has been observed for the period of record, 1998 to present. However, an estimate of adult abundance for the Upper Malheur River local population is not available at this time because of the inability to distinguish between bull trout and brook trout redds when not occupied.

Oregon Department of Fish and Wildlife estimated the bull trout population at 3,554 bull trout at least one year old, based on population sampling in 1993 and 1994 in Big Creek, Lake Creek, and the Meadow Fork of Big Creek. Densities ranged from a high of 0.474 fish per lineal meter (762.8 fish per mile) in Meadow Fork of Big Creek to a low of 0.039 fish per lineal meter (62.8 fish per mile) in Lake Creek (Buchanan *et al.* 1997).

Powder River Basin and the Hells Canyon Complex

The Hells Canyon Complex includes basins in Idaho and Oregon, draining into the Snake River and its associated reservoirs from below the confluence of the Weiser River downstream to Hells Canyon Dam. This recovery unit contains three Snake River reservoirs, Hells Canyon, Oxbow, and Brownlee. Major watersheds are the Pine Creek, Powder River, and Burnt River drainages in Oregon, and the Indian Creek and Wildhorse River drainages in Idaho. Inclusion of bull trout in the Oregon tributaries (*i.e.,* Pine Creek and Powder River) in one recovery unit is based in part on a single gene conservation unit (*i.e.,* roughly the major drainages in Oregon inhabited by bull trout) recognized by the Oregon Department of Fish and Wildlife (Kostow 1995), which is supported by the genetic analysis conducted by Spruell and Allendorf (1997). Although the genetic composition of bull trout in the two tributaries in Idaho has not been extensively studied, the streams were included in the recovery unit due to their close proximity to the tributaries in Oregon containing bull trout, and the likelihood that bull trout from all tributaries were able to interact historically. Administratively, the Oregon Department of Fish and Wildlife established a working group to develop bull trout conservation strategies in Pine Creek, and the streams in Idaho were included in the Hells Canyon Key Watersheds in the Idaho Bull Trout Conservation Plan (Grunder 1999).

The Hells Canyon Recovery Unit encompasses three 4th-field hydrologic units of the U.S. Geologic Survey. The Brownlee Reservoir hydrologic unit (hydrologic unit code (HUC)--1705201) includes the Snake River, Hells Canyon Complex of three reservoirs, and all tributaries in Idaho and Oregon from just downstream of the Weiser River confluence to Hells Canyon Dam, excluding the Burnt River and Powder River basins in Oregon. This hydrologic unit consists of 334,120 hectares (825,600 acres). The Burnt River hydrologic unit (HUC--1705202) includes the entire Burnt River basin, and consists of 282,319 hectares (697,600 acres). The Powder River hydrologic unit (HUC--1705203) includes the entire Powder River basin, and consists of 445,494 hectares (1,100,800 acres).

The Snake River flows in a generally south to north direction, and forms the boundary between Idaho and Oregon within the Hells Canyon Complex Recovery Unit. The recovery unit consists of 168 kilometers (104 miles) of the Snake River, of which most of the length is within the Hells Canyon Complex of reservoirs. Tributaries in which bull trout occur or may occur flow into the three Snake River reservoirs (Table 1). Elevations within the Hells Canyon Complex Recovery Unit range from about 2,133 to2,438 meters (7,000 to 8,000 feet) in the Wallowa Mountains and Blue Mountains in Oregon (Buchanan *et al.* 1997) and from 2,255 meters (7,400 feet) in the Seven Devils Mountains in Idaho (Grunder 1999), to 122 meters (400 feet) at Hells Canyon Dam (Saul *et al.* 2001).

In the final listing rule (63 FR 31647) the U.S. Fish and Wildlife Service identified four bull trout subpopulations in the Pine Creek watershed (Meadow Creek-Clear Creek, upper Pine Creek, East Pine Creek, and Elk Creek) and three in the Powder River basin (Powder River upstream of Mason Dam, North Powder River, and Big Muddy Creek) (U.S. Fish and Wildlife Service (USFWS) 1998).

Federal and State resource agencies and the Idaho Power Company have documented the occurrence of bull trout in portions of the Hells Canyon Complex Recovery Unit (*e.g.,* Buchanan *et al.* 1997; Grunder 1999; Chandler, J.A., *in litt.* 2000; Chandler *et al.* 2001). Distributional data for bull trout in the recovery unit comes primarily from presence-absence surveys and basin-wide surveys using techniques such as electrofishing, radio telemetry, spawning ground surveys, snorkeling, and traps.

The Recovery Unit Team expressed concern over several threats to fish and habitat within the Hells Canyon Complex. These include: the combination of effects from road building, timber harvest, irrigation, historic livestock grazing, dewatering by irrigation, passage problems at dams, and from the introduction of crappie, bluegill, brown trout, lake trout, brook trout, large and small mouth bass within the basin.

Pine Creek

Comprehensive data on bull trout abundance through time in the recovery unit does not exist. Hells Canyon Reservoir is the downstream reservoir in the Hells Canyon hydroelectric complex, lying between Hells Canyon Dam and Oxbow Dam, and forms the lower- most portion of the Hells Canyon Complex Recovery Unit. Bull trout occur in Hells Canyon Reservoir (Chandler, *in litt.* 2000) and two tributaries to the reservoir, the Pine Creek basin in Oregon (Buchanan *et al.* 1997) and Indian Creek basin in Idaho (Grunder 1999). The confluence of Indian Creek is within the Oxbow Dam bypass, a 3.7 kilometer (2.3 mile) reach of original river channel between Oxbow Dam and the point of water discharged from the Oxbow Dam Powerhouse (Idaho Power Company 1999). Oxbow Dam bypass is a relatively shallow backwater area maintained with a minimum flow of 2.8 cubic meters per second (100 cubic feet per second).

During 1993 through 1999, Idaho Power Company collected a total of 13 bull trout and 4 bull trout-brook trout hybrids upstream of Hells Canyon Dam in the reservoir and Indian Creek, using a downstream migrant weir near its confluence (Chandler, *in litt.* 2000). Two bull trout, one collected near Hells Canyon Dam and the other in Oxbow Dam bypass, were implanted with radio tags and subsequently located at least 8 kilometers (5 miles) upstream in Pine Creek during the spring and summer. Locations observed for one individual within Pine Creek included North Pine Creek and a tributary, Lake Fork Creek.

In the Pine Creek basin, bull trout occur in: upper Pine Creek, which includes West Fork Pine Creek, Middle Fork Pine Creek, and East Fork Pine Creek; Clear Creek; which includes upper Clear Creek, Trail Creek, and Meadow Creek; East Pine Creek; and Elk Creek, which includes the entire length of Elk Creek, Big Elk Creek, Aspen Creek, and Cabin Creek (Buchanan *et al.* 1997). Although bull trout were noted in a creel report from Lake Fork Creek in 1965, extensive sampling of the stream since 1990 collected brook trout, but did not detect bull trout (other than the bull trout observed there during the study by Idaho Power Company). The length distribution of bull trout surveyed from various streams in the Pine Creek basin during 1994 (Buchanan *et al.* 1997), and the limited pre- and post-spawning movements exhibited by radio-tagged fish (Chandler *et al.* 2001) suggest that most bull trout in the basin are resident fish.

However, the movement of radio-tagged bull trout from Hells Canyon Reservoir to Pine Creek suggests that migratory fish persist in the basin. Bull trout abundance was estimated for four streams in the Pine Creek basin by the U.S. Forest Service in 1994 (Buchanan et al. 1997). Maximum estimated abundance for bull trout was less than 400 individuals for each stream. Several index sites have been established in bull trout spawning and rearing habitat to conduct redd counts (Fedora and Walters, in litt. 2001). In the eight streams where survey sites exist, the actual number of redds observed ranged from 0 to 43 per site during 1998 through 2000, which is equivalent to 0 to 37.3 redds per kilometer (0 to 60.0 redds per mile) of stream length.

In Indian Creek, bull trout have been repeatedly observed in the headwaters near Bluejacket Mine and the upstream headwaters, including Camp Creek, since 1979, (Grunder 1999; Nelson 2001). Although population estimates have not been made in the Indian Creek basin, a U.S. Forest Service habitat survey crew observed 60 bull trout in Camp Creek (Nelson 2001). The U.S. Forest Service and Idaho Department of Fish and Game personnel estimated bull trout density in a reach of Indian Creek adjacent to Bluejacket Mine by electrofishing in 1998 (Grunder 1999). Bull trout density was 2.4 fish per 100 square meters (0.2 fish per 100 square feet). Based on 27 individuals, mean total length was 170 millimeters (range 103 to 219 millimeters; mean 7.0 inches, range 4.0 to 8.6 inches) suggesting that these were resident bull trout. However, bull trout were collected at a downstream migrant weir operated during fall 1998 and 1999 near the confluence of Indian Creek (Chandler and Richter 2001). One brook trout and 10 bull trout-brook trout hybrids (210 to 280 millimeters; 8.3 to 11.0 inches) were collected in 1998. One brook trout, three bull trout-brook trout hybrids, and two bull trout (220 and 270 millimeters; 8.7 and 10.6 inches) were collected in 1999, suggesting that migratory bull trout may occur in Indian Creek.

Powder River

In the Powder River basin, bull trout occur in tributaries of the Powder River upstream of Mason Dam (Silver Creek, Little Cracker Creek, and Lake Creek), tributaries of the Powder River between Mason Dam and the North Powder River confluence (Salmon Creek, Pine Creek, Rock Creek, and Big Muddy Creek), and the upper North Powder River and some tributaries (Anthony Creek, North Fork Anthony Creek, Indian Creek, and Wolf Creek) (Buchanan *et al.* 1997). For tributaries of the lower Powder River (*i.e.*, downstream of Thief Valley Dam), oral histories from residents indicate that bull trout occurred in Big Creek and were common in Eagle Creek during the 1940's and 1950's (Gildemeister 1992). However, there have been no recent reports of bull trout in Big Creek. There are creel reports from 1965 and angler reports during the mid-1980's of bull trout in Eagle Creek, but extensive surveys in 1991 and 1994 did not detect bull trout (Buchanan *et al.* 1997). The only report of bull trout in Brownlee Reservoir was a 305-millimeter (12 inch) individual captured by net during 1959 after the reservoir had filled (Buchanan *et al.* 1997).

Bull trout redd counts and density estimates have been performed in some tributaries of the Powder River basin, primarily as components of investigations of bull trout-brook trout interactions and spawning ground surveys. Bull trout densities were estimated in five tributaries of the upper Powder River and North Powder River in 1996 during an investigation of bull trout-brook trout distribution, abundance, and interactions (Bellerud *et al.* 1997). Mean densities of bull trout were 1.0 to 9.5 individuals per 100 meters (330 feet) of stream length. In an 8.6-kilometer reach (5.3 miles) of Silver Creek, spawning surveys were conducted to investigate the use of redds counts as an estimate of adult bull trout abundance. Multiple redd counts were conducted annually in September and October 1996 through 1999 (Bellerude et al. 1997; Hemmingsen et al. 2001a, 2001b, 2001c). The total number of redds observed per year in the study was 7 to 36 redds. In 1999, snorkel and electrofishing surveys were conducted in Silver Creek to determine bull trout age structure, size-at-maturity, and adult abundance (Hemmingsen et al. 2001c). All bull trout 150 millimeters (5.9 inches) and greater in fork length were mature; about a third below this value to 130 millimeters (5.1 inches) were mature. A total of 885 bull trout with 150 millimeters (5.1 inches) fork length and greater were estimated to occur in Silver Creek. Redd counts were also conducted in three streams during reconnaissance-level surveys in 1998. All bull trout inhabiting the Powder River basin are thought to be resident fish.

Imnaha-Snake River Basin

The Imnaha-Snake River Basin is located in the northeast corner of Oregon and spans the State line into western Idaho. It is defined by a combination of the Imnaha River subbasin and a portion of the Snake River watershed, from the confluence of the Salmon River south to Hells Canyon Dam. A large portion of the recovery unit lies within the boundaries of the Wallowa-Whitman National Forest, the Nez Perce National Forest, and the Hells Canyon Wilderness. The basin drains an area of approximately 2,847 square kilometer (1,112 square miles). The headwaters of the Imnaha River originate in the Eagle Cap Wilderness area. The mainstem Imnaha is formed at an elevation of 1,615 meters (5,300 feet) and flows in a northerly direction for approximately 101 kilometers (63.5 miles) to its confluence with the Snake River at river kilometer 306 (river mile 191) (U.S. Forest Service 1994; Northwest Power Planning Council 2001).

The Imnaha-Snake River basin includes bull trout from the Imnaha River, Sheep Creek, and Granite Creek watersheds. The entire Imnaha River subbasin, which constitutes the majority of the recovery unit, is in the State of Oregon. The Sheep Creek and Granite Creek subbasins are located in the State of Idaho.

After considering information that is currently available, including that in Ratliff and Howell (1992), Kostow (1995), and Buchanan *et al*. (1997), the recovery unit team identified seven extant, local populations of bull trout within the Imnaha-Snake Rivers Recovery Unit. A local population is considered to be fish from a given species which spawn in a particular lake or stream(s) at a particular season, and which to a substantial degree do not interbreed with any group spawning in a different place, or in the same place at a different season. The risk of any given population going extinct varies within the recovery unit. The risk of the Imnaha River local population going extinct is low (Ratliff and Howell 1992). The risk of either the local populations above or below the diversion in Big Sheep Creek going extinct is of special concern (see Ratliff and Howell 1992). The risk of the McCully Creek local population going extinct is considered moderate (Buchanan *et al*. 1997). The risk of the Little Sheep Creek local population going extinct is considered high (Buchanan *et al*. 1997). From the Idaho portion of the recovery unit, reports exist of bull trout in Sheep and Granite Creeks. However, information on the status of these stocks is not available, their risk of extinction cannot be determined, and both are considered research needs. All stocks identified in the recovery unit are believed to be native fish. There have been no known releases of hatchery-origin bull trout anywhere in the recovery unit.

In the past, bull trout occurred throughout the Imnaha-Snake Rivers Recovery Unit. Although bull trout were probably never as abundant as other salmonids in the subbasin, they were probably more abundant and more widely distributed than they are today. Reports from anglers who fished the Imnaha River in the 1940’s suggest that large bull trout were relatively abundant.

Currently, the Service considers there to be three core areas in the Imnaha-Snake Rivers Recovery Unit: the Imnaha River, Sheep Creek, and Granite Creek. Four bull trout local populations have been recognized in the Oregon portion of the recovery unit (Ratliff and Howell 1992): the Imnaha River (above the mouth of Big Sheep Creek), Big Sheep Creek, Little Sheep Creek, and McCully Creek. Although there have also been bull trout observed in the mouths of Deep and Wolf Creeks, there does not appear to be a distinct local population of bull trout in these creeks (USFWS 2002; Buchanan *et al*. 1997). All bull trout in the Imnaha-Snake Rivers Recovery Unit are native fish sustained by wild production. There is very little information to indicate whether these stocks are genetically distinct. The Oregon Department of Fish and Wildlife separated stocks based on geographical, physical, and thermal isolation of the spawning populations.

For the purposes of the recovery plan bull trout local populations within the Imnaha-Snake Rivers Recovery Unit have been designated based on reestablishment of connectivity and reduction of threats. The Oregon Department of Fish and Wildlife in cooperation with the Service, U.S. Forest Service, the Confederated Tribes of the Umatilla Indian Reservation, and the Nez Perce Tribe, conduct annual bull trout spawning ground surveys in selected locations within the basin. This data represents the best census information available for abundance within the Imnaha River subbasin. The Service is unaware of any census information for the Sheep Creek and Granite Creek stocks of bull trout.

The Recovery Unit Team expressed concern over several threats to fish and habitat within the Imnaha-Snake Basin. These include: the combination of effects from road building, historic livestock grazing, the presence of Hells Canyon Dam, and hatchery facilities designed to capture Chinook.

Imnaha River

Depending on the season, bull trout can be found throughout the Imnaha River (see Buchanan *et al*. 1997). For examples, summer distribution in the mainstem Imnaha River extends from at least river kilometer 64 (river mile 39.8) to the Forks at river kilometer 118 (river mile 73.3), whereas fall and spring distributions include the lower Imnaha and Snake Rivers. Bull trout have been observed throughout the mainstem of the Imnaha River as well as in the South Fork, Middle Fork, and North Fork of the Imnaha. In the Middle Fork, upstream distribution appears to be limited by a waterfall that is approximately 2 river kilometers (1.2 river miles) from the mouth. Bull trout have also been observed in Bear, Blue, and Soldier Creeks, all tributaries to the South Fork of the Imnaha River. Although there have been isolated reports of bull trout in Lightning Creek (Buchanan *et al*. 1997), standard surveys have not been able to document meaningful numbers of spawning and rearing fish.

Spawning in the Imnaha River presumably occurs in the headwater areas as well as in some headwater tributaries. Most known summer rearing and holding areas in the Imnaha River are on National Forest or wilderness lands above Summit Creek. On an intermittent basis, bull trout can also be found distributed throughout the mainstem Imnaha River, perhaps migrating to and from various tributaries or following sources of food. It is certain that some fluvial bull trout from the Imnaha River migrate out of the Imnaha River and overwinter in the Snake River and, given recent radiotelemetry data (Chandler and Richter 2001), fish found in the Imnaha River below Summit Creek are probably moving between summer or spawning habitat and overwinter habitat in the lower Imnaha or Snake Rivers. Fluvial adults appear to migrate upstream in the Imnaha River during the months of May, June, July, and perhaps August. Fluvial adults appear to move downstream in the Imnaha River during the months of August, September, October, and perhaps November.

Limited information is available on the abundance of bull trout in the Imnaha River. Standard redd counts (USFWS 2002) have been conducted only recently. Migratory adults captured at a chinook salmon weir (near river kilometer 74; river mile 46) have been enumerated since the mid-1980's (USFWS 2002). However, in many years the weir did not begin operating until after the middle of July (USFWS 2002). In some years, standard creel surveys are conducted between September and April for a summer steelhead fishery (Flesher, *in litt.* 2002). Although these surveys collect some information on bull trout, they are not done in a manner conducive to estimating abundance. Ratliff and Howell (1992) considered bull trout from the Imnaha River at low risk of extinction. Little information is available on the size of these fish at spawning, age at maturation, sex ratio, fecundity, time of emergence, or survival rates. It seems likely that bull trout in this population complex exhibit both resident and fluvial life history forms.

Big Sheep Creek. Bull trout in Big Sheep Creek have been observed throughout the mainstem as well as in the Middle and South Forks of the Imnaha River, Salt Creek, and Lick Creek (Buchanan et al. 1997). Summer distribution extends from approximately river kilometer 43 to 61 (river mile 26.7 to 37.9) in Big Sheep Creek, from river kilometer 0 to 11 (river mile 0 to 6.8) in Lick Creek, and includes the lower 2.5 river kilometers (1.6 river miles) of Salt Creek. Historically, summer distribution likely extended downstream in Big Sheep Creek to around the mouth of Coyote Creek. Although Smith and Knox (1992) concluded that at least 300 spawning bull trout were probably present, no specific population estimates have been conducted in Big Sheep Creek. Ratliff and Howell (1992) considered bull trout in Big Sheep Creek between a low and moderate risk of extinction. Although appears to occur above river kilometer 50 (river mile 31) near Owl Creek (Buchanan there is poor information on the dynamics of bull trout in Big Sheep Creek, the majority of summer rearing et al. 1997).

Presumably spawning occurs in the headwater tributaries. Resident fish in Big Sheep Creek were found to mature at a fork length of approximately 160 mm (6.3 inches) (Smith and Knox 1992). Otherwise, very little information is available on the size of fluvial fish at spawning, age at maturation, sex ratio, fecundity, time of emergence, and survival rates. Few, if any, attempts have been made to capture fluvial bull trout migrating in Big Sheep Creek. However, it seems likely that bull trout in this population exhibit fluvial and resident life history forms. A diversion for the Wallowa Valley Improvement Canal exists at approximately river kilometer 61 (river mile 37.9) of Big Sheep Creek. Fish can be found on both sides of this diversion, which has segregated the population of bull trout in Big Sheep Creek. While fish may occasionally ‘spill’ downstream, fish cannot pass upstream of the diversion.

Little Sheep Creek. Bull trout in Little Sheep Creek have been observed throughout the mainstem as well as in Cabin and Redmont Creeks (Buchanan et al. 1997). The summer distribution extends from approximately river kilometer 37 to 45 (river mile 23 to 28) in Little

Sheep Creek and includes the lower few kilometers of both Cabin and Redmont Creeks. Bull trout were observed in Little Sheep Creek during presence/absence surveys in 1991 but not in 1992. No specific population estimates have been conducted for bull trout in Little Sheep Creek. Very little information is available on the size of fish at spawning, age at maturation, sex ratio, fecundity, time of emergence, and survival rates. Buchanan et al. (1997) considered bull trout in Little Sheep Creek at a high risk of extinction. Although there is poor information on the dynamics of bull trout in Little Sheep Creek, the majority of summer rearing appears to occur above the canal diversion at approximately river kilometer 41 (river mile 25.5) (Buchanan et al. 1997). Presumably spawning occurs above river kilometer 41 (river mile 25.5) in Little Sheep Creek and in the lower portions of Cabin and Redmont Creeks.

Fluvial bull trout migrating upstream in Little Sheep Creek have been captured at the Oregon Department of Fish and Wildlife's steelhead facility (weir). The weir is at approximately river kilometer 8 (river mile 5) and generally operates between March and June. Although this evidence suggests that a fluvial component still exists in this population, it seems likely that bull trout in this population also exhibit a resident life history form.

A diversion for the Wallowa Valley Improvement Canal exists at approximately river kilometer 41 (river mile 25.5) of Little Sheep Creek. This diversion has segregated the population of bull trout in Little Sheep Creek. While fish may occasionally 'spill' downstream, fish cannot pass upstream of the diversion. In addition, fish above the diversion may not have originated in Little Sheep Creek but may have originated from any number of streams (*e.g.*, Big Sheep Creek) being diverted into the canal. Finally, some of the tributaries to Little Sheep Creek (*i.e.*, Redmont Creek) have also been segregated by a diversion for the canal.

McCully Creek. Bull trout have been observed throughout McCully Creek (Buchanan et al. 1997). Summer distribution extends from the uppermost reaches of McCully Creek down to the canal diversion (at approximately river kilometer 4.5 or river mile 2.8). Bull trout from McCully Creek are probably distributed in the canal. Fish movement up the canal is likely limited by a 9 meter (29.5 foot), cascading waterfall that is approximately 4 kilometers (2.5 miles) from McCully Creek. Fish movement down the canal is probably limited, at least seasonally, by poor water quality conditions and warm water temperatures that would force fish back into McCully Creek. Smith and Knox (1992) estimated approximately 8 bull trout per 100 square meters of McCully Creek, and extrapolated a total population estimate of 2,500 fish. However, Buchanan et al. (1997) considered bull trout in McCully Creek at a moderate risk of extinction because of the isolated nature of this population.

Although there is poor information on the dynamics of bull trout in McCully Creek, summer rearing and spawning appears to occur throughout the creek, particularly in National Forest and Wilderness areas (Buchanan *et al*. 1997). Very little information is available on the size of fish at spawning, age at maturation, sex ratio, fecundity, time of emergence, and survival rates. Fluvial bull trout appear to exist in all other populations of the Imnaha River subbasin, including Little Sheep Creek, to which McCully Creek is a tributary. Hence, it seems probable that McCully Creek once supported bull trout that expressed a fluvial life history. However, bull trout in McCully Creek have essentially been isolated above the canal diversion since the 1880's. Thus, bull trout in McCully Creek are no longer able to express a fluvial life history form, and instead exhibit a resident life history form.

The Wallowa Valley Improvement Canal diversion exists at approximately river kilometer 4.5 (river mile 2.8) of McCully Creek. This diversion has isolated the population of bull trout in McCully Creek to areas above the canal. While fish may occasionally 'spill' downstream, fish cannot pass upstream of the diversion. In addition, fish above the diversion may have originated from McCully Creek or from any number of streams (*e.g.*, Big Sheep Creek) being diverted into the canal.

