United States Department of the Interior

FISH AND WILDLIFE SERVICE

Western Washington Fish and Wildlife Office
510 Desmond Dr. SE, Suite 102
Lacey, Washington 98503

In Reply Refer To:
1-3-06-F-0246
1-3-06-F-0310

JUN 2 2 2007

Honorable Kimberly Bose, Secretary
Federal Energy Regulatory Commission
888 First Street NE
Washington D.C. 20426

Mark Ziminske, Chief
Environmental Resources Section
U.S. Army Corps of Engineers
P.O. Box 3755
Seattle, Washington 98124

Dear Secretary Bose and Mr. Ziminske:

This document transmits the U.S. Fish and Wildlife Service's (FWS) Biological Opinion (BO) on the effects to bald eagles *(Haliaeetus leucocephalus)*, bull trout (*Salvelinus confluentus*), marbled murrelet (*Brachyramphus marmoratus*), marbled murrelet critical habitat, northern spotted owls *(Strix occidentalis caurina)*, and northern spotted owl critical habitat from the relicensing of the Baker River Hydroelectric Project (FERC No. 2150) and continuing flood control operations at the project, in accordance with section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.). The April 7, 2006, request for formal consultation from the Federal Energy Regulatory Commission (FERC), which has jurisdiction over the relicensing of this hydroelectric project, was received on April 10, 2006. The May 8, 2006, request for formal consultation from the U.S. Army Corps of Engineers (ACOE), which has jurisdiction over continuing flood control operations, was received on May 10, 2006.

The April 7, 2006, Draft Environmental Impact Statement (DEIS) proposed a "may affect, not likely to adversely affect" determination for bald eagle, gray wolf (*Canis lupus*), grizzly bear (*Ursus artctos horribilis*), marbled murrelet, marbled murrelet critical habitat, northern spotted owl, and northern spotted owl critical habitat. The DEIS also proposed a "may affect, likely to adversely affect" determination for bull trout and bull trout critical habitat.

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Based on the information provided in the Final Environmental Impact Statement, other documents, and conversations with staff from Puget Sound Energy, ACOE, and the U.S. Forest Service (USFS), we have concluded that effects to the federally-listed grizzly bear and gray wolf associated with the proposed relicensing of the Baker Project would be insignificant and discountable. Therefore, we concur with your "may affect, not likely to adversely affect" determination for grizzly bear and gray wolf.

The FWS disagrees that "may affect, likely to adversely affect" is the appropriate effect determination for bull trout critical habitat. Virtually no areas below the Baker Dams are designated bull trout critical habitat, and therefore we believe that the appropriate determination is "no effect."

The FWS does not concur with the "may affect, not likely to adversely affect" determination for bald eagle, marbled murrelet, marbled murrelet critical habitat, northern spotted owl, and northern spotted owl critical habitat because of the potential for increased disturbance due to construction activities and increased visitor use, the potential to remove critical habitat and/or the potential to increase predation of marbled murrelet nests by corvids. We concur with the "may affect, likely to adversely affect" determination for bull trout. We therefore have conducted a formal consultation on the bald eagle, bull trout, marbled murrelet, marbled murrelet critical habitat, northern spotted owl, and northern spotted owl critical habitat.

This consultation is complex, involving two Federal action agencies, the analysis of over 50 license articles proposed in the Baker River Hydroelectric Project Settlement Agreement and covering the effects of a license for operation for up to 50 years. Because the applicant, Puget Sound Energy, has committed to fulfilling all of the Settlement Agreement, and because this commitment is tied to issuance of the license, we have chosen to define the proposed action as it is described in the Settlement Agreement rather than in the DEIS, as you have proposed.

Many of the activities evaluated in this consultation will be phased in over the period of the license and are not well defined at this time. In some cases, the applicant, Puget Sound Energy, has committed to providing funds to the USFS for completion of license articles. Where we have enough specific information to quantify effects on listed species, we have included that analysis here. For those future actions that are not currently well-defined, we have assumed a worst-case scenario, or have described the effects in general terms and have identified those actions that we believe will need future consultation tiered to this BO.

This BO is based on information provided in the September 2006 Final Environmental Impact Statement; the November 30, 2004, Baker River Hydroelectric Project Settlement Agreement; the November 7, 2006, USFS Final 4e Terms and Conditions; the April 30, 2004, license application and associated studies submitted to the Commission by Puget Sound Energy; meetings, telephone conversations, emails, field investigations; and other sources of information. A complete administrative record of this consultation is on file at the FWS' Western Washington Fish and Wildlife Office in Lacey, Washington.

If you have any questions regarding this Biological Opinion, please contact Jim Michaels at 360-753-7767 or Lou Ellyn Jones at 360-753-5822, of my staff.

Sincerely,

for Ken S. Berg, Manager
Western Washington Fish and Wildlife Office

cc:
ACOE (C. Ebel)
FERC (S. Hocking)
USFS (J. Vanderhayden)
Puget Sound Energy (C. Feldman)

Enclosures

Biological Opinion

for the

Federal Energy Regulatory Commission

U.S. Army Corps of Engineers

Relicensing of the Baker River Hydroelectric Project

FERC No. P-2150

FWS Reference Number: 1-3-06-F-0246
FWS Reference Number: 1-3-06-F-0310

Department of the Interior
U.S. Fish and Wildlife Service
Western Washington Fish and Wildlife Office
Lacey, Washington

June 2007

for Ken S. Berg

GLOSSARY

ACOE: U.S. Army Corps of Engineers

Act: Endangered Species Act or ESA

Action Area: The Baker River watershed and the Skagit River mainstem from the mouth of the Baker to the mouth of the Skagit.

Agreement: Settlement Agreement

ALP: Alternate Licensing Process

Article: Settlement agreement article or license article

Cfs: Cubic feet per second

DEIS: Draft Environmental Impact Statement

FEIS: Final Environmental Impact Statement

FERC: Federal Energy Regulatory Commission

FWS: U. S. Fish and Wildlife Service, referred to as USFWS in citations

LWD: Large woody debris

NMFS: National Marine Fisheries Service

NPS: National Park Service

NSO Northern Spotted Owl

PCE: Primary constituent element of designated critical habitat

Puget: Puget Sound Energy, PSE, or Licensee

Parties: Parties that negotiated and signed the Settlement Agreement

Services: FWS and NMFS considered together

USFS: U.S. Forest Service

WDOE: Washington Department of Ecology

WDFW: Washington Department of Fish and Wildlife

WDNR: Washington Department of Natural Resources

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INTRODUCTION

The action that comprises this consultation under the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*) (ESA) is the issuance of a 50-year license for the Baker River Hydroelectric Project by the Federal Energy Regulatory Commission (FERC) and the protection, mitigation, and enhancement measures contained in the Baker River Hydroelectric Project Relicensing Comprehensive Settlement Agreement, signed in November 2004 (Agreement). In addition, this consultation covers the continuation of existing flood control operations at the Baker River Hydroelectric Project under the jurisdiction of the U.S. Army Corps of Engineers (ACOE). Puget Sound Energy (Puget) filed the Agreement with the FERC on November 30, 2004. Signatories (Parties) to the Agreement include Puget, 11 government agencies, three Tribes, eight non-governmental organizations, and one citizen representative that participated in the relicensing of the projects. In a letter dated April 7, 2006, the FERC requested formal consultation under section 7 of the ESA and stated that the Draft Environmental Impact Statement (DEIS) serves as the biological assessment. The Final Environmental Impact Statement (FEIS), dated September 25, 2006, provides an even more current description of the project, and accordingly, we have used it as the biological assessment, plus the additional information provided by the Licensee and other Parties to the Agreement, to complete this consultation. We refer to scientific publications and published agency documents as literature cited and refer to unpublished written communications, e-mails, and meeting notes from other offices as *In Litteris.* A complete administrative record of this consultation is on file in the U.S. Fish and Wildlife Service's (FWS) Western Washington Fish and Wildlife Office in Lacey, Washington.

CONSULTATION HISTORY

The FWS has participated in the project relicensing since 2000. In the spring of that year, Puget began the relicensing process under the FERCs alternative licensing process in an effort to achieve a collaborative, consensus-based settlement agreement that would be supported by all Parties. On April 28, 2004, Puget submitted its application for a license. On November 30, 2004, Puget filed the Agreement with the FERC, which balances the conflicting interests of the Settlement Parties, including the utility, government agencies, Tribes, non-governmental organizations, and a citizen participant. Participants have worked to develop the Agreement as well as participate in resource working groups, policy groups, and the legal working group to arrive at a comprehensive plan that would reduce unnecessary conflict over the issuance and implementation of the license.

On June 19, 2005, the FERC issued a notice accepting Puget's license and requesting final recommendations, terms and conditions, and mandatory prescriptions pursuant to the Federal Power Act. On March 21, 2005, the Department of the Interior filed its recommendations, terms and conditions, and Fishway prescriptions for the FWS and the National Park Service (NPS). The recommendations included measures that would benefit species listed under the ESA that are found in the project area, including bull trout (*Salvelinus confluentus*), gray wolf (*Canis lupus,)* marbled murrelet (*Brachyramphus marmoratus*), northern spotted owl (NSO) (*Strix occidentalis caurina*), bald eagle (*Haliaeetus leucocephalus*) and grizzly bear (*Ursus arctos*

horribilis). In addition, our Fishway prescriptions, authorized under section 18 of the Federal Power Act, require connectivity for bull trout between Lake Shannon and Baker Lake.

On April 7, 2006, the FERC issued a DEIS for the Baker River Project and concurrently sent a letter to FWS requesting formal consultation under the ESA. In that letter, the FERC stated that the DEIS serves as the biological assessment and requested that FWS provide the biological opinion no later than 135 days from April 10, 2006, when we received the letter. The FERC proposed the following effect determinations:

- "May affect, not likely to adversely affect the bald eagle." The FWS does not concur with this effect determination because the proposed action is likely to increase disturbance due to construction activities and improvements to recreational facilities that may increase visitor use. Although the project is likely to improve the forage base for bald eagles, the increased human activity and project improvements may also limit or preclude bald eagles from using some areas for foraging, roosting and nesting in the future.

- "May affect, likely to adversely affect bull trout." The FWS agrees with this effect determination.

- "May affect, likely to adversely affect bull trout critical habitat." The FWS disagrees that this is the appropriate effect determination. The FWS identified the Baker River mainstem, Skagit River, Baker Lake, Lake Shannon, and select tributaries as proposed critical habitat for bull trout on June 25, 2004 (69 FR 35767). However, project reservoirs were excluded in the final designation dated September 26, 2005 (70 FR 56211). The final designation also excluded segments of waterbodies on lands that are covered by the Washington Department of Natural Resources Habitat Conservation Plan (WDNR) (HCP) and the Forest Practices HCP. These exclusions resulted in virtually no areas below the dams that are designated bull trout critical habitat. Therefore, the FWS believes that the appropriate determination is "no effect." Although critical habitat was designated in the upper Baker River system within North Cascades National Park, habitat in these waterbody segments are unaffected by the project.

- "May affect, not likely to adversely affect" the NSO. The FWS does not concur with this effect determination because the proposed action is likely to increase disturbance due to construction activities, result in some removal of suitable habitat, and because improvements to recreational facilities may increase visitor use.

- "May affect, not likely to adversely affect" NSO critical habitat. The FWS does not concur with this effect determination because the proposed action has a potential to remove designated critical habitat.

- "May affect, not likely to adversely affect" the marbled murrelet. The FWS does not concur with this effect determination because the proposed action is likely to increase disturbance due to construction activities, result in some removal of suitable habitat and

because improvements to recreational facilities may increase disturbance due to visitor use and potential predation of marbled murrelet nests by corvids.

- "May affect, not likely to adversely affect" marbled murrelet critical habitat. The FWS does not concur with this effect determination because the proposed action has a potential to remove designated critical habitat.

- "May affect, not likely to adversely affect" the gray wolf *(Canis lupus*). The FWS agrees with this effect determination.

- "May affect, not likely to adversely affect" the grizzly bear. The FWS agrees with this effect determination.

- No effect for the following species:
    - Golden paintbrush (*Castilleja levisecta*)
    - Canada lynx (*Lynx canadensis*)

In a letter dated May 8, 2006, ACOE requested formal consultation for continuing flood control operations at Upper Baker Dam. The ACOE also requested that we consider the FERC's DEIS as the biological assessment for section 7 consultation. In that letter, the ACOE concludes that flood control operations are likely to adversely affect bull trout and bull trout critical habitat. They also conclude that flood control operations are not likely to adversely affect the NSO, NSO critical habitat, marbled murrelet, marbled murrelet critical habitat, bald eagle, gray wolf or grizzly bear. We have combined the effects of the ACOE's flood control operations with the effects of FERC's proposed action to relicense the Baker River Hydroelectric Project into one biological opinion.

On June 16, 2006, the Department of the Interior provided comments on the DEIS for the FWS and the NPS. In that letter, we raised our concern that the FERC proposed to omit from the license significant sections of the Agreement, which would reduce the value of the license for protection, mitigation, and enhancement of fish and wildlife resources.

On July 3, 2006, the FWS sent another letter to the FERC clarifying the issues of concern for the formal consultation. In that letter, we stated that the DEIS did not constitute a complete initiation package for purposes of section 7 consultation. We went on to explain in detail the type of information we needed, in order to proceed with consultation. We stated that we would be working with Puget and other Parties to obtain the necessary information, and that we would initiate consultation when we had a complete initiation package.

On August 22, 2006, the FWS met with the National Marine Fisheries Service (NMFS), Puget, and the ACOE to address some of the information needs identified in our July 3, 2006, letter. On September 25, 2006, the FWS, Puget, Puget's consultants, and the U.S. Forest Service (USFS) met for a site visit. This visit, which included information on recreational measures, gave us enough specific information about construction impacts and recreation impacts to initiate consultation. On October 3, 2006, the FWS sent a letter to the FERC stating that the biological opinion would be completed by February 9, 2006, which is 135 days after September 25, 2006.

In order to be consistent with the timeline for NMFS' biological opinion, we stated that we would expedite the opinion, and strive to file it with the FERC on January 31, 2007.

On January 27, 2007, we informed the FERC by e-mail that we would be extending the deadline for issuance of the biological opinion to February 28, 2007. On March 21, 2007, we sent another email to the FERC explaining that we planned to issue a Draft Biological Opinion to Puget, the ACOE, and USFS; and therefore would issue the document sometime in April. On April 9, 2007, we sent a Draft Biological Opinion to Puget, the ACOE, and the USFS for their review. We received comments back from USFS on April 16, 2007, from the ACOE on April 18, 2007 and April 20, 2007, and from Puget on May 3, 2007. On May 11, 2007, we informed the FERC that we expected the final Biological Opinion to be completed by the end of May.

There is no requirement for FWS concurrence with "no effect" determinations. The determination that the proposed action will have no effect on lynx and golden paintbrush rests with the action agency; therefore, consultation on the above "no effect" species is not necessary. Pursuant to section 7(a)(2) of the ESA, the FWS has prepared this biological opinion regarding bull trout, bald eagles, marbled murrelets, marbled murrelet critical habitat, NSO, and NSO critical habitat. We will include letters of concurrence for a "not likely to adversely affect" determination for the gray wolf and grizzly bear.

BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

In its letter dated April 7, 2006, the FERC requested section 7 consultation based on the preferred alternative described in the DEIS, which consisted of the Baker Settlement Agreement as modified by FERC staff. The Department of the Interior and other Parties to the Agreement provided comments to the FERC with concerns about the proposed modifications to, and omissions from, the Agreement. The FEIS, which was issued September 26, 2006, incorporated more of the Agreement, although not all of it, and included some additional measures added by FERC staff. The FEIS states that Puget may elect to implement all of the Agreement even though the FERC does not recommend inclusion of the complete Agreement in the license. FERC staff also indicated that the license will reflect the FEIS, plus any mandatory conditions received under section 4e or section 18 of the Federal Power Act or under the 401 water quality certification.

Puget has committed to fulfilling the entire Agreement, whether the FERC includes the entire Agreement in the license or not. Section 7 regulations stipulate that the FWS must consider the direct and indirect effects of an action, as well as the effect of any interrelated and interdependent actions (50 CFR Sec. 402.02). We consider any articles that are excluded from the license to be interrelated and interdependent actions related to this project. Accordingly, we will consider the proposed action to consist of the project operations described in the FEIS plus the entire Agreement.

Our intent is to analyze and provide for incidental take of bald eagles, bull trout, marbled murrelets, and NSOs for those activities associated with the operations and activities authorized by this license. Many of the actions anticipated by the Settlement Agreement are described only at a conceptual level. As these activities are subsequently planned, additional section 7 consultation may also be required. At that time, it will be determined if additional measures are necessary to protect listed species. Direct take that is the result of handling of bull trout associated with research, which is normally covered under a separate 10(a)(1)(A) permit, will also be analyzed in this opinion.

Baker Hydroelectric Project Facilities and Operations

The Baker River Hydroelectric Project consists of the physical facilities of Upper Baker and Lower Baker Developments, which physically occupy about 18 miles of the Baker River. Also included in the project description are facility operations, under the jurisdiction of FERC, and flood control, under the jurisdiction of the ACOE. More detail about the project facilities and operations can be found in the effects sections for each species.

Upper Baker Development

Upper Baker Development, constructed in the late 1950s, begins at river mile (RM) 9.35 and consists of the following:

- Upper Baker Dam, a 312-ft-high concrete dam containing an ogee-type spillway fed by three radial gates approximately 25 ft by 30 ft in size, a gravity-type, gated intake opening with fish baffle, and three gravity-type non overflow sections about 1,000 ft in length. Upper Baker Dam is topped by a 12 ft-wide roadway at elevation 736.77 ft mean sea level North American Vertical Datum of 1988 (NAVD 88) (FERC 2006). Upper Baker Dam results in a 9-mile-long reservoir (Baker Lake) with a surface area of 4,980 acres and a volume of 274,221 acre-ft at normal full-pool elevation, which is 727.77 ft mean sea level.

- The Upper Baker Dam facility also contains two 13.5-ft-diameter, 320-ft-long steel penstocks that convey water to a powerhouse at the toe of the dam. The powerhouse is a 122 ft by 59 ft structure, containing two turbine-driven generators with a combined capacity of 90.7 megawatts (MW). Nearby is a step-up transformer and transmission lines.

- Adjacent to Upper Baker Dam is West Pass Dike, which is a 115-ft-high, 1,200-ft-long earth and rock fill dike and a 25-ft-high, 3,000-ft-long dike that impounds Depression Lake, a 44-acre pond fed by seepage from Baker Lake. At the southwest corner of Depression Lake, a water pumping station with two 54,000 gallon-per-minute pumps return water from Depression Lake to Baker Lake.

- Upstream of Upper Baker Dam is the downstream fish passage facilities, including a barrier net, floating surface collector, fish trap/sampling area, and fish transport system.

- West of Upper Baker Dam, adjacent to Sulphur Creek are artificial spawning beaches for sockeye and a juvenile fish rearing facility.

Lower Baker Development

Lower Baker Development, constructed in the mid 1920s, begins at river mile (RM) 0.6, and includes the following facilities:

- Lower Baker Dam is a 285-ft-high, 550-ft-long concrete arch dam at RM 1.2, with two non-overflow sections and a spillway in the center containing 23 vertical slide spill gates that are each 14-ft-high by 9.5-ft-wide. Lower Baker Dam results in a 7-mile-long reservoir (Lake Shannon), with a surface area of 2,278 acres and a volume of 146,279 acre-ft at normal full pool elevation of 442.35 ft mean sea level. The dam includes a concrete intake with trash racks and gatehouse located at the dam's left abutment.

- Water is fed to the powerhouse through a 1,410-ft-long pressure tunnel constructed of concrete and steel. The powerhouse, a structure that is 90 by 66 ft, is located on the east bank of the Baker River at RM 0.9, contains a single turbine generator with an authorized capacity of 79.3 MW. Adjacent to the powerhouse is a step up transformer and transmission lines to the Baker River substation. A 20-ft-diameter surge chamber is located just upstream of the powerhouse.

- Just downstream of the dam and powerhouse at the visitors' center in Concrete, Washington, is an adult trap and haul upstream fish passage facility that consists of a barrier dam across Baker River at RM 0.6, a fish trap, holding ponds, and fish lift.

- Upstream of Lower Baker Dam is a floating surface collector, consisting of barrier net, fish trap/sampling area, and fish transport system.

Hydropower and Flood Control Operations

The Baker River Hydroelectric Project is managed for multiple purposes, including power generation, flood storage, recreation, and fisheries.

Power generation is emphasized during periods of high energy demand, which typically occurs during weekdays, with peaks during the morning and early evening hours and seasonally during the late fall and early winter months. The project may also generate power continuously for several days or weeks during periods of high inflow. The project is operated to provide up to 100,000 acre ft of flood storage at Upper Baker Dam, if requested by the ACOE.

As directed by the ACOE, the utility draws the reservoirs down during the fall and winter months for purposes of flood control. For recreational purposes, when consistent with other objectives, the reservoirs are kept near full pool in the summer months. Full pool is at elevation 442.35 ft at Lake Shannon and 727.77 ft at Baker Lake. Minimum pool level is at elevation 389 ft at Lake Shannon and 685 ft at Baker Lake (FEIS page 3-36). Puget also provides a continuous minimum flow of 80 cfs from the Lower Baker facility to support the operation of the adult fish

trap. In the event of a shut down, Puget releases approximately 55 cfs through a water release pipe to support this facility.

The proposed action is the continued operation of the Baker River Hydroelectric Project in accordance with the Agreement for the license term of up to 50 years. The Agreement specifies construction of a new powerhouse, improvements to fish passage facilities, a modified reservoir and flow release regime, and various other environmental protection, mitigation, and enhancement measures (PMEs) as summarized in Appendix 1 Project Description and Effects.

Baker River Settlement Agreement

The Agreement is a comprehensive package of measures that provide protection, mitigation, and enhancement measures (PMEs) for aquatic, terrestrial, cultural, recreation and aesthetic resources and also provides for flood control and hydropower generation. Puget has committed to fund the USFS for some of the recreational and terrestrial measures in the Agreement, rather than doing the work themselves. Our intent is to evaluate these funded measures, or any future actions, as part of this biological opinion, provided we have sufficient site-specific information to evaluate the effects of these actions on listed species. Some of the funded measures are not described in sufficient detail to analyze effects to listed species. Appendix 1 indicates those future actions that are described in broad terms that may require additional section 7 consultation once detailed plans are developed.

A summary of the measures included in the Baker River Agreement is presented in Appendix 1 Project Description and Effects. The term, "article," refers to the proposed license article related to each measure as it appears in the Agreement, which is hereby incorporated by reference. More detailed information on each of these measures is provided in the Baker Settlement Agreement (Puget 2004a), in the FEIS (FERC 2006), and in the USFS' 4e document filed with the FERC on November 7, 2006 (USDA; USFS 2006 Final 4(e) terms and conditions responding to the September 2006 Final environmental impact Statement for Hydropower relicensing of the Baker River hydroelectric project, letter to Secretary Magalie R. Salas, FERC dated November 7, 2006).

Conservation Measures

The Agreement is a package of conservation measures developed to provide PMEs for resources that have been or may be impacted by the operation of the Baker Project during the license term. Much of the Agreement is designed to provide benefits to terrestrial or aquatic species and their habitats, so that in this opinion, we consider many of those articles to be conservation measures that will help conserve listed species. Other components of the Agreement provide PMEs for impacts to recreational users, many of which could potentially cause adverse impacts to listed species. The matrix shown in Appendix 1 Project Description and Effects indicates the articles proposed in the Agreement and their potential effects on listed species and their critical habitats. In some cases, conservation measures will provide benefits to certain listed species but may affect others, for example constructing upstream passage facilities at Upper Baker Dam (article 104) will benefit bull trout, and may also disturb bald eagles or marbled murrelets if not implemented during a timing window.

Action Area

The action area is defined as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR § 402.02). In delineating the action area, we evaluated the farthest reaching physical, chemical, and biotic effects of the action on the environment. The action area for the relicensing of the Baker River Hydroelectric Project and associated flood control for bull trout includes the Baker River watershed, which is U.S. Geological Survey Hydrologic Unit Code 17110005 (Upper Skagit). The action area extends into the lower Skagit River from the mouth of the Baker River to the mouth of the Skagit River. The action area for terrestrial species includes the Baker River watershed.

GRAY WOLF LETTER OF CONCURRENCE

Background

There are several documented sightings of gray wolves in the North Cascades Mountains of Washington (WDFW 2003). Gray wolves have been seen regularly in southern British Columbia north of the North Cascades National Park and Ross Lake National Recreation Area since 1984. In 1990, gray wolves with pups were observed near Hozomeen at the north end of Ross Lake (NPS 2003). Since then, three separate groups of gray wolves with pups have been observed in the Cascades. Gray wolves have been observed at McAlester Pass, the Pasayten Wilderness, Twisp River drainage, and Glacier Peak Wilderness, and near Steven's Pass. The Washington Department of Fish and Wildlife (WDFW) database of priority habitats and species reports two observations of gray wolves in the Baker River basin in 1984 and 1992 (WDFW 2004). There are no gray wolf population estimates for the North Cascades area.

The analysis of effects of the proposed action upon gray wolves primarily involves analyzing the indirect effects of the proposed actions to gray wolves by looking at effects to gray wolf prey species such as black-tail deer (*Odocoilus hemionus*) and elk (*Cervus elaphus*). Each proposed action will be evaluated for effects to gray wolves on this basis.

Project Facilities, Operations, and Flood Control

The following Agreement articles, as well as the project description on project facilities and operations in the FEIS, will be evaluated in this section:

- Article 106 Flow Implementation
- Article 107 Flood Control

A study prepared for Puget, Potential Future Vegetation of the Baker River Project Area, also referred to as Study T7-b (2003), estimated that 819 acres of good elk foraging habitat, and 152 acres of marginal foraging habitat would develop over 30 years around the perimeter of the reservoirs were it not for the regular fluctuations of the reservoirs.

The existing network of roads and campgrounds on the westside of Baker Lake would diminish the value of any elk or deer spring foraging habitat that might develop there if not for on-going fluctuation of water levels, due to the increased level of disturbance to these species from vehicle traffic and recreational use of roads and campgrounds. Elk and deer avoid areas of high human use activity (PSE 2002b) and would likely avoid using foraging habitat in the area of high human activity during the peak recreation season around the lake.

Human-caused mortality is a significant threat to gray wolves and is a factor to be considered when assessing project effects on gray wolves. The high density of roads, trails, and campgrounds surrounding the reservoir increases the risk of human-caused mortality of gray wolves. However, we do not believe that gray wolves or their prey species would be attracted to developed areas during the season of high human use, even if prey forage plants were available. Gray wolves would therefore not benefit from elk or deer forage developing in the fluctuation zones. We therefore expect that gray wolves would be insignificantly affected by on-going water level management.