Wallowa Valley Improvement Canal

Bull trout have been observed throughout the Wallowa Valley Improvement Canal (Buchanan et al. 1997). Construction of this canal began in the 1800's. The canal begins near Big Sheep Creek and carries water from various tributaries (e.g., Big Sheep Creek, Salt Creek, Little Sheep Creek, McCully Creek) into Prairie Creek or assorted irrigation canals found in the Wallowa Valley (which is part of the Grande Ronde Recovery Unit for bull trout). Parts of the canal were constructed while other parts utilized existing stream channels. The canal has a waterfall approximately 1 river kilometer (0.6 mile) below Ferguson Creek that is likely impassable to bull trout. Bull trout in the canal have not been recognized as a distinct population. The majority of bull trout in the canal probably originated from Big Sheep Creek, but some fish may be from a variety of streams (e.g., Salt Creek, Little Sheep Creek, McCully Creek). The number of bull trout in the canal is unknown. Although there is poor information on the dynamics of bull trout in the canal, summer rearing and spawning appears to occur throughout, but particularly in the uppermost reaches of the canal (Buchanan et al. 1997). All fish in the canal are resident; the fluvial life history form cannot be expressed by bull trout in the canal.

Umatilla -Walla Walla River Basins

The Umatilla-Walla Walla River basins are based in part on the inclusion of bull trout of these two river basins within the same Gene Conservation Group1 by Oregon Department of Fish and Wildlife (Kostow 1995). This Gene Conservation Group also includes the John Day River bull trout. The delineation of the Gene Conservation Group is supported by the genetic analysis conducted by Spruell and Allendorf (1997). The Umatilla-Walla Walla Recovery Unit was further defined to include only the Umatilla and Walla Walla river basins for administrative and logistical reasons. Populations in the Umatilla-Walla Walla Recovery Unit are widely separated from those in the John Day Basin and are managed in different Oregon Department of Fish and Wildlife administrative units, as well as different U.S. Forest Service National Forests.

Historically, the Umatilla and Walla Walla river basins contained important areas for anadromous salmon and steelhead production. Many actions identified for bull trout recovery will overlap with recovery objectives for anadromous fish species. Coordination of anadromous and resident fish efforts in the Umatilla-Walla Walla Recovery Unit is essential to ensure the recovery actions are not detrimental to all species concerned. In addition, this recovery unit geographically overlaps ceded lands of the Confederated Tribes of the Umatilla Indian Reservation. The Confederated Tribes of the Umatilla Indian Reservation have treaty rights that include fishing, hunting, and grazing. For purposes of recovery, the U.S. Fish and Wildlife Service considers a “recovered status” to include the possibility for harvest within specific areas of the recovery unit. When the Umatilla-Walla Walla Recovery Unit has achieved its goal, the Washington Department of Fish and Wildlife, the Oregon Department of Fish and Wildlife, and the Confederated Tribes of the Umatilla Indian Reservation will determine the location and level of bull trout harvest that can be sustained while maintaining healthy populations.

These basins are part of the Columbia River Distinct Population Segment and is located in northeastern Oregon and southeastern Washington. It is bordered on the north by the Snake River, on the east by the Tucannon and Grande Ronde Rivers, on the south by the John Day River, and on the west by the Columbia River. Both the Umatilla and the Walla Walla Rivers drain the western slopes of the Blue Mountains and enter the Columbia River from the east; the Umatilla River just downstream from McNary Dam (River Kilometer 469.9, River Mile 292) and the Walla Walla River upstream of the Umatilla River between McNary Dam and the confluence of the Columbia River with the Snake River (Oregon Water Resources Department (OWRD) 1974 and 1988).

The Umatilla River drains an area of approximately 2,540 square miles (6,579 square kilometers) and is approximately 89 miles (143 kilometers) from its mouth to where it divides into the north and south forks Umatilla River, each fork adding another approximately 10 miles (16 kilometers) of length. Major tributaries in addition to the north and south forks include Meacham Creek, Birch Creek, Butter Creek, and Wildlhorse Creek. Of these, the north and south forks and Meacham Creek contain the most current and potential bull trout spawning and rearing habitat for bull trout. The Umatilla River originates at elevations up to 4,228 feet (1,289 meters) and descends to an elevation of about 269 feet (82 meters) at its confluence with the Columbia River.

The Walla Walla River drains an area of approximately 1,758 square miles (4,453 square kilometers), of which 73 percent or 1,278 square miles (3,309 square kilometers) is located in Washington and 480 square miles (1,243 square kilometers) is located in Oregon (U.S. Corps of Engineers (USCOE) 1997). The north and south forks of the Walla Walla River originate in Oregon at elevations of 4,920 to 5,576 feet (1,500 to 1,700 meters). The North Fork Walla Walla River, 18 miles (29 kilometers) in length, and the South Fork Walla Walla River, 27 miles (43 kilometers) in length, join to form the mainstem Walla Walla River about 4 miles (6.4 kilometers) southeast of the town of Milton-Freewater, Oregon. Other major tributaries include the Touchet River, approximately 90 miles (145 kilometers) in length, and Mill Creek, approximately 35 miles (56 kilometers) in length. The Touchet River drains the northern and northwestern portions of the Walla Walla Basin before entering the lower mainstem Walla Walla River about 21.6 miles (34.8 kilometers) upstream of the Columbia River near the community of Touchet, Washington. From its headwaters in the Blue Mountains, Mill Creek dips south and flows for about 6 miles (10 kilometers) in Oregon (about 17 percent is in Oregon), then re-enters Washington to join the mainstem Walla Walla River downstream from the city of Walla Walla at River Mile 33.6 (River Kilometer 54). The elevation of the Walla Walla River is about 340 feet (104 meters) at its confluence with the Columbia River in Washington. The highest point in the Walla Walla Basin is Table Mountain at 6,250 feet (1,905 meters) elevation (USCOE 1997).

Bull trout in the Umatilla-Walla Walla Recovery Unit exhibit both fluvial and resident life histories. Adult resident forms are generally less than 300 millimeters (12 inches) in length, while adult fluvial bull trout can exceed 500 millimeters (20 inches) in length. Both forms spawn in headwater tributaries from late August into November, although the actual spawning season may vary within this period depending on local conditions in each stream. After spawning, fluvial bull trout return to overwintering areas in the mainstems of both river systems until the following spring when the upstream migration begins, presumably in response to increasing water temperatures. They spend the summer through fall in lower order tributaries or in the upper mainstems of the Umatilla and Walla Walla Rivers.

Scale analysis from bull trout captured in Mill Creek in 1998, showed bull trout up to nine years of age in the sample. Most fish captured in the upstream migrant trap and presumed upstream migrants were five years or older and those captured in the downstream migrant trap were age four or younger (Hemmingsen *et al*. 2001b). Scale analysis from 17 Umatilla River bull trout, including otoliths from two mortalities, showed bull trout larger than 250 centimeters (10 inches) were over 3 years of age (ODFW 1997b).

Martin *et al*. (1992) reported that the minimum fork length of any observed spawning bull trout was 250 millimeters (10 inches) in three southeast Washington streams, including Mill Creek, and ranged up to 600 millimeters (24 inches) in size. Bellerud *et al*. (1997) observed spawning bull trout ranging in size from 100 millimeters (4 inches) to greater than 500 millimeters (20 inches), with most of them in 300 millimeters (12 inches) or larger size classes. Size of bull trout observed during Oregon Department of Fish and Wildlife spawning ground surveys in the South Fork Walla Walla River in 1995 ranged in size from approximately 200 millimeters (8 inches) to greater than 610 millimeters (24 inches) (Germond *et al*. 1996a). Based on the scale analysis in 1998, most Mill Creek spawners are age four or older (Hemmingsen *et al*. 2001b). Eroded caudal fins indicating prior spawning activity suggest Umatilla bull trout reach sexual maturity and spawn in their fourth year (ODFW 1997b).

Additional information is needed on bull trout life history and abundance to better estimate adult abundance, monitor genetic health, and assess population viability in the recovery unit. A tentative list includes (1) annual abundance of breeders per local population and total for the recovery unit; (2) population structure and connectivity; (3) life history characteristics including age at first spawning, incidence, regularity and timing of repeat spawning, and total life span; (4) reproductive success in production of pre-adult offspring; (5) survival rates to breeding adult; and (6) reproductive success in replacement of breeders (USFWS 2002). For planning purposes the Umatilla and the Walla Walla river basins were each divided into major reaches based on existing or potential habitat, they provide for resident and migratory bull trout. Two habitat categories were identified: (1) spawning, juvenile rearing, and resident habitat, and (2) overwintering, migration, and sub-adult rearing habitat. Each river basin will be discussed separately.

The Recovery Unit Team expressed concern over several threats to fish and habitat within the Umatilla-Walla Walla basins. These include: effects from road building, timber harvest, irrigation, gravel mining, railroad operations, historic livestock grazing, dewatering by irrigation, and passage problems at dams throughout the unit; the introduction of, brook trout, and large mouth bass, and other non-native fish.

Umatilla Basin

For purposes of recovery the recovery unit team has identified two local populations, the North Fork and North Fork Meacham Rivers. Spawning has been documented in the North Fork Umatilla River. Population numbers in Meacham Creek are believed to be below what can be considered a viable population at this time due to lack of evidence of spawning.

Data from screw traps and radio-tagged bull trout show migrants in the mainstem Umatilla downstream of Meacham Creek (Reach I) in late October and early November. They currently use this reach as far downstream as Pendleton from late October until June when fish begin to migrate upstream, probably in response to warming water temperatures. Squaw Creek is also used by rearing and migrating bull trout (Contor *et al*. 1995). Juvenile rainbow trout have been observed downstream to Cayuse (River Kilometer 109, River Mile 67.5) during summer and this is currently the downstream summer distribution limit for cold water species (Umatilla-Walla Walla recovery unit team, *in litt*, 1999a).

Data from monitoring stations at Echo and Pendleton indicate the water temperatures increase above 12 degrees Celsius (54 degrees Fahrenheit) in this reach between June and October (ODFW, *in litt.* 1999b). The greatest bull trout adult densities were recorded at temperatures equal or less than 12 degrees Celsius (54 degrees Fahrenheit); no individuals were present at temperatures above 20 degrees Celsius (68 degrees Fahrenheit), as reported in the general literature (Buchanan and Gregory 1997). Very little is known about bull trout use of the mainstem and tributaries downstream of Pendleton, although a few bull trout have been observed there since 1994. Staff at the adult upstream migrant fish collection facility at Three Mile Dam recorded single bull trout in the spring of 1995, 1996, 1999 and 2000, and a bull trout was captured at the juvenile collection facility at Westland (River Mile 27.3, River Kilometer 44) in 1994 (ODFW unpublished data). Bull trout were also angled at Echo in 1998 and at approximately River Mile 42 (River Kilometer 68) in 1997, during the winter steelhead fishery. During November 1999, two bull trout were salvaged from lower McKay Creek, after McKay Reservoir water releases for fish migration were ended for the season.

Meacham Creek mainstem and tributaries (except for North Fork Meacham Creek) (Reach II) if restored could serve as future adult overwintering habitat. Suitable spawning and rearing habitat occurs in East Fork Meacham Creek, but bull trout have not been observed there (Germond *et al*. 1996b). Most bull trout use in North Fork Meacham Creek (Reach III) occurs upstream of the confluence of North Fork Meacham and Bear Creeks and in Pot Creek. Resident bull trout are also found in this reach. When redd counts were initiated in 1994, two redds were observed in the reach between Bear Creek and Pot Creek and one redd was observed in Pot Creek. One redd, possibly that of a bull trout, was observed in Pot Creek in 1995, but none have been seen during surveys since that time. A few adult bull trout have been observed in the North Fork of Meacham Creek several miles above the mouth during summer steelhead escapement surveys in April and May and one during spring chinook prespawning surveys in July (USFWS 2002).

The mainstem Umatilla River and tributaries from Meacham Creek to theconfluence of the North Fork and South Fork Umatilla Rivers (Reach IV) is used seasonally by rearing subadult and overwintering adult bull trout. Rearing and migration also occur in Ryan Creek (Germond *et al*. 1996b). Reach IV has the potential to provide year round rearing habitat if restored.

The North Fork Umatilla River (Reach V) supports most of the spawning, rearing and resident bull trout use in the Umatilla Basin. Most of the spawning occurs in the North Fork Umatilla mainstem between Coyote and Woodward Creeks, in approximately 5 kilometers (3 miles) of habitat. Some rearing occurs in Coyote Creek (Germond *et al*. 1996b), and one redd was found during spawning surveys in 1999 (USFWS 2002).

Bull trout spawning has not been observed in the South Fork Umatilla (Reach VI) since 1994. At that time one redd was counted in the reach between the mouths of Thomas and Shimmiehorn Creeks, although it may conceivably have been a spring chinook redd (USFWS 2002). Rearing occurs in Buck, Thomas, Spring, and Shimmiehorn Creeks (Germond *et al*. 1996). With restoration the South Fork Umatilla may also support another local bull trout population.

Evidence of spawning activity has not been observed in Meacham Creek since 1994, although some rearing is known to occur. With restoration this system could potentially support a local bull trout population. A coordinated effort to collect spawning count data involving Oregon Department of Fish and Wildlife, Confederated Tribes of the Umatilla Indian Reservation, and U.S. Forest Service has been ongoing since 1994. The apparent increase in redd counts is generally attributed to more restrictive angling regulations instituted in 1994 and 1997. Population estimates for adult bull trout populations in the North Fork Umatilla River between 1994 to 2000, based on redd counts, ranged from 53 to 352, and averaged 165 (USFWS 2002).

Walla-Walla River

The Walla Walla River once supported significant runs of spring chinook and steelhead. Fall chinook, chum, and coho salmon may have occurred in the Walla Walla River in smaller numbers. Information provided by the Confederated Tribes of the Umatilla Indian Reservation indicates tribal fishers took chum, steelhead, coho, and eels at usual and accustomed sites in the lower Walla Walla River near the mouth. Summer steelhead are the only native anadromous salmonid found in the Walla Walla River Basin at present, although their status is “depressed based on chronically low production” (Washington Department of Fish and Wildlife (WDFW) 1993). The last significant run of spring chinook was reported in 1925 (Nielson 1950), and they persisted into the 1950's (Van Cleave and Ting, *in litt.* 1960).

Habitat in the lower reaches of the Walla Walla River and its tributaries presents a challenge to salmonids due to inhospitable temperatures (*i.e.*, greater than 75 degrees Fahrenheit or 24 degrees Celsius) for extended periods of time (Mendel *et al*. 1999). The most downstream observation of salmonids in the mainstem Touchet River was in Washington, at Boles Bridge between Waitsburg and Prescott during the 1999 surveys.

Since 1984, hatchery steelhead have been released in the Walla Walla near Touchet (Martin *et al*. 2000). Hatchery steelhead smolts are also released in the Touchet River below the confluence of the Wolf Fork and Touchet River (Schuck *et al*. 1989) and at Dayton below the confluence of the South Fork Touchet and North Fork Touchet Rivers (USFWS 2002). Hatchery spring Chinook were reintroduced into the South Fork Walla Walla by Confederated Tribes of the Umatilla Indian Reservation in 2000 (NPPC 2001b). However Washington Department of Fish and Wildlife biologists have observed stray spring chinook entering and spawning in the basin in increasing numbers over the past four to six years (USFWS 2002).

For purposes of recovery planning, the recovery unit team has identified three local populations: (1) Upper Walla Walla Complex, which includes the North and South Forks of the Walla Walla River; (2) Mill Creek and tributaries; and (3) the Touchet River and tributaries. Of these, only the first is located in Oregon. Other tributary streams where bull trout may occur, but where their presence/absence has yet to be confirmed, include Cottonwood Creek (mainstem Walla Walla tributary), Little Meadows Canyon and Big Meadows Canyon (North Fork Walla Walla River tributaries).

Bull trout spawn mainly in the South Fork Walla Walla River (Reach I) between Table Creek and the second major tributary above Reser Creek (River Kilometer 24.6 to 34.9, River Mile 15 to 22), the lower 1.6 kilometers (7 miles) of Skiphorton, and the lower 0.8 kilometer (0.5 mile) of Reser Creek. The majority of spawning fish are found above Bear Creek (ODFW, *in litt*. 1999c). From 1992 to 2000, bull trout have been captured annually in a screen bypass trap on the South Fork Walla Walla River, approximately 3 kilometers (2 miles) upstream of the forks. The largest number of bull trout captured was 211, in 1992 (B. Kilgore, *in litt*. 2001).

Use by bull trout subadults and juveniles has been observed in the North Fork Walla Walla River (Reach II), as well as by adult fish during winter and spring months. Ten redds were observed during October 2000 (USFWS 2002). Some bull trout were captured in a screen bypass trap on the North Fork Walla Walla River located approximately 6.4 kilometers (4 miles) upstream of the forks between 1990 and 1992 (Confederated Tribes of the Umatilla Indian Reservation (CTUIR), *in litt*. 2001). Bull trout distribution and use of the North Fork Walla Walla River needs further investigation.

The mainstem Walla Walla River from the forks downstream to Cemetery Bridge in Milton-Freewater (Reach IIIA) provides year round subadult rearing habitat. From this reach downstream to the confluence with the Columbia River (Reach IIIB) the habitat is considered overwintering and migration, although bull trout use data are limited. Oregon Department of Fish and Wildlife screen bypass capture data from 1992 through 2000 show bull trout were captured at both the Eastside and Little Walla Walla diversions during the irrigation season (April to October) (B. Kilgore *in litt.* 2001). During fish distribution surveys conducted in the summer of 1998 in the Walla Walla River mainstem in Washington and in Yellowhawk Creek, bull trout were not encountered (Mendel *et al*. 1999).

Redd surveys have been conducted annually in the Walla Walla Basin through a coordinated effort involving the Oregon Department of Fish and Wildlife, U.S. Forest Service, Confederated Tribes of the Umatilla Indian Reservation, and Washington Department of Fish and Wildlife since 1994. Variation in locations and timing of redd surveys has occurred among years, particularly in the Touchet subbasin for the ten years surveys have been done (Mendel *et al*.

2000). Redd surveys conducted during 1998 and 1999 covered the same reaches, although the 1999 survey was started about two weeks earlier than in 1998 and included two more areas. The total number of redds per kilometer was 5.5 (8.9 per mile) in 1998 and 10.5 (16.9 per mile) in 1999 (Mendel *et al*. 2000). Total redds and redds per mile for the South Fork Walla Walla population for the period 1994 through 2000 varied from about twelve up to forty-four.

Grande Ronde River

The Grande Ronde River only encompasses bull trout from this one watershed. The majority of this watershed is in the State of Oregon. The lower portion of the Grande Ronde River, tributaries to this portion of the river, as well as tributaries to the mainstem of the Wenaha River (a major tributary to the Grande Ronde River) are located in the State of Washington.

The Grande Ronde River subbasin is located in the southwest portion of the Blue Mountains ecological province, encompassing an area of about 10,240 square kilometers (4,000 square miles) in northeastern Oregon and southeastern Washington (see Northwest Power Planning Council 2001). The subbasin is characterized by rugged mountains and two major river valleys, and is defined by the Blue Mountains to the west and northwest, and the Wallowa Mountains to the southeast. It is in these mountain ranges, with peaks as high as 7,700 feet (2,347 meters) in the Blue Mountains and nearly 10,000 feet (3,048 meters) in the Wallowa Mountains, where the headwater streams of the Grande Ronde River begin. The Grande Ronde River flows generally northeast 212 miles (339 kilometers) from its origin to join the Snake River at River Mile 169 (River kilometer 270), about 20 miles (32 kilometers) upstream of Asotin, Washington and 493 miles (789 kilometers) from the mouth of the Columbia River. The Grande Ronde River begins in the Blue Mountains near the Anthony Lakes recreation area, flows north, then northeast and through the cities of La Grande and Island City (River Mile 157, River kilometer 251). In the valley, the river slows and meanders the valley floor before continuing north-northeast through the towns of Imbler, and Elgin. A State ditch which eliminated approximately 20 River Miles (32 River kilometers) was developed to channelize the river through the Grande Ronde valley. Downstream of Elgin the river enters into a canyon, passes through Troy, Oregon (River Mile 46, River kilometer 74), then it crosses into Washington at River Mile 38.7 (River kilometer 62) before joining the Snake River. There are eight dams on the Columbia and Snake rivers between the Grande Ronde River and the Pacific Ocean. Major streams flowing into the Grande Ronde are Catherine and Joseph creeks and the Wallowa and Wenaha rivers.

All local populations identified in the recovery unit are believed to be native fish. There have been no known releases of hatchery-origin bull trout anywhere in the recovery unit. In the 1990's, one transfer of bull trout from Little Sheep Creek (Imnaha River subbasin) did occur into Wallowa Lake. There is no evidence, however, that these fish established a self-sustaining population or still exist (USFWS 2002). In the 1970's bull trout/Dolly Varden from Alaska were also released into Wallowa Lake. Again, there is no evidence that these fish still exist or established a selfsustaining population (Buchanan *et al.* 1997).

In the past, wild bull trout occurred throughout the Grande Ronde River subbasin. Although bull trout were probably never as abundant as other salmonids in the subbasin, they were certainly more abundant and more widely distributed than they are today. Currently, the U.S. Fish and

Wildlife Service considers there to be two core areas in the Grande Ronde River subbasin: the upper Grande Ronde River, and the Little Minam River. Although Wenatchee Creek has the potential to be a core area, it is currently considered a research need.

The Oregon Department of Fish and Wildlife recognizes nine local populations of bull trout within the Oregon portion of the basin (Buchanan *et al.* 1997). Distinct local populations are present in the Upper Grande Ronde River, Catherine Creek, Indian Creek, Minam River/Deer Creek complex, Lostine River/Bear Creek complex, upper Hurricane Creek, Wenaha River, Lookingglass Creek, and the Little Minam River. While Washington Department of Fish and Wildlife also recognizes the Wehana River local population of bull trout, they are uncertain about the existence of bull trout in Wenatchee Creek (Washington Department of Fish and Wildlife 1998). Finally, although the original local population of bull trout in the Wallowa River/Lake complex is believed to have been extirpated (Buchanan *et al.* 1997), bull trout from the Imnaha River subbasin were recently introduced into this complex (USFWS 2002).

The current status of bull trout that were introduced into the Wallowa River/Lake complex is unknown. All extant local populations of bull trout in the Grande Ronde River subbasin are native fish sustained by wild production. There is very little information to indicate whether these local populations are genetically distinct. The Oregon Department of Fish and Wildlife separated local populations based on geographical, physical and thermal isolation of the spawning populations.

For purposes of recovery local populations of bull trout within the Grande Ronde River subbasin have been aggregated based on the potential to reestablish connectivity and reduce threats (see Strategy for Recovery). The Oregon Department of Fish and Wildlife in cooperation with the U.S. Fish and Wildlife Service, U.S. Forest Service, the Confederated Tribes of the Umatilla Indian Reservation and the Nez Perce Tribe conduct annual bull trout spawning ground surveys in selected locations within the basin. This information represents the best census information available for bull trout distribution and abundance within the Grande Ronde River subbasin.

The Recovery Unit Team expressed concern over several threats to fish and habitat within the Grande Ronde River subbasin. These include: combinations of effects from road building, timber harvest, irrigation, and historic mining and livestock grazing; concern because of dewatering by irrigation, and passage problems at dams and hatcheries throughout; and from the introduction of brook trout.

Upper Grande Ronde River

In the upper portion of the Grande Ronde River subbasin, small groups of bull trout appear to be present all year in the mainstem, in Limber Jim, Indiana and Clear creeks (Buchanan *et al.* 1997), as well as Hoodoo Creek (a tributary to Beaver Creek) and Lookout Creek (a tributary to Fly Creek) (USFWS 2002). An isolated sighting has also been reported from Five Points Creek (Zakel, *in litt.* 1995). On an intermittent basis, bull trout can also be found distributed throughout the mainstem, perhaps migrating to and from various tributaries or following sources of food. Limited information is available on the abundance of bull trout in the upper Grande Ronde River. Standard redd counts or creel surveys are not conducted on a regular basis. Buchanan *et* *al.* (1997) reported that these fish were at moderate risk of extinction. Spawning and rearing appears to occur in relatively small, headwater areas including the upper Grande Ronde River, Limber Jim, Indiana and Clear creeks. Essentially no information is available on the size of these fish at spawning, age at maturation, sex ratio, fecundity, time of emergence, and survival rates. It seems likely that bull trout in this population exhibit a resident life history form. Although little information is available on the prevalence of fluvial bull trout in the Upper Grande Ronde River, the Confederated Tribes of the Umatilla Indian Reservation have trapped fluvial fish at a weir during the late summer and early fall (USFWS 2002).

Catherine Creek

Bull trout in Catherine Creek have been observed throughout the mainstem as well as in the North Fork Catherine Creek, South Fork Catherine Creek, Middle Fork Catherine Creek, Sand Pass Creek, Collins Creek and Pole Creek (Buchanan et al. 1997). Although presence/absence surveys suggest that numbers are low (West and Zakel, in litt. 1993), no specific population estimates have been conducted in Catherine Creek. Buchanan et al. (1997) considered bull trout in Catherine Creek at moderate risk of extinction. Although bull trout are occasionally observed during the summer as low in the watershed as the town of Union, the majority of summer rearing appears to occur above river kilometer 50 (River Mile 31) in the mainstem or in the headwater tributaries (Zakel, *in litt.*1995).

Presumably spawning also occurs in these headwater tributaries. Bull trout migrating downstream have been captured near the town of Union (USFWS 2002). These fish ranged from 121 to 255 mm (4.76 to 10 inches) in fork length and were captured during the months of September and October. Otherwise, very little information is available on the size of these fish at spawning, age at maturation, sex ratio, fecundity, time of emergence, and survival rates. It seems likely that bull trout in this population exhibit a resident life history form. Although little information is available on the prevalence of fluvial bull trout in Catherine Creek, the Confederated Tribes of the Umatilla Indian Reservation have also trapped fluvial fish at an upstream weir during the late summer and early fall (USFWS 2002).

Indian Creek

Bull trout have been observed in the mainstem of Indian Creek as well as the East Fork of Indian Creek and Camp Creek (Buchanan *et al.* 1997). All known holding and rearing areas are on National Forest lands in the headwaters of the drainage. Presumably spawning also occurs in these headwater tributaries. Historically, fish were probably distributed throughout the mainstem of Indian Creek and connected to the Grande Ronde River. However, habitat in the lower reaches of Indian Creek is severely degraded and there are no recent reports of bull trout in these reaches. No information is available on the abundance of bull trout in Indian Creek. Standard redd counts or creel surveys are not conducted on a regular basis. No information is available on the size of these fish at spawning, age at maturation, sex ratio, fecundity, time of emergence, and survival rates. It seems likely that bull trout in this population exhibit a resident life history form.

Minam River/Deer Creek complex

The Minam River and Deer Creek are both tributaries to the Wallowa River. The mouths of the Minam River and Deer Creek are separated by less than 3 River kilometers (1.86 River Miles). Given the potential for fluvial fish in these streams as well as their relative proximity, the U.S. Fish and Wildlife Service has grouped bull trout from the Minam River and Deer Creek as one local population complex (bull trout from more than one tributary that presumably function, both demographically and genetically, as one unit).

Bull trout have been observed throughout the mainstem of the Minam River, the North Fork Minam River and Elk Creek (Buchanan *et al.* 1997). All known summer rearing and holding areas in the Minam River are on National Forest lands (designated wilderness) above River kilometer 35 (River Mile 21.7). Spawning presumably occurs in these headwater areas as well as in headwater tributaries. Based on radiotelemetry data on bull trout from drainages adjacent to the Minam River (*i.e.* Lookingglass Creek and the Lostine River), fish found in the Minam River below River kilometer 35 (River Mile 21.7) are probably moving between summer or spawning habitat and overwinter habitat in the Wallowa, Grande Ronde or Snake Rivers.

Although the La Grande District of Oregon Department of Fish and Wildlife conducted some surveys in the mid-1990's, limited information is available on the abundance of bull trout in the Minam River. Standard redd counts or creel surveys are not conducted on a regular basis. Buchanan *et al.* (1997) considered fish from the Minam River at low risk of extinction. No information is available on the size of these fish at spawning, age at maturation, sex ratio, fecundity, time of emergence, or survival rates. It seems likely that bull trout in this population complex exhibit both resident and fluvial life history forms.

Bull trout have been observed throughout the mainstem of Deer Creek and in the mouth of Sage Creek. All known summer rearing and holding areas in the Deer Creek watershed are on National Forest lands (designated wilderness) between River kilometer 15 and River kilometer 25 (River Miles 9.3 and 15.5).

Spawning presumably occurs in these headwater areas as well as in headwater tributaries. Between fall and spring, bull trout have also been observed between River kilometer 0 and River kilometer 15 (River Miles 0 and 9.3) of Deer Creek. Based on radiotelemetry data on bull trout from drainages adjacent to the Deer Creek (*i.e.* Lookingglass Creek and the Lostine River), fish found in Deer Creek below River kilometer 15 (River Mile 9.3) are probably moving between summer or spawning habitat and overwinter habitat in the Wallowa, Grande Ronde or Snake Rivers.

Limited information is available on the abundance of bull trout in Deer Creek. One recent sampling effort observed 18 fish/100 square meters as well as 6.5 kilometers (4 miles) of habitat supporting that density (Oregon Department of Fish and Wildlife, *in litt.* 1993). Approximately 50 percent of these fish were longer than 160 millimeters (6.3 inches) in fork length, which is the approximate size when resident fish in the Grande Ronde River subbasin become mature (Hemmingsen *et al.* 2001c). Given this and other habitat data, it has been estimated that the summer rearing population of bull trout in Deer Creek is approximately 3,000 yearling or older fish. Standard redd counts or creel surveys are not conducted on a regular basis. Buchanan *et al.*

(1997) listed the status of fish from Deer Creek as special concern. No information is available on age at maturation, sex ratio, fecundity, time of emergence, or survival rates. It seems possible that bull trout in Deer Creek exhibit both resident and fluvial life history forms.

Lostine River/Bear Creek complex

The Lostine River and Bear Creek are both tributaries to the Wallowa River. The mouths of the Lostine River and Bear Creek are separated by less than 11 River kilometers (6.8 River Miles). Given that fluvial fish exist in the Lostine River and may exist in Bear Creek as well as the relative proximity of the streams, the U.S. Fish and Wildlife Service has grouped bull trout from the Lostine River and Bear Creek as one local population complex.

Bull trout have been observed throughout the mainstem of the Lostine River, as well as the mouths of Silver and Lake Creeks (Buchanan et al. 1997). All known summer rearing and holding areas in the Lostine River are on National Forest lands (that are bounded by designated wilderness) above River kilometer 20 (River Mile 12.4). Spawning presumably occurs in these headwater areas as well as in some headwater tributaries. Based on recent radiotelemetry data (USFWS 2002), fish found in the Lostine River below River kilometer 20 (River Mile 12.4) are probably moving between summer or spawning habitat and overwinter habitat in the Wallowa, Grande Ronde or Snake rivers. Fluvial adults appear to move into the Lostine River in the months of June, July, and August. Fluvial adults appear to move out of the Lostine in the months of September, October, and November.

Limited information is available on the abundance of bull trout in the Lostine River. Standard redd counts as well as counts of migratory adults captured at salmon weirs by have provided data only recently. Standard creel surveys are not conducted on a regular basis. Ratliff and Howell (1992) considered fish from the Lostine River at moderate risk of extinction.

Little information is available on the size of these fish at spawning, age at maturation, sex ratio, fecundity, time of emergence, or survival rates. It seems likely that bull trout in this population complex exhibit both resident and fluvial life history forms. Bull trout have been observed throughout the mainstem of Bear Creek as well as throughout Little Bear Creek and the mouth of Goat Creek (below awaterfall). All known summer rearing and holding areas in the Bear Creek drainage are on National Forest lands (much of which is designated wilderness). This distribution occurs primarily above River kilometer 19 (River Mile 11.8) in Bear Creek and above River kilometer 5 (River Mile 3.1) in Little Bear Creek. Summer distribution is currently (and presumably historically) disrupted by a loss of surface flow between Goat and Granite creeks.

Spawning presumably occurs in the headwaters of Bear and Little Bear creeks. Between fall and spring, bull trout have also been observed between River kilometers 0 and 19 (River Miles 0 and 11.8) of Bear Creek and between River kilometers 0 and 5 (River Miles 0 and 3.1) of Little Bear Creek. Given radiotelemetry data on bull trout from drainages adjacent to the Bear Creek (*i.e.* the Lostine River), fish found in these downstream reaches are probably moving between summer or spawning habitat and overwinter habitat in the Wallowa, Grande Ronde or Snake Rivers.

Limited information is available on the abundance of bull trout in Bear Creek. Standard redd counts or creel surveys are not conducted on a regular basis. Ratliff and Howell (1992) listed the status of fish from Bear Creek as special concern. No information is available on age at maturation, sex ratio, fecundity, time of emergence, or survival rates. It seems probable that bull trout in Bear Creek exhibit both resident and fluvial life history forms.

Upper Hurricane Creek

Bull trout have been observed in the mainstem of Hurricane Creek (Buchanan et al. 1997). All known holding and rearing areas are above River kilometer 16 (River Mile 9.9) and about half of this distribution is on National Forest lands that are designated wilderness. Spawning presumably occurs in the headwaters of Hurricane Creek. Between fall and spring, bull trout have also been observed between River kilometers 0 and 16 (River Miles 0 and 9.9) of Hurricane Creek. Given radiotelemetry data on bull trout from drainages adjacent to the Hurricane Creek (i.e. the Lostine River), fish found in these downstream reaches are probably moving between summer or spawning habitat and overwinter habitat in the Wallowa, Grande Ronde or Snake Rivers. No information is available on the abundance of bull trout in Hurricane Creek.

Standard redd counts or creel surveys are not conducted on a regular basis. No information is available on the size of these fish at spawning, age at maturation, sex ratio, fecundity, time of emergence, and survival rates. It seems likely that bull trout in this population exhibit both resident and fluvial life history forms.

Wenaha River

The Wenaha River drainage may have the most abundant and well distributed population of bull trout in the Grande Ronde River subbasin (Buchanan *et al.* 1997). Bull trout have been observed throughout the mainstem of the Wenaha River, South Fork Wenaha River, North Fork Wenaha River, Butte Creek, and Crooked Creek, as well as Milk Creek (tributary to South Fork Wenaha River), First Creek and Third Creek (tributaries to Crooked Creek) (Buchanan *et al.* 1997). All known summer rearing and holding areas in the Wenaha River or its tributaries are on National Forest lands (designated wilderness) above River kilometer 9 (River Mile 5.6) of the Wenaha River.

Spawning occurs in the headwater areas of the Wenaha River and many of its tributaries. Radiotelemetry data on bull trout from the Wenaha River (for example see Hemmingsen *et al.* 2001b) suggests that fish found below River kilometer 9 (River Mile 5.6) appear to be moving between summer or spawning habitat and overwinter habitat in the Grande Ronde and Snake rivers. In at least one case, a bull trout tagged in the Wenaha River also moved up the Grande Ronde River and entered Lookingglass Creek (Hemmingsen *et al.* 2001a).

Limited information is available on the abundance of bull trout in the Wenaha River. Standard redd counts or creel surveys are not conducted on a regular basis. Buchanan *et al.* (1997) considered fish from the Wenaha River at low risk of extinction. Little information is available on the size of these fish at spawning, age at maturation, sex ratio, fecundity, time of emergence, or survival rates. It seems likely that bull trout in this population exhibit both resident and fluvial life history forms.

Lookingglass Creek

Bull trout have been observed throughout the mainstem of Lookingglass Creek as well as in the lower half of Little Lookingglass Creek (Buchanan et al. 1997). Lookingglass Creek is primarily spring-fed with relatively moderate water temperatures. Bull trout are known to rear and hold during the summer in all areas of Lookingglass Creek. The upper half of this distribution is on National Forest lands. Spawning occurs in the headwater areas of Lookingglass and Little Lookingglass creeks and may also occur in other tributaries. Radiotelemetry data on bull trout from the Lookingglass Creek (for example see Hemmingsen et al. 2001a) suggests that fluvial bull trout may overwinter in the Grande Ronde or Snake rivers. In at least one case, a bull trout tagged in the Wenaha River also moved up the Grande Ronde River and entered Lookingglass Creek (Hemmingsen *et al.* 2001a).

Limited information is available on the abundance of bull trout in the Lookingglass Creek. Spawning ground surveys of index areas have been conducted recently. In 2001, 54 redds were observed during bull trout spawning ground surveys on National Forest land (USFWS 2002). In general, spawning ground and presence/absence surveys have suggested that bull trout abundance is low in the Lookingglass Creek drainage (West and Zakel, *in litt.* 1993). Standard creel surveys are not conducted on a regular basis. Buchanan *et al.* (1997) considered fish from Lookingglass Creek at moderate risk of extinction.

Little information is available on the size of these fish at spawning, age at maturation, sex ratio, fecundity, time of emergence, or survival rates. It seems likely that bull trout in this population exhibit both resident and fluvial life history forms.

Little Minam River

Bull trout have been observed in the Little Minam River as well as in the lower portion of Boulder Creek and throughout Dobbin Creek, both tributaries to the Little Minam River (Buchanan *et al.* 1997). A waterfall exists at approximately River kilometer 9 (River Mile 5.6) of the Little Minam River which is believed to prevent the upstream movement of most fish, including bull trout. Thus, a resident population of bull trout, which does not experience immigration of bull trout from other areas in the Grande Ronde River, exists above River kilometer 9 (River Mile 5.6). Bull trout are believed to rear and hold during the summer in all these areas of the Little Minam River drainage.

The entire distribution of bull trout in the Little Minam River is on National Forest lands (designated wilderness). Spawning occurs in the headwater areas of the Little Minam River and throughout Dobbin Creek. Limited information is available on the abundance of bull trout in the Little Minam River. Spawning ground surveys have been conducted over the last several years (Bellerud et al. 1997; Hemmingsen et al. 2001a, 2001b, 2001c, 2001d). Spawning ground surveys included all areas where bull trout could spawn in the Little Minam River and Dobbin Creek. In general, surveys were conducted once every two weeks during September and October.

In 2001, 434 redds were counted in the Little Minam River and Dobbin Creek (USFWS 2002). Standard creel surveys are not conducted on a regular basis. Ratliff and Howell (1992) considered fish from the Little Minam River at low risk of extinction. Fish spawning in the Little Minam River and Dobbin Creek are generally between 150 and 250 millimeters (5.9 to 9.8 inches) in fork length (Bellerud *et al.* 1997).

Little additional information is available on the size of these fish by age, age at maturation, sex ratio, fecundity, time of emergence, or survival rates. Given that fluvial fish are unlikely to immigrate to the Little Minam River (above River kilometer 9 or River Mile 5.6) for spawning it seems likely that this population of bull trout functions as a resident life history form. However, bull trout produced in the Little Minam River may emigrate to other areas (i.e. the Minam, Wallowa, and Grande Ronde rivers) in the Grande Ronde River subbasin.

Wallowa Lake/River

Historically, bull trout were present in the Wallowa River above Wallowa Lake, however, this population is believed to have been extirpated by the 1950's (Buchanan et al. 1997). Although a reintroduction program using bull trout and Dolly Varden (from Alaska) was initiated in 1968, this program was unsuccessful and terminated in 1978 (Buchanan et al. 1997). No bull trout or Dolly Varden were captured in the Wallowa Lake fishery between 1980 and 1996 (USFWS 2002). In 1997, 600 bull trout from Big Sheep Creek, a tributary to the Imnaha River, were introduced into Wallowa River above Wallowa Lake (USFWS 2002). The current status of these fish is unknown.

Wenatchee Creek

Historically, fluvial-sized bull trout (longer than 46 centimeters or 18 inches) were be found far up into Wenatchee Creek (USFWS 2002). However, in the 1960's a barrier waterfall formed near River kilometer 4 (River Mile 2.5) of Wenatchee Creek and currently, it is unlikely that fluvial bull trout would be able to get above this waterfall (USFWS 2002). In the mid-1980's, one account of resident bull trout existing above the barrier waterfall in Wenatchee Creek was published in the Lewiston Tribune (USFWS 2002). However, recent surveys have not been able to confirm the presence of resident bull trout in Wenatchee Creek.

Willamette River Basin

The Oregon Department of Fish and Wildlife (Kostow 1995) considers bull trout populations in the Willamette River as a gene conservation group. This delineation is supported by the genetic analysis conducted by Spruell and Allendorf (1997). Willamette River bull trout are included in the "coastal" group of bull trout populations that includes bull trout of the Lewis River (Washington) (Spruell *et al*. 1998), Hood River (Oregon), and Deschutes River (Oregon) (Spruell and Allendorf 1997). The Willamette River basin also contains many important areas for anadromous salmon and steelhead. Although bull trout are currently found only in a portion of the upper basin (McKenzie and Middle Fork Willamette River basins), the recovery unit encompasses the entire Willamette River basin, including historic bull trout habitat in the Santiam and Clackamas River basins.

The Willamette Recovery Unit Team identified one core area, the Upper Willamette River core area, and the Clackamas River core habitat. The Clackamas River core habitat does not currently support bull trout populations, but it historically supported bull trout, and the recovery unit team believes that it has the necessary elements to support reintroduction of bull trout. The Santiam River basin also had historic bull trout populations, but is not considered core habitat at this time because of uncertainties regarding its potential to support bull trout.

The Willamette River basin, situated in northwestern Oregon, includes the Willamette River , a major tributary of the Columbia River entering at about river kilometer 140, and its tributaries. The Willamette River drains part or all of ten counties—approximately 31,080 square kilometers (12,000 square miles), or almost one-eighth of Oregon's total area. It is bounded on the north by the Columbia River, and on the east, south, and west by the summits of the Cascade Range, the Calapooia Mountains, and the Coast Range, respectively. The north–south length of the basin is about 240 kilometers (149 miles), and its average east–west width is about 120 kilometers (75.6 miles). Principal streams of the basin head at elevations of 1,830 meters (6,004 feet) and higher in the bordering Cascade Range. In higher elevations of the Cascades where bull trout occur, precipitation ranges from 229 to 356 centimeters (90 to 140 inches), and snowfall is heavy, with considerable snowpack accumulation. Major tributaries of the Willamette River include the Clackamas (river kilometer 40), Tualatin (river kilometer 45), Molalla (river kilometer 58), Yamhill (river kilometer 88), Santiam (river kilometer 175), Calapooia (river kilometer 193), Marys (river kilometer 212), Long Tom (river kilometer 241), McKenzie (river kilometer 282), Middle Fork Willamette (river kilometer 301), and Coast Fork Willamette (river kilometer 301) Rivers.

The Recovery Unit Team expressed concern over several threats to fish and habitat within the Willamette River basin. These include: the combination of effects from road building, timber harvest, irrigation, and agricultural practices; dewatering by irrigation, and passage problems at dams throughout the basin; and from the introduction of brook trout.

Upper Willamette River Core Area

The core area encompasses the McKenzie and Middle Fork Willamette River basins and the portion of the Willamette River that connects the two stream systems. Local populations include the mainstem McKenzie River, Trail Bridge, and South Fork McKenzie River. Pending documentation of successful reproduction, a fourth local population may exist on the Middle Fork Willamette River above Hills Creek Dam.

The mainstem McKenzie River local population occurs from the mouth to Trail Bridge Dam and extends into portions of the South Fork McKenzie River, Gate Creek, Blue River, Horse Creek, Separation Creek, Deer Creek, Olallie Creek, and Anderson Creek. A total of 170 kilometers (105.6 miles) of stream habitat has been identified as being used by bull trout in the McKenzie River basin downstream of Trail Bridge Dam (Ziller and Taylor 2000). Most of the population occurs upstream of Leaburg Dam.

However, since 1995 when color video equipment was added to the dam, greatly facilitating identification of bull trout, from 4 to 28 bull trout (25.4 centimeters [10 inches] and larger) annually have been observed passing through the fish ladder at this site. A (29-inch) bull trout was captured by Oregon Department of Fish and Wildlife crews while seining near the mouth of the McKenzie River (WRUT, *in litt.*, 1997b). Dams on the Blue River and the South Fork McKenzie River limit upstream movement of the mainstem McKenzie River local population in these tributaries. Adult bull trout overwinter in the mainstem McKenzie River, distributed throughout the river as far downstream as Hendricks Bridge (river kilometer 38) (WRUT, *in litt.*, 1997a). They occupy large pools, using available large wood and undercut banks for cover (USDA 1995a). Upstream migration begins in April and continues through the summer until September when the fish are found staging in large pools near spawning tributaries (ODFW 2001a). Radio-tagged bull trout entered Anderson Creek in late August or early September. They remained in Anderson Creek for approximately one month and then quickly returned to overwintering sites lower in the river.

Several bull trout returned to the same overwinter sites each year during the period in which they were monitored (Ziller and Taylor 2000). In 1999 in Anderson Creek, data from a passive electronic counter (called a Vaki River Watcher) showed that bull trout migrated upstream and downstream at a higher rate during daylight hours (69 percent and 61 percent, respectively). Peak migration of bull trout through the fish counter in 1999 occurred during the middle of September. Bull trout ranged in size from 18 to 81 centimeters (7 to 31.9 inches) (Ziller and Taylor 2000). Bull trout habitat in McKenzie River spawning streams is characterized by abundant large wood (instream), high channel complexity, and a mature conifer canopy. Mainstem habitats used by bull trout, in addition to large pools, include side channels, river margins, and tributaries (USDA 1995a).

Known juvenile bull trout distribution in the mainstem McKenzie River, as determined from night snorkeling, extends at least 8 river miles downstream of Anderson and Olallie Creeks to just downstream of Lost Creek (ODFW 2001a), at approximately river kilometer 118. Data from a screw trap that has been operated seasonally since 1993 and located immediately downstream of the culvert passing under Highway 126 and approximately 0.4 kilometer (0.25 mile) upstream of the mouth of Anderson Creek (Ziller and Taylor 2000) indicate that the majority of bull trout fry (age less than 1 year) and juveniles (age greater than 1 year) migrate from Anderson Creek between February and June (ODFW 2001a). Peak migration occurs from the middle to the end of March (ODFW 2001a). A similar trap was installed in Olallie Creek in 1999 about 50 meters (164 feet) upstream of Highway 126 (Ziller and Taylor 2000).

During snorkel surveys in 1993, juvenile (7.6 to 12.7 centimeters [3 to 5 inches] in length) bull trout were observed in the lower 1.45 kilometers (0.9 miles) of Separation Creek, a tributary to Horse Creek. However, subsequent surveys in 1995 (using electrofishing techniques) and in 1997 (using snorkel and angling techniques) failed to identify spawning areas in Separation Creek (ODFW 1993b; USDA 1997). The bulk of spawning takes place in Anderson Creek (in approximately 3.8 kilometers [2.4 miles]) and to a lesser extent in Olallie Creek. Access to approximately 3.2 kilometers (2.0 miles) of spawning and rearing habitat in Olallie Creek upstream of Highway 126 was restored in 1995 when a culvert blocking passage was replaced.

Spawning has not been documented in other tributaries; for example, Blue River is thought to be used primarily for foraging (EWEB *et al*. 2001).

Spawning timing, based on redd counts from 1995 through 1999, showed that spawning peaked in the third week of September (Taylor and Reasoner 2000). In 1999, peak migration of bull trout (upstream and downstream) through the fish counter occurred from September 10 to 17 (Taylor and Reasoner 2000). Total adult abundance of bull trout is difficult to estimate because of a lack of information, including the following: (1) proportion of adult population spawning in a given year, (2) number of redds per female bull trout (ratio of 2 redds to 1 female bull trout), and (3) sex ratio (ratio during spawning of 1.3 males to 1 female up to 1 male to 2 females) (ODFW 2001a).

Using professional judgment and the monitoring data collected to date, local biologists estimate that the total adult bull trout population in the Willamette Recovery Unit is no more than 300 fish. The mainstem McKenzie River local population makes up the bulk of that total abundance. Since 1995, spawning surveys in Anderson and Olallie Creeks show an average of 80 redds per year in Anderson Creek and redd counts ranging from 6 to 10 in Olallie Creek. In 1999, an electric counter in Anderson Creek indicated that 249 bull trout adults passed upstream and 214 passed downstream (Ziller and Taylor 2000).

An estimate of abundance of juvenile bull trout migrating from Anderson Creek was made using data from the downstream migrant trap on Anderson Creek. Traps are operated four days a week, from early February until the first week in June (Ziller and Taylor 2000).

In 1999, densities of juvenile bull trout were estimated in 2.6 kilometers (1.62 miles) of Anderson Creek by using the modified Hankin and Reeves (1988) protocol. An average of 1.8 juvenile (age 1 to 2 years or more) bull trout per unit were observed in 60 habitat units. Pocket units had the highest observed densities (9.7 per 100 square meters), while the lowest densities were observed in fast water units (0.8 per 100 square meters) (Taylor and Reasoner 2000).

The Trail Bridge local population occurs in Trail Bridge Reservoir upstream to Tamolitch Falls, a natural barrier. The Trail Bridge pool, the mainstem McKenzie River to Tamolitch Falls, and the lower Smith River provide foraging and rearing habitat. Spawning and rearing habitat consists of Sweetwater Creek and the mainstem McKenzie River above the Trail Bridge pool (USDA 1997).