Aquatics

The following articles may affect, but are not likely to adversely affect gray wolves:

- Article 101 Fish Propagation
- Article 103 Upstream Fish Passage
- Article 104 Fish Connectivity Between Reservoirs
- Article 105 Downstream Fish Passage

These articles will involve construction projects near the Upper and Lower Baker Dams. Due to the location of these projects in high human use areas, gray wolf prey species and gray wolves will avoid these areas. The exposure of gray wolves to human use as a result of these projects is unlikely to increase, and the proposed actions are therefore considered insignificant to gray wolves.

Recreation and Aesthetics

The following articles may affect, but are not likely to adversely affect gray wolves:

- Article 303 Baker Lake Resort Redevelopment
- Article 309 Bayview Campground Redevelopment
- Article 306 Upper Baker Visitor Information Services
- Article 307 Upper Baker Visitor Interpretive Services
- Article 308 Managing Dispersed Campsites
- Article 310 Upper Baker Trail and Trailhead Construction
- Article 316 USFS Road Maintenance and Paving

Based on our conversations with USFS staff and review of USFS documents we have made the following assumptions about recreation impacts to gray wolves, their prey species, and their habitat in the proposed project analysis of effects:

- Human population growth will continue to increase during the foreseeable future (at least the next 20 years) whether the project is licensed or not. This increasing population will continue to use the project area for recreation.
- We assume that some level of increased recreation use will result because of improvements to campgrounds and other facilities, and that these improvements will also likely result in some decreased use of dispersed campsites.
- Campgrounds will continue to be used to "over capacity," and some recreational visitors will turn to dispersed camping as the result of full campgrounds. Part of dispersed campground users would use dispersed sites whether campgrounds are full or not.
- Elk and deer avoid areas of high human use such as roads, high use trails, and campgrounds.
- We assume that the USFS and Puget will follow existing Northwest Forest Plan policy in planning the development or redevelopment of recreational facilities such as concentrating development, reducing environmental impact, and discouraging dispersed camping. Current Forest Plan policy restricts new campground development in Late Successional Reserve (LSR) and Riparian Reserve areas and encourages full and efficient use of existing developed sites as well as closure or hardening those dispersed campsites that have the highest use.
- New trail construction during the life of the permit will be limited to 6 miles of construction connecting existing developed campgrounds on the west side of Baker Lake.
- The Upper Baker River Trailhead will not be expanded for increased visitor use.

Proposed recreation projects in the action area were evaluated given these assumptions and were analyzed for effects to gray wolves, their prey, and gray wolf and prey habitat on a project-by-project basis. Gray wolves could be affected by improvement and/or expansion of campsites and recreation facilities if those improvements tend to increase visitor use in the project area.

<u>Redevelopment of Bayview Campground and Baker Lake Resort</u>

The effects to gray wolves from the Baker Lake Resort Redevelopment (Article 303) and the Bayview Campground upgrade (Article 309) and are primarily related to how their prey species are affected by any increase in human use of the area. In addition, increasing human use of an area can lead to a greater risk of human-caused gray wolf mortality due to greater exposure of gray wolves to humans.

When considering the upgrade to the Bayview Campground and the redevelopment of the Baker Lake Resort, any increases in visitor use at either campground would not likely increase the chance for gray wolf/human encounters or gray wolf displacement because the project concentrates human use and development where it currently exists, and gray wolves generally avoid areas with high human use. Gray wolf prey species also generally avoid areas with high human use and, therefore, there is an extremely low likelihood that gray wolves will be attracted to such a high human use area. The exposure of gray wolves to human use is therefore unlikely, and the proposed actions in the Bayview Campground and Baker Lake Resort are considered insignificant to gray wolves.

Upper Baker Visitor Information/Interpretive Services Station

The creation of a Visitor Information/Interpretive Services Station (Articles 306 and 307) could benefit gray wolves by increasing visitor awareness and education about gray wolves.

Managing Dispersed Campsites

There is an extremely low likelihood that gray wolves or their prey species will be attracted to hardened dispersed sites due to high human presence (Article 308). The exposure of gray wolves to human use is therefore unlikely, and the proposed actions to harden dispersed camping sites around Baker Lake considered insignificant to gray wolves.

Upper Baker Trail and Trailhead Construction

Recreational users currently make trails through the woods to get from developed campsite to developed campsite and to scenic areas in the southwest part of Baker Lake. This is likely to continue in the future even if trails are not formalized. Article 310 of the Agreement would include construction of 6 miles of new trails that would connect campsites using existing foot trails or developing trails in the same general area that would avoid sensitive resources, and to concentrate the use that currently exists. Trend studies (USFS 2006) indicate that the predicted aging population will increase the need for accessible trails for families and trails near existing developed sites, such as the proposed trails connecting campsites.

The existing Upper Baker Trailhead currently receives an average of 2300 visitors each year. Visitors hike up the Baker River Trail or south on the Baker Lake Trail from the trailhead. The trailhead has space for 30–40 parked vehicles. There are approximately 30 dispersed camping sites adjacent to the parking area and on the Baker River sand bars and a single vault toilet at the trailhead. The Sulphide Creek Camp site 2.5 miles up the Baker River Trail from the trailhead is the only overnight destination for hikers, and use is restricted to 2 parties (8 persons maximum per party) per night and is managed by the NPS. The formal Baker River Trail ends at the Sulphide Creek Camp. NPS data indicated that in 1999, 25 parties (1 or more persons) representing 68 people visited the camp site, with 101 visitor nights (A. Dunphy pers. comm. 1/18/07). In previous years, the peak number of visitors was 78 parties representing 243 people. In addition to visitors hiking to the Sulphide Creek campsite, visitors can hike cross country on NPS lands. NPS data shows that in 1999 there were 179 parties hiking cross country from the Baker River Trail (A. Dunphy pers. comm. 1/18/07).

Trailhead maintenance as described in Article 310 and the Final 4(e) Terms and Conditions Responding to the September 2006 FEIS for Hydropower Relicensing of the Baker River Hydroelectric Project FERC Project No. 2150-033, outlines plans to accommodate existing use to reduce resource damage. To date the USFS has defined the parking area with boulders to prevent expansion of the existing parking area at the trailhead. There are no plans to expand the trailhead capacity for vehicles, campers, horse use, or hikers. Tent pads may be defined in dispersed camping sites to reduce vegetation damage.

Recreation development that increases hiking into areas with less human use or that increases overnight backcountry use will generally have an impact upon gray wolf prey species due to disturbance resulting in displacement of prey species from seasonal habitats. In addition to prey avoidance of areas with high human use, there could be an increased chance of gray wolf/human encounters due to higher trail use.

The proposed 6 miles of new trails connects existing campgrounds with high levels of human use during the summer. Elk and deer will avoid this area during this time period because of the high level of existing roads around the lake and the high level of human use between the road and the lake. There is an extremely low likelihood that gray wolves will be attracted to the areas where new trail construction will occur and, therefore, the proposed trail construction should not displace gray wolves or increase the chances for gray wolf/human encounters and human-caused wolf mortality. The exposure of wolves to human use on the proposed new trails is therefore unlikely, and we expect effects from the proposed trail construction to be insignificant.

The proposed maintenance at the Upper Baker Trailhead is designed to reduce resource damage from current use and will not increase the capacity of the trailhead for day or overnight hikers, horse users or campers. Therefore, trailhead maintenance will not increase the number of visitors into the wilderness areas beyond Sulphide Creek Camp and will not increase the types of recreational use in potential gray wolf or its habitat. The exposure of gray wolves to human use as a result of trailhead maintenance is unlikely to increase, and the proposed maintenance actions are therefore considered insignificant to gray wolves.

Road Maintenance and Paving

For Article 316, Puget would provide funds to the USFS for maintaining 25 miles of existing roads and paving approximately 1 mile of existing road to access Baker Dam from the Baker Highway. Road maintenance will maintain existing conditions of access, which tend to maintain recreational use on the western side of Baker Lake. The paving project is on Forest Road 1106, which goes from Baker Highway to Baker Dam, and is in an area that is developed, including Kulshan Campground and other facilities. This area would not be considered high quality ungulate habitat due to the high concentration of existing roads and human use. The exposure of gray wolves to human use is therefore unlikely, and the proposed road maintenance and paving action is considered insignificant to gray wolves.

Terrestrial

The following articles may affect, but are not likely to adversely affect gray wolves:

- Article 503 Elk Habitat
- Article 517 Road Closures for Grizzly Bears

Elk Habitat

The proposed development of elk forage habitat (Article 503) in the project area will benefit gray wolves by increasing gray wolf prey availability and reducing disturbance and the risk of human-caused mortality of gray wolves.

Road Closures for Grizzly Bears

Under Article 517 of the Agreement, Puget would provide funds to the USFS for a road closure program that would reduce human use disturbance in the area and increase the effectiveness of foraging habitat for gray wolf prey species.

The Puget commitment to fund the abandonment of 78 miles of road will provide ungulate foraging habitat and decrease disturbance and the risk of mortality to ungulates and gray wolves due to the exclusion of vehicles. The proposed road closures and road decommissioning will therefore be beneficial to gray wolves.

In addition to Article 517, the USFS has seasonally closed roads that access the lake during the winter and spring to reduce the use of ATVs. The USFS took this action because ATV users would enter mud areas along the shoreline during winter and spring drawdown. These road closures also reduce boating activity in the winter and spring. Some areas of the reservoir shorelines during low pool periods offer foraging for ungulates during spring fawning and calving season. Therefore, such seasonal road closures will help to decrease the risk of human/gray wolf interactions by preventing human access into these areas when ungulates and gray wolves could be present. The USFS has already completed section 7 consultation on this activity.

Conservation Measures for Gray Wolf

The following conservation measures, proposed as part of the project action, should minimize potential effects of the action on gray wolves. We have assumed that these conservation measures are part of the proposed action and, based on this assumption, we have concurred with the "not likely to adversely affect" determination.

1. New trail construction will be limited during the life of the permit to 6 miles of construction connecting existing developed campgrounds on the west side of Baker Lake.
2. The Upper Baker River Trailhead will not be expanded to encourage increased visitor use.
3. Approximately 73.6 miles of roads on the north side of Baker Lake, to the east of Swift Creek and those roads to the southeast of Baker Lake will be decommissioned. In addition, Puget will close 13.1 miles of roads year round and gate and close seasonally 3.3 miles of roads. As a result of these closures, there will be an increase of ungulate foraging habitat throughout the Baker River Basin. Seasonal road closures include roads that access the lake during the winter and spring, which will reduce the use of ATVs and reduce boating activity in the winter and spring.

Conclusion

In conclusion, the FWS concurs with the FERC's determination that the proposed actions included in the relicensing of the Baker River Hydroelectric Project are not likely to adversely affect the gray wolf in the project action area.

GRIZZLY BEAR LETTER OF CONCURRENCE

Background

The North Cascades Grizzly Bear Recovery Zone was established in 1993, and divided into Bear Management Units (BMUs) that approximate the size of a female grizzly bear home range. BMUs provide a way to track habitat availability and change due to various proposed actions at a scale (home range) of analysis appropriate for grizzly bears. The amount of available, preferred seasonal habitat in each BMU has been mapped throughout the Recovery Zone. Preferred seasonal habitat includes grass and forbs (early season), and berry crops, bulb, and root plants (late season). The suitability of available habitat is dependent upon whether or not the preferred seasonal habitat is considered "core habitat." Habitat is considered "core" if it is more than 0.3 mile (500 meters) from a road or high use trail (any non-motorized trail that receives an average of 20 or more parties/week during the grizzly bear season being assessed) (IGBC 1994).

Three (BMUs) border Lake Shannon and Baker Lake: Sisters BMU west of Lake Shannon, Baker BMU west of Baker Lake, and Welker BMU east of both reservoirs. A fourth BMU, the Baker-Goodell BMU, encompasses the Upper Baker River basin and the Goodell Creek watershed to the southeast. A description of available, preferred seasonal core habitat in the BMUs within the project area is summarized below (FERC 2006).

The Sisters BMU is 100,875 acres in size, with 45.9 percent located on Federal lands. Remaining lands are predominantly managed as private timberlands; with some residential developments present. The amount of early season preferred core habitat and late season preferred core habitat are each less than 50 percent of the BMU, which is well below the level of preferred core habitat believed to be necessary to support grizzly bear use.

The Baker BMU is 82,380 acres in size, with 96.7 percent in Federal ownership. Early and late season preferred core habitats are lacking in general throughout the BMU but are considered to be at high enough levels to support grizzly bears provided that the risk for mortality is low. The risk for mortality increases with higher open road and high use trail densities. There is a high level of recreational activity in this BMU, including a climbing route to Mt. Shuksan and other trails.

The Welker BMU is 153,461 acres in size and has a low level of preferred early season core habitat and moderate level of preferred late season core habitat. The amount of seasonally preferred habitats are within the range believed necessary to support grizzly bear use, provided that mortality risk, which results from high road and high use trail densities, is low. Welker BMU is 78 percent federally owned. Recreational pressures in the Welker BMU are lower than

described for the Baker BMU, reducing the risk of mortality to grizzly bears from bear/human encounters.

The Baker-Goodell BMU is 100,821 acres in size, with 99.95 percent in Federal ownership. The BMU contains high amounts of both early and late season core areas and a high amount of preferred habitat within the late season core. Early season preferred habitat levels are somewhat low (FERC 2006).

The grizzly bear is known to occur in the Upper Baker River watershed (USFS 2002, WDFW 2004). Nine grizzly bears were recorded on the Mt. Baker-Snoqualmie National Forest, including the Upper Baker River in 1929 (USFS 2002). The most recent grizzly sightings in the project vicinity include an observation of one adult and one young in the Baker River headwaters in 1991, 10 miles from the project area (WDFW 2004), and a grizzly bear track recorded in 1989 near Watson Peak, approximately 4.5 miles east of the Upper Baker Dam (WDFW 2004). Even though few grizzly bears have been sighted in the area, and the sightings were made 15 years ago, considering the large home range size and high mobility of grizzly bears, the project is likely within use areas of bears associated with the two most recent sightings.

The action area falls within the North Cascades Grizzly Bear Recovery Zone which has been identified as an important recovery area for the grizzly bears and within which grizzly bear recovery is a priority. Measures that are taken within the recovery zone to maintain suitable habitat and conditions for grizzly bear recovery when grizzly bear densities are low will ensure that habitat will remain suitable if grizzly bear numbers increase over the 50-year life of the proposed hydropower permit.

The analysis of effects of the proposed action primarily involves assessing the risk of increased grizzly bear mortality due to the potential for increased grizzly bear/human contact arising indirectly from the proposed action.

Project facilities, operations, and flood control

The following articles may affect, but are not likely to adversely affect grizzly bears:

- Article 106 Flow Implementation
- Article 107 Flood Control

One of the activities occurring under the new license is the regulation of water levels of the Baker Lake and Lake Shannon reservoirs for flood control and power generation. The fluctuation of water levels is part of the baseline and is also considered an ongoing effect that will continue to occur into the future, precluding the development of grizzly bear foraging habitat in the zone between minimum and maximum pool. This zone is termed the fluctuation zone. The T12 study on Grizzly Bear Spring Foraging Habitat Study, prepared for Puget, estimated that 442 acres of spring foraging habitat would develop around the perimeter of the reservoirs, mostly on the low gradient west side, at low pool, were it not for the yearly fluctuation of the inundation zone.

The largest areas of potential spring foraging habitat (i.e. wetlands) for grizzly bears in the project area are in the drawdown area of Baker Lake, particularly in the delta of the Baker River, at the mouth of Swift Creek, just south of the mouth of Park Creek, upland wetland areas up in the watershed of Swift Creek, low gradient banks of the reservoir along the south west side of Baker Lake, specifically between the mouths of Boulder and Little Sandy Creeks, the mouth of Little Sandy Creek, and south of the mouth of Sandy Creek (EDAW 2003). There is some scattered potential spring forage areas within the inundation zone of Lake Shannon that would develop into spring forage habitat were it not for the seasonal fluctuations (EDAW 2003).

Human caused mortality is a significant threat to grizzly bears, related to the amount and distribution of core habitat. The network of roads and campgrounds on the west side of Baker Lake diminishes the value of any spring foraging habitat that may develop there if not for the yearly fluctuation in water levels. None of the habitat that might develop along the lakeshore can be considered "core" as defined previously, and grizzly bears would not benefit from the inundated areas for spring foraging. If grizzly bears were attracted to areas of emergent vegetation around the lake for spring foraging, it would be at a time when people would be unlikely to be present (D. Gay pers. comm. 11/07/06).

Therefore, grizzly bears would not be significantly affected (either beneficially or adversely) from any increase or decrease in spring forage resulting from on-going project operation of water level management.

Aquatic

The following articles may affect, but are not likely to adversely affect grizzly bears:

- Article 101 Fish Propagation
- Article 103 Upstream Fish Passage
- Article 104 Fish Connectivity Between Reservoirs
- Article 105 Downstream Fish Passage

Project proposals for fish propagation and improvement of fish passage and aquatic habitat are intended to increase access and numbers of salmonids that spawn in the upper Baker watershed. The potential increase in salmonids could benefit grizzly bears by providing another forage source; however, due to the location of the projects in high human use areas, the increased forage source may not be available to grizzly bears who would avoid areas of high human use. Therefore, there is a low likelihood that grizzly bears would utilize any new forage source created by the proposed fish propagation and improved fish passage projects, and the effects to grizzly bears from the projects are considered insignificant.

Recreation and Aesthetics

The following articles may affect, but are not likely to adversely affect grizzly bears:

- Article 303 Baker Lake Resort Redevelopment
- Article 306 Upper Baker Visitor Information Services

- Article 307 Upper Baker Visitor Interpretive Services
- Article 308 Managing Dispersed Campsites
- Article 309 Bayview Campground Redevelopment
- Article 310 Upper Baker Trail and Trailhead Construction
- Article 316 USFS Road Maintenance and Paving

Recreation trend data indicate that the Washington State counties that are served by the Baker Lake area are some of the fastest growing in the state and are projected to grow during the next 10 years by 17 to 24 percent, which is a faster rate than the State average of 14 percent (USFS 2006). Campgrounds that are already at or over capacity are projected to be stretched completely past their limits. In order to concentrate development, reduce environmental impacts, and discourage dispersed camping that results in resource damage, current Forest Plan policy restricts new campground development in LSR and Riparian Reserve areas, and encourages full and efficient use of existing developed sites as well as closure or hardening those dispersed campsites that have the highest use.

Recreation trend data indicate that almost all the activities represented in the Baker Lake area will increase over the next few decades, except fishing (USFS 2006). Due to the aging of the population, recreational trend data project that activities more amenable to an aging population will be most popular (USFS 2006). The predicted fastest growing activities include nature activities such as bird watching, beach visitation, picnicking, swimming, and developed camping, which will grow between 19 to 23 percent during the next 10 years and 29 to 37 percent during the next 20 years (USFS 2006). All of this use is predicted to be concentrated along the western side of Baker Lake. Activities such as hiking, sightseeing by car and powered and non-powered boat use will also increase, though at a lower level (USFS 2006). Hiking is predicted to be either near campgrounds or on the Baker Lake Trail (USFS 2006). In summary, the recreational activities that are projected to increase the most due to general population increase are likely to be those that are concentrated near the developed areas of Baker Lake (USFS 2006).

Developed Camping

Camping currently occurs at the following developed facilities on USFS land: Panorama Point, Horseshoe Cove, Bayview, Shannon Creek, Maple Grove, Park Creek, Boulder Creek, and Baker Lake Resort. Kulshan Campground is owned by Puget and has no lakeside camping. The lakeside camping that could occur at Baker Resort is taken up by cabins, which block access to the lake. The current campground layouts are minimal, and recreationists coming to this popular destination often find the campgrounds full and go to other areas, often to dispersed campsite as an alternative (USFS 2006). According to the USFS, these campgrounds are at or over capacity on summer holidays and weekends in July and August (USFS 2006). The USFS determines the capacity of a campground based on the occupancy during peak times, which is on the weekends of July and August. The most desirable sites are around the lake. Eighty-seven percent of visitors indicate that they come to Baker Lake for the proximity of water (USFS 2006).

Dispersed Camping

Currently over 200 sites around Baker Lake and Lake Shannon show signs of dispersed camping (USFS 2006). Some of these sites are used frequently and regularly, and others are used infrequently. Visitor surveys taken at dispersed campsites indicate that 39 percent of dispersed campers are there because of overflow from more developed campgrounds that are either full or that have few desirable lakeside sites that are available (USFS 2006). Impacts of dispersed camping include sanitation issues (human refuse) and damage to native vegetation (USFS 2006).

Assumptions

Based on our conversations with USFS staff and review of USFS documents, we have made the following assumptions about recreation impacts to grizzly bears and their habitat in the proposed project analysis of effects. The assumptions were as follows:

- Human population growth will continue at high levels during the foreseeable future (at least the next 20 years) whether the project is licensed or not. This increasing population will continue to use the project area for recreation;
- We assume that some level of increased recreation use will result because of improvements to campgrounds and other facilities, and that these improvements will also likely result in some decreased use of dispersed campsites;
- The campgrounds will continue to be used to "over capacity" and at least part of the recreational visitors will turn to dispersed camping as the result of full campgrounds. Part of dispersed campground users would use dispersed sites whether campgrounds are full or not.
- We assume that construction within the zone of influence of listed species will be conducted within the timing windows to minimize effects to listed species.
- We assume that the USFS and Puget will follow existing Forest Plan policy in planning the development or redevelopment of recreational facilities such as concentrating development, reducing environmental impacts, and managing dispersed sites to protect natural resources. Current Forest Plan policy restricts new campground development in LSR and Riparian Reserve areas, and encourages full and efficient use of existing developed sites as well as closure or hardening those dispersed campsites that have the highest use.
- Bear resistant trash containers will be installed at all developed sites and hardened dispersed sites. Garbage will be regularly collected to minimize it from being an attractant to grizzly bears.
- Educational signs will be placed in all developed sites and hardened dispersed sites that discuss measures to improve sanitation and protect wildlife.
- New trail construction during the life of the permit will be limited to 6 miles of construction connecting existing developed campgrounds on the west side of Baker Lake.
- The Upper Baker River Trailhead will not be expanded for increased visitor use.

The recreation projects in the proposed action were evaluated given these assumptions, and are analyzed for effects to grizzly bear below on a project-by-project basis.

Baker Lake Resort Redevelopment

The proposal for redevelopment of the Baker Lake Resort (Article 303) includes removal of existing resort structures and construction of 50 campsites in their place, which would reduce the total number of available sites. This redevelopment will likely increase the overall use of the campground by providing lakeside camping, which is currently not configured efficiently or attractively for visitors. Currently, there are no bear-resistant containers in the resort, and human refuse is a sanitation issue. Anticipated increases in visitor use of the resort as a result of the proposed actions would not likely increase the chance for bear/human encounters or bear displacement because the project concentrates human use and development where it currently exists, and grizzly bears generally avoid areas with high human use. In addition, assuming that bear-resistant sanitation containers, regular garbage collection, and educational signage about reducing the risk of bear/human conflicts are implemented, the risk for bear/human encounters occurring will be minimized. There is an extremely low likelihood that grizzly bears will be attracted to human refuse in Baker Lake Resort after implementation of the sanitation improvements and an extremely low likelihood that grizzly bears would be attracted to such a high human use area. The exposure of grizzly bears to human use is therefore unlikely, and the proposed actions in the Baker Lake Resort considered discountable to grizzly bears.

Upper Baker Visitor Information/Interpretive Services Station

The creation of a VIS (Articles 306 and 307) could benefit grizzly bears by increasing visitor awareness and education about grizzly bears and about reducing the risks of conflict between bears and humans by camping and recreating in a manner that promotes good sanitation practices. Additionally, no effects are anticipated from project construction. Therefore creation of the visitor information station is expected to be wholly beneficial.

Managing Dispersed Campsites

There is currently no management of dispersed camping sites around Baker Lake, and human refuse is an issue at many of the sites. The presence of attractants such as human garbage increases the risk that bears will use such sites for foraging, increasing the chances for conflicts between bears and humans. As stated earlier, bear/human conflicts often end in bear mortality. The proposed improved sanitation and educational signage in hardened dispersed sites (Article 308) will greatly reduce the risk of exposure of grizzly bears to human refuse and thus conflict with humans. There is an extremely low likelihood that grizzly bears will be attracted to human refuse in hardened dispersed sites with the proposed dispersed campsite improvements. Because exposure of grizzly bears to human use is unlikely, effects of the proposed hardening of dispersed camping sites around Baker Lake are considered discountable to grizzly bears.

Redevelopment of Bayview Campground

Construction of Bayview campground was initiated in 1970, but the campground has not been completed to date due to lack of funding. The campground currently consists of two separate group sites that are available by reservation, each with a capacity of 25 persons per night. Based on USFS occupancy data, Bayview Campground, like other campgrounds on Baker Lake, is

operating at higher-than-sustainable levels during the peak visitor season of July and August. Many visitors are turned away because campgrounds are full during peak season or leave because desirable campsites are already taken. According to surveys at dispersed campsites, 39 percent of these overflow visitors wind up at dispersed campsites (USFS 2006).

The effects to grizzly bears from the Bayview Campground upgrade (Article 309) are related to any increase in human use of the area, and what type of visitor use occurs due to the upgrade. In general, increasing human use of an area can lead to a greater risk of grizzly bear/human conflicts, particularly over food resources in the form of human refuse, and in some cases, competition between humans and grizzly bears for a natural source of food such as spring range, berry crop concentrations, or a concentrated fish source during spawning. Increased risk of bear/human conflict often results in increased bear mortality (USFS 1986).

The types of visitors using any given recreation site can increase or reduce the chances for bear/human conflicts as well. Recreation development that increases hiking into grizzly bear core habitat or that increases overnight backcountry use will generally increase the risk of impact upon grizzly bears due to potential displacement from seasonal habitats, increased chance of bear/human encounters due to higher trail use, or introduction of human food sources into core habitat. The risk of increased human/bear conflict or bear displacement is reduced when visitors camp in defined sites with proper bear-resistant sanitation containers.

In the case of the upgrade to the Bayview Campground, increases in visitor use at the campground would not likely increase the chance for bear/human encounters or bear displacement because the project concentrates human use and development where it currently exists, and grizzly bears generally avoid areas with high human use. In addition, assuming that bear-resistant sanitation containers, regular garbage collection, and educational signage about reducing the risk of bear/human conflicts are implemented, the risk for bear/human encounters occurring will be reduced. There is an extremely low likelihood that grizzly bears will be attracted to human refuse in the developed Bayview Campground with the proposed campsite improvements, and an extremely low likelihood that grizzly bears would be attracted to such a high human use area. Because the exposure of grizzly bears to human use is unlikely, effects of the proposed redevelopment of Bayview Campground are considered discountable to grizzly bears.