Spawning occurs in the mainstem McKenzie River upstream of Trail Bridge Reservoir in about 1.1 kilometers (6.8 miles) of available habitat. In 1992, passage restoration in Sweetwater Creek (tributary to Trail Bridge Reservoir) through a blocked culvert under Highway 126 was completed, making 2.4 kilometers (1.49 miles) of additional spawning and juvenile rearing habitat accessible (Ziller and Taylor 2000). Fry transfers from Anderson Creek into Sweetwater Creek between 1993 and 1999, ranging from 308 to 1,889 fry annually, were designed to help reestablish spawning in this tributary. In 1999, five adults were video-recorded ascending into Sweetwater Creek from Trail Bridge Reservoir, and in 2001, 11 adults were recorded (USFWS 2002). Redds were first observed in 2000 when 2 were counted. In December 2001, four bull trout juveniles measuring 60 to 70 millimeters (2.36 to 2.76 inches) in length were observed during snorkel surveys (USDA 2001). Counting bull trout redds in the McKenzie River upstream of Trail Bridge is complicated by the presence of Chinook salmon redds. However, biologists estimated zero to 12 bull trout redds in this reach since they began spawning surveys in 1994 (Ziller and Taylor 2000). The population probably has fewer than 20 adults spawning each year (ODFW 2001a).

Bull trout redds (two) were first observed in Sweetwater Creek in 2000, and one redd has been counted so far during surveys in 2001 (USFWS 2002). However, no bull trout fry have been positively identified during two survey efforts (ODFW 2001a).

The third bull trout local population occurs in the mainstem South Fork McKenzie River upstream of Cougar Dam to approximately the wilderness boundary and also the lower portions of French Pete Creek and Roaring River—a total of 29.3 kilometers (18.2 miles) of habitat. Spawning and juvenile rearing are known to occur only in Roaring River, a large spring-fed tributary of the South Fork McKenzie River, or 5 kilometers (3 miles) of the total habitat of the local population (Ziller and Taylor 2000).

Radio-tagging four fish from 1997 through 1999 determined that bull trout reside in Cougar Reservoir until the end of April and move into the South Fork McKenzie River in early May. Two tagged fish entered Roaring River in late August and early September, presumably to spawn, and had reentered the reservoir by the middle of October (Ziller and Taylor 2000). A passive electronic counter installed in Roaring River in 1999 counted 41 fish passing upstream (66 percent) at night, while most downstream passage (71 percent) occurred during daylight hours. Most bull trout (83 percent) passing the counter migrated into Roaring River during the first two weeks in September. Migration peaked in late September and early October and was complete by early October. The average length of fish passing upstream was 42 centimeters (16.5 inches) and ranged from 21 to 58 centimeters (8.3 to 23 inches) (Ziller and Taylor 2000). In 2000, 81 bull trout were counted migrating up Roaring River (ODFW 2001a).

Redd counts in Roaring River showed a sharp increase over the past four years. The use of the radio tags and the Vaki counter has improved the ability to pinpoint timing and location of spawning in this very turbulent stream. The Oregon Department of Fish and Wildlife estimates the adult population of the South Fork McKenzie River at 80 to 100 adults (ODFW 2001a). In 1999, the estimated number of bull trout per redd was 3.2 in Roaring River.

Historic distribution in the Middle Fork Willamette River local population included the mainstem Middle Fork Willamette River, the North Fork Middle Fork Willamette River, Salt Creek, Swift Creek, Staley Creek, and Hills Creek Reservoir (ODFW 2001a).

In spite of extensive electrofishing and snorkeling survey efforts between 1993 and 1997 in approximately 400 kilometers (248.5 miles) of streams in the Middle Fork Willamette River and contiguous springs, bull trout were not located (ODFW and USDA 1998). Personnel with the Oregon Department of Fish and Wildlife and the U.S. Forest Service snorkeled most of the pools in the Middle Fork Willamette River from Paddy's Valley to Staley Creek, as well as much of Swift Creek, but no bull trout were found (ODFW 2001a). Nevertheless, persistent reports from anglers suggest that a few bull trout may remain in the basin. As late as 1990, a bull trout was documented in a photograph taken at the head of the middle fork arm of Hills Creek Reservoir. The most recent reliable report was by an angler who caught a subadult in early June 2000 in the Middle Fork Willamette below Hills Creek Dam (river kilometer 66). The origin of the fish is unknown; although it was possibly one of the 178 fry released in upper Middle Fork Willamette River tributaries in 1997 Ziller and Taylor 2000).

The Oregon Department of Fish and Wildlife assumed that a few bull trout remained in the basin and, in 1997, implemented a plan to restore bull trout to the Middle Fork Willamette River above Hills Creek Reservoir. Between 1997 and 2000, a total of 6,439 bull trout fry from Anderson Creek, approximately 25 to 35 millimeters (0.98 to 1.4 inches) in length, were released into seven sites in the Middle Fork Willamette River basin (Ziller and Taylor 2000). Spring-fed portions of the Middle Fork Willamette River and tributaries above Hills Creek Reservoir still appear to contain suitable spawning and rearing habitat for bull trout (ODFW 2001a).

Monitoring of the reintroduction effort by personnel of the Oregon Department of Fish and Wildlife and the U.S. Forest Service has shown that all locations that received more than 50 fish have juvenile bull trout present. A census at Iko Springs (a key release site at river kilometer 116) in June 2000 counted 67 juvenile bull trout in three age classes. One month later, during a snorkel survey in the Middle Fork Willamette River downstream of Iko Springs, 8 bull trout were observed; they were possibly outmigrants from Iko Springs (Ziller and Taylor 2000). In 2001, personnel of the Oregon Department of Fish and Wildlife night-snorkeled the Middle Fork Willamette River to determine the distribution and abundance of juvenile bull trout. They found juvenile bull tout inhabiting 8.85 kilometers (5.5 miles) of the Middle Fork Willamette River adjacent to the release sites (ODFW 2001a).

The current population of bull trout in the Middle Fork Willamette River is believed to be, at most, a handful of adults (ODFW 2001a). The population size that the Middle Fork Willamette River can support is not known, but local biologists believe the potential is similar to that of the South Fork McKenzie River (ODFW and USDA 1998). Juvenile abundance is estimated at approximately 250 individuals, based on monitoring at reintroduction sites (ODFW 2001a).

Clackamas River Core Habitat

The Clackamas River core habitat encompasses the Clackamas River basin. Currently, no bull trout are in this core area, but it did support a historic population in both the Santiam and Clackamas Rivers. The last documented bull trout observations in these systems were in 1945 (North Santiam), 1953 (South Santiam), and 1960 (Clackamas) (Goetz 1989). Massey and Keeley (1996) reported two instances of bull trout being caught in the 1970's. A 1992 survey of the upper mainstem Clackamas River (river kilometer 79 to 85), the Collawash River (river kilometer 6.45 to 13), and the East Fork Collawash River (river kilometer 0 to 3.9) by U.S. Forest Service and Oregon Department of Fish and Wildlife personnel failed to find bull trout (Eberl and Kamikawa 1992). Additional surveys in 1998 and 1999 failed to find bull trout in the upper mainstem Clackamas River (river kilometer 123.8 to 124.6) and tributaries (Cub, Berry, Farm, Dickey, Lemiti, and Squirrel Creeks), two tributaries of the Oak Grove Fork (Shellrock and Crater Creeks), and two tributaries (East Fork Collawash River and Elk Lake Creek) in the mainstem Collawash River (river kilometer 9.7 to 10.7) (Zimmerman 1999).

Based on the size of bull trout recorded in creel records dating from the 1940's and 1960's and on the locations where the fish were caught, these populations probably had a fluvial life history. No estimates of historic abundance for the Clackamas and Santiam basins are available. Goetz (1989) also reported that a bull trout in the Long Tom River appeared in creel records in 1962. However, the Long Tom River probably never supported a bull trout population because of the low elevation of its headwaters and subsequent lack of very cold water required by bull trout for spawning and rearing. This finding suggests that bull trout may have used the mainstem Willamette River as a foraging area.

Deschutes River Basin

Oregon Department of Fish and Wildlife (Kostow 1995) has designated the Deschutes River basin as a Gene Conservation Group. The delineation of the Gene Conservation Group is based on the genetic analysis conducted by Spruell and Allendorf (1997). The Deschutes River basin includes most of the basin, with the exception of the Odell Lake watershed which contains a separate population.

The Deschutes River originates at Little Lava Lake on the east slope of the Cascade Mountain range in Deschutes County, central Oregon. From this point it flows south through the Bureau of Reclamation's Crane Prairie and Wickiup Reservoirs, then generally north by northeast through Jefferson County. It then enters the Pelton/Round Butte Dam complex and its three reservoirs. The river continues flowing north by northeast through Wasco County, and forms the border between Wasco and Sherman counties to its confluence with the Columbia River, approximately 405 kilometers (252 miles) from its source. Elevation at Little Lava Lake is approximately 1,410 meters (4,700 feet), and elevation at the confluence with the Columbia River is approximately 23 meters (75 feet). The primary tributaries to the Deschutes River are the Little Deschutes River, Crooked River, Metolius River, Shitike Creek, Trout Creek, Warm Springs River, and the White River. The Deschutes River and its tributaries drain an area of approximately 26,939 square kilometers (10,400 square miles). Bend, Sisters, La Pine, Redmond, Prineville, and Madras are the major towns in the watershed.

The Odell Lake basin consists of Odell and Davis Lakes, the streams draining into them, and Odell Creek, that flows downstream from Odell Lake to Davis Lake. The lakes were isolated from the Deschutes River by a lava flow about 5,500 years ago that impounded Odell Creek and formed Davis Lake (USFS 1994). The lava flow isolated bull trout in Odell Lake from bull trout in the rest of the upper Deschutes Basin. Although Odell Lake bull trout are included in the Deschutes Gene Conservation Group (GCG) by Oregon Department of Fish and Wildlife, due to their natural isolation from other Deschutes River bull trout populations and for administrative and logistical reasons, Odell Lake bull trout are considered a separate recovery unit. At the time of listing Odell Lake and Deschutes River bull trout populations were managed in different Oregon Department of Fish and Wildlife administrative units, as well as different U.S. Forest Service ranger districts.

The Odell Lake watershed drains an area of approximately 302 square kilometers (117 square miles) of the slope of the Cascade Mountains crest in Central Oregon (USFS 1999a). Elevations range from 2,667 meters (8,748 feet) Diamond Peak to 1,459 meters (4,786 feet) at Odell Lake to 1,337 meters (4,385 feet) at Davis Lake (Johnson *et al.* 1985). The entire watershed lies within the Deschutes National Forest in Deschutes and Klamath Counties, Oregon. Diamond Peak Wilderness occupies the western portion of the watershed from Diamond Peak to the western shore of Odell Lake, approximately 15 percent of the recovery unit. In non-wilderness areas, two resorts, five campgrounds and over sixty summer homes have been developed on the shores of Odell Lake, while Davis Lake has three campgrounds. Recreational use in the area includes such activities as skiing, fishing, camping, hiking and other activities common to National Forest areas. Crescent Lake Junction, just outside of the watershed boundaries, is the nearest community (Fies *et al*. 1999).

Subadult bull trout also use lower Squaw Creek, a tributary to the Deschutes River 4.8 kilometers (2.9 miles) above Lake Billy Chinook. The Crooked River upstream of the Opal Springs Dam may also be used by bull trout; operators at Opal Springs Dam have reported seeing large fish moving upstream over the dam crest during periods of high flow (USFWS 2002).

The Metolius River-Lake Billy Chinook local population includes migratory bull trout that use the Metolius River and Lake Billy Chinook as seasonal foraging habitat and as a migration corridor (Buchanan et al. 1997). Bull trout spawn in Jack, Canyon, Roaring, Candle, and Jefferson creeks and in the Whitewater River. The local population has exhibited a positive trend in spawning numbers, based on numbers of redds observed, from 27 in 1987 to 330 in 1994 (Ratliff et al. 1996). The Shitike Creek and Warm Springs River have averaged about 232 and 202 spawners respectively between 1998 and 2001.

Estimated population numbers for adult fish system-wide increased from 818 in 1993 to 1,895 in 1994 (Buchanan et al. 1997). Collectively the three Metolius basin populations have averaged 786 spawners between 1998 and 2000, though in 2000 there were an estimated 1,263 spawners. Bull trout are found in the lower Deschutes River above Sherars Falls, Shitike Creek, and Warm Springs River. In 1998, Oregon Department of Fish and Wildlife and the Confederated Tribes of the Warm Springs estimated the population of bull trout in a 1.8 kilometer (3 mile) river reach of the Deschutes near North Junction at seven fish per 0.6 kilometer (1 mile) greater than 20 centimeters (8 inches) long. One or two adult bull trout are caught in the Pelton fish trap each year. The trap is located at the base of the Reregulating Dam. In 24 years of operation of a steep pass trap at Sherars Falls, one bull trout was recently captured; in addition, two bull trout were captured in the tribal dip net fishery at Sherar’s Falls during 2001 (USFWS 2002). Anglers have recently reported higher incidental hooking of bull trout in the Deschutes River, which may indicate that the population is increasing. Subadult and adult fish are seasonally present in the lower Deschutes River (Newton and Pribyl 1994).

In the Metolius, most spawning occurs between August 15 and October 1. However, spawning has been observed as early as July 13 and as late as mid-October (Ratliff et al. 1996). In Shitike Creek, spawning was observed from August 20 through early November, when water temperature averaged 6.2 degrees Celsius (43 degrees Fahrenheit) between River kilometer 30 to 45 (River Mile 18 to 27); this was the mean 7-day average from thermographs. In the Warm Springs River, temperatures averaged 6.6 degrees Celsius (44 degrees Fahrenheit) between River kilometer 52 to 59 (River Mile 31 to 35) during the late-August to early November spawning period (Brun 1999).

In the lower Deschutes River below the Pelton Round-Butte dams, bull trout spawn and rear in Shitike Creek and the Warm Springs River. Migratory bull trout are the primary life-history form present. In Shitike Creek the numbers of redds and juveniles appears to be stable. In the Warm Springs River there have been large fluctuations in redd counts and juvenile observations. During 1972 through 1988, low numbers of bull trout (0 to 27 fish) were recorded during surveys on the mainstem lower Deschutes River, and redd counts on Shitike Creek varied from 15 in 1990 to 6 in 1992 (Newton and Pribyl 1994). However, by 1998 redd counts had increased to 100; there were 115 and 76 redds counted in 1999 and 2000, respectively (Brun and Dodson 2000). In the Warm Springs River, 100 redds were counted in 1998, while 84 and 78 redds were counted in 1999 and 2000, respectively (Brun and Dodson 2000). Redd counts have averaged 101 redds in Shitike Creek, and 88 redds in the Warm Springs River from 1998 to 2001 (Brun and Dodson, in press). Juvenile bull trout densities in a 3.6 kilometer (2.2 miles) reach of the Warm Springs River were calculated at 0.005 per square meter (0.054 per square foot), while a density of 0.025 juvenile bull trout per square meter (0.27 per square foot) was calculated for the 1.1 kilometer (0.7 miles) surveyed in Shitike Creek (Brun 1999).

Deschutes basin bull trout exhibit both fluvial and adfluvial life histories. Fluvial bull trout migrate from their smaller natal stream to a larger river to rear, and then back to their natal stream to spawn. Adfluvial bull trout migrate from their smaller natal stream eventually entering a lake or reservoir to rear. After several years of growth, and with the onset of maturity, adfluvial bull trout retrace their earlier migration back to their natal stream to spawn.

In one recent study (Brun and Dodson 2000), radio-tagged adults began their migration in mid-May. They initially made short runs up and back down spawning streams. Later, one specimen moved upstream some 73 kilometers (44 miles) in Shitike Creek to reach spawning areas, and then moved quickly downstream after spawning. Other tagged fish showed similar behavior. In the Metolius, maturing bull trout moving from Lake Billy Chinook into the Metolius were captured from May through August. Peak upstream movement occurred between August 20 and September 15.

Juveniles moved downstream during both the spring and fall months. The majority were trapped during May and early June, while the remainder were captured during September. The mean fork-length of fish captured in Shitike Creek in the spring was 131 millimeters (5.2 inches), while fall migrants averaged 214 millimeters. Age two (120 to 140 millimeters or 4.7 to 5.5 inches) fish accounted for 83 percent of spring catch, and the remaining were assumed to be age three (160 to 200 millimeters or 6.2 to 7.8 inches). One age four fish (399 millimeters (15.7 inches)) was also captured. No juvenile fish were captured in the Warm Springs River Humphrey trap (Brun 1999).

Other studies (Ratliff et al. 1996) reported that approximately 2,900 juveniles moves downstream from Jacks Creek in the Metolius between April 24 and October 13. Most were captured in May and June. Over 93 percent were found when the trap was checked in the morning, indicating that they were moving at night. Over half were age two.

The Recovery Unit Team expressed concern over several threats to fish and habitat within the Deschutes River basin. These include: the combination of effects from road building, timber harvest, irrigation, and historic livestock grazing; dewatering by irrigation, and passage problems at dams throughout the basin; and from the introduction of brown trout, lake trout, brook trout, and large mouth bass within the basin.

The Recovery Unit Team expressed concern over several threats to fish and habitat within the Odell Lake subpopulation. These include: the combination of effects from road system, residential development, passage problems at dams throughout the basin, and from the introduction of brook trout, and lake trout.

Odell Lake

The Odell Lake watershed is part of the High Cascades Ecoregion and consists of basalt, andesite, and basaltic eruptive complexes that have formed volcanoes. Associated lava fields and the volcanoes themselves have been eroded over time by glaciers. Glacial landforms include cirques, valleys, and various types of moraines. Soils are highly influenced by ash and pumice deposits from the Mount Mazama eruption, which occurred approximately 6,700 years ago (USFS 1999a; U.S. Forest Service and Bureau of land Management (USFS and BLM) 1999). The lava flow that dammed Odell Creek and gave rise to Davis Lake occurred after the eruption of Mount Mazama, and is not covered by its pumice (Johnson *et al.* 1985).

Current bull trout distribution is limited to the lower Deschutes Core Area, which includes the five local populations in Shitike Creek, the Warm Springs River, and the three Metolius River population complexes. Bull trout currently inhabit most riverine habitats of the Metolius Subbasin. This includes First, Jack, Canyon, Roaring, Brush, Abbot, Candle, and Jefferson creeks, and Whitewater River. Some juvenile bull trout apparently expanded rearing habitat to Abbot Creek in 1994, as they were not observed in an earlier study (Ratliff and Fies1989). The Metolius River, Lake Billy Chinook Reservoir, the Deschutes River above Lake Billy Chinook upstream to Big Falls, the Crooked River above Lake Billy Chinook upstream to Opal Springs Dam, and the lower Deschutes River below the Pelton Round Butte dams support bull trout.

The Odell Lake subpopulation is presently limited to Odell Lake, which contains the last extant native lake migratory (adfluvial) bull trout in Oregon (Ratliff and Howell 1992; Buchanan et al. 1997). Odell Lake was isolated from other bull trout populations in the upper Deschutes by a lava flow that dammed Odell Creek about 5,000 to 6,000 years ago.

Bull trout are occasionally encountered in Odell Creek (U.S. Forest Service *in litt.* 2001), but are not known to spawn there. Bull trout were encountered in Davis Lake as recently as 1950 (USDA 1999a; USDA and BLM 1999; Northwest Power Planning Council (NPPC) 2001a), and one was caught by an angler in June of 2000, at the Davis Lake inlet of Odell Creek (USFWS 2002).

Bull trout historically used Crystal Creek (Oregon State Game Commission (OSGC) 1947), but have not been observed there in recent years (USDA 1994). Crystal Creek is a spring-driven system containing approximately one mile of low gradient fish habitat. Historically, bull trout used Crystal Creek (OSGC 1947), but currently it is used extensively by kokanee salmon during the spawning season. Redband trout are present, but in low numbers. The lower 0.8 kilometer (0.3 mile) of stream contains excellent rearing habitat for fish, because of the low gradient, extensive pool formation, and an abundant large wood supply (USDA and BLM 1999). Ideal spawning gravels in Crystal Creek are low due to the contribution of source material from the watershed into the stream and the gradient alteration created by a culvert at a railroad crossing. The spawning gravels and the jump and rest pool at the culvert crossing were improved in 1994 (USDA 1994). The shallow bay into which Crystal Creek empties may be a thermal barrier to bull trout. Biologists continue to investigate limiting factors in Crystal Creek.

Odell Lake is the only remaining natural adfluvial population of bull trout in Oregon. Little is known about its life history (USDA and BLM 1999). Spawning has been observed only in Trapper Creek during the months of August, September, and October (Sanchez 1998, Dachtler and Sanchez 2000, Oregon Fish and Wildlife (ODFW) 1999) Trapper Creek is the only tributary to Odell Lake with a known rearing and spawning population of bull trout. This habitat occurs in the lower 1.3 kilometers (0.8 mile) of Trapper Creek between the mouth and a 2.3 meter (7.5 feet) barrier waterfall. A 1996 USDA habitat survey found 35 percent of the total habitat units in Trapper Creek had bull trout-size spawning gravels; however, this is not all suitable spawning habitat because other factors, such as water depth and velocity, were not appropriate for spawning. In addition, large numbers of kokanee salmon redds may be superimposed on bull trout redds, which may have an effect on bull trout egg survival (USDA and BLM 1999). The 1996 survey found only five side channels for rearing, constituting only 5 percent of the total habitat area in the 1.3 kilometer (0.8 mile) reach of Trapper Creek (USDA and BLM 1999).

Bull trout population size in the Odell Lake Recovery Unit remains unknown. Angler observations of bull trout incidentally caught have been increasing since the harvest of bull trout was prohibited in 1991 (Buchanan et al. 1997). Bull trout captured incidentally have been estimated at 16 in 1996, 0 in 1997, 14 in 1998, and 30 in 1999 (ODFW in litt., 2001b). Data on incidental catch were not collected in 2000 or 2001.

Night snorkeling surveys conducted in Trapper Creek in 1996 found 26 juvenile bull trout ranging from age 0 or greater (20 to 40 millimeters (.79 to 1.57 inches)) to age 3 or greater (over 160 millimeters (6.3 inches)), and no adults. Seventy-six juvenile bull trout and eight adult spawners were observed 1997; 76 juveniles and 4 adults in 1998, and 82 juveniles and 3 adults in 1999 (USDA 1999a). In 2000, 121 juveniles and 2 adults were observed; in 2001, 208 juveniles and no adults were observed (USDA in litt., 2001). In 1998, redd surveys between August 28 and October 8 found a total of 9 redds and 11 adult bull trout. A fyke trap placed in Trapper Creek in 1999 captured 48 adult bull trout (23 females, 22 males, 3 undetermined) between August 19 and September 26. That same year, a total of 24 redds were counted on October 8. In 2000, the fyke trap captured 39 adult bull trout (20 males and 19 females). Twelve redds were observed that year. The fyke trap was not operated in 2001; 11 redds were observed in that year (ODFW, 2001b).

EFFECTS OF THE ACTION

The long-term goal of this proposed Restoration Program is to restore or enhance fish and wildlife habitat for native species, in particular, Federally listed, proposed, candidate and species of concern. In the process of conducting specific restoration activities there may be some short-term adverse effects to listed species. These short-term adverse effects are analyzed in the following sub sections:

Direct Harm

<u>Bull trout, Warner sucker and Oregon chub</u>
Timing and construction activities can dictate potential adverse effects to listed species from in-water work. Lethal, and sub-lethal effects are often unavoidable where in-water work cannot be conducted at a time, or in such a manner, that listed species are not present during construction or within isolated work areas. During periods of in-water work and through in-water work isolation, downstream or upstream passage may be partially or fully blocked.

While there are many individual restoration project sites under this proposed action, they will be conducted over a five year period across Oregon, thus spreading the potential for in-water work and fish capture and release resulting from individual projects over that time frame and across watersheds. The potential for in-water work and fish capture and release resulting from activities at an individual site is not expected to be a major effect. However, smaller batches of projects may be targeted at stream systems with multiple problem points (i.e., fish passage barriers) and will likely be constructed at roughly the same time to maximize efficiencies in construction. In these situations, the potential for in-water work and fish capture and release on local fish and wildlife populations within a system or 5th field HUC may be greater in magnitude than those at an individual site. However, based on past project experience, the numbers of fish handled are still expected to be low, primarily because in-water work windows are designed to miss sensitive fish spawning and migratory periods.

Fish capture and relocation is considered a minimization measure in and of itself. However, effects (sub-lethal and lethal) on listed fish species can occur during any activity that requires handling or that would otherwise displace listed fish species, (e.g., by blocking passage or access to habitats and displace fish from cover.) Handling and lethal take, including delayed mortality from stress and injury, from fish capture and release was estimated by using the following set of assumptions:

1. Some water-spanning culverts, small bridges, and water diversion structures may require in-water work area isolation and fish capture and release.

2. Each project requiring in-water work area isolation may require capture and release of a limited number of fish per in-water work season.

3. Take of adult bull trout and Warner suckers due to harassment or capture and release activities is not expected, and in the unlikely situation where it occurs is not expected to result in lethal take. Adult fish can be harassed out of the area prior to and during work area isolation, reducing the need to capture and release them.

4. For bull trout and Warner sucker, it is assumed that lethal take may occur. NOAA Fisheries has established that up to 6 percent of anadromous salmonids under their jurisdiction may be lost due to handling stress but the Service is aiming to meet the more conservative standard of four percent or less of the fish handled. Up to 500 bull trout adults and juveniles (in aggregate but primarily juveniles) per year may be handled

5. Juvenile Warner suckers are assumed to be handled at a lower rate than bull trout because they have a much smaller range within Oregon and will be encountered at fewer projects. A maximum of 250 juvenile suckers are expected to be handled annually at all projects within the range of the species; six percent of which may be killed by handling stress or injury.

6. Assumed lethal take for Oregon chub is two percent or less of the anticipated 20 Oregon chub per year potentially handled, due to handling stress or injury, or from unforeseen takings resulting from bridge construction. A lower percentage of take is assumed for Oregon chub than for other species based on discussion with Paul Sheerer (ODFW) regarding salvage experience and mortality associated with Oregon chub.

Although fish capture and relocation will likely result in take, it is assumed that take would be minimized from that which would occur without fish capture and release from project specific activities occurring within an isolated work area. In addition to direct effects to listed fish from in-water work, indirect effects are also anticipated from vegetation removal and associated effects as discussed above. In-water work will alter linear bank line habitat and riparian habitat.

Through the development and implementation of the general and project specific in-water work avoidance and minimization Project Standards (Appendix B), the resulting potential for adverse effects to listed aquatic species will be constrained and minimized, including lethal take of listed aquatic species, to the maximum extent possible.

Therefore, the Service expects any lethal effect from in-water work and fish capture and release to listed aquatic species will be limited to only those individuals for which lethal mortality is unavoidable during fish capture and removal efforts and for which severe or lethal adverse effects would be otherwise imminent from in-water work. In addition, the Service expects any sub-lethal effects, direct or indirect, from in-water work, fish capture and release, and habitat alteration to listed species will be limited to only those individuals for which mortality is unavoidable. The Service has developed numerical estimates for lethal and sub-lethal take of listed fish species from in-water work and fish capture and release in the Amount and Extent of the Take section of this BO.

Fender's blue butterfly

When establishing native vegetation, there is a small potential for the inadvertent stepping on Fender's larvae during planting efforts. This small potential is offset by the beneficial affect inherent in reestablishing prairie sites conducive for both Kincaid's lupine and Fender's. Most methods of noxious plant control (i.e. use of manual pulling, prescribed fire, mowing, etc.) in existing native prairie remnant habitat will be conducted during lupine and butterfly dormancy periods. All of these activities are expected to improve habitat conditions for the lupine and help to recover the species which intern improves habitat conditions for Fender's blue butterfly.

Although most of the habitat activities will be implemented when Fender's is in diapause, some take of Fender's eggs and larvae during these procedures is unavoidable. Take in the form of harm, egg and larval mortality, is most likely to result from mowing and prescribed burns, as these activities affect continuous swaths of habitat, as compared with specifically (and carefully) localized weed-pulling and planting activities

It is expected that manual removal of exotic species may affect, and to a minimal degree, are likely to adversely affect, Fender's blue butterfly in the short term. Removing exotic species with hand tools, may result in a small portion of the larvae being inadvertently crushed each season. These techniques, however, appear necessary to keep woody species and aggressive non-native herbaceous species from out-competing Kincaid's lupine and thus, eventually eliminating butterfly habitat.

To our knowledge, studies have not been conducted that specifically analyze adverse impacts to Fender's associated with mowing occupied habitat. Therefore, the effect of mowing on Fender's larvae is conjectural. Mowing may cause death or injury to larvae by crushing individuals with the wheels of the mower or by blowing them out of their diapause locations near the soil surface. Since it is not clear if these impacts actually occur, quantifying death and injury associated with mowing is not possible. However, described below are several studies where mowing has been implemented as a management tool and Fender's populations appear to increase in numbers after treatment. To our knowledge, there has not been a mowing study conducted that resulted in a decreased Fender's population the following year. Although we assume mowing occupied habitat has a short-term adverse affect to Fender's, it is clear that there is a long-term beneficial effect associated with this management technique.

All of the other mechanical management techniques have minimal potential to adversely impact Fender's relative to mowing. Potential impacts include the inadvertent stepping on larvae (injury and potentially mortality) when line trimming, grubbing, girdling trees, and removing woody species with a chain saw. The implementation of spring line trimming treatments has greater potential to adversely impact Fender's larvae than the inadvertent stepping, as there is some potential to inadvertently hit larvae with the line trimmer. Nonetheless, all of these *other mechanical techniques* have less potential for adverse affects than mowing, and all are expected to have long-term beneficial effects.

Survey, assessment, and monitoring activities (Project Category VIII) requiring the physical capture and handling of this species will only be conducted by qualified biologist(s) covered under a current 10(a)(1)(A) permit or other valid ESA coverage.

Increased Erosion, Turbidity, Sediment Transport, and Chemical Exposure

<u>Bull trout, Warner sucker and Oregon chub</u>

The likelihood of short-term increases in erosion, turbidity, sediment transport, and chemical exposure to aquatic or terrestrial environments are increased through the use of equipment, and materials within, and adjacent to, listed species aquatic habitats.

The displacement and transport of soil can result in turbidity and sedimentation within aquatic habitats. The effects of suspended sediments (turbidity) can be sub-lethal or lethal to individual fish, and may have direct effects on their habitat. These effects are generally correlated to the concentration of sediment within the water column. Fish death can be a result of a combination of factors, and thus is difficult to attribute to suspended sediment alone (Waters 1995). The sub-lethal effects of turbidity generally include avoidance and distribution, reduced feeding and growth, respiratory impairment, reduced tolerance to disease and toxicants, and physiological stress (Lloyd 1987 *in* Waters 1995). Reproductive failure can be attributed to both deposited and suspended sediment. Deposited sediments can smother salmonid redds by filling interstitial spaces or by entrapping emerging fry under a layer of consolidated sediments. Excessive turbidity can smother embryos and sac fry, and clog gills. Physical habitat is generally most affected by deposited sediments; naturally loose substrates such as cobble and gravel can become embedded with fine sediment, thus limiting available spawning habitat and diminishing the amount of available cover for overwintering juveniles and fry. Additionally, the infilling of pools reduces overhead cover for juvenile and adult salmonids (Waters 1995). Substrate embeddedness has also been shown to affect aquatic macroinvertebrate abundance and species composition, thus altering the availability and suitability of a critical food source. Lastly, soils can act as a delivery mechanism for transferring chemical pollutants from upland sources.

Chemical exposure can alter fecundity, increase disease, shift biotic communities, and reduce the overall health of listed species. If contamination levels are high enough, direct lethal effects are possible through the disruption of biological processes. The introduction of chemicals can be acute, occurring as a result of an accidental equipment leak during construction activities. The potential for adverse effects of chemical exposure may be sub-lethal or lethal, and are generally correlated to the concentration of chemical contaminants within the species aquatic or terrestrial environment.

The Restoration Program will implement the Project Standards in Appendix B to avoid or minimize potential adverse effects to listed species. The Project Standards also dictate methods to ensure the potential for increased risk of erosion, turbidity, sediment transport, and chemical exposure resulting from restoration project activities, are below thresholds associated with long-term adverse effects to listed species and their habitat, when they cannot be completely avoided.

The potential for increased risk of erosion, turbidity, sediment transport, and chemical exposure resulting from individual restoration project activities at a site is not expected to be a major effect. Individual restoration projects will be scattered across the state but often multiple projects may be targeted on a specific stream system identified to have multiple passage or diversion problems. In this case, multiple activities may occur within a system or 5^{th} field HUC but still are not likely to have a major effect due to the Project Standards being followed to avoid or minimize adverse effects.

Through the implementation of the general and activity specific erosion, turbidity, sediment transport, and chemical exposure Project Standards, potential adverse affects will be adequately constrained to avoid lethal take of listed species and minimize sub-lethal adverse effects.

Therefore, the Service does not expect any lethal effect from increased erosion, turbidity, sediment transport, or chemical exposure to listed aquatic species and adverse effects will be avoided or minimized. In addition, the Service expect any realized sub-lethal effect from increased erosion, turbidity, sediment transport, and chemical exposure to listed species will be avoided or minimized to only those likely to be minor and temporary in nature and long-term beneficial effects to water quality should occur at all restoration projects from comprehensive stormwater management strategies and facilities. Any realized short-term adverse effects will be distributed across Oregon and over a 5 year period.

Habitat Alteration

As described in the proposed action, clearing generally takes place within pre-marked areas in the specific vicinity of the construction site (i.e., immediately upstream and downstream of a culvert or diversion structure). For the purposes of this analysis we are focusing on the effects of vegetation clearing of both riparian and upland vegetation and management activities that affect succession and species composition of Fender's blue butterfly habitat.

<u>Bull trout, Warner sucker and Oregon chub</u>
The adverse effects from vegetation alteration carried out during the site specific projects under this BO are relatively small and variable. However, vegetation removal is likely to result in some degree of ground disturbance, generating the potential for soil erosion, and consequently resulting in limited amounts of temporary turbidity and sedimentation. Resident fish species habitat features include substrate composition; water quality; water quantity, depth, and velocity; water temperature; channel gradient and stability; food availability; cover and habitat complexity; habitat area, access, and passage; and floodplain and habitat connectivity (Buchanan et al. 1997, USFWS 1998). Large woody debris in channels creates complexity and provides refuge habitat for fish, as well as habitat for macroinvertebrates. Tree loss would also likely increase penetration of sunlight into streams, potentially increasing water temperatures.

The temporal and spatial scales of vegetation removal under this proposed action are important factors in evaluating the effects of the action. The temporal nature of vegetation removal is typically related to the age of the vegetation being removed and the time required to re-grow/replace it. Older trees take longer to be replaced and upland vegetation often takes longer to grow than riparian vegetation. Riparian vegetation such as red alder, cottonwood and willows grow rapidly but have comparatively shorter life expectancy compared to Douglas-fir and other regional conifer forest species. Large mature trees growing along roadways or stream corridors often have more developed (larger) limb structure due to the trees getting more sunlight as opposed to trees in dense stands. Not only are large mature trees important for LWD recruitment in streams to provide fish habitat but also nesting habitat for the listed birds as well as osprey nests and great blue heron nesting colonies. Therefore while the removal of younger riparian vegetation is considered a relatively temporary effect, the loss of mature trees can functionally be considered a long-term effect.

While there are many individual project sites under this proposed action, projects will be conducted over a five-year period across Oregon, thus spreading the adverse effects of vegetation removal over that time frame and across watersheds. On an individual project scale, vegetation removal is not expected to be a major effect. However, often stream systems with multiple identified problems are targeted for systematic restoration of problem points (i.e., fish passage blocks), these are often constructed at the same time or over a shorter duration to maximize efficiencies in construction. Based on this, the potential additive short-term adverse effects due to vegetation removal, on local fish populations, within a given system or 5th field HUC, may be greater in magnitude than those at individual bridge sites.

<u>Fender's blue butterfly.</u>

In formal consultation with the Corps, the Service described the affects of mowing 100 percent of the Kincaid's lupine patches at six sites within the Corps' Fern Ridge Project in Lane County, Oregon (USFWS 2002a). For Fender's blue butterfly, the biological opinion states that the effects of mowing are not entirely known, but some larval damage is possible, and while complete mowing of an occupied site is likely to adversely affect the butterfly, it will not result in jeopardy to the species, and, in combination with other mechanical and hand weed removal techniques and planting of adult nectar species "... would benefit the viability of Fender's blue butterfly populations over time." (USFWS 2002a). The Fender's populations at all of the Fern Ridge sites have increased in number since the onset of the mowing treatment (Corps 2002).

Preliminary observations from a study conducted at one of the Fender's sites, Fir Butte, show that mowing Himalayan blackberry appears to be beneficial for both lupine and butterfly. Mowing occurred in 6 plots in the fall of 1999, and in another 12 plots in the fall of 2000, to reduce blackberry cover. In the following monitoring events (spring 2000 and 2001), unmowed plots had a mean abundance of lupines and butterfly eggs that was lower than in the mowed plots, and a higher cover of blackberry. Increases in leaves and inflorescences and in Fender's egg abundance after the first two mowing years gives an early indication that in the long term, both species will benefit from the increased blackberry control effort (Kaye, 2002).

The effects of mowing on Kincaid's lupine, spur lupine, and Fender's blue butterfly were studied as part of a larger research project conducted from 1994 -1997 at Baskett Slough National Wildlife Refuge in Benton County, Oregon. The findings indicated that Kincaid's lupine plants were more vigorous with mowing than the control group, and that Fender's blue butterfly egg abundance was 10-14 times higher in mowed (Wilson and Clark, 1997). Monitoring has shown that mowing at Fir Butte resulted in increased Kincaid's lupine leaf density and Fender's egg abundance (Kaye 2002). The Service, in formal consultation with the Corps (USFWS 2002), concluded that mowing 100 percent of the Kincaid's lupine patches at six sites within the Corps' Fern Ridge Project in Lane County, Oregon, would have a beneficial impact on Kincaid's lupine.

Fender's blue butterflies will be dormant at the base of lupine plants in a larval stage of growth during proposed prescribed burn activities. In the proposed burn plots at project locations, larval mortality is expected to be 100 percent. Since up to $^{1}/_{3}$ of the occupied habitat might be burned annually at Fender's sites supporting more than 100 individuals, burning could result in the loss of 33 percent of the larval butterfly population at these sites in a given year. Similarly, since up to $^1/_4$ of the occupied habitat might be burned annually at sites supporting less than 100 individuals, burning could result in the loss of 25 percent of the larval butterfly population at these sites in a given year. As discussed below, post-burn lupine are very robust and readily attract female butterflies for egg deposition. Maintaining unburned occupied habitat within 100 m (109 yd) of the ABU will provide a recolonization source for the site and therefore, offset the associated short-term losses by providing the long-term beneficial effect of maintaining suitable Fender's habitat. Burn studies conducted in occupied habitat that document an increase in Fender's individuals after implementation of burn treatments are discussed below. To our knowledge, there has not been a burn study conducted that resulted in a decreased Fender's population the following year.

The effects of prescribed burning on Kincaid's lupine, spur lupine, and Fender's blue butterfly were also studied as part of a larger research project conducted from 1994-1997 at Baskett Slough National Wildlife Refuge in Benton County, Oregon. The findings indicated that Kincaid's lupine plants were more vigorous with burning treatments than the control group, and that Fender's blue butterfly egg abundance was 10-14 times higher in mowed or burned plots (Wilson and Clark, 1997). Lupine burn areas resulted in 100 percent larval mortality for Fender's blue butterfly, but the adult females from the unburned area were able to colonize all burned areas, including lupine in burn patches up to 107 m (117 yd) from the unburned source patch (Wilson and Clark, 2000; Wilson presentation, 2002.)

In formal consultation with BLM, the Service discussed impacts associated with implementation of the proposed Fir Butte management plan (USFWS 2002b). The plan included burning $^1/_3$ of the Fir Butte site in any given year and $^1/_2$ of the Oxbow West and Coble Sites in any given year. In analysis of worst-case scenarios, up to 66 percent and up to 50 percent of Oxbow West and Coble butterfly populations could be lost due to prescribed burns and other management activities. The no jeopardy finding was supported by the fact that these losses would "represent a very small number of individuals and a small level of impact in relation to the total butterfly population. These losses are anticipated to be compensated by the increases that will be realized by better quality habitat, additional nectar sites and more robust lupine plants."

In order to assess the management tradeoffs associated with burning prairie to restore Fender's habitat, Schultz and Crone (1998) present a modeling approach. In order to rank potential burn strategies, an empirically based mathematical model was developed with parameter estimates based on experiments conducted by Wilson and Clark from 1994 to 1997. Based on the study results, they recommend burning, on average, a third of a Fender's site every year (where funds permit) or every 2 years (if funds don't permit). "This strategy yields the highest long-term population growth rate for Fender's in both the step function model and the exponential decay function model" (Shultz and Chrone 1998).

None of the known sites will be removed due to management activities in the proposed action based on the timing, amount, and type of management activities proposed. As stated above while the proposed habitat management activities will result in probably loss of some larval Fender's all studies to date have shown overall benefits to habitat and Fender blue butterfly populations.

Effects to designated critical habitat

Warner sucker designated critical habitat

Critical habitat, as defined by section 3 of the Act, means: (i) The specific areas within the geographical area occupied by a species, at the time it is listed in accordance with the Act, on which are found those physical or biological features (I) essential to the conservation of the species and (II) that may require special management considerations or protection, and (ii) specific areas outside the geographical area occupied by the species at the time, upon a determination that such areas are essential for the conservation of the species.

Section 4(b)(8) requires, for any proposed or final regulation that designates critical habitat, a brief description and evaluation of those activities (public or private) which may adversely modify such habitat or may be affected by such designation. For Warner sucker designated critical habitat these activities include:

(1) Overgrazing by livestock, which would eliminate riparian vegetation and lead to streambank erosion and subsequent siltation of the stream and lake environment.

Most restoration projects addressing livestock grazing funded by the Service would aim to improve the stream and riparian conditions from the adverse effects of livestock grazing. This may be accomplished through fencing off riparian areas and providing off stream watering or livestock water gaps, hardened livestock crossings, and revegetating fenced riparian areas, etc. Restoration activities will not increase livestock use or damage but will improve riparian vegetation in areas impacted by livestock.

(2) Introduction of exotic fishes into streams or lakes of the Warner Valley, which might compete with or prey on Warner suckers.

The Resoration Program will not be funding the introduction of exotic game fish into waters of Oregon. Typically restoration projects focus on habitat but it is conceivable that projects may have a reestablishment component but only of native species appropriate for the site. In all cases reintroduction of listed species would be completed under a 10(a)(1)(A) permit and subsequent intra-Service consultation.

(3) Construction of additional diversion dams, that do not have adequate fish-passage facilities, on streams inhabited by Warner sucker.

The Restoration Program would not be funding the construction of new water diversion structures where none exist. In all water diversion projects funded under the Restoration Program, the Service's goal is to replace an existing diversion structure so that fish passage is provided and/or so that less water is withdrawn. There may be short-term effects to sucker habitat through increased turbidity and sediments during construction.

(4) Channelization or diversion of streams inhabited by Warner sucker.

The Restoration Program would only be funding projects that facilitate normal stream function and not channelizing streams. Projects are conducted that add channel diversity, reconnect or reestablish old natural channels where streams were previously channelized, and add structure to a stream channel.

(5) Application of herbicides or insecticide along stream courses or lakes inhabited by the Warner sucker, which could be toxic to the species or food.
While herbicide use may be a valid technique to control noxious weeds, this programmatic consultation does not cover herbicide use by the Service's Restoration Program. Projects using herbicides will be consulted on individually.

(6) Pollution of stream or lake habitat by silt or other pollutants.
Construction activities and heavy equipment associated with some restoration projects may have a temporary effect on this element. Increased sedimentation may occur due to vegetation removal and dirt work immediately downstream of a project (e.g., a culvert replacement). In all cases this is temporary sediment input since sites are re-vegetated, and other precautions are taken to prevent erosion (e.g., drift fence and ground covers). Chemical contamination is not anticipated but accidental small leaks/spills are possible when heavy equipment is being used.

(7) Removal of natural vegetation within or along streams.
Some restoration projects will have a short-term effect on this element because vegetation will be removed adjacent to some projects (e.g., culvert replacement). As stated above, these effects are short-term because site re-vegetation will be a component of the project. However there will be a period of time, generally from 1 to 5 years, where vegetation will be less extensive than it was prior to construction and stream shading will be less.

Based on the seven activities identified in the final rule designating critical habitat for the Warner sucker, the Service anticipates that the Restoration Program may only have short-term adverse effects on sediment and vegetation removal for site specific construction projects such as culvert or water diversion replacements. In addition, any long-term effects anticipated from the Restoration Program will be beneficial to designated Warner sucker critical habitat.

<u>Bull trout designated critical habitat</u>
The nine Primary Constituent Elements (PCE) of bull trout critical habitat identified in the proposed critical habitat rule can be negatively affected in a number of ways. Individual bridge projects may result in removal of riparian vegetation that provides shade, and water-edge habitat. This may result in increased stream temperatures, and reduced hiding cover and refugia for bull trout. Increased sedimentation resulting from project activities can reduce overall water quality, and depreciate the value of spawning gravels within, and adjacent to project areas. Projects that change stream flow characteristics may alter habitat parameters both above and below them for a considerable distance. The changes may occur through changing natural stream meander, changing the ratio of pools to riffles, changing the ratio, and lengths of slack versus fast water areas. Fish passage projects may allow undesirable non-native species, which compete with bull trout, access to bull trout habitat, thus reducing the habitat quality for foraging.

The discussion that follows lists each PCE and describes how actions authorized under the Restoration Program may affect those elements.

PCE 1) Permanent water having low levels of contaminants such that normal reproduction, growth and survival are not inhibited.
There is an extremely low risk that individual restoration projects will negatively affect this element. The use of mechanized equipment will expose the habitat to petroleum products, some of the construction activities may expose the habitat to green concrete, or PAH

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

Some individual restoration projects may remove, or alter riparian vegetation. Often, removal of such vegetation will reduce stream shade, which allows longer exposure of the stream surface to direct sunlight. This can lead to increased water temperatures, with resulting lower dissolved oxygen levels. The warmer water temperatures and decreased oxygen levels reduce the habitats holding capacity, and desirability. They also can lead to habitat conversion, where differing species more adapted to these conditions (e.g., brook trout), can push the bull trout out of the habitat.

PCE 3) Complex stream channels with features such as woody debris, side channels, pools, and undercut banks to provide a variety of depths, velocities, and in stream structures.
Some individual restoration projects may affect this element. Projects that change stream dynamics, even slightly, or short term can have profound effects on habitat quality, and composition. Placing structures that change stream flow velocities, or directions can change pool to riffle ratios, or slack versus fast water ratios for some distance away from the project site. These changes can cause shifts in the aquatic community, removing prey base, spawning sites and hiding cover for bull trout. The removal, or relocation of large wood can also change site dynamics, and stream complexity. Such changes can cause shifts that allow undesirable (non-native) species to enter the habitat and compete with bull trout.

PCE 4) Substrates of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. A minimal amount of fine substrate less than 0.63 cm (0.25 in) in diameter and minimal substrate embeddedness are characteristic of these conditions.
Any construction activity that produces sediment will affect this element. Increases in sediment will increase the degree of embeddedness, and decrease the availability of suitable spawning gravel, and substrate for juvenile rearing. Because of the high degree of sensitivity displayed by bull trout in all life stages (including adults), any increase in sedimentation can have a negative affect on habitat quality.

PCE 5) A natural hydrograph, including peak, high, low, and base flows within historic ranges or, if regulated, a hydrograph that demonstrates the ability to support bull trout populations.
Restoration project construction activities that may change flows (both instream, and inflows from upland areas) have the capacity to negatively affect this element. Wherever impermeable surfaces are created, overland flows from stormwater will be increased. This can lead to faster

input of waters into the stream system than would naturally occur. These types of flow changes can cause increased sedimentation, streambank instability, and erosion. Changes in peak flows can cause changes to the riparian plant community, which in turn, can cause changes to the aquatic community, reducing the desirability of the affected habitat to bull trout.

PCE 6) Springs, seeps, groundwater sources, and subsurface water connectivity to contribute to water quality and quantity.
Changes within the riparian area resulting from individual restoration project may occur. These changes may include the interception of groundwater that contributed to habitat quality for bull trout. Mechanical changes to the streambed, and streambanks could alter the function of groundwater within bull trout habitat. These changes, although often subtle, may have long lasting effects on habitat quality. Most restoration projects should have beneficial effects to this element

PCE 7) Migratory corridors with minimal physical, biological, or chemical barriers between spawning, rearing, overwintering, and foraging habitats, including intermittent or seasonal barriers induced by high water temperatures or low flows.
Because individual restoration projects have limited potential to cause temporary flow changes, and increased water temperature, it is unlikely that this element will be adversely affected. Thermal barriers to bull trout migration are already a significant threat to bull trout within many areas of the State. Increasing temperature on more sections of stream may make connectivity even more difficult for bull trout. Projects that temporarily reduce flows make this problem worse, as water in streams with low flows is more easily heated than that in streams with larger, deeper flow volumes. No individual restoration projects should result in a permanent barrier to bull trout passage and are likely to result in improved passage. However, some projects may act as temporary physical barrier, making habitat inaccessible during portions of the year.