Upper Baker Trail and Trailhead Construction

Recreationists currently make trails through the woods to get to and from developed campsites and to scenic areas in the southwest part of Baker Lake. This is likely to continue in the future even if the trails are not formalized. Article 310 of the Agreement facilitates construction of 6 miles of new trails that would connect campsites using existing foot trails. This article would develop trails so as to avoid sensitive resources and would concentrate the use that currently exists. Trend studies (USFS 2006) indicate that the predicted aging population will increase the need for accessible trails for families, and trails near existing developed sites, such as the proposed trails connecting campsites.

The existing Upper Baker Trailhead currently receives an average of 2,300 visitors each year. Visitors hike up the Baker River Trail or south on the Baker Lake Trail from the trailhead. The trailhead has space for 30–40 parked vehicles. There are approximately 30 dispersed camping sites adjacent to the parking area and onto the Baker River sand bars, and a single vault toilet at the trailhead. The Sulphide Creek Camp site 2.5 miles up the Baker River Trail from the trailhead is the only overnight destination for hikers, and use is restricted to 2 parties (8 persons maximum per party) per night, and is managed by the NPS. The formal Baker River Trail ends at the Sulphide Creek Camp. NPS data indicated that in 1999, 25 parties (1 or more persons) representing 68 people visited the campsite, with 101 visitor nights (A. Dunphy pers. comm. 1/18/07). In previous years, the peak number of visitors was 78 parties representing 243 people. In addition to visitors hiking to the Sulphide Creek campsite, visitors can hike cross-country on NPS lands. NPS data shows that in 1999 there were 179 parties hiking cross-country from the Baker River Trail (A. Dunphy pers. comm. 1/18/07).

Trailhead maintenance as described in Article 310 and the Final 4(e) Terms and Conditions document (USFS 2006), outlines plans to accommodate existing use to reduce resource damage. To date the USFS has defined the parking area with boulders to prevent expansion of the existing parking area at the trailhead. There are no plans to expand the trailhead capacity for vehicles, campers, horse use, or hikers. Tent pads may be defined in dispersed camping sites to reduce vegetation damage. Sanitation has not been identified as an issue at dispersed campsites or parking area at this time due to regular patrols by USFS personnel (A. Dunphy pers. comm. 1/18/07).

Recreation development that increases hiking into grizzly bear core habitat or that increases overnight backcountry use will generally impact grizzly bears due to their potential displacement from seasonal habitats, increased chance of bear/human encounters, or introduction of human food sources into core habitat.

The proposed 6 miles of new trails would connect existing campgrounds with high levels of human use during the summer. This area does not contain core habitat for grizzly bears due to the high level of existing roads around the lake and the high level of human use between the road and the lake. There is an extremely low likelihood that grizzly bears will be attracted to the areas where new trail construction will occur, and therefore, proposed trail construction should not displace grizzly bears or increase the chances for bear/human encounters and conflicts. The exposure of grizzly bears to human use on the proposed new trails is unlikely, and effects to grizzly bears are expected to be discountable.

The proposed maintenance at the Upper Baker Trailhead is designed to reduce resource damage from current use, and will not increase the capacity of the trailhead for day or overnight hikers, horse users, or campers. Therefore trailhead maintenance will not increase the number of visitors into the wilderness areas beyond Sulphide Creek Camp, and will not increase the types of recreational use in potential grizzly bear core habitat. The exposure of grizzly bears to human use as a result of trailhead maintenance is unlikely to increase, and effects to grizzly bears are expected to be discountable.

Road Maintenance and Paving

For Article 316, Puget would provide funds to the USFS for maintaining 25 miles of existing roads and paving approximately 1 mile of existing road to access Baker Dam from the Baker Highway. The road maintenance will maintain existing conditions of access, which tend to concentrate recreationists at the more accessible sites along southwestern Baker Lake. The paving project is on FR 1106, which goes from Baker Highway to the Baker Dam, and is in an area that is developed, including Kulshan and other facilities. This area is not considered core grizzly bear habitat due to the high concentration of existing roads and human use. The exposure of grizzly bears to human use from proposed road maintenance and paving actions is unlikely, and effects to grizzly bears are expected to be discountable.

Terrestrial

The following articles are wholly beneficial to grizzly bears:

- Article 503 Elk Habitat
- Article 517 Road Closures for Grizzly Bears

Elk Habitat

Article 503 will provide for the acquisition and management of 300 acres of elk forage habitat, and therefore this article is expected to be wholly beneficial to grizzly bears.

Road Closures/Decommissioning

Under Article 517 of the Agreement, Puget would provide funds to the USFS for a road closure program that would reduce human use disturbance in the area and increase the value of spring and early summer foraging habitat for grizzly bears.

The USFS has stated that it will decommission 73.6 miles of roads on the northside of Baker Lake, to the east of Swift Creek, and to the southeast of Baker Lake. In addition, 13.1 miles of roads will be closed year round, and 3.3 miles will be gated and closed seasonally. At a minimum, at least 9.3 miles of road closure would occur due solely to the proposed action and will increase the amount of core habitat for grizzly bears within the BMUs (D. Gay pers. comm. 10/27/06). As a result of these closures, there will be a total increase of 1,488 acres of early season grizzly bear foraging habitat and 2,416 acres of late season grizzly bear foraging habitat distributed throughout the Baker, Sisters, and Welker BMUs (D. Gay pers. comm. 12/14/06).

In addition to Article 517, the USFS has seasonally closed roads that access the lake during the winter and spring to reduce the use of ATVs in the mud surrounding the lake and to reduce boating activity in the winter and spring. Although it is unlikely that grizzly bears would enter low elevation habitat where camping currently exists close to the lake in the summer, if they were to enter the low elevation areas during the spring for foraging, these seasonal road closures would help to decrease the risk of human/grizzly interactions by preventing access into these areas when grizzly bears are present. When human activity is higher around the lake and in the

campgrounds, during summer, the grizzly bears are generally higher in the mountains (D. Gay pers. comm. 11/07/06).

The proposed road closures will improve elk habitat as well as increase grizzly bear core habitat, reducing disturbance and the risk of mortality. Therefore, the effects of road closures to grizzly bears are expected to be wholly beneficial. The USFS has already completed section 7 consultation on this activity.

Conservation Measures for Grizzly Bear

The following conservation measures, proposed as part of the project action, should minimize potential effects of the action on grizzly bears. These conservation measures represent the assumptions we used in concurring on the "not likely to adversely affect" determination.

1. Bear resistant trash containers will be installed at all developed sites and hardened dispersed sites. Garbage will be collected regularly to prevent attractants to grizzly bears.
2. Educational signs will be installed in all developed sites and hardened dispersed sites that discuss measures to improved sanitation and protect wildlife.
3. New trail construction will be limited during the life of the license to 6 miles of construction connecting existing developed campgrounds on the west side of Baker Lake.
4. The Upper Baker River Trailhead will not be expanded to encourage increased visitor use.

We do not anticipate grizzly bear/human conflicts from use of the Baker River trail and trailhead at this time due to the low densities of grizzly bears within the North Cascades Grizzly Bear Ecosystem. However, if grizzly bears are augmented into the North Cascades Grizzly Bear Ecosystem during the life of the permit and grizzly bears start using the Baker River trail area, we recommend that educational signage that addresses safety and sanitation practices be installed at the trailhead to reduce potential conflicts between bears and recreationists, and that bear-proof garbage receptacles with regular garbage collection be installed at the trailhead and at any dispersed camp sites adjacent to the trailhead.

Conclusion

In conclusion, the FWS concurs with the FERC's determination that the proposed actions that are part of the relicensing of the Baker River Hydroelectric Project may affect but are not likely to adversely affect the grizzly bear or grizzly bear habitat in the project action area.

INTRODUCTION TO SPECIES EFFECTS

Assumptions

This biological opinion evaluates the effects to listed species of articles proposed in the Settlement Agreement. The types of effects expected are displayed in Appendix 1 Project Description and Effects, as follows: a) no effect, b) insignificant or discountable--may affect,

not likely to adversely affect, c) LAA--likely to adversely affect, and for future projects that are not planned specifically yet, d) PAA-- have the potential to "likely to adversely affect."

Articles identified as "no effect" are listed in Appendix 1 Project Description and Effects, but otherwise may or may not be discussed in the text. Articles identified as insignificant or discountable are discussed briefly in the text. The articles identified as "LAA" or "likely to adversely affect" are defined well enough in the FEIS for us to predict adverse effects on listed species of the action. Effects of articles identified as "LAA" are discussed at length in the text, and where appropriate, the level of take quantified and included in our Incidental Take Statement.

The articles identified as "PAA" have the potential to "likely to adversely affect" and are not defined well enough in the FEIS to quantify take, but we believe they may have adverse effects. Plans showing exact location, timing, and other necessary details, will be developed at a later time, either by the USFS or by Puget. For those articles designated as "PAA," we have identified conservation measures that would minimize effects to listed species and recommend that the licensee or the USFS incorporate these conservation measures when developing more specific plans in the future. The effects of articles identified as "PAA" are discussed in a general way in the opinion. We have made a reasonable worst-case assumption about potential impacts to listed species in order to conduct a plan-level jeopardy analysis. These future actions will be taking place on USFS lands or on lands owned or acquired by Puget. Because these actions are not defined specifically enough in the FEIS or supporting documents to conduct a take analysis, future tiered section 7 consultations would be needed once specific plans have been drawn up. Appendix 1 Project Description and Effects identifies the actions for which future consultations may be needed for certain species.

In making our reasonable worst-case assumptions about potential adverse effects of future actions, we relied on a number of assumptions.

Northwest Forest Plan

Where those future actions will occur on USFS land, we assume that the Northwest Forest Plan will reduce the effects of any actions on listed species. The activities that would be implemented as a result of the recreation articles (articles 301-318) would all occur on USFS land designated under the Northwest Forest Plan as LSR. The objective of LSR is to protect and enhance conditions of late-successional and old-growth forest ecosystems, which serve as habitat for late-successional and old-growth related species including the NSO (USDI 1994).

In addition to protecting and enhancing habitat for NSOs, "Preproject surveys of marbled murrelet habitat are required according to protocol currently used by the Federal agencies…If behavior indicating occupation is documented, all contiguous existing and recruitment habitat for marbled murrelets (i.e., stands that are capable of becoming marbled murrelet habitat within 25 years) within a 0.5-mile radius will be protected…" (USDI 1994: Standards and Guidelines C-10). "Existing developments in late-successional reserves such as campgrounds, recreation residences…are considered existing uses with respect to late-successional reserve objectives, and

may remain, consistent with other standards and guidelines" (USDI 1994: Standards and Guidelines C-17).

Based on the objective and the standards and guidelines for LSR, we assume that activities implemented as a result of the recreation articles would protect NSO habitat and would also require pre-project surveys to determine marbled murrelet occupancy. If marbled murrelet occupancy was determined, that habitat would be protected according to the standards and guidelines.

Elk Forage Habitat Land and Washington State Forest Practices Rules

Article 503 provides funding to acquire approximately 300 acres of elk foraging habitat for the purpose of providing significant and reliable foraging resources for the Nooksack Elk Herd to improve habitat conditions for its recently declining population. In addition to land acquisition, the article also includes habitat enhancement, management, and maintenance of acquired lands during the term of the license. We assume that the licensee, under advisement of the Terrestrial Resources Implementation Group, will avoid the potential to adversely affect suitable and/or occupied habitat for NSOs and marbled murrelets when considering potential land for acquisition, enhancement, management, and maintenance.

Our assumption is based on the following factors: 1) the intent of Article 503 is to acquire elk foraging habitat with a combined elk forage equivalency value of at least 1,437, where each habitat type receives a specific score; the highest score value of 9 is for cultivated pasture land managed to provide elk forage; other habitat types receive a score of 3 or 1; therefore, non-forested pasture land would be sought after more so than mature forest that owls and marbled murrelets would occupy, 2) the cost to acquire mature forest would be more than other habitat types that have an equal or higher elk equivalency value, therefore, mature forest would not be the most economically desirable land to acquire for elk forage habitat, and 3) if mature forest was part of the acquired land, the land would be in non-Federal ownership and thus regulated almost certainly by the Washington Forest Practices Rules. These rules provide measures to minimize and avoid adverse effects to occupied owl and murrelet habitat, therefore, any timber harvest as part of the enhancement or management of acquired lands would be subject to the constraints of the Washington Forest Practices Rules. For all of these reasons, we have determined that the adverse effects to NSOs and marbled murrelets would be substantially minimized as a result of implementing Article 503.

Decision-making as Part of the Settlement Agreement

As a signatory to the Agreement, with representation on several standing committees defined under the Agreement, the FWS assumes that where conflicts exist in the planning of future actions, deference will be made to protect listed species.

The Agreement identifies the Baker River Coordinating Committee as a licensing implementation entity providing participation to each party of the Agreement. In addition, the Agreement provides for the ongoing implementation workgroups for terrestrial, recreation, and aquatic resources, and fish passage design. The Agreement also provides protocols for decision-

making and conflict resolution. Decisions are made through consensus, defined as lack of objection. Where consensus cannot be achieved, conflict resolution protocols are used.

Our agency has been a member of the Baker River Interim Coordinating Committee, the Terrestrial Resources Implementation Group, the Recreation Resources Group, and the Aquatics Resources Group and the Fish Passage Design Team since these groups were formed. Under the Agreement, the sub-groups are intended to function as technical groups convened on an ongoing basis to address implementation issues throughout the term of the license. Based on our participation on the Baker River Coordinating Committee and the various resources groups for the past 5 years, we believe that the Parties to the Agreement have a good working relationship and a commitment to achieve consensus. Members work in a collaborative fashion to achieve solutions to problems that span a diverse cross-section of interests, needs, and regulatory requirements. Based upon our participation in the development of the Agreement and as a member of the standing committees defined in the Agreement, as well as our experience working with Agreement parties and implementation groups in other hydroelectric projects, such as the Skagit, the Cowlitz and the Lewis, we believe that where conflicts exist in the planning of future actions, that reasonable efforts will be made to ensure protection of listed species.

Organization of this Section

Because the effects of the action on bull trout are very different from the types of effects we have analyzed for terrestrial species, the organization of the bull trout section differs significantly from that of the terrestrial species. For bull trout, we have organized effects around types of effects (i.e., construction effects, fish passage effects, etc.) and in the terrestrial sections; we have organized effects around articles (aquatics, recreation, terrestrial, etc.).

Where articles have no effect on a listed species, we may or may not discuss it in the text, depending upon the need for context. All articles that will have “no effect” on listed species are listed in Appendix 1 Project Description and Effects.

BALD EAGLE

STATUS OF THE SPECIES: Bald Eagle – Pacific Population

A detailed account of the taxonomy, ecology, and reproductive characteristics of the bald eagle is presented in the Pacific Bald Eagle Recovery Plan (USDI 1986), the final rule to reclassify the bald eagle from endangered to threatened in all of the lower 48 states (USDI 1994), and the proposed rule to delist the bald eagle (USDI 1999). The most current information regarding bald eagles in Washington State and a detailed description of their biology and conservation can be found in the Washington State Status Report for the Bald Eagle (Stinson et al. 2001). A summary is provided below.

The bald eagle was federally listed in 1978 as an endangered species in all states except Michigan, Minnesota, Wisconsin, Washington, and Oregon, where it was designated as threatened (USDI 1978). The listing was a result of a decline in the bald eagle population

throughout the lower 48 States. The decline was largely attributed to the widespread use of dichloro-diphenyl trichloro-ethane (DDT) and other organochlorine compounds, in addition to habitat loss, disturbance, shooting, electrocution from power lines, poisoning, and a decline in the food base.

The bald eagle was reclassified in 1995 from endangered to threatened as a result of a significant increase in the number of nesting pairs, increased productivity, and expanded distribution (USDI 1994). Since 1989 the bald eagle nesting population has increased at an average rate of approximately 8 percent per year (USDI 1999). The national average for fledglings per occupied breeding area is greater than one; therefore, the bald eagle population continues to increase. Certain geographically restricted areas, such as southern California, the Columbia River, the Great Lakes, and parts of Maine still have contaminant threats (USDI 1999). However, bald eagle recovery goals have generally been met or exceeded throughout its range (USDI 1999).

The delisting goals for the Pacific Recovery Area include 1) a minimum of 800 nesting pairs, 2) an average reproductive rate of 1.0 fledged young per occupied breeding area, with an average success rate for occupied breeding areas of not less than 65 percent over a 5-year period, 3) breeding population goals attained in at least 80 percent of management zones, and 4) wintering populations which are stable or increasing (USDI 1986).

In the Pacific Recovery Area population delisting goals have been met since 1995, the productivity objective of an average of 1.0 young per occupied breeding area has been met since 1990, and the average success rate for occupied breeding areas of 65 percent has been exceeded since 1994 (USDI 1999). However, as of 1999, the distribution objective among management zones had not yet been fully achieved.

Of the seven states covered in the Pacific Recovery Area, Washington State supports the largest breeding and wintering populations (USDI 1986). In 2001, 684 nest territories were occupied in Washington (WDFW, 2003, unpub. data). Most nesting territories in Washington are located on the San Juan Islands, along the coastline of the Olympic Peninsula, along the Strait of Juan de Fuca, Puget Sound, Hood Canal, and the Columbia River. Wintering concentration areas in Washington are along salmon spawning streams and waterfowl wintering areas (Stinson et al. 2001).

Conservation Needs

Habitat

Nesting and wintering habitats are critical to the continued survival of the bald eagle (USDI 1999). Development-related habitat loss has been a significant threat to bald eagles in the Pacific Recovery Area of Washington, Idaho, Nevada, California, Oregon, Montana, and Wyoming (USDI 1994), although availability of habitat does not appear to be limiting bald eagle populations at this time (USDI 1999). Urban and recreational development, logging, mineral exploration and extraction, and other forms of human activities can adversely affect the suitability of breeding, wintering, and foraging habitat. While individual and small-scale actions may not appear to significantly affect the species as a whole, the cumulative long-term effects

throughout the recovery area pose an important threat to the recovery of the species (USDI 1999).

Availability of suitable trees for nesting and perching is critical for maintaining bald eagle populations. The primary objective of the bald eagle recovery process is to provide secure habitat for bald eagles within the recovery area, and to increase population levels in specific geographic areas to the extent that the species can be delisted. Achieving the recovery goal of increasing the number of nesting pairs within the recovery area requires protection of existing habitat for breeding and wintering bald eagles, and restoring habitat that has been lost due to development or habitat modification.

Nesting Habitat

Suitable habitat for bald eagles is characterized by accessible foraging areas and trees that are large enough for nesting and roosting (Stalmaster 1987). Food availability, such as aggregations of waterfowl or salmon runs, is a primary factor attracting bald eagles to wintering areas and influences nest and territory distribution (Stalmaster 1987, Keister et al. 1987).

Bald eagles generally nest in the same territories each year and often use the same nest repeatedly, although alternate nests in the territory may be used as well. Bald eagle nests in the Pacific Recovery Area are usually located in uneven-age stands of coniferous trees with old-growth forest components (USDI 1986) that are located within 1 mile of large bodies of water (Stalmaster 1987). Factors such as relative tree height, diameter, tree species, form, position on the surrounding topography, distance from the water, and distance from disturbance influence nest site selection. Anthony and Isaacs (1989) found that bald eagles construct nests in Douglas-fir (*Pseudotsuga menziesii*) or Sitka spruce *(Picea sitchensis*) trees with an average diameter of 170.7 centimeters (cm) diameter breast height (DBH) and a height of 56.6 meters (m) in Douglas-fir forests, and an average diameter of 106.8 cm DBH and a height of 38.6 m in mixed-conifer forests. Suitable perch trees, which bald eagles use for guarding the nest, loafing, and foraging, are also a component of suitable nesting habitat (Stalmaster 1987, Buehler 2000).

Wintering Habitat

Wintering bald eagles typically congregate in large aggregations where, most importantly, food is abundant (See Foraging). Suitable perch sites adjacent to foraging areas and winter roost habitat are also necessary. In Washington, these criteria are typically met where waterfowl and salmon populations are present, as well as marine areas (Stinson et al. 2001).

When foraging, bald eagles select perches that provide an unobstructed view of the surrounding area, generally the tallest trees in the area. Tree species commonly used in Washington for perching in winter include black cottonwood (*Populus trichocarpa*), bigleaf maple (*Acer macrophyllum*), Douglas-fir, or Sitka spruce (Stalmaster and Newman 1979).

Wintering bald eagles often roost at communal sites which provide shelter during inclement weather. Bald eagles may roost communally in single trees or large forest stands of uneven ages.

Bald eagles may remain at their daytime perches throughout the night as well, but typically gather at large communal roosts in the evening.

Communal night roosting sites are traditionally used year after year. Roost trees are usually the largest and have the most open structure (Keister and Anthony 1983, Watson and Pierce 1998a). They are often located in areas that provide a more favorable microclimate during inclement weather (Keister et al. 1985, Knight et al. 1983, Watson and Pierce 1998a). Prey sources may be available in the general vicinity, but for roosting, close proximity to food is not as critical as the need for shelter. In Washington, 26 roosts studied by Watson and Pierce (1998a) were all within 1,100 m of foraging areas. However, Stalmaster (1987), in reviewing a variety of studies found that only 40 percent were within 1 kilometer of water.

Human Disturbance

Human disturbance is a continuing threat, which may increase with increasing human populations and development (USDI 1999). Bald eagles vary in their sensitivity to disturbance, but generally nest away from human disturbance (Stinson et al. 2001). However, distance, duration, visibility and position of an activity affect bald eagle response, with distance being the most important factor (Grubb and King 1991, Grubb et al. 1992, Watson 2004). The response of nesting bald eagles to human activity can range from behavioral, such as flushing, or reduced nest attendance, to nest failure (Fraser et al. 1985, McGarigal et al. 1991, Grubb and King 1991, Grubb et al. 1992, Anthony et al. 1995, Steidl and Anthony 1996, Watson and Pierce 1998a). Wintering bald eagles may also be displaced from foraging areas by human activities (Stalmaster and Newman 1978, Stalmaster and Kaiser 1998). The magnitude of response varies inversely with distance, and increases with disturbance duration, the number of vehicles or pedestrians per event, visibility, sound, and position in relation to nest (above, at eye-level, or below the nest) (Grubb and King 1991, Watson 2004). Watson and Pierce (1998a) found that vegetative screening and distance were the two most important factors determining the impact of disturbances. Heavy vegetative screening can dramatically reduce bald eagle response to human activity. Human activities that are distant, of short duration, out of sight, few in number, below the nest, and quiet have the least impact (Grubb and King 1991, Watson 2004).

The effects from disturbance to nesting bald eagles vary, depending on the stage of nesting. In western Washington most bald eagles engage in courtship behavior in January and February, and begin to incubate their eggs by the third week in March. Young hatch by late April, and generally fledge during early to mid-July (Watson and Pierce 1998a). Anderson (1990) found in red-tailed hawks (*Buteo jamaicensis*), as well as in his review of other studies, that adults were more defensive as the parental investment in the young increased (and were therefore less likely to leave the nest unattended or abandon the nest). The natural exposure time from incubation to brooding also naturally increases (Watson and Pierce 1998a), and the bald eaglets began to thermoregulate at the age of 15 days (Bortolotti 1984), indicating that bald eaglets would be less affected by disruption of adult nest attendance as the nesting season progresses.

Contaminants

Contaminants, in particular organochlorine compounds such as DDT, are recognized as one of the primary causes of the decline of bald eagle populations (USDI 1986, 1999). DDT was banned, and registrations cancelled for other toxic persistent chemicals such as dieldrin, heptachlor and chlordane for all but the most restricted uses. The use of polychlorinated biphenyls has also been phased out. The reduction of these chemicals in the environment has resulted in a reduction of these levels of contaminants in bald eagles and a steady increase in bald eagle numbers (Schmitt and Bunck. 1995). However, residues of PCBs and Dichloro-diphenylethylene continue to depress productivity in certain locations such as the Channel Islands in California, the Great Lakes and the Lower Columbia River (USDI 1999). Bald eagles continue to be affected by accumulated chemicals such as mercury (USDI 1999), as well as poisoning by lead, organophosphorus and carbamate (Franson et al. 1995).

Foraging

An important component of bald eagle nesting and wintering areas is a consistent source of food. Fish and waterfowl are typically the most important food resource (Stalmaster 1987). Coastal and estuarine areas also provide abundant prey resources, including seabirds and marine invertebrates (Watson et al. 1991, Watson and Pierce 1998b). The availability of food resources is critical during brood rearing, when food limits survival of young (Stalmaster 1987).

Food resources govern the distribution of bald eagles in the winter. In Washington, salmon carcasses, particularly those of chum salmon (*Oncorhynchus keta*), are the most important food source (Watson and Pierce 2001). Because survival of bald eagles in their first year is typically low (Stalmaster 1987), winter food availability is important for survival. Stalmaster and Kaiser (1998) and Hansen and Hodges (1985) have also suggested that winter food shortages or disrupted winter foraging may result in reduced reproductive rates.

Summary

The bald eagle population in the Pacific Recovery Area continues to increase and the majority of recovery objectives have been met. The threats to bald eagles have been reduced, particularly impacts from contaminants and shooting. However, the loss of potential nesting and wintering habitat, and disturbance of bald eagles by humans continues. Threats from these factors have been reduced, but they continue to slow increases in bald eagle populations.

ENVIRONMENTAL BASELINE—Bald Eagle (in the action area)

Bald eagles use the Baker River basin for nesting, foraging, and overwintering. The project's reservoirs have supported up to four pairs of breeding bald eagles in recent years (Puget, 2002f; Puget, 2004c). Two nesting territories have been documented in use at Baker Lake between 1991 and 2003. One of these territories is located near the outlet of the Baker River at the head of Baker Lake. The other territory is located near Boulder Creek and has included at least three different nest sites. During 2002, a third nest territory was occupied near Thunder Creek on

Lake Shannon. Neither the Baker River nor the Boulder Creek territory was active during 2002, and the nest at the Baker River territory was blown out of the tree during the previous winter. One of the Baker Lake pairs may have shifted to the new territory at Lake Shannon during 2002. During 2004, three nest sites were active at Baker Lake, including a new nest near the Maple Grove Campground (Puget, 2004c). The Thunder Creek territory at Lake Shannon was inactive during 2004.

Appendix 3 shows the number of bald eagle chicks observed at each nest territory during summer surveys between 1991 and 2006. Some of the surveys were conducted by boat, which provided incomplete viewing of the nests; therefore, it is possible that chicks were present but not counted during these surveys. Aerial surveys, which provide better views of the nests, were conducted in 1992, 2000, 2001, 2003, 2004, 2005, and 2006. These surveys do not provide complete data on the number of young eagles that actually fledged. Between 1991 and 2004, a total of 13 chicks were observed during eight seasons at the Baker River territory. During the same period, five chicks were observed in five seasons at the Boulder Creek nest territory. In 3 years of surveys at the Thunder Creek nest territory on Lake Shannon, three chicks were observed during two nesting seasons. Two eggs (probably non-viable), one in 2004 and one in 2006 were observed in the new nest at Maple Grove since 2004. This nest had been observed previously, but had never been associated with actively nesting bald eagles (Puget, 2004c). Additional information obtained after publication of the FEIS reported activity at the Baker River and Thunder Creek territories in 2005 and 2006, but no chicks were observed. As in other areas of the State, the population of this species in the vicinity of the proposed action has continued to increase.