PCE 8) Abundant food base including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish.
Construction activities associated with restoration projects may affect this element. Changes in stream flow, temperature, sedimentation, cobble embeddedness, riparian vegetation, and altered access can result in changes within the aquatic and riparian systems. These changes can result in a reduction in prey base, as the system shifts away from the parameters preferred by bull trout.

PCE 9) Few or no predatory, interbreeding, or competitive nonnative species present.
Construction activities associated with restoration projects may affect this element. Changes in stream flow, temperature, sedimentation, cobble embeddedness, riparian vegetation, and altered access can result in changes within the aquatic and riparian systems. These changes can make bull trout habitat suitable for other non-native predatory fish that compete with bull trout. Such changes can ultimately make bull trout unsuitable. If the incursion of non-native fish includes brook trout, the genetic integrity of the bull trout population is placed at risk. Bull trout x brook trout hybrids are known to occur in several streams in eastern Oregon. These hybrids present a continued risk to the usefulness of the habitat as they are not sterile, and will re-cross themselves freely with either bull trout, or brook trout.

Even though the implementation of the Restoration Program will have some limited adverse effects on the PCEs of the proposed critical habitat for bull trout, those effects are expected to be minor overall.

As described in the species effects analysis, the Project Standards have been designed to substantially avoid or minimize the amount and severity of the potential effects to the physical and biological habitat components represented by the PCEs. The in-water work windows in conjunction with the equipment operation, construction techniques, and pollution and erosion control Project Standards are designed to minimize entry into streams of sediments and contaminants. The construction techniques and restoration materials Project Standards are designed to replace proper functioning conditions for riparian vegetation in areas where construction activity removed it. In many cases this may be an improvement by replacing exotic species (e.g., Himalayan blackberry) with native species. As a result, while potential short-term effects are likely, the Service anticipates that no PCE will be eliminated or significantly reduced within any proposed critical habitat unit through implementation of the Restoration Program.

CUMULATIVE EFFECTS

Cumulative effects are defined in 50 CFR 402.02 as "those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation." The Service is not aware of any specific future non-federal activities within the action area that would cause greater effects to listed species than presently occurs. The action area includes significant tracts of private and state lands. Land use on these non-federal lands includes rural development, agricultural, and commercial forestry. Chemical fertilizers or pesticides are used on many of these lands, but no specific information is available regarding their use. The Service generally does not consider existing rules governing timber harvests, agricultural practices, and rural development on non-federal lands within Oregon to be sufficiently protective of watershed, riparian, and stream habitat functions to support the survival and recovery of listed species. Therefore, habitat functions for listed species may be at risk as a result of future activities on some non-federal lands within the state.

CONCLUSION

After reviewing the current status of the Warner sucker, Oregon chub, bull trout, and Fender's blue butterfly, the environmental baseline for the action area, the effects of the proposed action and cumulative effects, the Service has concluded that the various proposed habitat restoration activities funded and potentially implemented under the Service's Restoration Program is not likely to jeopardize the continued existence of these species. The Service also concluded that the proposed action is not likely to destroy or adversely modify designated Warner sucker critical habitat or proposed bull trout critical habitat. The Service reached its conclusion for each species based on the following factors:

Warner sucker

1. The proposed action is likely to adversely affect Warner sucker through the temporary increase in sediments and turbidity during in-water work associated with Warner sucker habitat restoration projects. The temporary disturbance to relatively small amounts of habitat distributed across the range of the species will ultimately effect a minor portion of the existing suitable habitat across the landscape.

2. The short-term disturbance of small amounts of habitat throughout the range of the Warner sucker will not significantly alter the amount or distribution of habitat that is known to support suckers, its habitat and population connectivity and/or movement.

3. The number of individuals adversely affected, and the nature of the effects are not expected to be significant enough to alter the size or productivity of any populations of Warner sucker.

Oregon chub

1. The proposed action is likely to adversely affect Oregon chub through the temporary increase in sediments and turbidity during in-water work associated with Oregon chub habitat restoration projects. The temporary disturbance of relatively small amounts of habitat distributed across the range of the species will ultimately effect a minor portion of the existing suitable habitat across the landscape

2. The short-term disturbance of small amounts of habitat throughout the range of the spotted owl in Oregon will not significantly alter the amount or distribution of habitat that is known to support bull trout connectivity and movement/dispersal.

3. The number of individuals adversely affected, and the nature of the effects are not expected to be significant enough to alter the size or productivity of any populations of Oregon chub.

Bull trout

1. The proposed action is likely to adversely affect bull trout through the temporary increase in sediments and turbidity during in-water work associated with bull trout habitat restoration projects. The temporary disturbance of relatively small amounts of habitat distributed across the range of the species will ultimately effect a minor portion of the existing suitable habitat across the landscape

2. The temporary disruption of small amounts of habitat throughout the range of the bull trout in Oregon will not significantly alter the amount or distribution of habitat that is known to support bull trout habitat and population connectivity and/or movement.

3. The number of individuals adversely affected, and the nature of the effects are not expected to be significant enough to alter the size or productivity of any populations of bull trout.

Fender’s blue butterfly

1. The proposed action will adversely affect the Fender's blue butterfly through manual, mechanical, and prescribed burning of occupied habitat patches to increase the overall habitat condition. The temporary removal of food plant habitat distributed across the four county range of the species will ultimately effect a minor portion of the existing suitable habitat across the landscape overall.

2. The temporary removal of portions of habitat patches throughout the range of the Fender's blue butterfly in Oregon will not significantly alter the amount or distribution of habitat that is currently known to support Fender's blue butterflies, or its habitat and population connectivity and movement/dispersal.

3. The number of individuals adversely affected, and the nature of the effects are not expected to be significant enough to alter the size or productivity of any populations of Fender's blue butterfly.

Our conclusion is based on the following considerations: (1) The proposed restoration projects require individual review to ensure the proposed action will be in compliance with the BA and this BO, and that applicable PDCs or Project Standards are fully implemented during project administration, design, construction, monitoring, and reporting; (2) taken together, the PDCs and Project Standards applied to each project will ensure avoidance or minimization of harassment and ensure short-term adverse effects to water quality, channel conditions and dynamics, flows and watershed conditions will be brief, minor, and scheduled to occur at times that are least sensitive for the aquatic species' life-cycles; (3) the underlying objective of promoting habitat restoration by improving long-term ecosystem characteristics and restoring natural habitat forming processes is expected to result in projects having beneficial long-term effects; and (4) the individual and combined effects of all the actions proposed in this way are not expected to impair currently properly functioning habitats, appreciably reduce the functioning of already impaired habitats, or retard the long-term progress of impaired habitats toward proper functioning condition essential to the long-term survival and recovery at the watershed (5^{th} Field HUC), population, or DPS scale.

Reinitiation of Consultation

This concludes formal consultation on the action in the NFLCD's Restoration Program. As provided in 50 CFR § 402.16, Reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to and extent not considered in this BO; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this BO; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operation causing such take must cease pending reinitiation.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by the Service's Restoration Program for the exemption in section 7(o)(2) to apply. The Restoration Program has a continuing duty to regulate the activity covered by this incidental take statement. If the Service's Restoration Program (1) 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 Restoration Program must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement. [50 CFR § 402.14(i)(3)]

Amount or Extent of Anicipated Take

The Service anticipates incidental take of all four species will be difficult to detect because the presence and number of individuals is difficult to determine within a project area and detecting a dead or impaired specimen is highly unlikely. Although the Service anticipates the Warner sucker, Oregon chub, bull trout and Fender's blue butterfly will be incidentally harassed and harmed (killed or injured) as a result of sediments and turbidity, in-water work, capturing , and handling, or burning and mowing habitat, accurately quantifying these effects is difficult. For instance, crushed juvenile fish or larval butterflies would be extremely difficult to find in order to quantify incidental take. Therefore, even though incidental take is expected to occur, data are not available and are not sufficient to enable the Service to estimate an exact number of individuals which are taken for most of the proposed actions. However, the Service is quantifying incidental take in the form of conservative estimates and percentages based on research and similar past project activities.

Warner sucker

The Service anticipates 250 Warner suckers may be incidentally taken per year due to harm from handling during capture and removal from project sites of which up to 10 per year may be lethally taken as a result of capture and handling (Table 6). The Service does not anticipate any lethal incidental take of Warner sucker from implementation of the Restoration Program other than for handling. However, Warner suckers may be harmed due to short-term increases in sedimentation and turbidity. The Service does not anticipate the proposed action will destroy or adversely modify designated critical habitat for the Warner sucker.

Oregon chub
The Service anticipates 500 Oregon chub per year may be incidentally taken per year due to harm from handling during capture and removal from project sites of which up to 10 per year may be lethally taken as a result of in-water work and capture and handling during implementation of the Restoration Program.

Bull trout
The Service anticipates 500 bull trout may be incidentally taken due to harm from handling during capture and removal from project sites of which up to 20 per year may be lethally taken as a result of capture and handling (Table 6). The Service does not anticipate any lethal incidental take of bull trout from implementation of the Restoration Program other than for handling. However, bull trout may be harmed due to short-term increases in sedimentation and turbidity. The Service does not anticipate the proposed action will destroy or adversely modify designated critical habitat.

Table 6. Numbers of Warner sucker, Oregon chub, and bull trout that may be captured/handled during in-water work and the numbers that potentially may be lost to handling.

Species	Handled/captured	Handling loss
Warner sucker	250	10
Oregon chub	500	10
Bull trout	500	20

Fender's blue butterfly
The Service anticipates Fender's blue butterflies may be incidentally taken due to crushing associated with mowing or burning during prescribed management burns (Table 7). The Service does anticipate lethal take of butterfly larvae due to habitat management but lupine and associated Fender's populations are known to increase based on active management.

Table 7. Area of occupied Fender's blue butterfly sites which may be treated by mowing or prescribed burning and has incidental take associated with it.

Management tool	Population size	Percent treated
Mowing	all sites	no more than 75% of site
Prescribed burning	$\geq$ 100 adults/site	maximum of 1/3 of site; 3+ year rotation
	$\leq$ 100 adults/site	maximum of ¼ of site; 3+ year rotation

In the accompanying biological opinion, the Service determined that these levels of anticipated take are not likely to result in jeopardy to the Warner sucker, Oregon chub, bull trout, or Fender's blue butterfly and will not result in destruction or adverse modification of designated critical habitat for the Warner sucker and bull trout.

REASONABLE AND PRUDENT MEASURES

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

1. Complete an electronic database for all of the restoration programs that in addition to basic project tracking will also track beneficial and adverse affects to listed species.

TERMS AND CONDITIONS

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

Term and Condition 1.
An electronic database will be developed and used for all individual restoration projects within the various restoration programs so that the adverse and beneficial affects of the restoration projects within each program can be tracked and reported on in a similar manner. Data that will be collected within the database include, but are not limited to, the following:

a) Species being affected
b) Amount of incidental take incurred for a project
c) If different than b., the number of acres, individuals, or other appropriate metric being temporarily or permanently affected by the project
d) Conservation measures used to avoid or minimize adverse effects
e) If species has a recovery plan is the project addressing a specific recovery implementation task?

Reporting requirements

Upon locating dead, injured, or sick bull trout during the time when herbicide application is occurring on BLM managed lands, initial notification must be made to the Service's Division of Law Enforcement in Wilsonville, Oregon at 503-682-6131. Instructions for proper handling and disposition of such specimens will be issued by the Division of Law Enforcement. Care must be taken in handling sick or injured fish to ensure effective treatment and care, and in handling dead specimens to preserve biological material in the best possible state. In conjunction with the care of sick or injured Warner sucker, Oregon chub, or bull trout, or the preservation of biological materials from a dead trout or Fender's blue butterfly, the Restoration Program has the responsibility to ensure that information relative to the date, time, and location of the listed fish or butterfly when found, and possible cause of injury or death of each individual be recorded and provided to the Service.

Results of all project and annual monitoring conducted within the Coastal, Greenspaces, Jobs in the Woods, Partners for Fish and Wildlife, and Private Stewardship Grants Programs will be summarized in regards to effects to listed species and be made available to Service personnel tracking take for individual species and to recovery personnel.

CONSERVATION RECOMMENDATIONS

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

1. Track and report all beneficial restoration projects aimed at conservation and recovery of anadramous fish species administered by NOAA Fisheries.

In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

REINITIATION NOTICE

This biological opinion and conference opinion addresses the effects of implementing the Service's Oregon Fish and Wildlife Office, Non-Federal Lands Conservation Division's Restoration Program within Oregon from 2004 to 2009, to Warner sucker, Oregon chub, bull trout and Fender's blue butterfly and Warner sucker designated critical habitat and bull trout proposed critical habitat. In addition outlines the bases for our concurrence with the other species as indicated in table 1.

This concludes formal consultation on the proposed action described in the Biological Assessment dated May 6, 2004. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or designated critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

If you have questions or require additional information regarding this consultation, please contact David Leal or Joe Zisa of the Oregon Fish and Wildlife Office at 503-231-6179.

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Appendix A. State and sub-office areas of responsibility.

Add map

Appendix B. Project design standards (Project Standards) for all restoration activities.

Project design standards for all restoration activities.

General Requirements

1. All regulatory permits and official project authorizations must be secured before project implementation. Follow all terms and conditions included in these documents.
2. The Oregon guidelines for the timing of in-water work must be followed for each affected stream reach when completing restoration activities requiring in-water work. The timing of in-water work may be extended if the Oregon Department of Fish and Wildlife approves an extension based on current year site specific conditions. In-water work should occur during the lowest water period within the timing guidelines for the affected stream reach.
3. Significant modifications to a project work plan must be reviewed and approved by appropriate agency personnel and the landowner(s) before completing the modifications.
4. Explosives (*i.e.,* dynamite and gun powder) must not be used on a project site.
5. Pesticides must not be used to control or remove invertebrate and vertebrate species and microorganisms (*e.g.,* viruses, bacteria, and fungi).
6. Herbicides must not be used to control or remove invasive and non native vegetation.
7. Monitoring, as necessary, is required for at least one year following completion of a project.

Equipment Operation

1. Use existing roads or travel paths to access project sites whenever possible.
2. All temporary access roads for equipment must be constructed as follows:
   - Use existing roads and travel paths whenever possible, unless construction of a new road or path would result in less habitat loss.
   - Temporary roads and paths must not be built mid-slope or on slopes steeper than thirty percent.
   - Minimize soil disturbance and compaction whenever a new temporary road or path is necessary within 150 feet[24] of a stream, water body, or wetland by clearing vegetation to ground level and placing clean gravel over geotextile fabric, unless otherwise approved by the Fish and Wildlife Service.
   - Minimize the number of temporary stream crossings.
   - Survey any potential spawning habitat within 300 feet downstream of a proposed stream crossing. Do not place a temporary stream crossing at known or suspected spawning areas, or within 300 feet upstream of such areas if spawning areas may be affected.
   - Design a temporary stream crossing to provide for foreseeable risks (*e.g.,* flooding and associated bedload and debris, to prevent the diversion of stream flow out of the channel and down the road if the crossing fails).

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[24] Distances from a stream or water body are measured horizontally from, and perpendicular to, the bankfull elevation, the edge of the channel migration zone, or the edge of any associated wetland, whichever is greater. "Channel migration zone" means the area defined by the lateral extent of likely movement along a stream reach as shown by evidence of active stream channel movement over the past 100 years (*e.g.,* alluvial fans or floodplains formed where the channel gradient decreases, the valley abruptly widens, or at the confluence of larger streams).

- Vehicles and machinery must cross riparian areas and streams at right angles to the main channel whenever possible.
- When a project is complete, obliterate all temporary access roads that will not be in footprint of a new bridge or other permanent structure, stabilize the soil, and revegetate the site. Abandon and restore temporary roads in wet or flooded areas by the end of the local in-water work period.

3. Equipment must be limited in capacity, but sufficiently sized to complete required restoration activities. When heavy equipment will be used, the equipment selected must have the least adverse effects on the environment (*e.g.*, minimally sized, low ground pressure equipment).
4. Minimize the use of equipment in or adjacent to a stream channel to reduce sedimentation rates and channel instability.
5. Aquatic and riparian habitats must not be used as equipment staging or refueling areas. Locate these areas 150 feet or more from any stream, water body, or wetland. (Note: This distance must be greater if a staging or refueling area is up slope from an aquatic or riparian habitat). These areas should be used to store equipment, supplies, materials, and fuels, and for the cleaning, maintenance, and refueling of equipment.
6. To reduce potential contamination, limit the size of staging and refueling areas and only store enough supplies, materials, and equipment on-site to complete the project.
7. All equipment operated within 150 feet of an aquatic habitat, must be inspected daily for fluid leaks before leaving the equipment staging area. All detected leaks must be repaired in the staging area before the equipment resumes operation.
8. All equipment must be cleaned to remove external oil, grease, dirt, and mud before beginning operations below the bankfull elevation of a stream.
9. All stationary power equipment (*e.g.*, generators) operated within 150 feet of any aquatic habitat must be diapered to prevent leaks and/or enclosed in a containment device (*e.g.*, non permeable drip pan) of adequate capacity to retain equipment fluids (*e.g.*, gasoline, diesel fuel, and oil) if a leak occurs.

<u>Pollution and Erosion Controls</u>

1. A written hazardous spill contingency plan must be developed for all project sites where hazardous materials (*e.g.*, fuels, oils, and fertilizers) will be used or stored. For information on your role in a spill response, please review the Oregon Department of Environmental Quality (ODEQ) fact sheet at the following web site: http://www.deq.state.or.us/wmc/cleanup/factsheets/WhatToExpectWhenYouHaveSpilled.pdf.
2. Appropriate materials and supplies (*e.g.*, shovels, disposal containers, absorbent materials, first aid supplies, and clean water) must be available on-site to cleanup any small accidental spill. Responding personnel must be trained in dealing with the spill.
3. Hazardous spills must be reported to the Oregon Emergency Response System at 1-800-452-0311 (system available 24 hours a day). Please review the ODEQ emergency response web site at http://www.deq.state.or.us/wmc/cleanup/spl0.htm for more information.
4. The removal, transport, and disposal of hazardous materials must be done according to U.S. Environmental Protection Agency and ODEQ regulations.
5. All hazardous materials must be handled in strict accordance to label specifications. Proper personal protection (*e.g.*, gloves, face masks, and clothing) must be worn by all personnel

handling hazardous materials. Obtain a copy of the material safety data sheet from the manufacturer for detailed information on each hazardous material. Contact the Oregon Poison Control Center at 1-800-222-1222 (24 hours) for assistance in responding to emergency exposures.

6. Install hazardous material containment booms in situations where there is a potential for release of petroleum or other toxicants in aquatic habitats or construct containment berms in non aquatic habitats.
7. Contaminated or sediment laden water from a construction project (*e.g.*, concrete washout, pumping for work area isolation, and vehicle wash water) must not be discharged directly or indirectly into any aquatic habitat until it has been treated by a proper method (*e.g.*, bioswale, filter system, and settlement pond).
   - Design, build, and maintain facilities to collect and treat all construction discharge water using the best available technology applicable to site conditions. Provide treatment to remove debris, nutrients, sediment, petroleum hydrocarbons, metals and other pollutants likely to be present.
   - If construction discharge water is released using an outfall or diffuser port, velocities must not exceed four feet per second, and the maximum size of any aperture must not exceed one inch.
   - Do not release construction discharge water within 300 feet upstream of active spawning areas or areas with submerged aquatic vegetation.
   - Do not allow pollutants including green concrete, contaminated water, silt, welding slag, sandblasting abrasive, or grout cured less than 24 hours to contact any wetland or the two year floodplain.
8. Store construction waste in leak-proof containers until they can be transported off-site for recycling, reuse, or disposal at an upland facility approved to accept the specific waste. Project personnel must remove all waste from the project site at the completion of the project.
9. Temporary erosion controls must be installed at all project sites where restoration activities will result in soil disturbance and the potential for sediment transport. Controls must remain in place and be maintained until vegetation is established at the sites or as needed to prevent erosion. Controls include, but are not limited to, silt fences, straw bales[25], sandbags, jutte mats, coffer dams, water bladders, and coconut logs.
10. During construction, all erosion controls must be inspected daily during the rainy season and weekly during the dry season to ensure they are working adequately[26].
    - If monitoring or inspection shows that the erosion controls are ineffective, mobilize work crews immediately to make repairs, install replacements, or install additional controls as necessary.
    - Remove sediment from erosion controls once it has reached one-third of the exposed height of the control.

[25] When available, certified weed-free straw or hay bales must be used to prevent introduction of invasive and non native weeds.

[26] "Working adequately" means that project activities do not increase ambient stream turbidity by more than ten percent when measured relative to a control point immediately upstream of the turbidity causing activity.

- Sediments collected behind erosion control structures must be removed and stabilized at an appropriate upland disposal site immediately after the completion of a project.

11. Emergency erosion controls (*e.g.,* silt fences and straw bales) must always be available on-site whenever surface water is present at a project site.
12. An oil-absorbing floating boom must be present on-site when operating heavy equipment within 50 feet of aquatic habitats.
13. Locate stockpile areas on or immediately beside a project site whenever possible, but at least 150 feet from aquatic habitats. Erosion controls must be implemented around stockpiled materials, as needed, to prevent the introduction of pollutants into the surrounding areas.
14. Excess excavated materials removed during the completion of a project must be disposed of properly and stabilized to eliminate future environmental problems. Disposal sites must not be located in aquatic or riparian habitats or floodplains.
15. Concrete structures used in open-bottom culvert and bridge installations (*e.g.,* vault sections, footers, wing walls, and abutments) must be cured before they are placed in aquatic habitats.

Construction Techniques

1. The boundary of a project site must be flagged to prevent soil disturbance to areas outside the site. Confine construction impacts to the minimum area necessary to complete the project.
2. Limit the removal of any native vegetation to the amount that is absolutely necessary to complete a construction activity.
3. Conserve native materials for site restoration as follows:
   - Leave native materials where they are found, whenever possible.
   - Replace native materials that are damaged or destroyed with functional equivalents during site restoration.
   - Stockpile any large wood, native vegetation, weed-free topsoil, and native channel material displaced by construction for use during site restoration.
4. Completely isolate an in-water work area from the active flowing stream using inflatable bladders, sandbags, sheet pilings, or similar materials if adult or juvenile fish are reasonably certain to be present, or if the work area is 300 feet upstream of spawning habitats. This does not apply to the placement of large woody debris and boulders to construct fish habitat structures.
5. Fish screens must be installed, operated, and maintained according to NOAA Fisheries' fish screen criteria[27] on each water intake used for project construction, including pumps used to isolate an in-water work area.
6. Institute practices that prevent construction materials and debris from dropping into aquatic habitats. Remove any materials that do drop in with a minimal amount of disturbance to these habitats.

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[27] National Marine Fisheries Service, *Juvenile Fish Screen Criteria* (revised February 16, 1995) and *Addendum: Juvenile Fish Screen Criteria for Pump Intakes* (May 9, 1996) (guidelines and criteria for migrant fish passage facilities, and new pump intakes and existing inadequate pump intake screens) (http://www.nwr.noaa.gov/1hydrop/hydroweb/ferc.htm). Note: New criteria are currently being drafted by NOAA Fisheries.

7. Cease project operations under high stream flow conditions that may result in inundation of the project area, except for efforts to minimize or eliminate resource damage.
8. Temporary coffer dams built as a part of a project must use materials from non streambed sources that are free of fines. Upon project completion, coffer dams must be removed from the stream or feathered out in the stream channel.
9. Stream banks damaged from project activities must be restored to a natural slope, pattern, and profile that are suitable for the establishment of permanent herbaceous and/or woody vegetation as appropriate.
10. Stabilize all disturbed areas following any break in work unless construction will resume within seven days.