It is not known whether bald eagles nested along the Baker River prior to construction of the project reservoirs. Spawning summer steelhead and sockeye could have provided a food source during the nesting season (USFS 2002b). On the other hand, the reservoirs may have improved the quality of breeding habitat for bald eagles by creating a more dependable summer food source of fish and waterfowl. No specific data are available to verify these assumptions. The nearest active bald eagle nest site outside of the project vicinity is located on the Skagit River downstream of the Baker River confluence (Smayda Environmental Associates, Inc., 2003; WDFW, 2004).

Wintering bald eagles use the project's reservoirs in small to moderate numbers. No wintering roost sites are known to occur in close proximity to the reservoirs. No estimates of bald eagle winter use of the Baker River are available prior to construction of the project's two dams in 1924 (lower dam) and 1956 (upper dam). Chinook, coho, pink, and chum salmon as well as winter steelhead trout and coastal cutthroat trout could have provided a potential pre-project food resource for wintering bald eagles, with adult runs extending primarily from August through December.

Wintering bald eagles regularly congregate along the Skagit River from September to January to feed on salmon carcasses. The Skagit River can attract high numbers of bald eagles that feed primarily on chum salmon, but are also known to consume coho and steelhead (Stinson et al., 2001). Winter bald eagle distribution and abundance along the Skagit River is highly correlated with chum salmon abundance. Currently, mainstream Skagit River fall chum stocks are healthy

and production levels appear consistent with available habitat (WDFW and WWTIT, 1994). Several winter roost site are known to occur along the Skagit River. Some of these eagles likely use Baker Lake and Lake Shannon for foraging while wintering along the Skagit River.

EFFECTS OF THE ACTION—Bald Eagle

The Final FEIS described the project elements that may affect the bald eagle. Under the proposed action, Puget would operate the project in accordance with the Agreement. The Agreement specifies the construction of a new auxiliary powerhouse at the Lower Baker Development, a modified reservoir and flow release regime, and various other protection, mitigation and enhancement measures in the form of 50 proposed license articles. License articles listed in Appendix 1 Project Description and Effects indicate those articles that could potentially have adverse effects to eagles and eagle habitat and which articles would have no effect or insignificant effects on bald eagles.

The proposed action is likely to benefit bald eagles by increasing the forage base in the Baker River, the two project reservoirs (Lake Shannon and Baker Lake) and, to a lesser extent, the Skagit River. The proposed action may also increase disturbance to individual bald eagles as a result of the construction and operation of power generating facilities; reservoir management; improvements, expansion and use of recreational facilities such as campgrounds, roads, and trails; and increased recreational boat traffic and associated visitor/angler use in the reservoirs. Increased human activity as a result of project improvements may also limit or preclude eagles from utilizing some areas within the project area for foraging, roosting, and nesting in the future.

Project Facilities, Operations, and Flood Control

The following articles may affect, but are not likely to adversely affect bald eagles:

- Article 106 Flow Implementation
- Article 107 Flood Control

To meet proposed ramping rates and to generate additional power with proposed minimum flows, the proposed action includes partial rehabilitation of the original power generating facilities at the Lower Baker Development that were destroyed by the 1965 landslide. A new auxiliary powerhouse with two new 750-cfs turbine-generators would be installed on existing penstocks using the concrete foundation of the original 1925 powerhouse located adjacent to and immediately north (upstream) of the existing Lower Baker powerhouse. The powerhouse would be a 170-ft-long by 100-ft-wide reinforced concrete building.

To protect the new powerhouse against any potential landslide, a substantial concrete superstructure would be built to withstand the backfill and surcharge load resulting from a typical landslide. It would house the two new turbine-generators, two new 17,000-kilovolt amperes transformers, and associated mechanical and electrical support equipment. The new auxiliary powerhouse would be connected to the existing Unit 3 powerhouse at its north end, and would include a connecting stairway. The new auxiliary powerhouse superstructure would

extend the existing powerhouse profile and include a sloping roof ranging from 30 to 70 ft in height, and would have two steel roof hatches for access to the turbine-generators and the transformers. The roof and roof hatches would be capable of withstanding the external loads resulting from landslide overburden. Crane rails for the existing overhead gantry crane at Unit 3 would be extended some 170 ft north for installation and maintenance of the new equipment. Additional access for construction, operation, and maintenance of the new facilities would be provided by a new access platform to be built adjacent to the west of the auxiliary powerhouse foundation.

Two new 750-cfs, horizontal-shaft Francis turbine-generators would be connected to existing abandoned 7-ft diameter penstocks. The new turbines would have a stainless-steel runner diameter of 5.58 ft, rotate at 360 rpm, and produce 15 MW. A horizontal synchronous generator would be direct-connected to each turbine and provide an output voltage of 13.8 kilovolt amperes to the low voltage side of a step-up transformer. Each new turbine configuration would include a new 84-inch butterfly valve that would serve as a turbine guard valve. The new units would be configured to operate in synchronization with the existing Unit 3, enabling a continuous discharge at all times when the penstocks are watered up.

Construction activity is not expected to affect nesting bald eagles as no nesting territories are located in close proximity to the powerhouse site. The closest known nesting territory is approximately 2 miles away, along the Skagit River.

The noise and human activity associated with construction could affect bald eagles by temporarily displacing them from foraging and perching habitat in the vicinity of the Lower Baker powerhouse. Preliminary site investigations and excavation of old facilities would occur over an approximately 3-month period prior to construction; this activity is tentatively scheduled to occur from late March through late May. Construction of the powerhouse facility is expected to occur primarily during a 24-month period, with winter outdoor work shutdowns occurring between late November and early March. The proposed construction schedule would result in the majority of sound-generating activity occurring outside of the documented peak bald eagle wintering period at Lake Shannon, December through February, and outside of the generalized critical winter roost period identified for Washington State of November 15 through March 15 (Watson and Roderick, 2002). Any displacement of bald eagles resulting from the powerhouse reconstruction would be temporary and would affect only a localized portion of the available foraging and perching habitat in the basin. Once construction is completed, no measurable increase in disturbance to bald eagles is anticipated. Therefore the effects from construction of the new turbines and improvements to the powerhouse are expected to be insignificant.

Under Article 106, Puget would operate the project in accordance with an Interim Protection Plan (IPP) for the first 6 years. Under the IPP, Puget would moderate flows in the Skagit River by limiting flow reductions attributable to the project and by capturing high flows or augmenting low flows in order to improve spawning conditions for Chinook salmon. Puget would also use best efforts to protect other species of salmonids by reducing the project's maximum generation from 4,100 to 3,200 cfs; by investigating ways and using best efforts to reduce ramping rates; and by limiting the amount of daily amplitude change and minimizing the difference between spawning and incubation flows. Within 6 years of license issuance, Puget would install two new

turbine-generators in the new auxiliary powerhouse, described previously, giving Puget the operational flexibility to implement new minimum flows, maximum flows and ramping rates specified in Article 106. These actions should subsequently improve the forage base for eagles, particularly those that winter in the vicinity of the project.

Under Article 107(a), Puget would continue to provide up to 74,000 acre-ft of storage for flood control at the Upper Baker Development if requested by the ACOE. Up to 16,000 acre-ft would be provided from October 15 to March 1 and up to an additional 58,000 acre-ft would be provided from about September 1 to April 15. These provisions would provide storage about two weeks earlier and about 6 weeks longer than current operations (if requested by the ACOE). Finally, Article 107 would provide up to 29,000 acre-ft of storage for flood control at the Lower Baker Development from October 1 to March 1 upon the ACOE's request. This storage would be in addition to any storage provided at the Upper Baker Development.

No direct effects would be expected to occur to wintering or breeding bald eagles as a result of the reservoir level management regime to be implemented under the proposed action. The reservoirs would be managed under the current regime for the next 6 years, until the Lower Baker power plant modifications are completed. At that time, the new management regime would be implemented; typical reservoir patterns of winter drawdown and summer high water levels would not change under the new regime, so no new areas would be subject to inundation. Reservoir management will continue to preclude or delay 2,269 acres of habitat in the fluctuation zone from developing into potentially suitable bald eagle roosting or nesting habitat.

No adverse effects are expected to occur to wintering or breeding bald eagles as a result of the project releases to be implemented under the proposed action. Project releases from the Upper and Lower Baker developments would remain at current levels until the Lower Baker power plant modifications are completed. At that time, increased minimum flow and seasonal ramping rate requirements would be implemented. Over time, the IPP is expected to result in reduced levels of fish stranding and redd dewatering, contributing to greater fish productivity. Increases in the availability of salmon as a food resource could benefit bald eagles, primarily during the winter season when the majority of the salmon runs occur.

Aquatics

The following aquatics article is not well-defined in the FEIS and has a potential to adversely affect bald eagles:

- Article 110 Shoreline Erosion

<u>Shoreline Erosion</u>

Article 110 would require Puget to develop a Reservoir Shoreline Erosion Control Plan (Erosion Control Plan). Under this plan, Puget would evaluate individual eroding sites, propose site-specific treatment measures, prioritize sites for treatment, monitor treated and untreated sites, and update the plan every 5 years. This plan would ensure that ongoing shoreline erosion and

ongoing erosion in drawdown areas are addressed. No specific site locations or treatments have been identified.

Although project locations and specific treatments have not been identified, we anticipate heavy equipment will be necessary to treat at least some of the sites. Sound generated by heavy equipment and increased human activity during construction could temporary displace foraging and perching eagles. Sites located within 400 meters and 800 meters line of site from an active bald eagles nest may disturb nesting eagles. This level of disturbance could be avoided if sites were chosen based on their proximity (not within 800 meters) to nesting territories or if construction occurred outside of the nesting season (January 1 to August 15).

Suitable perching and nesting trees close to the water's edge may need to be removed prior to stabilizing the banks. If only a few large trees are removed per site, impacts to the availability of suitable perch and nest trees are expected to be minimal. Removing several large trees per site could have a greater impact on the availability of perch and nest trees. We do recognize that stabilizing areas of chronic erosion can prevent other large trees from falling into the reservoirs and such actions could preserve suitable stands of trees that would otherwise be lost to shoreline erosion. Once treated, stabilized sites are not expected to further limit or preclude eagles from foraging, roosting, or nesting in close proximity to these areas in the future. Based on the availability of suitable foraging, and perching habitat in the basin, the effects to perching and foraging bald eagles are expected to be insignificant. Depending upon the location of erosion sites to be stabilized and the proximity to nest trees, this activity has a potential to adversely affect nesting bald eagles. Additional section 7 consultations with the USFS may be necessary once specific sites and treatments are known.

The following aquatics articles may affect, but are not likely to adversely affect bald eagles:

- Article 101 Fish Propagation
- Article 103 Upstream Fish Passage
- Article 104 Fish Connectivity Between Reservoirs
- Article 105 Downstream Fish Passage

<u>Fish Propagation</u>

Under Article 101, Puget proposes to develop and implement a fish propagation facilities plan (FPFP) to support fish propagation and enhancement programs. Puget would develop the FPFP through consultation with the Aquatics Resources Group. Implementing the FPFP would necessitate construction of new facilities and modification of existing facilities to support fish propagation and enhancement programs. Construction activities associated with fish propagation consist of the following: 1) Improving Spawning Beach 4 by separating the spawning beach chambers with concrete walls, installing separate water supply lines to each spawning beach chamber, and installing a sediment separator in the water supply lines. Puget also may need to stabilize a historic landslide to prevent material from moving into the water supply for the spawning beach, 2) Expanding the hatchery facility at the Sulphur Springs site within the previously disturbed footprint, and 3) Decommissioning the Upper Baker spawning beaches, which would likely include demolition of the existing water intake structure in Channel Creek

and removal of all structures followed by the creation of a meandering side channel to Channel Creek.

Construction activities associated with fish propagation will generate sound from heavy equipment and will involve increased human activity. Construction activities at all sites are expected to last a relatively short duration and should be completed during the first several years of license implementation. No overstory trees are anticipated to be removed during the construction. Short-term effects may include the displacement of bald eagles that could otherwise perch and forage in the vicinity of the construction sites. Any displacement of bald eagles resulting from this construction would be temporary and would affect only a localized portion of the available foraging and perching habitat in the basin, therefore the effects to foraging and perching bald eagles would be insignificant.

Improvements to fish propagation facilities are expected to have no effect on nesting eagles. Currently, none of the sites is located in close proximity to a known eagle nesting territory. It is not likely but possible that a nest could be constructed in these areas prior to construction activities as construction of these facilities would occur during the first 5 years after the license is granted. If this occurs, construction activities within 400 meters and 800 meters line of sight could disturb nesting eagles. Adherence to timing restrictions would minimize this disturbance so that effects to nesting bald eagles would be insignificant.

Increased infrastructure and human activity associated with fish propagation post-construction are not likely to further limit or preclude eagles from foraging, roosting, or nesting in close proximity to these facilities in the future and would have no effect on bald eagles.

Improvements to fish propagation facilities are expected to increase production and distribution of forage fish over the 50-year license term. Eagles that forage, nest, and winter in the vicinity of the project should benefit from increases in the number of fish produced in the Baker and Skagit River systems as a result of improved fish propagation facilities and the demolition and restoration of the Upper Baker spawning beaches.

Upstream Fish Passage and Connectivity between Reservoirs

Puget is required to provide safe and effective upstream passage of salmonids at the Baker River Project by using trapping, sorting, holding, and hauling facilities located on the Baker River and other operations and facilities as appropriate for the Baker River Project, in accordance with Article 103. Upstream passage facilities include the construction of new facilities and renovations to existing facilities. New facilities will likely be constructed near or adjacent to the existing Baker adult fish trap or otherwise within disturbed areas such as parking lots or areas of riprap. A fishway to improve connectivity between Lake Shannon and Baker Lake will be installed in the Baker River or Sulphur Creek, just downstream of Upper Baker Dam, in accordance with Article 104.

Construction of the upstream fish passage facilities and fishway will generate sound from heavy equipment and will involve increased human activity. Construction is expected to be of a relatively short duration and should be completed during the first several years of license implementation. No overstory trees are anticipated to be removed during the construction of fish

passage facilities, and few, if any, overstory trees are expected to be removed during the construction of the fishway. Short-term effects to eagles may include the displacement of bald eagles that could otherwise perch and forage in the vicinity of the construction sites. Few large trees are expected to be removed, having minimal impact on the availability of suitable perch sites. Therefore, effects to perching and foraging bald eagles from construction of these facilities are expected to be insignificant.

Construction of fish passage facilities and fishway are expected to have an insignificant effect on nesting eagles. Currently, neither of the sites is located in close proximity to a known eagle nesting territory. The closest nesting territory to the proposed upstream facility at Upper Baker Dam is more than 2 miles at Maple Grove on Baker Lake. The closest nesting territory to the Baker adult trap is 1.5 miles away along the Skagit River. It is not likely but possible that a nest could be constructed in these areas prior to construction activities as construction of these facilities would occur during the first 5 years after the license is granted. If this occurs, construction activities within 400 meters and 800 meters line-of-sight could disturb nesting eagles. Adherence to timing restrictions would minimize this disturbance so that effects to nesting bald eagles would be insignificant. The minor amount of increased human activity and infrastructure associated with improvements to upstream fish passage and fishway following construction activities is not likely to further limit or preclude eagles from foraging, roosting, or nesting in close proximity to the facilities in the future and would have no effect on nesting bald eagles.

Operation of the fish passage facilities and the fishway are expected to increase production and distribution of forage fish over the 50-year license term. Eagles that forage, nest, and winter in the vicinity of the project should benefit from increases in the number and distribution of fish produced in the Baker River, the reservoirs, and, to a lesser extent, the Skagit River as a result of improved fish passage facilities and fishway.

Downstream Fish Passage

To improve downstream migration of fish, Puget would construct and operate passage facilities for downstream migratory fish at the Upper Baker and Lower Baker developments using floating surface collector (FSC) technology. Implementing this measure would include the preparation of launch sites on both Baker Lake and Lake Shannon for the FSCs fabrication, the installation of FSCs in Baker Lake adjacent to Upper Baker Dam and in Lake Shannon adjacent to Lower Baker Dam, and the construction of acclimation facilities located near the confluence of the Baker and Skagit Rivers. The FWS completed section 7 consultation on the preparation of launch sites for the Upper Baker FSC on February 10, 2005.

Construction and use of the upper Baker Lake FSC is expected to have no effect on nesting bald eagles, as no known nest sites are located in the vicinity. The nearest known bald eagle nest site is at Maple Grove, approximately 2 miles north of the site, on the east side of Baker Lake. It is not likely but possible that a nest could be constructed in this area prior to construction activities as construction of this facility would occur during the first 1-2 years after the license is granted. If this occurs, construction activities with in 400 meters and 800 meters line-of-sight could disturb nesting eagles. Adherence to timing restrictions would minimize this disturbance so that effects to nesting bald eagles would be insignificant.

Wintering bald eagles could be temporarily disturbed and/or displaced from foraging or perching activity as a result of noise and human activity associated with the FSC construction. Temporary increases in sound levels would occur from construction vehicles and activities during the construction of the FSC (1 calendar year). Displacement of bald eagles resulting from FSC construction would be temporary and would affect a localized portion of the available wintering bald eagle habitat in the basin, and therefore the effects on wintering bald eagles would be insignificant.

Construction of the Lower Baker FSC and launch site would not affect nesting bald eagles as no known nest sites are located in the vicinity. The nearest known bald eagle nest site is along the Skagit River, more than 2 miles from the proposed FSC site at the Lower Baker dam. The Thunder Creek nest site is almost 3 miles north of the FSC construction and launch site. It is not likely but possible that a nest could be constructed in these areas prior to construction activities as construction of this facility would occur during the first 5 years after the license is granted. If this occurs, construction activities with in 400 meters and 800 meters line-of-sight could disturb nesting eagles. Adherence to timing restrictions would minimize this disturbance so that effects to nesting bald eagles would be insignificant.

Construction sound and activity at the Lower Baker FSC construction and launch site may temporarily displace foraging or perching bald eagles in the vicinity during two successive winters, including portions of the critical roost period (Watson and Roderick, 2002) of November 15 through March 15. During the third winter of the construction, activity would be limited to restoration work, which would rely primarily on manual installation of plant materials, with very limited use of heavy equipment. Displacement of bald eagles resulting from FSC construction would be temporary and would affect a localized portion of the available foraging and perching bald eagle habitat in the basin, and therefore the effects on foraging and perching wintering bald would be insignificant.

Approximately 7 acres of reservoir drawdown zone would be affected by construction of the Lower Baker FSC and launch site. This area is primarily non-vegetated or sparsely vegetated. Shoreline habitats dominated by the invasive weed reed canary grass (*Phalaris arundinacea*) and upslope, previously disturbed habitats characterized by deciduous tree and shrub species, would also be affected. Portions of the site not needed for permanent facilities would be re-vegetated upon completion of construction. Individual trees that could be used as bald eagle perches may be removed; however, no known perch or roost trees would be cleared, therefore the effects on perching and roosting bald eagles would be expected to be insignificant. Once constructed and moved into place, the FSCs are not expected to further limit or preclude eagles from foraging, roosting, or nesting in close proximity to the facilities in the future and therefore are expected to have no effect on foraging, roosting or nesting bald eagles. Operation of the downstream FSCs is expected to increase production and distribution of forage fish over the long-term.

The following aquatics articles are expected to have no effect on bald eagles:

- Article 102 Aquatic Reporting
- Article 108 Gravel Augmentation

- Article 109 Large Woody Debris
- Article 401 Water Quality

These articles are either reporting or planning tasks that would occur in an office type setting or their implementation in the project area would have no effect on bald eagles or their habitat. Article 401 would improve water quality of the reservoirs and would have no effect on bald eagles.

Article 102 is a reporting requirement for all aquatic articles and is a task that would occur in an office setting. Its implementation in the project area would have no effect on bald eagles or their habitat. Article 108 requires the licensee to track gravel aggradation in the Skagit and supplement with gravel as needed to off-set gravel interruption by the projects. Article 109 requires the development of a plan to collect floating wood and make it available for habitat projects by other groups. These articles would have no effect on bald eagles or their habitats.

Recreation

The following recreation articles are not well-defined in the FEIS and have a potential to adversely affect bald eagles:

- Article 302 Aesthetics Management Plan
- Article 305 Lower Baker Developed Recreation
- Article 306 Upper Baker Visitor Information Services
- Article 308 Managing Dispersed Campsites
- Article 309 Bayview Campground Redevelopment
- Article 310 Upper Baker Trail and Trailhead Construction
- Article 312 Developed Recreational Monitoring
- Article 316 USFS Road Maintenance and Paving

<u>Aesthetics Management Plan</u>

Among other activities, proposed Article 302, Puget would provide funds to the USFS to implement the following measures for non-project facilities in the vicinity of Baker Lake: 1) vegetation management at Panorama Point, Horseshoe Cove, Shannon Creek, Bayview Campground, and Maple Grove Campground, and 2) vegetation management between USFS developed sites and/or viewpoints, and Baker Lake in two to four yet to be identified locations averaging less than one-quarter acre in size. The specific vegetative management measures to be implemented at the USFS sites and the two to four locations averaging less than one-quarter acre in size are not identified in the proposed article.

Sound from equipment and increased human activity during vegetation-management activities could temporarily disturb perching and foraging eagles. Removal of overstory trees could occur at five known sites and at an additional two to four sites not yet identified. The two to four sites not yet identified could be as much as a quarter acre in size per site. Removal of overstory trees could have localized effects on the number of trees available for foraging, roosting, and nesting

eagles. Additional section 7 consultations by the USFS may be necessary once specific sites are identified and vegetation management activities at each site are known.

Lower Baker Developed Recreation

Within 1 year of license issuance, Puget would, in cooperation with Skagit County, initiate efforts to acquire a public access site on Lake Shannon for the purpose of providing boat access to Lake Shannon. Site acquisition and selection criteria shall be developed in consultation with the Recreation Resources Group, of which FWS is a participating member. This action shall include, and may be limited to, identifying an access area suitable for the construction of a concrete boat launch, parking area, and day use area, that has an existing road access, commensurate with the State's Organization for Boating Access ("SOBA") Design Handbook for Recreational Boating and Fishing Facilities standards for small access sites.

Lower Baker Developed Recreation will generate sound from heavy equipment and will involve increased human activity. Construction is expected to last a relatively short duration. Overstory trees may be removed to accommodate boat access to Lake Shannon. Short-term effects to eagles may include the displacement of bald eagles that could perch, forage, and nest in the vicinity of the construction site. Removal of overstory trees could have a localized affect on the number of perch sites available for foraging and roosting bald eagles. A developed boat access site may limit or preclude eagles from foraging, roosting, or nesting in the vicinity of the boat access in the future. An increase in human disturbance over the term of the license could have adverse affects on foraging and roosting bald eagles.

Currently, no bald eagle nesting territories occur on Lake Shannon. The nearest nesting territory is located along the Skagit River approximately 2 miles away, and therefore, no impacts to nesting eagles are anticipated as long as no new nesting territories develop along Lake Shannon. Since this license article anticipates that it could take as long as 10 years to acquire and construct a boat access facility, new territories could be established along Lake Shannon over that period. If new territories are established, construction at the selected site could adversely affect bald eagles if it occurs within 400 meters or 800 meters line-of-sight of a bald eagle nest or roost site. Prolonged disturbance could lead to reduced feeding opportunities or nest abandonment. These levels of disturbance could be avoided if sites were chosen based on their proximity (not within 800 meters) to nesting territories or if construction occurred outside of the nesting season (January 1 to August 15).

Providing boat access to Shannon Lake would increase boat traffic on the lake, in turn, resulting in increased disturbance to nesting, foraging, and roosting eagles over the license term. Not only is disturbance to eagles anticipated in the immediate vicinity of the boat access site, but an increase in human presence on the lake can be expected to occur. An increase of boat activity on the lake could negatively impact the overall use of the lake and riparian zone of influence by eagles. As a result, eagles may not build new nests in close proximity to the shoreline, and roosting, perching, and foraging eagles could be disturbed or displace more frequently. An increase in human disturbance of eagles due to this activity over the term of the license could have adverse affects on foraging and roosting eagles.

Due to the lack of a specific project location, we are unable to make an effect determination on site-level impacts at this time. Therefore, depending upon the location of the site, future section 7 consultations may be necessary.

Upper Baker Visitor Information Services

Article 306 would require Puget to provide funds to the USFS for: 1) constructing and operating an Upper Baker Visitor Information Services Station (VIS) with parking, information kiosks, and sanitation facilities at Baker Lake, 2) USFS staff for visitor information services at Baker Lake from Memorial Day through Labor Day, and 3) USFS staff at its VIS in Sedro Woolley, Washington from Memorial Day through Labor Day.

Construction activities could generate sound and involve increased human activity. Construction is expected to last a relatively short duration. Overstory trees may be removed to accommodate the VIS. Short-term effects to eagles may include the displacement of bald eagles that could perch, forage, roost, and nest in the vicinity of the construction site. Removal of overstory trees could have a localized effect on the number of perch sites available for foraging and roosting eagles. A developed site with increased human presence may limit or preclude eagles from foraging, roosting, or nesting in the vicinity of the VIS in the future. Due to the lack of a specific project location, we are unable to make an effect determination at this time. Therefore, depending on the location of the VIS, future consultation with the USFS may be necessary.

Managing Dispersed Campsites

Under Article 308, Puget would make funds available to the USFS for the purposes of contributing to the preparation and implementation of a Dispersed Recreation Management Plan (DRMP). The DRMP may describe management actions, routine operations and maintenance, monitoring objectives, and design plans to carry out hardening actions at three to six high-priority sites. The DRMP may also include descriptions of initial management actions which are intended to limit the adverse impacts of dispersed recreation use through increased monitoring, routine maintenance, information, and site hardening.

Construction could generate sound and involve increased human activity. Construction is expected to last a relatively short duration. Overstory trees maybe removed to improve dispersed campsites. Short-term effects to eagles may include the displacement of bald eagles that could otherwise perch, forage, and nest in the vicinity of the construction sites. Removal of overstory trees could have localized effects on the number of perch and nest sites available for foraging, roosting, and nesting eagles.

A developed site with increased human presence may limit or preclude eagles from foraging, roosting, or nesting in the immediate vicinity of these dispersed campsites in the future. An increase in human disturbance of eagles due to this activity over the term of the license could have adverse affects on foraging and roosting bald eagles.

Due to the lack of a specific project location, we are unable to make an effect determination at this time. Therefore, depending on the location of the dispersed camp sites, future consultation with the USFS may be necessary.

Bayview Campground Redevelopment

Article 309 would make funds available to the USFS for the purpose of contributing to the rehabilitation and reconstruction of the 28-unit Bayview Campground. Funds may be used to contribute to rehabilitation and reconstruction of the existing campground to a similar level of development as other USFS sites developed according to USFS "Development Level 4,[1]" as defined in "Recreation Management Systems, Meaningful Measures for Quality Recreation Management, dated January 2002, as amended, and "Built Environment Image Guide for National Forests and Grasslands," dated December 2001.

Construction activities could generate sound and involve increased human activity. Construction is expected to last a relatively short duration. Overstory trees may be removed to improve Bayview Campground. Short-term effects to eagles may include the displacement of bald eagles that could otherwise perch, forage, and nest in the vicinity of the campground during construction. Removal of overstory trees could have localized effects on the number of perch sites available for foraging, roosting, and nesting eagles.

Improvements to this campground could result in increased human presence which may further limit or preclude eagles from foraging, roosting, or nesting in the vicinity of Bayview Campground in the future. Improvements could also result in greater recreation use of areas around the campground and Baker Lake. An increase in human disturbance of eagles due to this activity over the term of the license could have adverse affects on foraging and roosting eagles.

Although we know the general location of Bayview Campground, we do not have site-specific details about the work that will be planned there. Due to the lack of a site plan, timing of project implementation and specific details about construction at this site, we are unable to make an effect determination. Therefore, depending on the exact plan for Bayview Campground, future consultation with the USFS may be necessary.

Upper Baker Trail and Trailhead Construction

Within four years following license issuance, Puget would make funds available to the USFS for the purpose of contributing to trail-based recreation in the project vicinity (Article 310). The funds are intended to contribute to USFS efforts to provide up to 6 miles of new multi-season, multi-use, non-motorized trails. Funds made available may be used for trail planning and construction consistent with the USFS trail development standards, as set forth in the "Trails Management Handbook, FSH 2309.18."

Construction could generate sound and involve increased human activity. Construction is expected to last a relatively short duration. Overstory trees may be removed to construct the trailhead and trail. Short-term effects to eagles may include the displacement of bald eagles that

[1] Level 4 Definition: Site heavily modified. Some facilities designed strictly for comfort and convenience of users. Luxury facilities not provided. Facility design may incorporate synthetic materials. Extensive use of artificial surfacing of roads and trails. Vehicular traffic controls usually obvious. Primary access usually over paved roads. Development density 3-5 family units per acre. Plant materials usually native. Interpretive services often formal or structured.

could otherwise perch and forage in the vicinity of the construction. Removal of overstory trees could have localized effects on the number of perch sites available for foraging, roosting, and nesting eagles. Improvements to trails could result in increased human presence which may limit or preclude eagles from foraging, roosting, or nesting in the vicinity of trailhead and trail. An increase in human disturbance of eagles due to this activity over the term of the license could have adverse affects on foraging and roosting eagles.

Due to the lack of a specific project location and exact description of the project and timing, we are unable to make an effect determination at this time. Therefore, depending on the location of the new trails, future consultation with the USFS may be necessary.

Developed Recreational Monitoring

Under Article 312, Puget would prepare a Developed Recreation Monitoring and Funding Plan that would provide for monitoring site use and occupancy levels at several USFS campgrounds including Horseshoe Cove, Panorama Point, Bayview, and Shannon Creek and at Puget's Baker Lake Resort. Data would be provided to the USFS annually and monitoring results would be evaluated no later than 8 years after license issuance to determine if additional capacity is warranted. Puget proposes that expansion of the Baker Lake Resort campground would be warranted when monitoring documents that the average site occupancy for Horseshoe Cove, Panorama Point, Bayview, Shannon Creek, and Baker Lake Resort is 60 percent or greater during July and August for 2 consecutive years. If that benchmark is reached, Puget would provide funds to the USFS for developing additional capacity, as specified in the Recreation Implementation Schedule.

No effects to bald eagles are anticipated as a result of monitoring activities only; however, expansion of campground capacity could potentially have adverse effects to bald eagles. When and where those effects would occur is undeterminable at this time. If expansion occurs, construction activities could generate sound and involve increased human activity, although the duration would be relatively short. Short-term effects to bald eagles may include the displacement of bald eagles that could otherwise perch, forage, and nest in the vicinity of one or more campgrounds during construction. Expansion of campgrounds could also result in removal of overstory trees which could limit or preclude bald eagles from foraging, roosting, or nesting in the vicinity.

Campground expansion could result in increased human presence which may limit or preclude bald eagles from foraging, roosting, or nesting in the vicinity. It is possible that new nesting territories could be established prior to the expansion of one or more campgrounds mentioned. If this occurs, sites within 400 meters and 800 meters line-of-sight from an active bald eagle nest may result in disturbance to nesting bald eagles which can lead to reduced feeding opportunities for young eagles or nest abandonment. Disturbance can be avoided if sites targeted for expansion are chosen based on their proximity to nesting territories (400 meters or 800 meters line-of-sight to nest trees or if construction occurs outside of the nesting season (January 1 to August 15).

Due to the lack of a specific project site or plans for campground expansion, should they occur, we are unable to make an effect determination at this time. Therefore, depending on the sites

that may eventually be selected for expansion, future consultation with the FERC or the USFS may be necessary.

USFS Road Maintenance and Paving

Within 6 months of license issuance, and annually thereafter, Puget would make funding available to the USFS for the purpose of contributing to the routine maintenance of portions of up to 25 miles of the following existing Forest Roads (Article 316) directly providing access to the project and project-related facilities: FR 11 (Baker Lake Highway); FR 1106 (Depression Lake); FR 1107 (Anderson Road); FR 1118 (Horseshoe Cove and Bayview); FR 1122 (Lower Sandy Creek); FR 1136 (Lower Boulder Creek); FR 1137 (Panorama Point); FR 1142 (Baker Lake Resort); FR 1150 (Shannon Creek Campground); and FR 1168 (Baker River Trailhead North). Funding is intended to be used, in part, to pave FR 1106 during the sixth year following license issuance and for periodic resurfacing.

Sound from heavy equipment could disturb perching and foraging eagles during the periodic maintenance of 25 miles of road and paving up to an additional 6 miles of road. An increase of human activity during road maintenance could also disturb foraging, perching, and nesting eagles. Road improvements especially paving FR1106, could lead to an increase in the level of human activity on these roads and in adjacent areas over the license term. Such activity could further limit or preclude foraging, roosting, or nesting eagles from using areas in close proximity to these roads in the future. The USFS has completed section 7 consultation for these activities through 2007. Depending upon site specific plans for this type of work in the future, additional section 7 consultations may be necessary.

Potential Effects from Increased Recreational Use

As discussed earlier in this biological opinion, we believe that some level of increased recreation use will result because of improvements to campgrounds and other facilities that are provided by the recreation articles. The actual amount of increased recreational use that any individual license article would contribute is probably minimal; however, for the project area over the life of the license, there will be some increase that could significantly affect bald eagles.

The principal source of effects to bald eagles from increased recreation in the action area is disturbance caused by the anticipated increase in boating, hiking, camping, and fishing. The proposed action, which includes improvement and/or construction of roads and trails, expanding and improving campgrounds and other recreational facilities, creation of a boat access, and improvements to fish passage and fish propagation facilities, will likely result in an increase of human use of the project area over the license term.

The USFS reports the number of dispersed campsites within the vicinity of the Baker River Project has increased by approximately 18 campsites per year, and demand for such sites is expected to increase between 7 and 15 percent by 2010 (USFS 2002a). Although this demand is expected to increase, much of the suitable land area at Baker Lake is already being used, potentially limiting additional use. The hardening of three to six dispersed campsites will likely not have an overall effect on the amount of dispersed sites used in the action area. Increases in

the number of campground sites and dispersed sites are expected to increase disturbance to foraging, roosting, and nesting bald eagles in the action area.

Over the terms of the license, boat traffic associated with these infrastructure improvements (campgrounds, boat ramp, and roads) is likely to flush eagles from perches and/or reduce the foraging efforts of individual bald eagles. The proposed fish propagation and fish passage facilities including the fishway between the two reservoirs will likely result in increases to the numbers and distribution of anadromous and resident fish using the Baker River and the two reservoirs. The FWS anticipates that both bald eagles and anglers would be attracted to the increased numbers of fish. Although improvements geared towards increasing the number and distribution of fish using the Baker River system are likely to provide an enhanced prey base, it may also lead to an increase in the number of anglers/boaters using the area. Although Washington recreational trend data projects that fishing is not likely to increase over the next two decades, boating in general, may. (FERC 2006). Boater and angler presence will disturb those bald eagles trying to forage on fish. The co-occurrence of foraging bald eagles and anglers/boaters is likely to flush bald eagles or reduce their foraging efforts.

Foraging bald eagles are susceptible to disturbance by boat traffic, but the effect of disturbance depends on the proximity of perch trees and foraging sites, as well as time of year. Foraging bald eagles on the Columbia River estuary maintained an average distance of 400 meters from stationary boats, and they responded to boat presence by reducing feeding time and the number of foraging attempts (McGarigal et al. 1991). However, bald eagles may also shift foraging areas based on boat traffic (Anderson, WDFW, pers. comm. 2006; McGarigal et al. 1991). Grubb and King (1991) found bald eagles were more often flushed from perches than nests and were most easily disturbed when foraging. Stalmaster and Kaiser (1998) found that bald eagle feeding on the Skagit River declined exponentially with increases in disturbance events associated with recreation. When more than 40 recreational events occurred per day there was an 89 percent reduction in bald eagle feeding time. Bald eagles also fed 30 percent less on the weekends when the recreational use was highest. Although increased boat use is not expected to change current traffic patterns or boat use areas associated with the reservoirs, an overall increase in boat traffic may cause an increase in disturbance of foraging bald eagles. Therefore, the FWS anticipates individual foraging bald eagles are more likely to be flushed from perches or reduce their foraging efforts as a result of increased boat traffic/angler presence over the term of the license.

Wintering bald eagles are also susceptible to disturbance on their foraging grounds. However, fishing on the Baker Reservoirs is closed in the winter. Most of the campgrounds are closed, and there is very little human presence in the area during that time of year. The potential for disturbance of wintering bald eagles due to increased recreational use is therefore expected to remain discountable in the future.

Nesting bald eagles are susceptible to disturbance by boat traffic, but the affect of disturbance depends on proximity to the nest, as well as time of year. There is a partial timing overlap between the bald eagle breeding season and the boating season. In the action area, bald eagles remain near nest sites from January through August, but eggs tend to hatch in April and bald eaglets typically fledge in June. The current operating seasons for boat launch facilities, depending on weather and snow-melt, are as follows: Shannon Creek and Panorama Point—one

week before Memorial Day through the weekend following Labor Day; Horseshoe Cove—second weekend in May through the third weekend in September; and Baker Lake Resort—first weekend in May through the first weekend in October. During the peak recreational season (June through August) there would be no change in boat launch usability under the proposed action. All four of the boat launches would be usable 100 percent of the time from June 1 to August 31.

The USFS estimates 6,000 people fish at Baker Lake and its tributaries each year, and 3,000 people boat and bank fish at Lake Shannon per year. Among the Baker Lake survey respondents who indicated they fish, approximately 50 percent fish from shore, 40 percent fish from a boat, and 10 percent fish from both the shore and a boat (Huckell/Weinman Associates, 2004c). Boating and fishing during late spring and early summer would avoid the sensitive period of nesting and incubation, but would coincide with the period when bald eagles are feeding young at the nest. Foraging bald eagles on the Columbia River estuary maintained an average distance of 400 meters from stationary boats, and they responded to boat presence by reducing feeding time and the number of foraging attempts (McGarigal et al. 1991). Grubb and King (1991) found bald eagles were more often flushed from perches than nests and were most easily disturbed when foraging. An increase in recreational boaters/anglers could further reduce feeding time and foraging attempts of adult bald eagles during the period of the year when they are feeding their young; nest abandonment as a result of increased boater/angler presence is less likely but still could occur.

With all these actions, disturbance to perching, foraging, nesting bald eagles is expected to increase over the license term adversely affecting eagles and precluding otherwise suitable habitat from being occupied and utilized by bald eagles. Use of the project area and measures developed under articles 512 for bald eagle management plans should help in the planning of recreational improvements while minimizing effects to bald eagles from increased use. Depending upon the type of projects and activities planned to fulfill the recreational articles, additional section7 consultations with the USFS may be necessary.

The following recreation articles may affect but are not likely to adversely affect bald eagles:

- Article 303 Baker Lake Resort Redevelopment
- Article 313 Upper Baker Developed Recreation Maintenance
- Article 314 Upper Baker Trail and Trailhead Maintenance

Baker Lake Resort Redevelopment

Article 303 would provide for the redevelopment of the resort at Baker Lake into a USFS "Development Level 3" campground, as defined in the USFS "Recreation Management Systems Meaningful Measures for Quality Recreation Management," dated January 2002, as amended, and the "Built Environment Image Guide for National Forests and Grasslands," dated December 2001. At a minimum, Puget would provide for the necessary decommissioning of the existing site in addition to what would be required under the termination of the Special Use Authorization, including building removal and the development of between 30-50 campsites.

The redevelopment plan for the Baker Lake Resort would include:

• Coordination of the removal of those structures and facilities associated with a "resort" and retention of facilities needed for a "Development level 3" campground.[2]

• Vegetation management on the site including thinning for overstory health, the use of native species for rehabilitation, erosion control, and screening between camping units, and vegetation removal to open views to the lake.

• Reconfiguring to decrease overall campsite density and/or to include a variety of types of site: single, double, group including removing and rehabilitating sites next to sensitive areas.

• Reconfiguring roads and parking areas to improve circulation patterns.

• Replacing or rehabilitating campsite features (table, fire pit, spurs, tent pads, dock, and boat ramp).

• Consideration for day use facilities including shelters suitable for interpretive or education programs.

• Reconstruction of the water system including an additional six communal water Sources, plus distribution lines and the installation of a generator to run the well and water system.

Redevelopment of Baker Lake Resort into a "Level 3" campground will generate sound from heavy equipment and will involve increased human activity during the time of construction. Construction is expected to last a relatively short duration. Overstory trees may be removed to accommodate demolition and construction activities, construct new campsites and campground buildings, reconfigure roads and trails, improve views of the lake, and manage forest health. Short-term effects to eagles may include the displacement of bald eagles that could otherwise perch and forage in the vicinity of the resort. Any displacement of bald eagles resulting from this construction would be temporary and would affect only a localized portion of the available perching and foraging habitat in the basin, therefore the effects are expected to be insignificant.

Redevelopment of Baker Lake Resort is expected to have no effect on nesting eagles. Currently, no nesting territories are located in close proximity to the site. It is not likely but possible that a nest could be constructed in these areas prior to construction activities as funding for construction of this facility would occur within the first 5 years after the license is granted. If this occurs, construction activities with in 400 meters and 800 meters line-of-sight could disturb

[2] Level 3 Definition: Site modification moderate. Facilities about equal for protection of natural site and comfort of users. Contemporary/rustic design of improvements is usually based on use of native materials. Inconspicuous vehicular traffic controls usually provided. Roads may be hard surfaced and trails formalized. Development density about 3 family units per acre. Primary access may be over high standard roads. Definition from: Meaningful measures for quality recreation management – developed sites costing instructions. USFS. February 2002.

nesting eagles. Adherence to timing restrictions would minimize this disturbance so that effects to nesting bald eagles would be insignificant.

Maintenance of Facilities and Trails

Articles 313 and 314 address routine maintenance of the Baker Lake developed areas and associated trails. Although these activities will occur in or adjacent to suitable bald eagle foraging, roosting or nesting habitat, normal campground and trail maintenance activities typically do not exceed ambient use of these sites and few, if any, impacts to habitat are expected to occur because of such activities. Therefore the effects of facility and trail maintenance on foraging, roosting or nesting bald eagles are expected to be insignificant.

The following recreation articles are expected to have no effect on bald eagles:

- Article 301 Recreation Management Report
- Article 304 Baker Reservoir Management Plan
- Article 307 Upper Baker Visitor Interpretive Services
- Article 311 Lower Baker Trail Construction
- Article 315 Lower Baker Trail Maintenance
- Article 317 Access to Baker Lake
- Article 318 Law Enforcement

Articles 301, 304, 307, and 318 are articles are reporting or planning tasks that would occur in an office type setting and their implementation in the project area would have no effect on bald eagles or their habitat.

Articles 311 and 315 allow for the construction and maintenance of the Lower Baker Trail. This 2 mile trail is situated close to the Town of Concrete. No bald eagles utilize this area and no bald eagle habitat is present, therefore, these articles are expected to have no effect on bald eagles. Article 317 requires the licensee to continue to assure public access to Baker Lake using FR 1106 across the Upper Baker River dam. This article represents no change in how the public access Baker Lake prior to this action; therefore, no effects to bald eagles are expected.

Terrestrial

The following terrestrial articles may affect, but are not likely to adversely affect bald eagles:

- Article 502 Deciduous Forest Habitat
- Article 503 Elk Habitat
- Article 504 Wetland Habitat
- Article 505 Riparian Habitat
- Article 515 Late Seral Forest

Articles 502, 503, 504, 505 and 515 will result in the acquisition and/or management of land for the protection of various habitats for at least the term of the license. Article 502 will result in the acquisition and management of deciduous forest lands. Article 503 will result in the acquisition

and management of lands for elk forage. Tree removal and/or habitat enhancement activities may take place under these articles. Because lands acquired under these articles are not currently suitable bald eagle habitat, we expect that any disturbance caused by land management activities would be insignificant. Current management will preclude such areas from developing into suitable bald eagle habitat. If managed under the intent of these articles, acquired lands would potentially develop into mature habitats suitable for bald eagle use, and therefore it is expected that the long term effects from these articles would be beneficial.

Articles 504 and 505 will result in the acquisition and management of wetland and riparian/aquatic habitat. Acquisition of these lands will protect habitat that could be used by bald eagles. Although some habitat enhancement activities could be undertaken, such as thinning, planting vegetation, or placement of habitat structures, it is unlikely that these activities would disturb bald eagles provided that timing restrictions are implemented. Article 515 provides for pre-commercial thinning of up to 321 acres of second-growth forest on USFS lands in the Baker River watershed and is intended to reduce edge effects on marbled murrelets and NSOs by accelerating the development of late-seral forest characteristics. Article 515 may involve timber-management activities, but these activities are not expected to significantly disturb bald eagle nesting, roosting, or foraging behaviors provided that timing restrictions are placed on any habitat enhancement activities within a quarter mile of any nest tree. Acquisition, protection, and/or management of deciduous forests, second-growth forests, wetlands, and riparian areas are expected to benefit bald eagles as the vegetation matures into suitable habitat or provides areas of minimal disturbance.

The following terrestrial articles are considered wholly beneficial to bald eagles:

- Article 512 Bald Eagle Night Roost Surveys
- Article 513 Bald Eagle Management Plans
- Article 517 Road Closures for Grizzly Bear

Article 512 Bald Eagle Night Roost Surveys and 513 Bald Eagle Management Plans will ensure that winter night roosts and nest sites on project lands, to include all lands acquired under the new license, are identified and the surrounding area managed for the protection of bald eagles. These articles are considered wholly beneficial to bald eagles. Article 517 would close some roads in the project area potentially minimizing disturbance to eagles. The USFS has already completed section 7 consultation on this activity.

The following terrestrial articles will have no effect on bald eagles:

- Article 501 Terrestrial Resource Management Plan
- Article 506 Osprey Nest Structures
- Article 507 Floating Loan Platforms
- Article 508 Noxious Weed Control
- Article 509 Special Status Plants
- Article 510 *Carax flava*
- Article 511 Decaying and Legacy Wood

- Article 514 Habitat Evaluation Procedures
- Article 516 Mountain Goats

Articles 506, 507, 508, 509, 510, 511, and 516 provide for artificial and natural osprey nest structures; installing and maintaining platforms for common loon nesting; managing project lands for the control of noxious weeds; managing plants of special status; the managing for the protection of yellow sedge; management through protection of snags, logs and residual live trees; and habitat improvements in the mountain hemlock zone. These activities would have no effect on bald eagles or their habitat. The remaining articles 501 and 514 are reporting or planning tasks that would occur in an office setting, and their implementation would have no effect on bald eagles or their habitat.

CUMULATIVE EFFECTS – Bald Eagle

Cumulative effects include the effects of future State, Tribal, local or private actions that are reasonably certain to occur in the action area. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of ESA.

Cumulative effects to the bald eagle may result from timber harvest and recreation activities in the action area. Land ownership and management in the watershed is dominated by Federal government holdings in the Mt. Baker-Snoqualmie National Forest (55.6 percent of the total watershed area) and in North Cascades National Park (30.4 percent), so development may not be as much of a concern. Over 99 percent of the watershed above Upper Baker Dam (RM 9.35) consists of Federal lands. Private and State holdings account for the remaining 14 percent of the watershed's area. The private and State holdings are primarily confined to the lower watershed tributaries entering Lake Shannon and to the Lower Baker River downstream of Lake Shannon. About 49 percent of the watershed is managed as wilderness, roadless areas, or national park. Recreation and management of lands for protection of natural values are the predominant land uses in the watershed. Most of the 14 percent of land in private and State ownership has been extensively harvested and is managed for silviculture. The Baker River Project, including Baker Lake and Lake Shannon, occupies about 5 percent of the watershed.

Timber harvest will somewhat reduce the amount of mid-successional, mature, and old-growth timber that would otherwise supply trees suitable for roosting, nesting, and foraging, but less than 14 percent of land in the watershed is managed for silviculture. These lands are generally confined to the lower portions of the watershed entering Lake Shannon and the Baker River below lower Baker Dam, so the reduction is more likely to occur adjacent to Lake Shannon. Currently, only one bald eagle nesting territory is located along Lake Shannon at Thunder Creek. Over the license term, fewer new nesting territories are expect to develop in the Lake Shannon area than the Baker Lake area because more land around Shannon Lake is in private ownership and subject to more frequent harvesting or possible development pressures. Noise during timber harvest could cause disturbance if implemented near a nest site during the breeding season or disturb or temporarily displace perching and foraging eagles if implemented near foraging sites. Again, this is more likely to occur in the Lake Shannon watershed. Increase in the number of

houses or other structures could also preclude eagles from nesting. The requirement by the State to prepare bald eagle management plans would be expected to minimize some of these effects.

The Baker River basin is accessible to more than 6.5 million people in northern Puget Sound and southern British Columbia via an approximate 2-hour drive (100 miles). The area is easily accessed by a system of county and USFS roads. The mountainous terrain, project reservoirs, and water courses offer spring, summer, and fall recreational opportunities including developed and dispersed camping, fishing, picnicking, swimming, hiking, boating, mountaineering, scenic driving, and environmental education and interpretation. Winter activities, such as cross-country skiing and snowmobiling, occur near the project. Long-term increases in human activity will increase over the license term at an increasing rate. Likely places that will experience this increase are campgrounds both established and dispersed, trails, along the shorelines, and on the reservoirs. Increased recreation, especially boating, is expected to negatively affect bald eagle foraging at the reservoirs and nesting and roosting nearby.

We expect that climate change will alter the ecosystem that supports bald eagles during the term of the license. Effects of climate change may alter the geographic or elevation range of bald eagles, may affect their forage species, and may affect bald eagles in ways that are currently unknown.

CONCLUSION – Bald Eagle

After reviewing the best scientific and commercial data available, the current status of the bald eagle, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the FWS's biological opinion that implementation of the proposed action is not likely to jeopardize the continued existence of the bald eagle.

Since 1989 the bald eagle nesting population has increased at an average rate of approximately 8 percent per year (USDI 1999). Bald eagle recovery goals have generally been met or exceeded throughout its range (USDI 1999). In the Pacific Recovery Area population delisting goals have been met since 1995, the productivity objective of an average of 1.0 young per occupied breeding area has been met since 1990, and the average success rate for occupied breeding areas of 65 percent has been exceeded since 1994 (USDI 1999). However, as of 1999, the distribution objective among management zones had not yet been fully achieved (USDI 1999).

Bald eagles were first observed nesting at the reservoirs in the action area in 1991. The number of bald eagle nest territories has increased since then to four. Fifteen chicks have been produced since surveys were first conducted, although no chicks were observed in 2006. Productivity (number of young per occupied territory) has ranged from 0.60 to 1.5 since 1991.

Construction activities would not result in a significant loss of suitable bald eagle habitat. Some tree removal will occur near project facilities as part of construction, in established campgrounds, at designated view points, and other recreational facilities. Overall, when compared to the amount of forested area within the action area, the ownership patterns in the watershed, and the management of these lands; the amount of overstory trees being affected by

the proposed action is not significant. Construction activities, where project locations are known, do not occur within 400 or 800 meters line-of-sight of a bald eagle nest or roost site. Other activities where location are unknown like dispersed campsites, Lake Shannon boat access and visitors information center may occur within the specified distances of a nest of 400 or 800 meters, but this is not anticipated, because such actions may require additional section 7 consultations and requirements by the State to prepare bald eagle management plans, which would be expected to minimize impacts to nests and winter roost sites.

Expansion of campgrounds and improvements in recreational facilities are expected to increase the number of recreationists in the action area and especially the number of boaters and, possibly, anglers. Increases in the number of people camping and hiking are expected to be greater at developed sites over the term of the license. Boat traffic associated with these increases in recreationists is anticipated to be likely to flush bald eagles from perches or reduce their foraging efforts. Although there is likely to be an increased number of boaters and anglers using the reservoirs over the period of the license, the pattern and timing of use of the reservoirs is not anticipated to change. Additionally, despite fairly high on-going recreational use, bald eagles have nested near the reservoirs since 1991, and during that time the numbers of nesting territories have steadily increased from two to four. It would appear that these bald eagles are fairly tolerant of humans and, generally they have been able to successfully forage and fledge young despite these disturbances. Therefore, with an improved prey base, the increase in recreational users is not anticipated to result in the abandonment of existing nesting territories or appreciably reduce their overall productivity. Over time, it is not unreasonable to expect that the number of nesting territories will continue to increase as the overall population of eagles in Washington increases.

Operation of the fish passage facilities, installation of a fishway between the reservoirs, and the implementation of a fish propagation plan are expected to increase production and distribution of forage fish over the 50-year license term. The FWS believes that eagles that forage, nest, and winter in the vicinity of the project should benefit from increases in the number and distribution of fish in the Baker River, the reservoirs and, to a lesser extent, the Skagit River as a result of improved fish passage facilities and fishway. The FWS also believes anglers would be attracted to improved fish populations in the Baker River system. So although the proposed action is likely to result in an enhanced prey base, it could also bring an increase in the number of boaters and anglers that could disturb foraging, roosting, and nesting bald eagles. This condition is not expected to change significantly as a result of the proposed action as some level of disturbance to eagles is part of the baseline condition. The proposed action would, however, provide an enhanced forage base for bald eagles and although angler presence may reduce the foraging efficiency of wintering bald eagles, the increased amount and distribution of prey may benefit the wintering population of bald eagles in the action area.