Restoration Materials

1. The use of non native vegetation will be limited to situations where appropriate native vegetation (*e.g.,* grasses) is not commercially available or would not meet immediate project goals (*e.g.,* temporary cover using sterile wheatgrass). Non native vegetation planted at a project site must be a close subspecies or variety to native species or reproductively altered (*i.e.*, sterilized) to avoid future ecological complications with native species. The Fish and Wildlife Service must review and approve the use of non native vegetation on project sites before project implementation.
2. Native vegetation must be planted on disturbed sites within thirty days of disturbance (including the project site, disposal and staging areas, and access roads) to reduce erosion, establish cover, provide shade, and prevent non native plant colonization. Non native vegetation may be planted (*see item 1 above*) if soil disturbances occur outside of the appropriate planting periods for native vegetation (*i.e.*, replanting of native vegetation must occur before the first April 15 following construction). Erosion controls must remain in place at disturbed sites until vegetation is well established.
3. Replant each area requiring revegetation using a diverse assemblage of species native to the project area or region, including grasses, forbs, shrubs and trees. Invasive and noxious species must not be used for revegetation.
4. Obtain project boulders, rock, and large wood[28] outside of aquatic habitats. These materials must also be obtained during appropriate seasonal periods to minimize or eliminate soil disturbance and compaction.
5. Riparian timber stands must not be harvested to supply large wood to complete a restoration activity.
6. A limited number of trees in upland timber stands may be harvested for large wood to complete a restoration activity, but methods of selection and harvest must be reviewed and approved by the Fish and Wildlife Service before completing a timber harvest.
7. Down coarse woody debris[29] and boulders in riparian and upland habitats may be used to complete a restoration activity, but these materials must remain at or near their original

[28] "Large wood" means a tree, log, or rootwad big enough to dissipate stream energy associated with high flows, capture bedload, stabilize streambanks, influence channel characteristics, and otherwise support aquatic habitat function, given the slope and bankfull channel width of the stream in which the wood occurs. See Oregon Department of Forestry and Oregon Department of Fish and Wildlife, *A Guide to Placing Large Wood in Streams*, May 1995 (http://www.nwr.noaa.gov/1salmon/salmesa/4ddocs/lrgwood.pdf).

[29] "Coarse woody debris" consists of snags, fallen logs, wind blown trees, and large branches.

locations to maintain the natural (or current) characteristics of the local area. Methods of selection, collection, and use must be reviewed and approved by the Fish and Wildlife Service before completing the activity.

Pressure Treated Wood Products

1. Pressured treated wood[30] containing water-borne or oil-borne preservatives must not be placed in areas where they will be in constant contact with standing or moving water or placed over water where they will be exposed to mechanical abrasion or leachate may enter aquatic habitats (*e.g.,* bridge construction or decking at a road-stream crossing).
2. Dispose of treated (preserved) wood debris removed during a project at an upland facility approved for hazardous materials of this classification. Do not allow any treated wood debris (*i.e.,* saw dust and scrape wood) to be stacked next to or enter any aquatic habitat (*e.g.,* stream, wetland, and pond).
3. Treated wood debris or products that fall into any aquatic habitat must be removed immediately.
4. Treated wood products used for authorized structures must be certified as to being produced using the most current version of the American Wood-Preservers Association best management practices.
5. Treated wood products of unknown origin or method of treatment must not be used for any restoration application.
6. A project specific biological assessment must be written if pressure treated wood products are not used according to the conditions stated above. This process may result in NOAA Fisheries and Fish and Wildlife Service issuing biological opinions under the Endangered Species Act for the project.

Fish and Wildlife Requirements

1. Complete restoration activities at a project site in a timely manner. This will reduce disturbance and displacement of fish and wildlife in the project area.
2. Provide passage for any adult or juvenile salmonid species present in the project area during construction, unless otherwise approved in writing by the Fish and Wildlife Service. Upstream passage is not required during construction if it did not previously exist.
3. Before and intermittently during pumping to isolate an in-water work area, an attempt must be made to capture and release federally listed fish species from the isolated area using trapping, seining, electrofishing, or other methods as are prudent to minimize risk of injury to them.
   - The entire capture and release operation must be conducted or supervised by a fishery biologist experienced with work area isolation and competent to ensure the safe handling of all listed fish.
   - Do not use seining or electrofishing if water temperatures exceed 18^{o} C.

[30] "Treated wood" means lumber, pilings, and other wood products preserved with alkaline copper quaternary (ACQ), ammoniacal copper arsenate (ACA), ammoniacal copper zinc arsenate (ACZA), copper naphthenate, chromated copper arsenate (CCA), pentachlorophenol, or creosote.

- If electrofishing equipment is used to capture fish, comply with NOAA Fisheries' electrofishing guidelines[31].
- Handle listed fish with extreme care, keeping fish in water to the maximum extent possible during seining and transfer procedures to prevent the added stress of out-of-water handling.
- Transport fish in aerated buckets or tanks.
- Release fish into a safe release site as quickly as possible and as near as possible to capture sites.
- Do not transfer listed fish to anyone except NOAA Fisheries' or Fish and Wildlife Service' personnel as appropriate, unless otherwise approved in writing by the respective Federal agency.
- Obtain all Federal, State, and local permits necessary to conduct the capture and release activity.
- Fish and Wildlife Service and NOAA Fisheries' personnel or its designated representative must be allowed to accompany the capture team during capture and release activities.
- A report must be prepared addressing the capture and release of listed fish species during the isolation of an in-water work area. The report must include the following:
    - Supervisory fish biologist's name and address.
    - Methods of work area isolation.
    - Stream conditions before, during, and after completion of work area isolation.
    - Methods and means of fish capture.
    - Number of fish captured by species.
    - Location and physical condition of all fish released.
    - Any incidence of observed injury or mortality to listed fish.

4. An attempt must also be made to capture and release non listed fish and wildlife (*e.g.,* amphibians and reptiles) from isolated work areas as addressed above. Consult with the Fish and Wildlife Service or Oregon Department of Fish and Wildlife for guidance on capture and release techniques for these species.

Project design standards for riparian, wetland, upland, coastal, and estuarine habitat restoration.

General Requirements

1. Knowledgeable and trained personnel (*e.g.,* biologist, hydrologist, or engineer) must be involved in the design and implementation of habitat restoration projects.
2. Deposition of fill materials in any habitat must not violate Federal, State, county, or local regulations and guidelines as set forth by the Oregon Division of State Lands, U.S. Army Corps of Engineers, or other regulatory agencies.
3. Hydric soils from wetlands and topsoil from riparian and upland areas must be salvaged, stockpiled, and then replaced in appropriate project areas during construction activities. It may not be appropriate to reuse these soils if they are contaminated with toxic materials or

[31] National Marine Fisheries Service, *Backpack Electrofishing Guidelines* (December 1998) (http://www.nwr.noaa.gov/1salmon/salmesa/pubs/electrog.pdf).

contain reproductive parts (*e.g.,* seeds, bulbs, and rhizomes) of invasive, non native, or noxious vegetation.

4. Berms and dikes that are breached or constructed must meet appropriate Federal and State engineering and safety standards.
5. Berms and dikes that are breached, removed, or constructed must not cause the artificial entrapment of fish and other aquatic species in areas adjacent to them. Artificial entrapment refers to man-made habitat changes or structures (*e.g.,* isolated ditches, depressions, or other topographical changes) that would not allow the passive surface flow of water to return to a stream channel as water levels recede.
6. A project specific biological assessment must be written for constructed berms and dikes adjacent to a fish bearing stream[32] containing federally listed anadromous fish species. This process may result in NOAA Fisheries issuing a biological opinion under the Endangered Species Act for the project. The Fish and Wildlife Service must review and approve the designs for these structures adjacent to non anadromous stream reaches.
7. Appropriate pollution and erosion controls must be implemented as they apply to specific restoration activities.

<u>Livestock Fencing</u>

1. Livestock fence installations must be reviewed and approved by the Fish and Wildlife Service before installation to ensure compliance with wildlife compatible fence designs.
2. Woven wire fence installations must be limited to areas around buildings and barns.
3. The durability of fencing materials must meet intended livestock management objectives.
4. An electric fence (hard-wired or solar powered) is a preferred alternative to a traditional wire fence.
5. Cross-pasture fencing should be combined with perimeter pasture fences to promote better pasture management.
6. Fences must not be constructed in areas where natural barriers restrict livestock movements.
7. Fences must not be constructed on steep hillsides.
8. Fences must not restrict the natural movement of any wildlife species, especially deer, elk, and pronghorn.
9. Adjustable or lay-down fences/panels should be constructed in areas of high deer, elk, and pronghorn use and within traditional migration corridors for these species.
10. Pole-topped fences should be constructed in areas where elk frequently cross back and forth. This will help to reduce fence damage and repair costs.
11. Fences in or near areas where sage grouse are known or suspected to occur should be designed and constructed as follows:
    - Increase the visibility of fences occurring within 0.5 miles of seasonal sage grouse habitats to prevent injuries to flying grouse (*see item 14 below*).
    - Use smooth wire for the top and bottom wires, not barbed wire.

[32] "Fish bearing streams" refer to perennial and ephemeral streams that are known to contain one or more native fish species. A stream is assumed "fish bearing" unless a presence/absence or other appropriate survey has been completed to prove otherwise.

- Avoid creating potential raptor perches within 1.5 miles of seasonal sage grouse habitats by reducing fence post height to four feet or less. Where fence posts must exceed this height, modify the top of the posts (*e.g.,* cut the top of wooden posts to a steep point).
- Fences within 1.5 miles of seasonal sage grouse habitats should maximize the setback distance from streams, ponds, springs, seeps, and wet meadows to accommodate grouse flight lines. Avoid constructing fences across water sources.

12. Maintain a clear line of sight along a fence line for a distance of at least ten feet to make it more visible to wildlife.
13. Fences should be constructed at least 100 feet from the perimeter of a wetland to reduce potential collisions with flying waterfowl and large wading birds.
14. Tie colored flagging on the top wire of all new fences to make them more visible to wildlife. For a more permanent visible marker, slide PVC pipe (*i.e.,* one to two foot lengths) onto one of the upper fence wires during construction. Use white PVC pipe or paint the pipe with a bright color for more visibility.

<u>Livestock Stream Crossings</u>

1. Livestock crossings must not be located in areas where compaction or other damage may occur to sensitive soils and vegetation (*e.g.,* wetlands) due to congregating livestock.
2. Livestock must be encouraged to loaf away from crossing locations.
3. Livestock crossings must be designed and constructed to accommodate reasonably foreseeable flood risks, including associated bedload and debris, and prevent the diversion of stream flow out of the channel and down an adjacent road if there is a crossing failure.
4. Locate livestock crossings where native riparian vegetation will not have to be cleared to install the structure.
5. Suspended livestock crossings must be load rated for its intended use (*e.g.*, type of livestock, farm equipment, and vehicles to cross the structure).
6. Abutments for livestock bridge crossings (*e.g.,* railroad car and constructed bridges) must be armored and placed above the bankfull elevation[33] of the stream.
7. Culverts used for livestock stream crossings on fish bearing streams must follow project design standards for fish passage improvements (*see Appendix A4*).
8. Minimize the number of livestock crossings installed on a landowner's property. Locate the crossings where they will best meet livestock management objectives.
9. The maximum width of a non hardened ford livestock crossing must be not exceed ten feet.
10. Each livestock crossing must be fenced to restrict livestock access to the stream channel. Fencing can be installed as a temporary or permanent installation, depending on local stream conditions and grazing management requirements.

<u>Hardened Livestock Fords</u>

1. Construct a hardened livestock ford where stream banks are naturally low.
2. The stream bank, channel, and approach lanes in the pasture must be stabilized with native vegetation, geotextile fabric, and angular rock to reduce chronic sedimentation problems; however, these materials must not impede natural channel migration potential.

[33] "Bankfull elevation" means the bank height inundated by a 1.5 to 2 year average recurrence interval and may be estimated by morphological features such average bank height, scour lines and vegetation limits.

3. Livestock fords must not be constructed within known or suspected spawning areas, or within 300 feet upstream of such areas if they may adversely affect them.
4. Livestock fords must be designed to allow the passage of juvenile and adult fish at normal seasonal stream flows.
5. The maximum width of a hardened ford must be not exceed eight feet.
6. Follow other appropriate project design standards under Livestock Stream Crossings.

Livestock Watering Facilities

1. Livestock off-channel watering facilities must not be located in areas where compaction or other damage may occur to sensitive soils and vegetation (*e.g.,* wetlands) due to congregating livestock.
2. Livestock watering facilities should be constructed in a manner that meets its primary purpose while providing additional benefits to wildlife. Facilities must be designed to prevent the entrapment of wildlife if they are installed to provide multiple benefits.
3. A solid, dry surface is recommended around all watering facilities to prevent ground saturation, runoff, and erosion. A concrete pad or a plastic/geotextile/gravel grid must be constructed around a facility to minimize or eliminate these problems.
4. Float-controlled devices in all watering facilities must be inspected weekly to ensure that they are operating properly and not contributing to excess water overflow.
5. A natural spring used as water source must be protected from livestock degradation by fencing off the perimeter of the spring and developing a low impact water withdraw system.
6. Pump intakes for livestock watering facilities must to be screened according to NOAA Fisheries' fish screen criteria when they are placed in a stream channel.
7. Ponds used for livestock watering must be constructed according to all State and local requirements and the following criteria.
    - Ponds must not be constructed within the channel (*i.e.,* water course) of a perennial, intermittent, or ephemeral stream.
    - Ponds must not be directly filled (*i.e.,* diverted) from any fish bearing stream unless the diversions are screened according to NOAA Fisheries' fish screen criteria. A water over-flow or by-pass device must also be installed to prevent excessive water diversion.
    - Consider placing ponds where they can be naturally filled by snow melt, rainfall, or overland surface flows, or through an existing domestic water supply.
    - Costs (*e.g.,* labor, materials, and supplies) associated with the construction of ponds that will be stocked with native and/or non-native fish are not reimbursable with Fish and Wildlife Service restoration program funding.

Prescribed Burns

1. A prescribe burn plan must be reviewed and approved by the Fish and Wildlife Service before conducting the burn. The plan must set biological and ecological goals based on local site conditions and evaluate factors that may affect the outcome of the prescribed burn. Always consider non burning alternatives whenever possible.
2. A prescribed burn must be conducted in a manner that is consistent with appropriate Federal, State, county, and local regulations, including smoke management regulations.
3. All permits and official authorizations must be secured before conducting a prescribe burn.
4. Adjacent landowners and the local fire department must be notified of all burn activities in advance.

5. A contingency plan should be developed for reestablishing control of a prescribed burn in situations where the burn escapes containment boundaries. The plan must also address the reestablish of native vegetation in these areas within the season of disturbance.
6. Prescribed burns are not authorized within riparian[34] and wetland areas, and must also be located at least 100 feet away from the edge of perennial and ephemeral stream channels.
7. Prescribed burns adjacent to riparian areas should occur during periods when appropriate moisture content will reduce unintended spread to riparian areas. Spring burns are preferred over Fall burns since they produce "cooler" fires resulting in a mosaic of treated and untreated areas. Soil moisture is also more available in the Spring resulting in quicker plant regrowth. However, seasonal timing of a prescribed burn must meet its primary purpose.
8. Qualified personnel in the use of fire must be involved in all aspects of a prescribed burn.
9. Project personnel assisting with a prescribed burn must have access to proper protective clothing (Nomex), boots, gloves, helmets, goggles, face shields, and two-way radios with a weather channel.
10. Appropriate fire suppression equipment must always be located at the project site during a prescribed burn.
11. Chemical retardants, foam, and other additives must be prevented from entering any water source, except in situations where overriding immediate safety exist.
12. All participants must attend a planning session before completing a prescribed burn and be informed of contingent burn plans in the event of a wildfire.
13. Potential affects to aquatic habitats must be considered when a prescribed burn will occur near these areas (*e.g.,* wetlands, permanent or ephemeral streams).
14. A prescribed burn must not occur in areas with moderate to high erosion potential, unless complete revegetation will occur thirty days before the rainy season.
15. Prescribed burning of slash material or invasive/non native vegetation must be planned and managed to maximize the benefits and reduce the detrimental effects of a burn.
16. Develop a site plan for rapid native revegetation after a prescribed burn.
17. Sedimentation and erosion controls, as appropriate, must be installed at all prescribed burn sites. Controls must remain in place and be maintained until vegetation is established at these sites.

<u>Soil Stabilization</u>

1. Designs for soil bio-engineered stabilization projects must be reviewed and approved by the Fish and Wildlife Service before completing project activities.
2. Whenever possible, soil stabilization efforts must employ natural or bio-engineering techniques.

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[34] "Riparian areas" are defined as two site potential tree heights (of native, site potential vegetation) located from the channel migration zone (defined as the area defined by the lateral extent of likely movement along a stream reach as shown by evidence of active stream channel movement over the past 100 years, *e.g.,* alluvial fans or floodplains formed where the channel gradient decreases, the valley abruptly widens, or at the confluence of larger streams). These areas are plant communities contiguous to and affected by surface and subsurface hydrologic features of perennial or intermittent lotic and lentic water bodies. Riparian areas have one or both of the following characteristics: 1) distinctively different vegetative species than adjacent areas, and 2) species similar to adjacent areas but exhibiting more vigorous or robust growth forms. These areas are usually transitional between wetland and upland areas.

3. The following materials must not be used for stabilization:
   - broken pieces of asphalt and concrete.
   - metal refuse and debris (*e.g.*, metal refuse containers, car bodies, and tires).
   - organic waste materials (*e.g.*, discarded lumber, pressure treated wood products, and herbaceous vegetation).
   - stream channel materials (*e.g.*, woody debris and gravels collected within the channel), unless materials were initially removed during construction activities.
4. Straw used as mulch must not be moldy, caked, decayed, or otherwise of low quality. Ensure that the mulch does not contain invasive or non native plant seeds or other reproductive parts.
5. Stream bank protection techniques depend on the mechanisms of stream bank failure operating at site- and reach-scale.[35] Appropriate techniques must be employed to minimize or eliminate adverse affects to natural stream and floodplain functions by limiting actions that are expected to have long-term adverse effects on aquatic habitats. The following bank protection techniques are approved for use individually or in combination:
   - Planting woody trees and shrubs or other planting variations (*e.g.*, live stakes, brush layering, facines, and brush mattresses).
   - Planting herbaceous vegetation, where available records *(e.g.*, historical accounts and photographs) show that trees and shrubs did not exist on the site within historic times.
   - Installing deformable soil reinforcements consisting of soil layers or lifts strengthened with fabric and vegetation.
   - Installing coir logs (*i.e.*, long bundles of coconut fiber), straw bales, straw logs, or other similar non-toxic biodegradable materials used individually or in stacks to trap sediment and provide a growth medium for plants.
   - Reshaping stream banks and grading slopes to reduce bank slope angles without changing the location of the bank toe; increase roughness and cross-section; and provide more favorable vegetative planting surfaces.
   - Installing floodplain roughness (*e.g.*, floodplain tree and large woody debris rows, live siltation fences, brush traverses, brush rows, and live brush sills) to reduce the likelihood of avulsion in areas where natural floodplain roughness is poorly developed or has been reduced.
   - Installing floodplain flow spreaders (consisting of one or more rows of trees and accumulated debris) to spread flow across the floodplain.
   - Install flow-redirection structures[36] such as barbs, vanes, or bendway weirs, when designed as follows, unless otherwise approved by the Fish and Wildlife Service.

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[35] For guidance on how to evaluate streambank failure mechanisms, streambank protection measures, and use of an ecological approach to management of eroding streambanks, see, *e.g.*, Washington Department of Fish and Wildlife, Washington Department of Transportation, and Washington Department of Ecology, *Integrated Streambank Protection Guidelines*, various pagination June 2002 (http://www.wa.gov/wdfw/hab/ahg/strmbank.htm), and Federal Interagency Stream Restoration Working Group, *Stream Corridor Restoration: Principles, Processes, and Practices*, various pagination October 1998 ((http://www.usda.gov/stream_restoration/)http://www.usda.gov/stream_restoration/newgra.html).

[36] See *e.g.*, Natural Resources Conservation Service Technical Notes (Engineering - No. 12 and 13, respectively), *Design of Stream Barbs*, July 2001 and *Design of Rock Weirs*, February 2001 (http://www.id.nrcs.usda.gov/technical/engineering/index.html).

- No part of the flow-redirection structure may exceed bank full elevation, including all rock buried in the bank key.
- Build the flow-redirection structure primarily of wood or otherwise incorporate large wood at a suitable elevation in an exposed portion of the structure or the bank key. Placing the large woody debris near streambanks in the depositional area between flow-direction structures to satisfy this requirement is not authorized, unless those areas are likely to be greater than one meter in depth, sufficient for salmon rearing habitats.
- Fill the trench excavated for the bank key above bankfull elevation with soil and top with native drought tolerant vegetation.
- The maximum flow-redirection structure length must not exceed one-quarter of the bankfull channel width.
- Place rock individually with an excavator without end dumping the rock from a haul vehicle.
- If two or more flow-redirection structures are built in a series, place the flow-redirection structure farthest upstream within 150 feet or 2.5 bankfull channel widths from the flow-redirection structure farthest downstream.
- When appropriate, plant native woody riparian vegetation at disturbed sites and in areas adjacent to the project to improve the riparian habitat.

6. Whenever possible, use large wood as an integral component for all stream bank protection treatments[37]. Minimize or eliminate the use of sheet pile, riprap, gabions, cable, concrete, and/or similar materials in stream bank protection projects.
   - Large wood should be intact and not decayed with untrimmed root wads (where available) to provide functional refugia habitat for fish. Use of decayed or fragmented wood is not acceptable.
   - Rock may be used instead of large wood for the following purposes and structures. The size of rock that is used must not impair natural stream flows into or out of secondary channels. Whenever possible, place topsoil over the rock and plant with native woody vegetation.
     - As ballast to anchor or stabilize large woody debris components of an approved bank treatment.
     - To fill scour holes to protect the integrity of the project, if the rock is limited to the depth of the scour hole and does not extend above the channel bed.
     - To construct a footing, facing, head wall, or other protection necessary to prevent scouring, downcutting, fill slope erosion, or another type of failure at an existing flow control structure (*e.g.*, culverts and water intakes), utility line, or bridge support.
     - To construct a flow-redirection structure as described above (*see item 5*).

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[37] See, *e.g.*, Washington Department of Fish and Wildlife, Washington Department of Transportation, and Washington Department of Ecology, *Integrated Streambank Protection Guidelines*, Appendix I:Anchoring and placement of large woody debris, June 2002 (http://www.wa.gov/wdfw/hab/ahg/strmbank.htm); Oregon Department of Forestry and Oregon Department of Fish and Wildlife, *A Guide to Placing Large Wood in Streams*, May 1995 (http://www.nwr.noaa.gov/1salmon/salmesa/4ddocs/lrgwood.pdf), and Natural Resources Conservation Service Technical Notes (Engineering - No. 15), *Incorporation of Large Wood Into Engineering Structures*, June 2001 (http://www.id.nrcs.usda.gov/technical/engineering/index.html).

Silvicultural Treatments [38]

Juniper Tree Removal: Riparian and Upland Habitats

1. Riparian and upland juniper tree harvest plans must be reviewed and approved by the Fish and Wildlife Service before completing project activities.
2. Silvicultural activities in riparian areas are limited to juniper tree removal.
3. Juniper tree removal in riparian or upland areas must not result in significant soil disturbances that may cause increased sedimentation and erosion.
4. Only fifty percent of the juniper trees greater than ten inches in diameter at breast height may be removed in a riparian project area in order to limit the reduction in shade to adjacent permanent or ephemeral water bodies. The remaining juniper trees may be removed when native vegetation is planted or released in these areas to reestablish baseline shading conditions before the removal of juniper trees.
5. At least ten percent of the juniper trees greater than ten inches in diameter at breast height must be retained for wildlife in an upland project area.
6. Removed juniper trees may be used for soil bio-engineered stabilization and fish habitat structures, as appropriate.
7. Slash materials should be gathered by hand or with light machinery to reduce soil disturbance and compaction. Avoid accumulating or spreading slash in upland draws, streams, and springs. Slash control and disposal activities must be conducted in a manner that reduces the occurrence of debris in aquatic habitats.

Conifer/Hardwood Silvicultural Treatments: Upland Habitats

1. Upland silvicultural treatment plans must be reviewed and approved by the Fish and Wildlife Service before completing project activities.
2. Silvicultural treatments must not occur if they remove or degrade occupied or suitable unsurveyed habitats for federally listed terrestrial species.
3. Silvicultural treatments that would reduce vegetative habitat and cover must not occur in snowshoe hare habitat. Snowshoe hare habitat is considered areas where live limbs (*e.g.*, tree, brush, and limbs) can be reached by hares at snow depth.
4. Silvicultural treatments may occur in upland project areas that are at least 500 feet (*i.e.*, measured as a straight line distance from the nearest edge of the stand to the stream channel) from a fish bearing stream that contains federally listed aquatic species. The timber stand must also be on a slope of less then twenty percent to the stream channel.
5. Silvicultural treatments may occur in upland project areas that are at least 250 feet or two site potential tree heights away (*i.e.*, which ever is greater) away from a fish bearing stream that does not contain federally listed fish species. The timber stand must also be on a slope of less then twenty percent to the stream channel.