The road maintenance and wildlife habitat enhancement articles range from beneficial effects to the potential for adverse effects depending on how those projects are designed in the future. However, based on what we know of these articles at this point in time, we expect the majority of any adverse effects to be sub-lethal effects such as disturbance of foraging, perching, and nesting eagles and the loss of a comparatively small number of overstory trees. We expect lethal effects such as nest abandonment or unsuccessful fledging to be minimal based on known information about eagle success in the project area and the availability of suitable habitat.

Many of the recreational articles will require future consultations. The increased human use of areas in and around campsites and boating use of Baker Lake and Lake Shannon could have adverse effects on foraging and roosting eagles due to disturbance and slight disruption of foraging, nesting and roosting behaviors. However, the disturbance is expected to only slightly reduce the reproduction capability, numbers, or distribution of bald eagles. Evaluation and analysis of these indirect effects would be addressed if and when individual consultations become necessary.

Conservation Measures

To minimize and mitigate impacts to eagles, Puget will conduct two surveys 15 years apart to identify the location of any bald eagle winter night roosts on project lands or in the immediate vicinity of project lands (Article 512). Survey results will be used to develop Bald Eagle Management Plans. Bald Eagle Management Plans (Article 513) will include provisions for the following: (1) managing bald eagle nest and night roosts on project lands to protect bald eagles; (2) periodic surveys of project lands to identify new nests or night roosts which should be added to the plan; and (3) surveys of any lands acquired and added to the project boundary in the future as directed by the FERC. In addition, Article 505 would require Puget to develop an Aquatic Riparian Habitat Protection, Restoration and Enhancement Plan to acquire, protect and enhance low-elevation bottomland ecosystems in the Skagit River basin focusing on habitat for anadromous salmonids, other aquatic species such as amphibians, and riparian-dependent birds including bald eagles. This article could potentially include the acquisition of riparian areas with known bald eagle nest sites.

BULL TROUT

STATUS OF THE SPECIES—Bull Trout

Listing Status

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

Throughout its range, the bull trout is threatened by the combined effects of habitat degradation, fragmentation, and alterations associated with dewatering, road construction and maintenance, mining, grazing, the blockage of migratory corridors by dams or other diversion structures, poor water quality, entrainment (a process by which aquatic organisms are pulled through a diversion or other device) into diversion channels, and introduced non-native species (64 FR 58910).

Poaching and incidental mortality of bull trout during other targeted fisheries are additional threats.

The bull trout was initially listed as three separate Distinct Population Segments (DPSs) (63 FR 31647; 64 FR 17110). The preamble to the final listing rule for the United States coterminous population of the bull trout discusses the consolidation of these DPSs with the Columbia and Klamath population segments into one listed taxon and the application of the jeopardy standard under section 7 of the Act relative to this species (64 FR 58910):

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

Current Status and Conservation Needs

In recognition of available scientific information relating to their uniqueness and significance, five segments of the coterminous United States population of the bull trout are considered essential to the survival and recovery of this species and are identified as interim recovery units: 1) Jarbidge River, 2) Klamath River, 3) Columbia River, 4) Coastal-Puget Sound, and 5) St. Mary-Belly River (USFWS 2002; 2004a, b). Each of these interim recovery units is necessary to maintain the bull trout's distribution, as well as its genetic and phenotypic diversity, all of which are important to ensure the species' resilience to changing environmental conditions.

A summary of the current status and conservation needs of the bull trout within these interim recovery units is provided below and a comprehensive discussion is found in the FWSs draft recovery plans for the bull trout (USFWS 2002; 2004a,b).

The conservation needs of bull trout are often generally expressed as the four "Cs": cold, clean, complex, and connected habitat. Cold stream temperatures, clean water quality that is relatively free of sediment and contaminants, complex channel characteristics (including abundant large wood and undercut banks), and large patches of such habitat that are well connected by unobstructed migratory pathways are all needed to promote conservation of bull trout at multiple scales ranging from the coterminous to local populations (a local population is a group of bull trout that spawn within a particular stream or portion of a stream system). The recovery planning process for bull trout (USFWS 2002; 2004a,b) has also identified the following conservation needs: 1) maintenance and restoration of multiple, interconnected populations in diverse habitats across the range of each interim recovery unit, 2) preservation of the diversity of life-history strategies, 3) maintenance of genetic and phenotypic diversity across the range of each interim recovery unit, and 4) establishment of a positive population trend. Recently, it has also been recognized that bull trout populations need to be protected from catastrophic fires across the range of each interim recovery unit (Rieman et al. 2003).

Central to the survival and recovery of bull trout is the maintenance of viable core areas (USFWS 2002; 2004a,b). A core area is defined as a geographic area occupied by one or more local bull trout populations that overlap in their use of rearing, foraging, migratory, and overwintering habitat. Each of the interim recovery units listed above consists of one or more core areas. There are 121 core areas recognized across the coterminous range of the bull trout (USFWS 2002; 2004a,b).

Jarbidge River Interim Recovery Unit

This interim recovery unit currently contains a single core area with six local populations. Less than 500 resident and migratory adult bull trout, representing about 50 to 125 spawning adults, are estimated to occur in the core area. The current condition of the bull trout in this interim recovery unit is attributed to the effects of livestock grazing, roads, incidental mortalities of released bull trout from recreational angling, historic angler harvest, timber harvest, and the introduction of non-native fishes (USFWS 2004a). The draft bull trout recovery plan (USFWS 2004a) identifies the following conservation needs for this interim recovery unit: 1) maintain the current distribution of the bull trout within the core area, 2) maintain stable or increasing trends in abundance of both resident and migratory bull trout in the core area, 3) restore and maintain suitable habitat conditions for all life history stages and forms, and 4) conserve genetic diversity and increase natural opportunities for genetic exchange between resident and migratory forms of the bull trout. An estimated 270 to 1,000 spawning bull trout per year are needed to provide for the persistence and viability of the core area and to support both resident and migratory adult bull trout (USFWS 2004a).

Klamath River Interim Recovery Unit

This interim recovery unit currently contains 3 core areas and 7 local populations. The current abundance, distribution, and range of the bull trout in the Klamath River Basin are greatly reduced from historical levels due to habitat loss and degradation caused by reduced water quality, timber harvest, livestock grazing, water diversions, roads, and the introduction of non-native fishes (USFWS 2002). Bull trout populations in this interim recovery unit face a high risk of extirpation (USFWS 2002). The draft Klamath River bull trout recovery plan (USFWS 2002) identifies the following conservation needs for this interim recovery unit: 1) maintain the current distribution of bull trout and restore distribution in previously occupied areas, 2) maintain stable or increasing trends in bull trout abundance, 3) restore and maintain suitable habitat conditions for all life history stages and strategies, 4) conserve genetic diversity and provide the opportunity for genetic exchange among appropriate core area populations. Eight to 15 new local populations and an increase in population size from about 2,400 adults currently to 8,250 adults are needed to provide for the persistence and viability of the 3 core areas (USFWS 2002).

Columbia River Interim Recovery Unit

The Columbia River interim recovery unit includes bull trout residing in portions of Oregon, Washington, Idaho, and Montana. Bull trout are estimated to have occupied about 60 percent of the Columbia River Basin, and presently occur in 45 percent of the estimated historical range

(Quigley and Arbelbide 1997). This interim recovery unit currently contains 97 core areas and 527 local populations. About 65 percent of these core areas and local populations occur in central Idaho and northwestern Montana. The Columbia River interim recovery unit has declined in overall range and numbers of fish (63 FR 31647). Although some strongholds still exist with migratory fish present, bull trout generally occur as isolated local populations in headwater lakes or tributaries where the migratory life history form has been lost. Though still widespread, there have been numerous local extirpations reported throughout the Columbia River basin. In Idaho, for example, bull trout have been extirpated from 119 reaches in 28 streams (Idaho Department of Fish and Game in litt. 1995). The draft Columbia River bull trout recovery plan (USFWS 2002) identifies the following conservation needs for this interim recovery unit: 1) maintain or expand the current distribution of the bull trout within core areas, 2) maintain stable or increasing trends in bull trout abundance, 3) restore and maintain suitable habitat conditions for all bull trout life history stages and strategies, and 4) conserve genetic diversity and provide opportunities for genetic exchange.

This interim recovery unit currently contains 97 core areas and 527 local populations. About 65 percent of these core areas and local populations occur in Idaho and northwestern Montana. The condition of the bull trout within these core areas varies from poor to good. All core areas have been subject to the combined effects of habitat degradation and fragmentation caused by the following activities: dewatering; road construction and maintenance; mining; grazing; the blockage of migratory corridors by dams or other diversion structures; poor water quality; incidental angler harvest; entrainment into diversion channels; and introduced non-native species. The FWS completed a core area conservation assessment for the 5-year status review and determined that, of the 97 core areas in this interim recovery unit, 38 are at high risk of extirpation, 35 are at risk, 20 are at potential risk, two are at low risk, and two are at unknown risk (USFWS 2005).

Coastal-Puget Sound Interim Recovery Unit

Bull trout in the Coastal-Puget Sound interim recovery unit exhibit anadromous, adfluvial, fluvial, and resident life history patterns. The anadromous life history form is unique to this interim recovery unit. This interim recovery unit currently contains 14 core areas and 67 local populations (USFWS 2004b). Bull trout are distributed throughout most of the large rivers and associated tributary systems within this interim recovery unit. Bull trout continue to be present in nearly all major watersheds where they likely occurred historically, although local extirpations have occurred throughout this interim recovery unit. Many remaining populations are isolated or fragmented and abundance has declined, especially in the southeastern portion of the interim recovery unit. The current condition of the bull trout in this interim recovery unit is attributed to the adverse effects of dams, forest management practices (e.g., timber harvest and associated road building activities), agricultural practices (e.g., diking, water control structures, draining of wetlands, channelization, and the removal of riparian vegetation), livestock grazing, roads, mining, urbanization, poaching, incidental mortality from other targeted fisheries, and the introduction of non-native species. The draft Coastal-Puget Sound bull trout recovery plan (USFWS 2004b) identifies the following conservation needs for this interim recovery unit: 1) maintain or expand the current distribution of bull trout within existing core areas, 2) increase bull trout abundance to about 16,500 adults across all core areas, and 3) maintain or increase connectivity between local populations within each core area.

St. Mary-Belly River Interim Recovery Unit

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

Life History

Bull trout exhibit both resident and migratory life history strategies. Both resident and migratory forms may be found together, and either form may produce offspring exhibiting either resident or migratory behavior (Rieman and McIntyre 1993). Resident bull trout complete their entire life cycle in the tributary (or nearby) streams in which they spawn and rear. The resident form tends to be smaller than the migratory form at maturity and also produces fewer eggs (Fraley and Shepard 1989; Goetz 1989). Migratory bull trout spawn in tributary streams where juvenile fish rear 1 to 4 years before migrating to either a lake (adfluvial form), river (fluvial form) (Fraley and Shepard 1989; Goetz 1989), or saltwater (anadromous form) to rear as subadults and to live as adults (Cavender 1978; McPhail and Baxter 1996; WDFW et al. 1997). Bull trout normally reach sexual maturity in 4 to 7 years and may live longer than 12 years. They are iteroparous (they spawn more than once in a lifetime). Repeat- and alternate-year spawning has been reported, although repeat-spawning frequency and post-spawning mortality are not well documented (Leathe and Graham 1982; Fraley and Shepard 1989; Pratt 1992; Rieman and McIntyre 1996).

The iteroparous reproductive strategy of bull trout has important repercussions for the management of this species. Bull trout require passage both upstream and downstream, not only for repeat spawning but also for foraging. Most fish ladders, however, were designed specifically for anadromous semelparous salmonids (fishes that spawn once and then die, and require only one-way passage upstream). Therefore, even dams or other barriers with fish passage facilities may be a factor in isolating bull trout populations if they do not provide a downstream passage route. Additionally, in some core areas, bull trout that migrate to marine waters must pass both upstream and downstream through areas with net fisheries at river mouths.

This can increase the likelihood of mortality to bull trout during these spawning and foraging migrations.

Growth varies depending upon life-history strategy. Resident adults range from 6 to 12 inches total length, and migratory adults commonly reach 24 inches or more (Pratt 1985; Goetz 1989). The largest verified bull trout is a 32-pound specimen caught in Lake Pend Oreille, Idaho, in 1949 (Simpson and Wallace 1982).

Habitat Characteristics

Bull trout have more specific habitat requirements than most other salmonids (Rieman and McIntyre 1993). Habitat components that influence bull trout distribution and abundance include water temperature, cover, channel form and stability, valley form, spawning and rearing substrate, and migratory corridors (Fraley and Shepard 1989; Goetz 1989; Hoelscher and Bjornn 1989; 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), bull trout should not be expected to simultaneously occupy all available habitats (Rieman et al. 1997).

Migratory corridors link seasonal habitats for all bull trout life histories. The ability to migrate is important to the persistence of bull trout (Rieman and McIntyre 1993; Gilpin, *in litt.* 1997; Rieman et al. 1997). Migrations facilitate gene flow among local populations when individuals from different local populations interbreed or stray to non-natal streams. Local populations that are extirpated by catastrophic events may also become reestablished by bull trout migrants. However, it is important to note that the genetic structuring of bull trout indicates there is limited gene flow among bull trout populations, which may encourage local adaptation within individual populations, and that reestablishment of extirpated populations may take a long time (Spruell et al. 1999; Rieman and McIntyre 1993). Migration also allows bull trout to access more abundant or larger prey, which facilitates growth and reproduction. Additional benefits of migration and its relationship to foraging are discussed below under "Diet."

Cold water temperatures play an important role in determining bull trout habitat, as these fish are primarily found in colder streams (below 15 °C or 59 °F), and spawning habitats are generally characterized by temperatures that drop below 9 °C (48 °F) in the fall (Fraley and Shepard 1989; Pratt 1992; Rieman and McIntyre 1993).

Thermal requirements for bull trout appear to differ at different life stages. Spawning areas are often associated with cold-water springs, groundwater infiltration, and the coldest streams in a given watershed (Pratt 1992; Rieman and McIntyre 1993; Baxter et al. 1997; Rieman et al. 1997). Optimum incubation temperatures for bull trout eggs range from 2 °C to 6 °C (35 °F to 39 °F) whereas optimum water temperatures for rearing range from about 6 °C to 10 °C (46 °F to 50 °F) (McPhail and Murray 1979; Goetz 1989; Buchanan and Gregory 1997). In Granite Creek, Idaho, Bonneau and Scarnecchia (1996) observed that juvenile bull trout selected the coldest

water available in a plunge pool, 8 °C to 9 °C (46 °F to 48 °F), within a temperature gradient of 8 °C to 15 °C (4 °F to 60 °F). In a landscape study relating bull trout distribution to maximum water temperatures, (Dunham et al. 2003) found that the probability of juvenile bull trout occurrence does not become high (i.e., greater than 0.75) until maximum temperatures decline to 11 °C to 12 °C (52 °F to 54 °F).

Although bull trout are found primarily in cold streams, occasionally these 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. 1997). Availability and proximity of cold water patches and food productivity can influence bull trout ability to survive in warmer rivers (Myrick et al. 2002). For example, in a study in the Little Lost River of Idaho where bull trout were found at temperatures ranging from 8 °C to 20 °C (46 °F to 68 °F), most sites that had high densities of bull trout were in areas where primary productivity in streams had increased following a fire (Bart Gamett, U.S. Forest Service, pers. comm. 2002).

All life history stages of bull trout are associated with complex forms of cover, including large woody debris, undercut banks, boulders, and pools (Fraley and Shepard 1989; Goetz 1989; Hoelscher and Bjornn 1989; Sedell and Everest 1991; Pratt 1992; Thomas 1992; Rich 1996; Sexauer and James 1997; Watson and Hillman 1997). Maintaining bull trout habitat requires stability of stream channels and maintenance of natural flow patterns (Rieman and McIntyre 1993). Juvenile and adult bull trout frequently inhabit side channels, stream margins, and pools with suitable cover (Sexauer and James 1997). These areas are sensitive to activities that directly or indirectly affect stream channel stability and alter natural flow patterns. For example, altered stream flow in the fall may disrupt bull trout during the spawning period, and channel instability may decrease survival of eggs and young juveniles in the gravel from winter through spring (Fraley and Shepard 1989; Pratt 1992; Pratt and Huston 1993). Pratt (1992) indicated that increases in fine sediment reduce egg survival and emergence.

Bull trout typically spawn from August through November during periods of increasing flows and decreasing water temperatures. Preferred spawning habitat consists of low-gradient stream reaches with loose, clean gravel (Fraley and Shepard 1989). Redds are often constructed in stream reaches fed by springs or near other sources of cold groundwater (Goetz 1989; Pratt 1992; Rieman and McIntyre 1996). Depending on water temperature, incubation is normally 100 to 145 days (Pratt 1992). After hatching, fry remain in the substrate, and time from egg deposition to emergence may surpass 200 days. Fry normally emerge from early April through May, depending on water temperatures and increasing stream flows (Pratt 1992; Ratliff and Howell 1992).

Migratory forms of bull trout may develop when habitat conditions allow movement between spawning and rearing streams and larger rivers, lakes or nearshore marine habitat where foraging opportunities may be enhanced (Frissell 1993; Goetz et al. 2004; Brenkman and Corbett 2005). For example, multiple life history forms (e.g., resident and fluvial) and multiple migration patterns have been noted in the Grande Ronde River (Baxter 2002). Parts of this river system have retained habitat conditions that allow free movement between spawning and rearing areas and the mainstem Snake River. Such multiple life history strategies help to maintain the stability

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

Diet

Bull trout are opportunistic feeders, with food habits primarily a function of size and life-history strategy. A single optimal foraging strategy is not necessarily a consistent feature in the life of a fish, because this strategy can change as the fish progresses from one life stage to another (i.e., juvenile to subadult). Fish growth depends on the quantity and quality of food that is eaten (Gerking 1994), and as fish grow, their foraging strategy changes as their food changes, in quantity, size, or other characteristics. Resident and juvenile migratory bull trout prey on terrestrial and aquatic insects, macrozooplankton, and small fish (Boag 1987; Goetz 1989; Donald and Alger 1993). Subadult and adult migratory bull trout feed on various fish species (Leathe and Graham 1982; Fraley and Shepard 1989; Brown 1994; Donald and Alger 1993). Bull trout of all sizes other than fry have been found to eat fish half their length (Beauchamp and Van Tassell 2001). In nearshore marine areas of western Washington, bull trout feed on Pacific herring (*Clupea pallasi*), Pacific sand lance (*Ammodytes hexapterus*), and surf smelt (*Hypomesus pretiosus*) (WDFW et al. 1997; Goetz et al. 2004).

Bull trout migration and life history strategies are closely related to their feeding and foraging strategies. Migration allows bull trout to access optimal foraging areas and exploit a wider variety of prey resources. Optimal foraging theory can be used to describe strategies fish use to choose between alternative sources of food by weighing the benefits and costs of capturing one source of food over another. For example, prey often occur in concentrated patches of abundance ("patch model;" Gerking 1994). As the predator feeds in one patch, the prey population is reduced, and it becomes more profitable for the predator to seek a new patch rather than continue feeding on the original one. This can be explained in terms of balancing energy acquired versus energy expended. For example, in the Skagit River system, anadromous bull trout make migrations as long as 121 miles between marine foraging areas in Puget Sound and headwater spawning grounds, foraging on salmon eggs and juvenile salmon along their migration route (WDFW et al. 1997). Anadromous bull trout also use marine waters as migration corridors to reach seasonal habitats in non-natal watersheds to forage and possibly overwinter (Brenkman and Corbett 2005; Goetz et al. 2004).

<u>Changes in Status of the Coastal-Puget Sound Interim Recovery Unit</u>

Although the status of bull trout in Coastal-Puget Sound interim recovery unit has been improved by certain actions, it continues to be degraded by other actions, and it is likely that the overall status of the bull trout in this population segment has not improved since its listing on November 1, 1999. Improvement has occurred largely through changes in fishing regulations and habitat-restoration projects. Fishing regulations enacted in 1994 either eliminated harvest of bull trout or restricted the amount of harvest allowed, and this likely has had a positive influence on the abundance of bull trout. Improvement in habitat has occurred following restoration projects intended to benefit either bull trout or salmon, although monitoring the effectiveness of these projects seldom occurs. On the other hand, the status of this population segment has been adversely affected by a number of Federal and non-Federal actions, some of which were addressed under section 7 of the Act. Most of these actions degraded the environmental baseline; all of those addressed through formal consultation under section 7 of the Act permitted the incidental take of bull trout.

Section 10(a)(1)(B) permits have been issued for Habitat Conservation Plans (HCP) completed in the Coastal-Puget Sound population segment. These include: 1) the City of Seattle's Cedar River Watershed HCP, 2) Simpson Timber HCP, 3) Tacoma Public Utilities Green River HCP, 4) Plum Creek Cascades HCP, 5) Washington State Department of Natural Resources HCP, 6) West Fork Timber HCP (Nisqually River), and 7) Forest Practices HCP. These HCPs provide landscape-scale conservation for fish, including bull trout. Many of the covered activities associated with these HCPs will contribute to conserving bull trout over the long-term; however, some covered activities will result in short-term degradation of the baseline. All HCPs permit the incidental take of bull trout.

Changes in Status of the Columbia River Interim Recovery Unit

The overall status of the Columbia River interim recovery unit has not changed appreciably since its listing on June 10, 1998. Populations of bull trout and their habitat in this area have been affected by a number of actions addressed under section 7 of the Act. Most of these actions resulted in degradation of the environmental baseline of bull trout habitat, and all permitted or analyzed the potential for incidental take of bull trout. The Plum Creek Cascades HCP, Plum Creek Native Fish HCP, and Forest Practices HCP addressed portions of the Columbia River population segment of bull trout.

Changes in Status of the Klamath River Interim Recovery Unit

Improvements in the Threemile, Sun, and Long Creek local populations have occurred through efforts to remove or reduce competition and hybridization with non-native salmonids, changes in fishing regulations, and habitat-restoration projects. Population status in the remaining local populations (Boulder-dixon, Deming, Brownsworth, and Leonard Creeks) remains relatively unchanged. Grazing within bull trout watersheds throughout the recovery unit has been curtailed. Efforts at removal of non-native species of salmonids appear to have stabilized the Threemile and positively influenced the Sun Creek local populations. The results of similar efforts in Long Creek are inconclusive. Mark and recapture studies of bull trout in Long Creek indicate a larger migratory component than previously expected.

Although the status of specific local populations has been slightly improved by recovery actions, the overall status of Klamath River bull trout continues to be depressed. Factors considered threats to bull trout in the Klamath Basin at the time of listing – habitat loss and degradation caused by reduced water quality, past and present land use management practices, water diversions, roads, and non-native fishes – continue to be threats today.

Changes in Status of the Saint Mary-Belly River Interim Recovery Unit

The overall status of bull trout in the Saint Mary-Belly River interim recovery unit has not changed appreciably since its listing on November 1, 1999. Extensive research efforts have been conducted since listing, to better quantify populations of bull trout and their movement patterns. Limited efforts in the way of active recovery actions have occurred. Habitat occurs mostly on Federal and Tribal lands (Glacier National Park and the Blackfeet Nation). Known problems due to instream flow depletion, entrainment, and fish passage barriers resulting from operations of the U.S. Bureau of Reclamation's Milk River Irrigation Project (which transfers Saint Mary River water to the Missouri River Basin) and similar projects downstream in Canada constitute the primary threats to bull trout and to date they have not been adequately addressed under section 7 of the Act. Plans to upgrade the aging irrigation delivery system are being pursued, which has potential to mitigate some of these concerns but also the potential to intensify dewatering. A major fire in August, 2006 severely burned the forested habitat in Red Eagle and Divide Creeks, potentially affecting three of nine local populations and degrading the baseline.

ENVIRONMENTAL BASELINE—Bull Trout

Regulations implementing the Act (50 CFR § 402.02) define the environmental baseline as the past and present impacts of all Federal, State, or private actions and other human activities in the action area. Also included in the environmental baseline are the anticipated impacts of all proposed Federal projects in the action area that have undergone section 7 consultation, and the impacts of State and private actions which are contemporaneous with the consultation in progress.

Status of the Species in the Action Area

This section provides a tiered review of the status of bull trout within the action area. It provides a general summary of the status of bull trout within the Lower Skagit core area, and then a more specific status of bull trout within the Baker River watershed. Status within the Baker River watershed also describes the habitat changes that have taken place following construction of the two dams and the current habitat conditions for bull trout. The effects of the proposed action are largely contained within the Baker River watershed, although foraging, migration, and overwintering (FMO) habitats within the lower Skagit River (from the Baker River confluence to Mount Vernon) and bull trout using these areas that are from other parts of the Lower Skagit core area may be affected by this proposed action.

Lower Skagit Core Area

The Lower Skagit core area comprises the Skagit basin downstream of Seattle City Light's Diablo Dam, including the mainstem Skagit River and the Cascade, Sauk, Suiattle, White Chuck, and Baker River including the lake systems (Baker Lake and Lake Shannon) upstream of upper and lower Baker Dams.

Bull trout, which occur throughout the Lower Skagit core area, include fluvial, adfluvial, resident and anadromous life history forms. Resident life history forms, found in several locations in the core area, often occur with migratory life history forms. Adfluvial bull trout occur in Baker, Shannon, and Gorge Lakes. Fluvial bull trout forage and overwinter in the larger pools of the upper portion of the mainstem Skagit River and, to a lesser degree, in the Sauk River (WDFW et al. 1997; Kraemer, *in litt.* January 2003).

Many bull trout extensively use the lower estuary and nearshore marine areas for extended rearing and subadult and adult foraging. Key spawning and early rearing habitat, found in the upper portion of much of the basin, is generally on federally protected lands, including North Cascades National Park, North Cascades Recreation Area, Glacier Peak Wilderness, and Henry M. Jackson Wilderness Area.

The status of the bull trout core area population is based on four key elements necessary for long-term viability: 1) number and distribution of local populations, 2) adult abundance, 3) productivity, and 4) connectivity (USFWS 2004).

Number and Distribution of Local Populations

Nineteen local populations were identified in the Bull Trout Draft Recovery Plan (USFWS 2004): 1) Bacon Creek; 2) Baker Lake; 3) Buck Creek; 4) Cascade River; 5) Downey Creek; 6) Forks of Sauk River; 7) Goodell Creek; 8) Illabot Creek; 9) Lime Creek; 10) Lower White Chuck River; 11) Milk Creek; 12) Newhalem Creek; 13) South Fork Cascade River; 14) Straight Creek; 15) Sulphur Creek; 16) Tenas Creek; 17) Upper South Fork Sauk River; 18) Upper Suiattle River; and 19) Upper White Chuck River. Although initially identified as potential local populations in the draft recovery plan (USFWS 2004), Stetattle Creek and Sulphur Creek (Lake Shannon), each now meets the definition of local population based on subsequent observations of juvenile bull trout and prespawn migratory adult bull trout (R2 Resource Consultants and Puget Sound Energy 2005; J. Shannon, *in litt*. 2004). With 21 local populations, the bull trout in the Lower Skagit core area is at diminished risk of extirpation and adverse effects from random, naturally-occurring events (see "Life History").