[38] "Silvicultural treatments" refers to removing or girdling dominate hardwood or conifer trees, removing understory vegetation to release existing hardwood or conifers trees; pre-commercial thinning timber stands to reduce hardwood or conifer stocking rates; planting hardwood or conifer seedlings to establish or reestablish timber stands; and removing ground fuels to reduce fuel loading.

6. Silvicultural treatments may occur in upland project areas that are at least 125 feet or two site potential tree heights (*i.e.*, which ever is greater) away from a non-fish bearing stream. The timber stand must also be on a slope of less then twenty percent to the stream channel.
7. If the status of a stream (*i.e.*, whether it contains federally listed species) is unknown, then silvicultural treatments in upland project areas must adhere to requirements addressed in item 4 above.
8. Timber yarding techniques used during silvicultural treatments must not cause excessive soil disturbances and compaction.
9. Slash materials should be gathered by hand or with light machinery to reduce soil disturbance and compaction. Avoid accumulating or spreading slash in upland draws and springs. Slash control and disposal activities must be conducted in a manner that reduces the occurrence of debris in aquatic habitats.
10. Silvicultural treatments on upland project sites should maintain a visual barrier of undisturbed vegetation next to open roads to minimize or eliminate wildlife disturbances.
11. A project specific biological assessment must be written for silvicultural treatments that do not meet the criteria above. This process may result in NOAA Fisheries and the Fish and Wildlife Service issuing biological opinions under the Endangered Species Act for the project.

Revegetation Techniques

1. Native vegetation must be planted on disturbed project sites, where appropriate, and protected from further disturbance until new growth is well established. Non native vegetation may be used, but is subject to the conditions addressed in Appendix A1 under Restoration Materials (*see items 1, 2, and 3*).
2. Temporary or permanent fencing must be installed, as necessary, to prevent livestock access to revegetated sites.
3. Native vegetation should be salvaged, as appropriate, from areas where soil disturbance will be occurring on a project site and replanted later at the site.
4. Vegetative planting techniques must occur during the optimal planting period for the respective plant species and not cause major soil disturbance whether planting is done by manual labor or mechanical equipment.
5. Purchase plant materials from reputable suppliers or growers. These materials must be properly stored, handled, and planted.
6. Seeds used to grow seedlings should have been collected in an area where the environmental conditions (*e.g.*, elevation and range) closely match those on project sites. Refer to a tree seed zone map and ensure that every purchased box or bag of seedlings are clearly marked with the seed zone and elevation.
7. Improve seedling growth by removing competing plant species (*e.g.*, grasses) around them.
8. Employ the proper methods to protect seedlings from animal, insect, and environmental damages. Periodically examine seedlings for damages and diseases.
9. Surface application of plant fertilizers must be applied at agronomic rates, but not within fifty feet of any aquatic habitat.
10. Control and removal of invasive and non native plant species must be completed in a manner that eliminates the accidental dispersal of seeds or reproductive plant parts to other locations. Project personnel must complete the following tasks:

- clean all equipment, vehicles, and tools used at a project site before going to a new location.
- shake out all work clothes worn before leaving a project site.
- change work clothes (*e.g.,* coveralls, gloves, and hats) if workers will be going to a new location.
- launder work clothes frequently.
- properly dispose of all invasive and non native plant materials removed during a treatment in a timely manner.

Project design standards for instream habitat restoration.

General Requirements

1. Knowledgeable and trained personnel (*e.g.,* fisheries biologist, hydrologist, or geomorphologists) must be involved in the design and implementation of all instream restoration activities.
2. Appropriate pollution and erosion controls must be implemented as they apply to specific instream habitat restoration activities.
3. Landowners receiving basal area credits under the Oregon Department of Forestry Forest Practice Administrative Rules for large woody debris placements cannot be reimbursed for any project cost with Fish and Wildlife Service restoration program funding.
4. A project specific biological assessment must be written for a re-channelization project on a fish bearing stream containing federally listed anadromous fish species. This process may result in NOAA Fisheries issuing a biological opinion under the Endangered Species Act for the project. The Fish and Wildlife Service must review and approve the designs for these projects adjacent to non anadromous stream reaches.

Techniques and Materials

1. Materials used for instream structures should be the same type of materials that historically occurred at the site. The Fish and Wildlife Service must review and approve the use of other type of materials before project implementation.
2. Durable rock and wood materials must be used for instream structures.
3. Boulders and large wood used for instream structures need to be appropriately sized and placed to minimize or eliminate the movement of these materials during high flow events. Size standards must be determined by qualified professionals and based on individual stream reaches and their seasonal discharge rates.
4. Down coarse woody debris[39] and boulders in adjacent riparian and upland habitats may be incorporated into an instream structure. However, these materials must remain at or near their original locations to maintain the natural (or current) characteristics of the local area. Methods of selection, collection, and use must be reviewed and approved by the Fish and Wildlife Service before completing the activity.
5. Existing individual instream boulders and large wood may be repositioned in the stream channel or incorporated within new or naturally occurring instream structures. However,

[39] "Coarse woody debris" consists of snags, fallen logs, wind blown trees, and large branches.

the repositioning or use of these materials must not occur if they are providing adequate fish habitat in their current locations.

6. Additional boulder and wood materials may be added to naturally occurring instream structures to create more complex structures. The structural integrity of original structures must not be compromised when completing this activity.
7. Naturally occurring instream structures must not be removed if they are providing adequate fish habitat, unless there is a safety concern to existing infrastructures or other property (*e.g.*, culverts and bridges). The Fish and Wildlife Service must review and approve the removal of these structures before completing the activity. Appropriate materials that are removed must be replaced in the same stream reach as close as possible to its original location.
8. Cable should not be used to anchor boulders and large wood within the stream channel. Use larger materials (*i.e.*, key pieces) to ballast or stabilize smaller materials or bury them in the stream bank. The Fish and Wildlife Service must review and approve the use of cable in stream habitats before project implementation.
9. Do not use full spanning rock weirs for instream structures, unless they are placed in an incised and/or widened channel where the goal of the placement is to agrade and narrow the channel by recruiting stream bedload at the site. Use large wood in place of these weirs if the appropriately sized wood pieces are available and can be maintained in the stream channel.
10. The installation of an instream structure must not result in a fish passage barrier to juvenile or adult fish or other aquatic species, especially during critical life cycle periods.
11. An instream structure altering the stream hydrology must not adversely affect adjacent or down stream properties, culverts, and bridges. Do not place instream structures 0.25 miles upstream of a culvert or bridge without obtaining landowner approval.
12. Natural alcoves and side channels enhanced by installing boulder/large wood structures for rearing and off-channel refuge habitats must not cause the entrapment of fish and other aquatic species. Surface water in these areas must be able to passively flow back to the stream channel as water levels recede.
    - A project specific biological assessment must be written for these activities on a fish bearing stream containing federally listed anadromous fish species. This process may result in NOAA Fisheries issuing a biological opinion under the Endangered Species Act for the project.
    - The Fish and Wildlife Service must review and approve the designs for these activities on non anadromous stream reaches.
13. Soil disturbance along stream channels must be minimized or eliminated whenever possible.
14. Undisturbed vegetated buffer zones must be retained along stream channels, to the maximum extent possible, to reduce sedimentation rates and channel instability.
15. Native vegetation must be protected to the maximum extent possible when constructing temporary access trails to a stream. Shrub and tree removal within trail footprints must be completed so that there is not a significant reduction of shade along the stream channel.
16. Salmon carcasses used for stream nutrient enrichment must be certified free of diseases by an Oregon Department of Fish and Wildlife pathologist and in compliance with regulations under the Oregon Department of Environmental Quality. The Oregon Department of Fish and Wildlife must also have identified the project stream reach as appropriate for salmon carcass placement.

Project design standards for fish passage improvements.

<u>General Requirements</u>

1. Knowledgeable and trained personnel (*e.g.,* fisheries biologist, hydrologist, or engineer) must be involved in the design and construction of all fish passage improvements.
2. Fish passage improvements must be designed, constructed, and maintained to avoid disrupting the migration and movement of fish and other aquatic species.
3. Materials used for fish passage improvements must be clean, non-erodible, and non-toxic to aquatic species.
4. Appropriate pollution and erosion controls must be implemented as they apply to specific fish passage improvements.
5. The amount of excavation required for a fish passage improvement must be minimized to prevent changes to the stream channel.
6. Grade control structures must be considered when there is a potential for stream channel incision[40] above or below an existing fish passage barrier.
7. A project specific biological assessment must be written for the installation or upgrade of a tide gate. This process may result in NOAA Fisheries issuing a biological opinion under the Endangered Species Act for the project.

Artificial Fishways

1. An artificial fishway is defined as any non-culvert related fish passage structure constructed within a stream channel to aid in the passage of juvenile and/or adult fish or other aquatic species. This includes stand alone fishways and those incorporated into approved irrigation diversions. The structure must also be a semipermanent or permanent installation and constructed of wood, rock, concrete, and/or metal. Simple boulder-step pool weirs are not defined as an artificial fishway if they are designed and constructed to meet NOAA Fisheries' fish passage criteria[41] and Oregon Road/Stream Crossing Restoration Guide[42]. A closed or open by-pass fish conveyance (*e.g.*, piped or ditched system) installed within an irrigation diversion is not defined as an artificial fishway if fish are returned to the original stream a short distance downstream of the diversion.
2. A project specific biological assessment must be written for the installation or upgrade of an artificial fishway on a fish bearing stream containing federally listed anadromous fish species. This process may result in NOAA Fisheries issuing a biological opinion under the

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[40] See *e.g.*, Janine Castro - Fish and Wildlife Service, *Geomorphologic Impacts of Culvert Replacement and Removal: Avoiding Channel Incision*, February 2003, to help in determining channel incision potential (http://pacific.fws.gov/jobs/orojitw/standard/proj-std.htm).

[41] NOAA Fisheries, *Anadromous Salmonid Passage Facility Guidelines and Criteria* (draft document) (http://www.nwr.noaa.gov/1hydrop/hydroweb/docs/release_draft.pdf).

[42] Oregon Department of Forestry and Oregon Fish and Wildlife Department, *Oregon Road/Stream Crossing Restoration Guide*, June 1999 (http://www.dfw.state.or.us/odfwhtml/infocntrfish/management/oregonrd_stream.pdf).

Endangered Species Act for the project. The Fish and Wildlife Service must review and approve the designs for these activities on non anadromous stream reaches.

Culverts and Bridges

1. Designs for culvert and bridge installations must be reviewed and approved by the Fish and Wildlife Service before completing project activities.
2. All culvert installations must be in compliance with NOAA Fisheries' fish passage criteria and Oregon Road/Stream Crossing Restoration Guide.
3. Culverts must be installed at right angles to the stream channel whenever possible.
4. Culvert inlets and outlets must be properly protected (*e.g.,* rock armored). Use a filter fabric under the protective materials to prevent future scouring actions and erosion.
5. Open-bottom and arch culverts are the preferred culvert types when replacing existing round corrugated metal culverts.
6. Multiple side-by-side culverts must not be installed at a road-stream crossing within the main channel to improve fish passage. Install an appropriately sized single culvert or bridge to improve fish passage at the location. Note: This does not preclude the installation of side relief culverts on road fills to prevent roadbed scouring on high stream flows.
7. Concrete sloped head walls or angled wing walls are not recommended on corrugated metal culvert installations. Boulder armoring around a culvert inlet and outlet is the preferred alternative.
8. Concrete slurry must not be used as a matrix to anchor culverts or rock armoring.
9. Depending on local site conditions, appropriately sized non angular boulders should be placed inside the culvert to allow for the development of low velocity micro habitats and help collect and maintain stream bedload within the culvert.
10. The installation of a boulder or log weir to back water at the culvert outlet is not recommended as a permanent solution to correct an improperly installed or undersized culvert.
11. An existing culvert to be upgraded in a stream with a gradient of six percent or greater must be replaced with a bridge.
12. Bridge designs and installations must conform to Federal and State engineering and safety standards for their intended use.
13. Bridge abutments must be designed and installed in a way that does not alter stream flows or channel stability and be located above the bankfull elevation. Abutments must be properly protected (*e.g.,* rock armored) to prevent future scouring actions and erosion.
14. Bridge abutments and culverts must not be backfilled with vegetation, debris, or mud. Use clean rock and gravel that is appropriately sized and placed in the proper portions to backfill the structure. Fill materials must be compacted using vibrating compaction equipment.
15. Maintenance schedules must be developed for culvert and bridge installations to ensure they remain in proper functioning condition.
16. Fill excavated during the temporary or permanent removal of a culvert must be placed and stabilized at an appropriate upland disposal site. Grade the sides of the stream crossing at a 2:1 or greater slope to reduce excessive sedimentation and erosion.
17. Install armored relief dips or side relief culverts in the road fill during culvert installations, as appropriate, to prevent roadbed scouring on high stream flows or if there is a moderate to high potential for debris to plug a culvert. These structures should always be installed if

additional fill is added to the road base to increase the road fill height to accommodate a larger culvert installation.

18. Bridge designs must incorporate necessary elements to allow for wildlife movement over or under bridges whenever possible.

Irrigation Diversions

1. A project specific biological assessment must be written for the installation of an infiltration gallery or lay-flat stanchion in a fish bearing stream containing federally listed anadromous fish species. This process may result in NOAA Fisheries issuing a biological opinion under the Endangered Species Act for the project. The Fish and Wildlife Service must review and approve the designs for these structures on non anadromous stream reaches.
2. Designs for irrigation diversions listed below will need to be reviewed and approved by the Fish and Wildlife Service and/or NOAA Fisheries before project implementation, without the need for a project specific biological assessment. This includes designs for headgates, headgate/sluice gate combinations, fish screening, diversion dams/structures, and water delivery systems (*i.e.*, open ditch or closed pipe systems). Irrigation diversions include cross vanes, "W" weirs, "A" frame weirs, central pumping stations, and individual pump intakes.
3. Diversion dams/structures may be removed or improved where they are resulting in fish passage barriers, downstream scour, sediment concerns due to deposition behind the dam, or unacceptable habitat modifications. They should be removed if they are abandoned, in need of extensive repairs, or are considered unnecessary to meet water demands.
4. Multiple diversions may be consolidated into one permanent diversion.
5. Abandoned open ditches and other similar structures must be plugged or backfilled, as appropriate, to prevent fish from swimming or being entrained into them.
6. Project cooperators and landowners must coordinate their efforts with appropriate local governments, irrigation districts, and Federal and State agencies. Projects should be supported by watershed based analyses with the involvement of multiple landowners and users.
7. The design of an irrigation diversion structure must enable the landowner to comply with all appropriate Oregon Water Resources Department rules and regulations. A new or replacement diversion structure cannot be sized to exceed the amount of the landowner's legal water right(s).
8. Appropriate fish passage for juvenile and adult salmonids and other aquatic species must be incorporated into irrigation diversions. Diversions must be operated and maintained in a manner to allow the passage of aquatic species during operational and non-operational periods. Requirements under Artificial Fishways (*see this appendix*), as appropriate, must be followed during the irrigation diversion design process.
9. Irrigation diversions must be installed with an appropriate flow meter or flume to measure water withdrawals whenever possible.
10. Fill excavated during the temporary or permanent removal of an irrigation diversion or water control structure must be placed and stabilized at an appropriate upland disposal site.
11. General operation and maintenance procedures for an irrigation diversion must be outlined in a Fish and Wildlife Service landowner agreement to ensure that they will be functioning as intended.

Fish Screen Requirements

1. Irrigation diversion intake and return points must be designed to prevent all salmonid life stages from swimming or being entrained into the irrigation system. Diversions, including temporary and permanent pump intakes, must meet NOAA Fisheries' fish screen criteria. NOAA Fisheries' fish screen criteria applies to federally listed salmonid species under their jurisdiction as well as bull trout, Oregon chub, and Warner sucker under Fish and Wildlife Service jurisdiction.
2. All fish screens must be sized to match the landowner's documented or estimated historic water use and legal water right(s).
3. Periodic maintenance of fish screens (*e.g.,* cleaning debris buildup and replacement of parts) must be conducted to ensure they are properly functioning.

Project design standards for road and trail improvements.

General Requirements

1. Knowledgeable and trained personnel *(e.g.,* park manager, hydrologist or engineer) must be involved in the design and implementation of all road and trail improvements.
2. Appropriate pollution and erosion controls must be implemented, as needed, on road and trail improvements to prevent erosion.
3. Road and trail improvements should be inspected at regular intervals, especially after heavy rainfall, to ensure they are properly functioning.

Techniques and Materials

1. A road or trail entrance closed by ditching must have the disturbed areas stabilized and revegetated (*e.g.,* seeded and mulched) as soon as possible.
2. An abandoned or decommissioned road or trail must be revegetated with native vegetation to the extent needed to prevent erosion.
3. Till compacted road and trail surfaces, as needed, to promote vegetation establishment and growth.
4. Ensure that drainage patterns on a altered road or trail will not result in increased sediment transport to downslope habitats. Use the most effective methods (*e.g.,* water bars, rolling dips, adding durable surface materials, and reshaping the road surface) to keep water from accumulating on a road or trail surface.
5. Fill excavated during the temporary or permanent removal of a road or trail culvert must be placed and stabilized at an appropriate upland disposal site. Grade the sides of the stream crossing at a 2:1 or greater slope to reduce erosion potential.
6. Install water energy dissipaters on all cross drainage culvert outfalls (*e.g.,* culvert extensions and rock piles) to prevent downslope erosion.
7. Cross drains should be inspected for damage or blockage before and during the rainy season.
8. Do not sidecast excavated road or trail materials and avoid accumulating or spreading these materials in or near aquatic habitats.
9. Road and trail improvements must be completed and stabilized before the rainy season.

Project design standards for surveys, assessments, and monitoring activities.

General Requirements

1. Knowledgeable and trained personnel (*e.g.*, educational instructors, wildlife or fisheries biologist or hydrologist) must be involved in the design and implementation of surveys, assessments, and monitoring activities.
2. Survey, assessment, and monitoring activities requiring the physical capture and handling of federally listed species must only be conducted by qualified biologist(s) covered under a current 10(a)(1)(A) permit or other valid ESA coverage.

Techniques and Materials

1. Project personnel must stay out of a stream channel as much as possible and avoid disturbing spawning areas and redds when entering the stream.
2. In the event that federally listed fish species are accidentally captured during surveys, assessments, or monitoring activities, they must be released immediately at the capture location.
3. Macroinvertebrate or other instream sampling should be completed during the Oregon guidelines for the timing of in-water work to the extent possible.
4. Project personnel working in a stream must not cause a significant increase in the turbidity from the suspension of fine sediments.
5. Project personnel must avoid conducting activities within a stream channel when federally listed fish or other aquatic species are actively spawning.
6. Equipment and materials use during surveys, assessments, and monitoring activities must not be toxic to terrestrial or aquatic species.
7. Project personnel should coordinate with Federal, State, and local agencies and organizations to avoid the duplication of survey, assessment, and monitoring activities. Obtain all required permits from appropriate agencies before completing these activities.
8. Make survey, assessment, and monitoring data and results available to other interested parities, to the extend possible, by publishing and disturbing reports or providing the information on an Internet web site.

Project design standards for wildlife habitat structures.

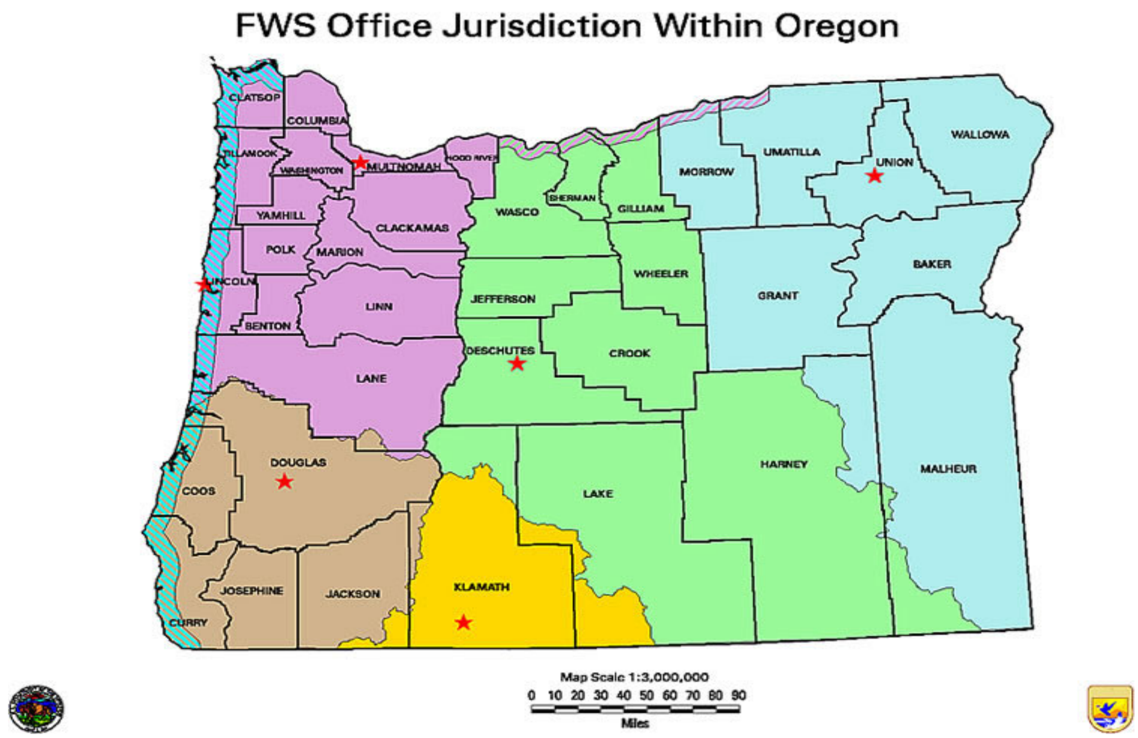
1. Wildlife nesting structures should be:
   - built for specific native avian and mammalian species.
   - designed for easy cleaning and maintenance.
   - properly suspended or supported.
   - protected from wind driven rain.
   - properly ventilated.
   - designed to eliminate predation or placed in protected areas.
   - built without perches to prevent house sparrow and starling occupancy.
   - constructed with pine, plywood, cedar, redwood, or cypress (cedar preferred).
2. Do not use pressure treated or creosote-based wood products for any part of a nesting or feeding structure.
3. Clean parasites, wasps, hornets, and mice from nesting structures on a periodic basis.
4. Open nesting structures during non breeding periods to reduce mice occupancy.
5. Locate nesting structures to meet natural territorial spacing requirements for the specific species that will be using the structures.

6. Bat roosting and nesting structures should not be placed over open waterways or busy roadways.
7. Limit general public access to nesting structures by locating them in secure or inaccessible areas to reduce vandalism and disturbance.
8. Leave bark and branches on large woody materials used for instream structures to help reptiles and amphibians obtain better leg holds when climbing on these materials.
9. Retain or provided down and decaying coarse woody debris to provide for terrestrial wildlife habitats and nutrient recycling.
10. Retain or develop snags (*i.e.*, standing dead trees), as needed, on project sites for cavity dependent wildlife species. Guidance for snag creation is as follows:
    - Snags should be at least six feet high and six inches in diameter at breast height for small and large cavity nesting birds, and up to twenty inches in diameter for large cavity nesting mammals.
    - Snags should be created by girdling selected trees at their base with a chainsaw.
    - Create snags in areas where they would occur naturally due to habitat conditions, windfall, fires, or other natural causes.
    - Use a combination of conifer and hardwood trees for snags.
11. Construct brush piles along habitat edges to provide cover and shelter for a variety of wildlife species. Guidance for brush pile construction is as follows:
    - Use large logs and rocks for the base layer to provide tunnels and openings at ground level.
    - Stack lighter woody materials (*e.g.,* limbs and slash) in a criss-cross pattern on top of the base layer.
    - Brush piles should be four to eight feet high and fifteen to twenty feet wide to provide adequate wildlife cover and shelter.
    - Construct several brush piles within the same area.
    - Do not place brush piles under tree canopies due to potential wildfire hazards.
    - Brush piles should last eight to ten years, depending on the size and type of materials used to build them.

Appendix A: Office responsibilities within Oregon.

Because of our efforts to manage on an ecosystem basis, some of Oregon is under the jurisdiction of offices outside the state. The yellow area of this map is managed by the Klamath Basin Ecosystem Restoration Office, under the regional management of the California/Nevada Operations Office in Sacramento, California, and is not covered under this biological opinion.

The area of responsibility of each of the offices is color coded on the map.



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