Adult Abundance

The Lower Skagit core area, with a spawning population of migratory bull trout that numbers in the thousands, is probably the largest population in Washington (C. Kraemer, *in litt*. 2001). Consequently, the bull trout population in this core area is not considered at risk from genetic drift.

The majority of local populations in the core area include 100 adults or more; therefore, they are

at a diminished risk of extirpation. However, some local populations probably have fewer than 100 adults and may be at risk from inbreeding depression. There is some risk of extirpation of the following local populations due to their lower numbers of adults; however, other factors, such as stable or increasing population trends may reduce this risk. Fewer than 100 migratory adults and a limited number of resident fish use the Forks of the Sauk River; however, the migratory component appears abundant and is increasing (C. Kraemer, *in litt*. January 2003). Fewer than 100 adults probably occur in Tenas Creek, but this local population is presumed to be increasing. The Straight Creek local population includes fewer than 100 migratory adults and an unknown number of resident fish (C. Kraemer, *in litt*. July 2001), but the migratory component appears stable. The Lime Creek local population probably has fewer than 100 migratory adults, but resident and migratory components are considered abundant. The South Fork Cascade River local population probably has fewer than 100 migratory adults (C. Kraemer, *in litt*. July 2001); however, resident and migratory components are considered stable. Based on recent observations, the Sulphur Creek local population in the Lake Shannon system also has fewer than 100 adults (R2 and PSE 2006). Prior to 2004, Goodell Creek supported more than 100 adult spawners. In October 2003, a large landslide in Goodell Creek blocked access to the majority of spawning habitat for migratory bull trout in the Goodell Creek local population. Adult counts of migratory bull trout in 2004 and 2005 have been fewer than 100 individuals (M. Downen, *in litt*. September 2006) in this local population. In the Baker Lake local population annual peak counts of 85 adults have been recorded between 2001 and 2005 (R2 and PSE 2006). Since the most upstream accessible habitat was not surveyed in these efforts and bull trout typically spawn as far upstream as they can within a stream system, this would suggest that on average there may be at least 100 adults in this local population. Total adult abundances in Newhalem Creek and Stettatle Creek local populations are unknown.

Productivity

Long-term redd counts in the index areas of the Lower Skagit core area generally indicate stable to increasing population trends. Therefore, this core area is not considered at risk of extirpation at this time. Recent declines in redd counts may indicate a potential change to this long-term trend (M. Downen, *in litt*. September 2006).

Connectivity

The presence of migratory bull trout in most of the local populations indicates the bull trout in the Lower Skagit core area have a diminished risk of extirpation from habitat isolation and fragmentation. However, the lack of connectivity of the Baker Lake and Sulphur Creek local populations in the Baker River system and Stetattle Creek local population in the Gorge Lake system with other local populations in the core area is a concern with respect to long-term persistence, life history expression, and refounding. In addition, there is currently only partial connectivity within the Baker Lake system, with no upstream passage for adults within Lake Shannon at upper Baker Dam.

Changes in Environmental Conditions and Population Status

Since the bull trout listing, Federal actions occurring in the Lower Skagit core area have caused harm to, or harassment of, bull trout. These actions include statewide Federal restoration programs that include riparian restoration, replacement of fish passage barriers, and fish habitat improvement projects; federally funded transportation projects involving repair and protection of roads and bridges; and section 10(a)(1)(B) permits for HCPs addressing forest management practices. Capture and handling, and indirect mortality, during implementation of section 6 and section 10(a)(1)(A) permits have negatively directly affected bull trout in the Lower Skagit core area.

The number of non-Federal actions occurring in the Lower Skagit core area since the bull trout listing is unknown. Activities conducted on a regular basis, such as emergency flood control, development, and infrastructure maintenance, affect riparian and instream habitat and probably have negatively affected bull trout and parts of their forage base.

Threats

Threats to bull trout in the Lower Skagit core area include:

- Gorge and Baker Dams restrict connectivity of the Stetattle Creek, Baker Lake, and Sulphur Creek (Lake Shannon) local populations with the majority of other local populations in the core area due to impaired fish passage.

- Operations of the Lower Baker Dam occasionally have significantly negatively affected water quantity in the lower Baker and Skagit Rivers.

- Agricultural practices, residential development, and the transportation network, with related stream channel and bank modifications, have caused the loss and degradation of FMO habitats in mainstem reaches of the major forks and in a number of the tributaries.

- Estuarine nearshore foraging habitats have been, and continue to be, negatively affected by agricultural practices and development activities.

Baker River Watershed

Bull trout express adfluvial, anadromous, and possibly fluvial life histories within the Baker River system. Historically, bull trout natal to the Baker River watershed appeared to be largely anadromous and fluvial based on past descriptions (U.S. Fish Commission 1901). Currently, the majority of the population appears to express an adfluvial life history, spawning and rearing in tributary systems and then maturing within a lake.

Number and Distribution of Local Populations

There are two local populations (spawning groups) encompassed by the Baker River system, Baker Lake and Sulphur Creek. These two local populations are part of the furthest downstream watershed to support spawning and rearing habitat for bull trout within the Lower Skagit core area. Baker Lake local population consists of a complex of tributaries to the lake, with the primary spawning and rearing occurring in the upper Baker River and its tributaries, but with use also occurring in the lake's smaller tributaries, Swift and Park Creeks. It is unknown whether the Baker Lake local population may actually be comprised of more than one local population due to the limited genetics information that is currently available to inform population structure. The Sulphur Creek local population consists of a single tributary which is the only known spawning and rearing habitat within Lake Shannon.

Adult Abundance

Although it is likely that on average a least 100 adults are present in the Baker Lake local population, historic accounts would suggest abundances were significantly larger prior to dam construction. Smith and Anderson (1921) reported that Baker Lake contained "large numbers" of bull trout, with fish commonly 11.0 to 17.6 kilograms (5 to 8 pounds) in size. In addition, pre-dam efforts to reduce the "Dolly Varden" (bull trout) population in the Baker system reported, "great quantities came up from the Skagit River, and it was soon found to be impossible to materially reduce them without making a systematic effort on the main river (U.S. Fish Commission 1901)."

Location, Distribution, and Condition of Habitat

The spawning and rearing habitats within upper Baker River, and Park, Swift and Sulphur Creeks remains relatively intact. The most significant post-dam change has been to the total amount of habitat available within these streams. Inundation by the reservoirs largely eliminated the lower reaches of these streams, with the most significant change occurring to the upper Baker River. It is likely that part of the historic riverine spawning and rearing habitat was permanently lost.

Historically, the majority of FMO habitat for bull trout natal to the Baker River system was distributed within Baker Lake, the mainstem Baker River, other reaches of the Skagit River system, and Puget Sound. The primary FMO habitat available to Baker River Basin bull trout today is provided by the two lakes/reservoirs, although FMO habitat is also provided by accessible tributaries to the lakes, such as Bear Creek and potentially Thunder and Rocky Creeks (R2 Resource Consultants 2003). Construction of the Upper Baker Dam, completed in 1959, inundated the valley containing this section of the Baker River that included the original Baker Lake. The natural lake was inundated by the impoundment and the resulting reservoir is now significantly larger in size and depth. This has increased the FMO habitat provided by the original Baker Lake. Lake Shannon was created by the placement of Lower Baker Dam, completed in 1925 and later raised to its current elevation in 1927. Lake Shannon has also increased the amount of available FMO lake habitat. However, as a result of both projects, the historic FMO riverine habitat provided by the Baker River has largely been replaced. It is assumed that the two lakes likely provide more FMO habitat than was originally available in the Baker River system, and that the habitat is at least equivalent in value to that which was lost or

inundated. However, the two dams have impeded upstream and downstream fish passage which has limited bull trout access to FMO habitat both within and outside of the Baker River Basin. Under current conditions, bull trout natal to the Baker River Basin appear to only infrequently migrate to the Skagit River and Puget Sound to mature (PSE 2002b), which is likely influenced by both the available passage conditions at the dams and the increase in FMO lake habitat provided by the two reservoirs. It is unknown if bull trout natal to areas outside of the Baker River Basin use this FMO habitat less compared to pre-dam conditions, but based on behavior and migratory movements of bull trout observed in other riverine systems it is likely that it was much higher.

The two reservoirs seasonally fluctuate in elevation as a result of operations related to power generation and flood control. These seasonal fluctuations have precluded the establishment of riparian areas, stable habitat features, and stable benthic communities within the eulittoral zone; facilitated shoreline erosion in sections of these reservoirs; and have precluded the downstream transport of Large Woody Debris (LWD) and sediments to the lower Baker and Skagit Rivers. Dam operations have reversed the natural seasonal fluctuations in elevation of Baker Lake, which would have been at its fullest during the winter and spring and lowest during summer and fall. Under the current operational regime, high water levels during the summer growing season effectively prevent establishment of vegetation within the drawdown zone, including the delta. Low water levels during the fall and winter flood season expose the delta's distributary channels to potential scour and lateral migration. This increased magnitude of seasonal fluctuations has exposed a larger area to cyclical deposition, scour, and dewatering than was typical in historic Baker Lake (R2 Resource Consultants 2005a).

These two lakes/reservoirs support runs of primarily sockeye (*Oncorhynchus nerka*) and coho salmon (*O. kisutch*), but also include Chinook salmon (*O. tshawwytscha*), pink salmon (*O. gorbuscha*), chum salmon (*O. keta*), steelhead trout (*O. mykiss*), coastal cutthroat trout (*O. clarki*) and mountain whitefish (*Prosopium williamsoni*), providing key foraging opportunities for bull trout. The most abundant forage is likely concentrated in Baker Lake where the majority of salmonid spawning habitat is located. Kokanee (*O. nerka)* reported in the lake also provide forage for bull trout. However, recent research indicates that a significant portion of the kokanee salmon observed in the Baker Lake sport fishery may in fact be "residual" sockeye. Successful spawning by residual sockeye or kokanee has not been documented in Baker Lake although individuals presumed to be residuals have been observed with adult sockeye in spawning areas. Hatchery rainbow trout are also stocked within Baker Lake and Lake Shannon, which also adds to the available forage base for bull trout. Bull trout that migrate out of the Baker River system may use other parts of the Skagit River basin and/or Puget Sound nearshore marine waters as FMO habitat during part of their life history.

Threats Identified in Project Area

Threats to bull trout in the Baker project area include the following in order of their judged priority based on the current best available information:

1. The Baker Dams restrict the connectivity/access of the anadromous life history form (within Baker Lake and Sulphur Creek local populations) to freshwater and marine FMO

habitats outside of the Baker River system.

2. The Baker Dams have negatively affected survival rates of bull trout "smolts" due to downstream passage over spillways and through the turbines.

3. Upper Baker Dam has likely reduced (by inundation) the total amount of available instream spawning and rearing habitat for bull trout within the upper Baker River.

4. The Baker Dams restrict connectivity of the Baker Lake, and Sulphur Creek (Lake Shannon) local populations with the majority of other local populations in the core area due to limitations in fish passage.

5. Operations of the Lower Baker Dam occasionally have significantly negatively affected water quantity in the lower Baker and Skagit Rivers.

6. Non-native brook trout are present within the Baker River system and pose the threat of hybridization. Currently no hybridization has been reported. Currently, brook trout are primarily located in high mountain lakes and associated drainages; however, downstream movement can bring them ultimately into contact with bull trout.

EFFECTS OF THE ACTION – Bull Trout

Project Facilities, Operations, and Flood Control

The following articles are likely to adversely affect bull trout:

- Article 106 Flow Implementation
- Article 107 Flood Control

Project facilities and operations and maintenance activities will have both negative and positive effects to bull trout during the life of the project. These articles address minimization of impacts of the project facilities and they address the restoration of habitat conditions conducive to support the life history requirements of bull trout and other native salmonids utilizing the basin. Although flood regulation can have negative effects to bull trout and their habitat, improved flows and ramping abilities at Lower Baker Dam will provide conservation benefits to the species. The magnitude of negative effects will depend on the severity and duration of reservoir draw down at each lake and the effectiveness and methods used in erosion control management.

<u>Flow Implementation</u>

The proposed flow regime under Article 106 is intended to provide greater minimum instream flows to the Baker River and mainstem Skagit River below the Lower Baker Dam. Puget would operate the project in accordance with an IPP for the first 6 years of the license. These flows do not necessarily mimic the natural flow pattern, but are designed to moderate flows in the Skagit River by limiting flow reductions attributable to the project and by capturing high flows or

augmenting low flows in order to improve spawning conditions for Chinook salmon. Although the mean annual discharge for the Baker and Skagit Rivers is essentially the same when comparing regulated with unregulated conditions, the proposed action alters seasonal runoff components, particularly in the fall, winter, and spring. In general, reservoir drawdown during late August through mid-November results in higher average daily flows in the Baker and Skagit Rivers compared with unregulated conditions; flood control operations result in capture and gradual release of flood flows, which decreases the magnitude of peak flows, but the duration of the event is increased; and reservoir refill reduces flows in the Baker and Skagit Rivers from April through June as compared with unregulated conditions. Given the size of the Baker and Skagit Rivers downstream of lower Baker Dam, the minimum flow of 1,000 cfs (from August 1 to October 20) and 1,200 cfs (October 21 to July 31), and the fact that bull trout use these river reaches for FMO habitat, we do not expect the general flow regime to have adverse affects to bull trout. Bull trout, either entering the lower Baker River from the Skagit River or leaving the Baker River to enter the Skagit River, would have access to diverse habitats (including pools interspersed with runs and small rapids, and cool water within the mainstem and in side-channel areas of the lower reaches of the Baker and Skagit Rivers). Upstream access for adults and subadults to the upper Baker River watershed would be provided through passage facilities (see Fish Passage and Transport Effects section). In addition, bull trout would indirectly accrue benefits from these minimum instream flows through the anticipated increase in the available forage base resulting from improved spawning conditions for Chinook salmon.

We expect adverse effects to juvenile/subadult bull trout related to daily fluctuation in flows. Down ramping rates for the lower Baker and Skagit Rivers under WDFW criteria range from 1-inch per hour day and night between June 15 and October 31, 2-inches per hour day and night between November 1 and February 15, and 2 inches per hour only at night between February 16 and June 15 (FERC and ACOE 2006). Per the Settlement Agreement, ramping rates specific to the Skagit River only apply at flows of 26,000 cfs or less. Bull trout juveniles/subadults (smolts) moving downstream through the Skagit River would continue to be exposed to stage reductions that would cause risk of stranding and potentially associated mortality of this life stage. Stranded individuals may die from predation, subsequent poor water quality, desiccation, or eventual starvation or isolation if the isolated area does not reconnect with the main channel flow (R2 2005c). Once the new generating units at the Lower Baker powerhouse come on line, hourly flow fluctuations associated with power generation may still cause some stranding of bull trout smolts, although we expect the level of stranding and associated mortality would be significantly reduced compared to current operations under the Interim Protection Plan, described earlier. However, under the proposed action the number of ramping events that exceed 2 inches per hour would be reduced in all months, and the number of ramping events that exceed 4 inches per hour would be dramatically reduced or eliminated for all months except June. The most likely period for bull trout to become stranded is during the peak smolt outmigration when juvenile/subadult bull trout abundance is highest in these areas, generally April through May (USFWS 2004). Approximately 60 ramping events that exceed the WDFW interim criteria would occur during these months (FERC and ACOE 2006). However, we do not anticipate that the stranding of bull trout would occur during most events as discussed below.

Since there is no information on the current level of stranding at this project due to ramping events, only a rough prediction can be made regarding the level of future mortality that may

occur to juvenile bull trout. The amount of fish stranding resulting from ramping is related to fish size, where smaller individuals, especially fry, tend to be more susceptible to stranding (R2 2005c). Because most of the bull trout using these reaches will be at least larger-sized juveniles or subadult bull trout, we expect the overall level of stranding to be low. A worst-case estimate of potential mortality is that one bull trout mortality would occur at 25 percent of the exceedance events (i.e., 15 mortalities a year). Although the risk of stranding mortality will be higher during the 6-year post licensing interim period (i.e., until the new generating units come on line), we believe that any potential mortalities that occur during that timeframe are likely captured by using this worst-case estimate for the 50-year license period.

Flood Control and Power Generation

As a result of flood control (Article 107) and power generation, reservoir pool levels will have annual, seasonal fluctuations. These fluctuations will result in a seasonal reduction of available habitat for bull trout through the reduction of littoral habitat in both reservoirs and a permanent reduction in a stable littoral aquatic community in the shoreline areas exposed during drawdown. Reservoir fluctuations can affect water quality, the euphotic zone, available fish habitat, aquatic invertebrate and plankton production, and can potentially cause redd dewatering. Reservoir drawdowns would typically begin in late August or early September in order to maintain lake elevation through Labor Day. Under current operation, the ACOE requires Puget to provide a total of 74,000 acre-ft of storage in Baker Lake: 16,000 acre-ft from November 1 to March 1 and an additional 58,000 acre-ft of storage from November 15 to March 1 each year. Under the proposed action, Puget could provide 74,000 acre-ft of storage over an extended period of time (16,000 acre-ft from October 15 to March 1 and an additional 58,000 acre-ft of storage from September 1 to April 15), however, the ACOE intends to use storage as outlined under the existing time periods (FERC and ACOE 2006).

During the period of drawdown, shoreline habitat previously inundated during part of the year would subsequently be exposed for significant periods of time. Reservoir fluctuations will continue to occur throughout the winter and spring, which will determine the presence or absence of species in the temporally inundated area and can affect community structure in the eulittoral zone (Fisher and Öhl 2005). In addition, this annual fluctuation effectively precludes the establishment of vegetation within the drawdown zone and along the reservoirs' lower elevation shorelines. The lake shorelines at these lower elevations lack typical riparian cover elements that could be used by bull trout and their prey species, and likely do not provide as optimal of habitat as do the full pool shorelines. For example, sculpin (C*ottus sp*.), which have been shown to be a significant prey item in the diet of bull trout in another western Washington lake system, Chester Morse Lake (Wyman 1975), inhabit the eulittoral areas within Baker Lake and Lake Shannon when inundated, but then must migrate from these areas to survive once the reservoir is drawn down. However, it is unclear how this obligatory migration affects survival of individual sculpin or their overall population abundance. Chester Morse Lake also experiences significant annual fluctuations in reservoir height related to flood control management, yet short-head sculpin (*Cottus confuses*) populations appear to remain common and available to bull trout (Tabor et al. 2006).

Although juvenile and adult bull trout will typically be in the tributaries to the lakes during the beginning of the drawdown period (i.e., juveniles will be rearing and adults will be spawning), later in the drawdown period (i.e., December) adult bull trout will begin to reenter the lakes to overwinter. Subadult bull trout will likely remain in the lakes throughout the drawdown period. It is not known if this reduction in lake elevation and related seasonal loss of eulittoral zone habitat adversely affects overwintering adult and subadult bull trout. Although overall "space" within the reservoir will have been reduced during low pool elevation, prey resources will become concentrated which has been shown to facilitate foraging by fish predators and increase population abundance (Willis 1986). Drawdowns that occur within reservoirs have the potential to increase water temperatures due to lower pool volume, however, because the drawdown period in Baker Lake and Lake Shannon occurs during the late fall through early spring, no increases in water temperature are expected from the reduced lake volume. Therefore, bull trout and their prey species would not be subject to any adverse effects from temperature increases.

Bull trout have been known to spawn on river deltas entering lakes; in some cases (e.g., Chester Morse Lake, WA) use of these areas can be substantial (USFWS 2004). However, in the Baker River system only individual bull trout have been observed on the upper delta among spawning sockeye, yet no bull trout have been observed spawning or defending any of the redds located on the delta (R2 2005a). These individuals observed on the delta are likely adults foraging or staging prior to migration upstream into the upper Baker River and its tributaries to spawn, alternatively they may be immature individuals that are keying on the foraging opportunities provided by spawning sockeye. Because of some uncertainty regarding which of a mixed group of salmonids observed in a particular location may have constructed a specific redd, there is still a possibility that bull trout may on occasion spawn within the area of inundation.

The increased magnitude of seasonal fluctuations has exposed a larger area to cyclical deposition, scour, and dewatering than was typical in historic Baker Lake. If reservoirs are drawn down early, any redds created in the drawdown zone could be inundated later during incubation when the reservoir refills to detain peak runoff as part of the ACOE' flood control agreement. If the reservoirs are drawn down later, redds would be subject to dewatering and would also be subject to later inundation during peak runoff events from the upper Baker River. Redds under either scenario would be subject to scour caused by down cutting as the reservoir recedes and/or by high stream flows during peak runoff. However, given recent studies indicating that the majority of spawning bull trout appear to use areas within the Baker River system well upstream of the drawdown zone (R2 2006), effects to bull trout from redd inundation or scour under the proposed actions are anticipated to be rare. Nonetheless, in order to assume a worst-case scenario, for the purposes of this biological opinion we assume one bull trout redd a year could be adversely affected by inundation and scour associated with reservoir fluctuation.

The loss of sockeye redds in this same area could potential reduce the total amount of available forage for bull trout in Baker Lake. However, the effect of this loss to bull trout is expected to be insignificant due to the small number of redds affected relative to the overall sockeye production within the system, and the location of significant sockeye spawning in nearby Channel Creek which would minimize this potential loss.

Summary of Project Facilities, Operation, and Maintenance Effects

We expect most activities under project facilities, operation, and maintenance will not result in significant disruption of normal behaviors or result in injury or mortality to individuals. Overall, bull trout will incur significant benefits from greater instream flows, maintenance of river gravel levels, LWD removal from lakes for habitat restoration, and control of severe or high erosion along lake shores.

The risk of direct exposure to individual bull trout from activities associated with LWD removal and erosion control is considered discountable. Although there remains some uncertainty regarding the indirect consequences to bull trout from these proposed activities, these are generally anticipated to be insignificant.

Continued ramping is expected to result in some degree of stranding of juvenile/subadult bull trout throughout the 50-year license period. Installation of the new generating units at the Lower Baker powerhouse will reduce ramping impacts, however, hourly flow fluctuations associated with power generation may still cause some stranding of bull trout smolts. The level of stranding and associated mortality is expected to be significantly reduced compared to current operations under the IPP, but not eliminated.

Reservoir fluctuations in Baker Lake will continue to risk stranding and/or scour of some bull trout redd sites (estimated at one per year) and some annual loss/reduction in eulittoral habitats. Although a loss of a redd does result in significant consequences to some individuals (i.e., eggs), we do not anticipate significant consequences to the Baker Lake local population as a whole, since the majority of spawning appears to occur well upstream of the delta. The reduction in eulittoral habitats has both anticipated beneficial and negative impacts to bull trout and their prey species. However, because of the overall amount of habitat available within the reservoirs, the anticipated annual concentration of prey resources, and the proposed sockeye propagation efforts, we believe reservoir fluctuation will generally not significantly alter the normal behaviors (i.e., feeding, breeding, sheltering) of bull trout.

Aquatics

The following aquatics articles may adversely affect bull trout, and will also result in long-term benefits:

- Article 101 Fish Propagation
- Article 103 Upstream Fish Passage
- Article 104 Fish Connectivity Between Reservoirs
- Article 105 Downstream Fish Passage

Effects from Construction for all Aquatic Articles

This section discusses the construction effects of articles 101, 103, 104, 105 and 110. Construction of facilities and infrastructure (access roads and landings) will occur as a result of several of the articles under the proposed action and may have both short- and long-term effects.

The primary effects to bull trout and/or their habitat, which are related to construction, result from turbidity and sediment inputs, riparian vegetation removal, channel modification, installation of erosion control measures, and pile driving. We generally expect most construction impacts, including demolition, to be limited in magnitude and duration, with the exception of riparian vegetation removal and channel modification, which are typically longer lasting. Note that effects from construction of the Upper Baker Dam FSC were previously addressed in an informal consultation completed in 2005 and will not be addressed further in this biological opinion.

Turbidity/Sediment and Contaminants

All construction projects conducted under the Agreement have the potential to deliver sediment to waterbodies as a result of runoff from disturbed sites. Most construction-related (including demolition) sediment releases and turbidity are expected to be small (i.e., localized) in magnitude and short (i.e., hours to days) in duration due to the water quality protection plan that will be implemented at Puget construction sites (i.e., new powerhouse, fish passage facilities, FSC fabrication/staging areas, fish propagation facilities, and stress relief ponds). In addition, localized, short-term increases in turbidity are likely to occur during construction of an upstream fish passage facility below Upper Baker Dam (i.e., within lower Sulphur Creek) and during shoreline erosion control efforts. In all cases, short-term increases in the rate of delivery (i.e., pulses) of fine sediment to Baker Lake and Lake Shannon will occur as a result of each of these activities. Although the short-term effects from these construction activities may result in disturbance to trout and/or temporary alteration of bull trout habitat, neither lethal impacts to individuals nor permanent alterations to habitat are anticipated. One of the construction projects will result in major short-term (i.e., days to a month) increases in turbidity following connection of the new fish propagation side channel (FERC and ACOE 2006) within Channel Creek. These increases in turbidity would likely extend into Baker Lake near the creek's confluence.

FSC fabrication and installation preparations at the Lake Shannon launch site, facility upgrades at the lower Baker trap-and-haul facility, and construction of upstream passage facilities in the vicinity of Upper Baker Dam will cause short-term increases in turbidity. In addition, these activities could possibly contaminate water in Sulphur Creek, Baker River and/or Lake Shannon with potentially hazardous materials in some circumstances (i.e., use of mechanical equipment, use of concrete). The implementation of Best Management Practices (BMP) (i.e., timing construction for the dry season; developing appropriately sized stormwater detention facilities; using appropriately sized equipment for demolishing the spawning beaches and constructing the side-channel; segregating work areas with cofferdams; maintaining a dry environment around curing concrete; refueling equipment in areas away from surface waters; mulching disturbed areas; and revegetating disturbed areas) (FERC and ACOE 2006) is expected to limit demolition and construction effects to minor localized turbidity and negligible contamination from hazardous materials associated with the construction. Any elevated turbidity or minor contamination is expected to be very localized and ephemeral due to the BMPs that are implemented and the volume of water within the lake and river. The bull trout (i.e., subadults and adults) utilizing this part of the lake and river are not anticipated to be significantly affected physically or behaviorally by the limited magnitude or duration of these effects. It is anticipated that any bull trout can/will easily avoid these short-term events without significantly affecting

their normal feeding or migration behaviors, or will not encounter these events at all. Therefore, the effects to bull trout from construction of the new powerhouse, recreational facilities, hatchery, and stress relief ponds are expected to be insignificant.

We anticipate potential adverse effects to bull trout from the elevated turbidity associated with the side channel connection in Channel Creek that is part of Article 101. Based on observations made during sockeye and coho spawning surveys, current use of Channel Creek by bull trout appears to be rare, so few individuals are anticipated to be exposed to elevated turbidity levels. Only foraging subadults appear to intermittently use Channel Creek, since spawning adults have never been detected during the salmon spawning surveys (P. Hilgert, R2 Resource Consultants, Inc., *in litt*. 2006), which generally encompass the bull trout staging and spawning period. Although bull trout have not been observed in Channel Creek on an annual basis, for the purposes of this biological opinion we estimate as a worst-case scenario that two subadult bull trout may be significantly disrupted from normal behaviors or sustain sublethal physical effects (i.e., non-lethal injuries) as a result of elevated turbidity levels following the side channel connection to Channel Creek.

Under Article 104, in-water construction in Sulphur Creek (i.e., installation of concrete sill for weir) associated with upstream passage improvements may generate localized turbidity in the stream's lower reaches that could affect returning bull trout spawners. There may be some sublethal effects (i.e., gill abrasion), as a result of suspended sediments, to staging adults holding in the creek or at the creek's confluence with Lake Shannon. The highest levels of the construction-related turbidity will have been flushed or dissipated downstream and into the lake prior to the peak spawning migration due to the moderate base flows within Sulphur Creek. Therefore, the highest turbidity levels at the time of construction are unlikely to be encountered by most bull trout. Any pulsed levels of elevated turbidity generated during initial rain events following post-construction are not anticipated to result in injury or mortality of bull trout or to modify their normal migration behavior, since the moderate base flows will have likely flushed much of the sediment out prior to rain events. We believe that effects from elevated turbidity will only occur at specific times, during and immediately following initial weir construction/installation, and during the early portion of the spawning run following construction season after the fall rains. For the purposes of this biological opinion, we estimate as a worst-case scenario that two adult bull trout may be adversely affected (i.e., non-lethally injured) as a result of elevated turbidity during construction/installation of a weir.

The installation of concrete could also result in short-term contaminant effects to lower Sulphur Creek and Lake Shannon. The use of cofferdams to segregate work areas from the remainder of the wetted channel is anticipated to prevent any direct effects to bull trout from concrete contamination. Any contaminated water remaining within the cofferdams after the concrete has cured is anticipated to be pumped upland or into settling tanks (e.g., Baker tanks) for offsite/upland treatment or disposal, which will prevent exposure to bull trout. Therefore, the effects to bull trout of the short-term water contamination due to installation of concrete in Sulphur Creek are expected to be discountable.

Cofferdam Placement and Wier Construction in Sulphur Creek

The installation of cofferdams and construction of the weir within and along Sulphur Creek (Article 104) could temporarily alter the downstream movements of bull trout juvenile/subadults migrating to Lake Shannon and possibly into marine waters to mature; and/or temporarily alter the upstream movements of pre-spawn adults from Lake Shannon into Sulphur Creek. Cofferdams will temporarily narrow the stream channel (likely by half of its existing width), and construction will create various visual and audible disturbances at the site. We do not anticipate this to prevent migration of individuals, but it will likely affect behavior and alter migrations of some individuals.

Since the peak outmigration in Sulphur Creek likely occurs from May to mid-June, based on Lower Skagit outmigrant trap data, we anticipate most juvenile/subadult outmigrants will have completed their migration to Lake Shannon prior to the initiation of in-water work in the creek. Based on this migration timing and the anticipated Hydraulic Project Approval in-water work window (i.e., July 1-September 30), we expect most individuals will likely avoid any impacts to their migration. There is a potential for the downstream migration of juveniles/subadults and upstream migration of pre-spawn adults to be impaired or delayed for individuals that migrate later in the season (i.e., after July 1). Migration delay can cause delayed spawning and physical stress in adults. Past records for the mainstem Skagit River outmigrant trap indicate that on average about 6 percent of the annual outmigrants may migrate after July 1. Therefore, for this biological opinion we assume six percent of the juvenile bull trout outmigrants from Sulphur Creek could be affected, and of those, we estimate that 50 percent could be injured by migration delay or have their behavior significantly disrupted by these construction activities. Based on recent juvenile sampling (N. Verretto, Puget Sound Energy, *in litt*. 2006a), we estimate as a worst-case scenario that annually up to 35 juveniles could potentially outmigrate from Sulphur Creek. Therefore, our calculated estimate of injury is one juvenile bull trout.

For adult migrants, limited surveys indicate that the majority of adults enter this lower reach during late August through September (R2 2006). If in-water construction is completed prior to August 20 we would not expect any adult spawners to be significantly delayed in their migration. Any in-water construction occurring after August 20 and continuing through September 30 could delay spawner migration during the day, however, it is anticipated that adults will have the opportunity to pass upstream undisturbed during the night. We do not anticipate that the delay in migration will be severe enough to increase the risk of predation on individuals. As a worst-case scenario, we expect that the effects of delaying migration on adult bull trout will be significant, and estimate that two adults will be temporarily disrupted to the point of resulting in potential sublethal effects (i.e., delayed spawning, physical stress), if work is conducted during this time period. We expect the effect of predation on individuals from these behavioral disruptions to be insignificant.

As part of site preparation for the placement of the cofferdams within this reach, it is anticipated that fish relocation efforts will occur prior to this construction activity. Relocation efforts will likely use a combination of seining, dipnetting, and electrofishing. Capture and handling can result in physical stress and disrupted foraging, rearing, and migratory behavior. Based on recent sampling efforts to determine the presence and numbers of bull trout in this reach of Sulphur Creek (N. Verretto, Puget Sound Energy, *in litt.* 2006a), we estimate no more than two juvenile

bull trout could be captured and handled during relocation efforts. As a worst-case scenario, we assume one of these captured individuals could sustain sublethal injuries.

Channel/Bank/Shoreline Modification and Riparian Vegetation Removal

Installation of a concrete sill across Sulphur Creek (Article 104) will eliminate that portion of stream channel habitat within the footprint of the sill. Natural channel contour would be permanently altered, channel substrate would be permanently replaced or displaced by the weir's concrete sill structure, and any hyporrheic flow would likely be interrupted at this location. The footprint of the concrete sill may require excavation of a 60-ft cross section approximately 20 ft wide and up to 5 ft deep into the channel (N. Verretto, Puget Sound Energy, pers. comm. 2006c). This will simplify existing channel habitat and eliminate interstitial spaces within this footprint, and depending on weir design, may require additional habitat alterations immediately upstream and downstream of the weir for other trap and haul infrastructure. Juvenile bull trout rearing habitat and macroinvertebrate habitat would be permanently lost at the location of the concrete sill. Additional alterations (i.e., bank hardening, moving of additional substrate, additional channel modifications) could also reduce the value of habitat features currently used by juvenile and adult bull trout. However, only one juvenile char was observed in recent electrofishing survey work in the lower reach of Sulphur Creek (lake confluence to spring) (N. Verretto, Puget Sound Energy, pers. comm. 2006a), the proposed location of the weir. In comparison, over 30 juvenile bull trout were captured during the same survey in the slightly shorter stream reach immediately upstream. This would suggest that juvenile habitat in the lower reach may not be optimal or perhaps as important for juvenile rearing compared to the upstream reach. Therefore, the permanent alteration of this portion of the available instream habitat would result in considerably less effect to juvenile bull trout. We therefore expect the effect of the loss of stream habitat by the footprint of the weir on juvenile bull trout to be insignificant. Within the footprint of the concrete sill, any holding habitat used by pre-spawning adults during upstream migration into Sulphur Creek would also be eliminated. However, this holding habitat will be replaced by the weir and trap, and all bull trout will be moved immediately upstream or to other locations upon reaching the weir. This would eliminate the necessity for holding habitat to support natural upstream migration at this particular location in the creek.

Although demolition and construction associated with the relicensing will largely occur on preexisting disturbed sites, riparian vegetation removal may result during some activities. Effects from riparian vegetation removal will range from long-term (i.e., generally the period of time until regrowth of vegetation reaches equivalent value to what was lost has occurred) to permanent. Construction of a small access road would likely be necessary to allow equipment into lower Sulphur Creek for the construction of the sill and delivery of material for the weir and trap at the upstream fish passage facility. This would result in permanent vegetation removal along one bank of lower Sulphur Creek in the immediate location of the weir. This would generally include the complete removal of all riparian vegetation within the width of the road bed and within the construction staging area. Although we do not have site plans that would indicate the exact location or area of riparian vegetation that would need to be removed, we estimate as a worst-case scenario that the activity would increase solar radiation in the vicinity of the weir and may incrementally increase water temperatures immediately downstream of this location during peak summer temperature periods. This incremental increase (likely less than a

degree) is not anticipated to cause any disruption of migration since temperatures typically don't exceed 10 C in Sulphur Creek, well below the threshold at which we might expect significant effects. However, due to the requisite cold water requirements for juvenile rearing any increase in temperature could incrementally affect the rearing success of individuals in at least part of the reach. Therefore, the effects of riparian vegetation removal to bull trout migration are expected to be insignificant, but are likely to adversely affect juvenile rearing.

The construction of the side channel (Article 101) will require the permanent removal of some existing riparian vegetation along Channel Creek. Most riparian vegetation removal will occur at the point of connection with the creek. It is anticipated that as the side-channel stabilizes overtime, that the remaining riparian vegetation surrounding the side channel will expand. Foraging sub-adult bull trout may occur in Channel Creek intermittently; however, the area of riparian vegetation removal is small, and the effect on water temperatures is expected to be minimal. We therefore expect the effect from riparian vegetation removal along Channel Creek to be insignificant to foraging sub-adult bull trout.

Pile Driving and Anchor Placement

FSC barrier/guide net installation at lower Baker Dam (Article 105) will require pile driving at two locations along the shore of Lake Shannon near the dams to create anchor points, but will not occur in water (N. Verretto, Puget Sound Energy, pers. comm. 2006b). Approximately 12 steel pipe piles will be installed over a period of approximately one week using a vibratory hammer. No proofing of these piles with an impact hammer will be required since they are not load-bearing (J. Fillis, Puget Sound Energy, 2006). In addition, the placement of two permanent underwater anchors will likely be required to complete the FSC barrier/guide net installation (N. Verretto, Puget Sound Energy, pers. comm. 2006b).

Vibratory hammers produce underwater peak pressures that are approximately 17 dB lower than those generated by impact hammers (Nedwell and Edwards 2002). Not only are these sounds different in intensity, but also in frequency and impulse energy (total energy content of the pressure wave), which may account for the fact that no fish kills have been associated with use of vibratory hammers. Most of the sound energy of impact hammers is concentrated between 100 and 800 Hz, the frequencies thought to be most harmful to aquatic animals, while the sound energy from the vibratory hammer is concentrated around 20 to 30 Hz. Additionally, during the strike from an impact hammer, the sound pressure rises much more rapidly than during the use of a vibratory hammer (Carlson et al. 2001; Nedwell and Edwards 2002).

Since pile driving will be conducted using a vibratory hammer, require no proofing, and will occur over a brief time period, we do not anticipate adverse effects to bull trout in the form of physical injury or mortality, or behavioral disruption from vibratory pile driving based on the differences, discussed above, in the underwater sounds produced by this construction activity. Therefore, the effects to bull trout are expected to be insignificant.

Two additional anchor points that are located in-water will likely be required for the FSC barrier/guide net installation within Lake Shannon. This will require the placement of two 2,000-pound stockless anchors set upstream of large floats, with tension lines radiating from

each to the vertical break in the guide net (N. Verretto, Puget Sound Energy, pers. comm. 2006b). Anchor deployment would employ a barge with a crane, so we do not anticipate that the loading and placement of these anchors will result in the significant alteration of FMO habitat within or along Lake Shannon, nor do we expect any direct effects to occur to individual bull trout either during or after placement. Therefore, any potential effects to bull trout are expected to be discountable.

Summary of Construction Effects

In summary, most construction related to fish propagation facilities is expected to result in limited adverse effects or insignificant effects to bull trout. The primary construction effects to bull trout and their habitat will be from sediment and turbidity; loss, disturbance, or modification of instream habitat; sound and visual disturbance; bank modification, and loss of riparian vegetation. Construction effects to bull trout (i.e., subadults) within Channel Creek are expected to be very limited due to the low likelihood of exposure. Effects to bull trout and their habitat from potential contaminant inputs (e.g., concrete, construction machinery), pile driving, and anchor placement are expected to be insignificant due to the application of BMPs and the localized impact of these effects relative to the large volume of water where these activities will take place.

Fish Propagation

Fish propagation activities under Article 101 will likely have both positive and negative effects to bull trout. An apex predator, such as bull trout, is anticipated to benefit from the increase in productivity and related increase in prey base, particularly sockeye salmon. Construction of fish propagation facilities may have some short term adverse effects from increases in turbidity. Other effects include changes in habitat conditions, primarily related to water quality (nutrients and contaminants), within the basin and the possible resulting change in interspecific interactions between bull trout and other salmonid species.

Reservoir Nutrient Enhancement

Nutrient enhancement either by deployment of salmon carcasses or fertilizer has been proposed if/when it is determined that nutrients may be limiting sockeye production in the Baker River watershed. The enrichment of the freshwater ecosystem from input of salmon carcasses may have far reaching benefits throughout the food web by increasing primary productivity. The increase in marine derived nutrients will likely increase the aquatic invertebrate biomass, thereby increasing the forage base for juvenile anadromous salmonids as well as juvenile bull trout and other native fishes. There are no data on the potential for marine derived nutrients themselves to have adverse effects on the aquatic environment. However, carcasses can introduce additional substances other than marine-derived nutrients, specifically, disease and contaminants.

With respect to diseases, under the proposed action the State co-managers will closely evaluate any proposed use of fish carcasses to avoid the introduction of potential fish diseases into the Baker River system. We believe the overall risk of introducing disease into the Baker River system remains unchanged under the proposed action, since the screening of carcasses does not

preclude diseases from entering the system via live salmon returning to spawn. The risk of introducing diseases that may affect bull trout is considered discountable. No direct disease impacts have been noted across the range of bull trout and it is clear that no known diseased hatchery carcasses would be introduced.

Salmon have been noted to transfer contaminants into ecosystems via their carcasses (Ewald et al. 1998; O'Toole et al. 2006). Persistent organic chemicals such as DDT and polychlorinated biphenyls are transferred through the food chain and are retained within the tissues of salmon. Analyses show that as the fish burn fat on their spawning migration, they do not metabolize these pollutants (Ewald et al. 1998). These contaminants, acquired during the salmons' ocean migration, concentrate in their tissues and roe. They are ultimately passed (i.e., biotransferred) on to the freshwater ecosystem in which the salmon return and are introduced into the food chain. In addition, because of their trophic position in the food chain, bull trout may bioaccumulate these introduced contaminants more quickly and in greater amounts relative to other salmonids. In mature female bull trout, a proportion of these contaminants could be passed to developing eggs, which could affect their survival rates (Ewald et al. 1998). Over the life of the proposed action, it is likely that the addition of carcasses and the increase in sockeye escapement will increase contaminant loads within "resident" fish in the Baker River system. Although the ultimate implications for bull trout are uncertain due to indeterminant loading for individuals in future years, some life stages of bull trout appear to have greater sensitivity than other salmonids to some contaminants (Guiney et al. 1996; Cook et al., *in litt*. 1999). Contaminants from this source could result in an incremental reduction of fitness for some bull trout and survival rates of their eggs. However, given the lack of specific contaminant data for the Baker River system, we are relying on a surrogate example to make a conclusion regarding the effects to bull trout. Ewald et al. (1998) found in their study in the Copper River, Alaska, that sockeye salmon (the carrier of the polychlorinated biphenyls and DDT contaminants) had contaminant loads far below the levels that have caused concern with regard to human consumption or fish reproduction. Although present, the contaminant loads within the muscle tissue of the top aquatic predator consuming sockeye salmon, Arctic grayling (*Thymallus arcticus*), were determined to be significantly less than observed within the prey. Assuming that sockeye salmon from the Baker River system would incur similar contaminant loads, that these loading rates would not significantly increase during the term of the License, and that bull trout would consume amounts of sockeye salmon similar to arctic grayling, we anticipate that individual bull trout would experience minimal effect from this source of contaminant. These individuals are likely from the oldest age classes, since they would have presumably accumulated the highest levels of contaminants.

Although the addition of nutrients using fertilizers will likely have beneficial effects to bull trout through increased productivity, it is difficult to predict any broader ecological consequences of this proposal related to changes in the food chain and water chemistry. This uncertainty makes it difficult to predict whether any resultant changes (i.e., type and magnitude) would have adverse effects to bull trout. For the purposes of this biological opinion, we are assuming that if the State's fishery co-managers (i.e., WDFW and Tribes) determine future reservoir nutrient enhancement using fertilizers is necessary to support the proposed sockeye fry production, it will be guided by a rigorous protocol such as that recommended by Ashley and Stockner (2003). We expect the protocol to have a rigorous monitoring element that can identify potential risks to bull

trout in advance of implementing nutrient enhancement actions, and therefore, would avoid any significant effects to bull trout. The effects from reservoir nutrient enhancement are therefore expected to be insignificant.

Interspecific Competition for Food and Space

The FEIS (FERC and ACOE 2006) states, "A primary goal of the Proposed Action is to release a total of 14.5 million sockeye fry to the Baker River watershed following a phased propagation program." With regard to potential competition, we do not anticipate juvenile bull trout and sockeye salmon to compete for rearing habitat in the reservoirs. Early rearing habitat for bull trout is believed to be primarily located in tributaries to the lakes. While the rearing of older age classes of juvenile bull trout does occur in the lakes, these would be attaining sizes capable of predating on sockeye juveniles. In addition, juvenile bull trout and sockeye of similar sizes would be foraging on different food resources, bull trout being more piscivorous and sockeye planktivorous. We do not anticipate a substantial degree of overlap in habitat use or food resource use within the reservoirs by juvenile bull trout and sockeye that would lead to significant competition. Therefore, we expect the effects to bull trout to be discountable.

Competition for Spawning Habitat

Returning adult sockeye salmon are confined to artificial spawning beaches and allowed to naturally spawn within Baker Lake tributaries. Currently about 4,000 spawners are confined to the artificial spawning channels where no competitive interactions with bull trout can occur (A. Aspelund, PSE, pers. comm. 2006). Sockeye escapement that exceeds this number is currently released into Baker Lake where spawners are allowed to naturally spawn in tributary systems.

Although Baker Lake sockeye salmon were historically shoreline spawners, today sockeye released into the impounded lake are not known to utilize any of the current lake shoreline to spawn except areas in the vicinity of the Baker River delta. Most sockeye released into Baker Lake to naturally spawn use Channel Creek and the mainstem Baker River. Although most sockeye naturally spawning within the Baker River use the lower reaches in the vicinity of the delta, adults have been observed as far upstream as Bald Eagle Creek (rkm 13.3) (R2 2003). However, bull trout are not known to spawn within Channel Creek, and most bull trout using the Baker River appear to spawn higher upstream than the majority of sockeye. Therefore, at the current sockeye abundances we anticipate minimal competitive interactions for spawning sites between sockeye salmon and bull trout within stream environments.

As future sockeye production increases, the number of spawners released into Baker Lake could increase. In turn, this could increase the future risk of competitive interactions with bull trout for spawning sites, since a larger sockeye salmon population could expand further upstream into the Baker River. However, once the proposed hatchery facility is fully completed up to 8,500 adult sockeye would be held at these facilities in addition to the 4,000 held at the spawning beaches.

The targeted future sockeye escapement to the Baker River system will likely range around 10,000 to 12,000 spawners (A. Aspelund, Puget Sound Energy, *in litt*. 2006). This will generally reduce or maintain the number of adults that are currently released into Baker Lake to naturally

spawn. However, additional adults may be released into Baker Lake to support recreational fisheries, and some of those not captured by anglers will likely spawn in reaches of the Baker River. Given the current spawning site selection by sockeye salmon and the likely maintenance of escapement at or near current levels for natural spawners, we anticipate the future amount of superimposition on bull trout redds to be low. For the purposes of this biological opinion, and in order to be conservative, we anticipate no more than one redd a year may be completely impacted (eliminated) by sockeye redd superimposition after maximum escapement is reached in approximately year 2020 based on timing of completion of Phase 2 hatchery improvements (~2017).

Propagation Operations

Operating the expanded sockeye propagation facility to meet higher fish production levels would result in an increased use of formalin and feed, and consequently, would increase loads of formalin and nutrients discharged into Lake Shannon (FERC and ACOE 2006). The long-term effects on Lake Shannon water quality and to bull trout are expected to be insignificant throughout the term of the new license, due to the lake volume, water exchange rate, and the level of the expected increases in load.

Summary of Effects from Fish Propagation

Fish propagation activities are likely to have significant beneficial effects on bull trout in the Baker River system. An apex predator, such as bull trout, is anticipated to benefit from the increase in productivity and related increase in prey base, particularly sockeye salmon. Significant competition between bull trout and other salmonids (particularly sockeye salmon) for food or general space is not expected. However, there may be some limited amount of competition for spawning sites in future years, which is anticipated to result in low levels of redd superimposition.

Reservoir nutrient enhancement efforts may increase the risk of introduction of disease and increased contaminants. However, harmful effects to bull trout or their forage base from disease are not anticipated due to management procedures. In addition, bull trout appear to have low susceptibility to most salmonid diseases. Only minimal effects to bull trout from biotransferred contaminants are expected due to current and anticipated loading levels. Uncertainty still remains regarding whether significant unforeseen ecological changes to the foodweb or water quality will occur within the lakes, but the expected monitoring of nutrient enhancement efforts is expected to largely avoid the risk of significant changes.

<u>Fish Passage</u>

Implementation of fish passage activities (Articles 103, 104, and 105) may negatively affect bull trout during collection, upstream or downstream transportation, handling, and release. However, bull trout passage at the facilities will provide substantial conservation benefits to the species by improving connectivity of local populations within the core area as well as allowing for the recovery of the anadromous form in these local populations. This would strengthen the genetic resiliency of the core area and reduce the risk of extirpation of these local populations within the

Baker River system from stochastic events. These articles address specific recovery actions identified within the Draft Bull Trout Recovery Plan necessary to meet key Recovery Plan Objectives for bull trout. The magnitude of negative effects will depend on the bull trout attraction efficiency at each facility as well as the injury and mortality rates associated with passage through the facilities, including both the mechanical effect of the structures and the effect of any human handling and transport. Bull trout may also be negatively affected during unintended passage through project operations either by entrainment through turbines or over the facilities' spillways during spill events.

Upstream Passage at Lower Baker Dam

Under Article 103, the existing adult fish trap at Lower Baker Dam will be significantly upgraded, adding fish sorting capability and increasing capacity to accommodate run growth. Upstream fish passage will be designed to exceed the approximately 99.5 percent adult salmonid survival under current operations (FERC and ACOE 2006). Puget will allocate up to $20,000 annually for additional upstream passage facility modifications, if needed, as technology advances or monitoring suggest additional modifications are needed. Although no bull trout injuries or mortalities have been recorded at the current upstream passage facility, there is still a slight risk that injuries could occur such as descaling and abrasions from contact with the facilities or from human handling. Based on the past 11-years of trap-and-haul records at Lower Baker (R2 2006; D. Bruland, Puget Sound Energy, *in litt*. 2006b), it is expected that 22 individuals on average could be annually passed through the facilities from 2007 to 2012. After 2011, we estimate that the average number handled may double to 44 individuals, and after 2017 it may triple to 66 individuals a year as a result of increasing population abundance tied to increased sockeye production. All individuals captured and handled could receive some level of handling stress, although it will typically result in no greater than sublethal effects. However, for this biological opinion we expect that 0.5 percent of the fish captured and handled could receive an injury severe enough to result in mortality. The primary benefits of the upgraded fish passage facilities include reduced handling stress due to automated sorting features and reduced crowding and injury from other adult salmonids due to additional holding ponds. Improved bull trout passage over Lower Baker Dam will benefit bull trout through maintenance of high survival rates of spawning adults, maintenance and enhancement of diverse life history forms (especially anadromy), and continued opportunity for genetic exchange or refounding between other local populations.

Upstream Fish Passage at Upper Baker Dam

There is currently no upstream passage facility for fish trapped below Upper Baker Dam. There is an interim period of up to 3 years before the investigation into passage alternatives would occur, and at least another 2 years before a fishway is constructed. Under Article 104, upstream fish passage will be designed to maintain connectivity between Lake Shannon and Baker Lake. Design of the fishway may range from collect-and-haul operations, a temporary weir and trap on Sulphur Creek or a similar facility installed below Upper Baker Dam, up to a more permanent trap-and-haul facility below the dam. Although the alternative for this fishway has not been identified yet, for purposes of this biological opinion, we are evaluating the effects of the worst-case alternative, which would be the weir and trap on Sulphur Creek. The specific design focus

of the fishway would be for bull trout, although no explicit design criteria have been established. It is anticipated that any approved fishway design will also allow the capture and transport of subadult bull trout, to allow the return of any downstream migrants residing in Lake Shannon back upstream into Baker Lake. Depending on the design of the fishway and related operations, there may be a range of potential effects to bull trout. These effects may span from minor handling stress up to mortality and could include permanent instream habitat alteration as well.

Handling and Stress

We expect that with any approved fishway design, the risk of injury or mortality from capture and handling will be extremely low. However, handling stress and injuries are more likely to occur with any designs requiring more manual capture and handling and less likely to occur with fishways having more automated features. Under the most handling intensive and most likely upstream fish passage alternative, a weir, all returning pre-spawn adult bull trout will be captured then handled. All bull trout returning to Sulphur Creek will be handled since it will be necessary to sort spawners belonging to Sulphur Creek from those that belong in the Upper Baker system. Sulphur Creek spawner surveys conducted in 2004 and 2005 reported total annual counts of 28 and 57, respectively (R2 2006). Therefore, it is assumed that no more than 57 adults currently return to Sulphur Creek on an annual basis. This number has a high likelihood of being an overestimate of the actual return to Sulphur Creek due to adults moving in and out of the system over the spawn period and the potential double-counting of some adults during the protracted survey/spawn period (August to December). Because of the greater uncertainty regarding the actual number of individuals returning to Sulphur Creek, we are using the average of these two counts (n=42) as the current, worst-case baseline. This is more than twice the highest peak count of bull trout (n=18) in Sulphur Creek of all surveys conducted in 2004 and 2005, and therefore protective.

We assume that for any passage facility option that is selected, it will be required to have no less than a 99 percent survival rate, although the actual survival rate is likely to be higher. Therefore, we estimate (i.e., once the weir is installed) a worst-case scenario of no more than one adult bull trout to be annually killed as a result of capture and handling associated with initial operation of the weir. In fact, a 99 percent survival rate would actually suggest that no more than one bull trout is initially killed every other year. By 2012, proposed Phase 1 hatchery improvements are scheduled to have been completed and sockeye production significantly increased (FERC and ACOE 2006). Since we anticipate bull trout abundance to likely increase with future fish propagation actions, the number of bull trout returning to Sulphur Creek is predicted to increase overtime. Therefore, the number of individuals potentially injured and/or killed during fish passage operations will likely increase. Therefore, after 2012 we assume the number of bull trout returning to the Upper and Lower Baker Dam passage facilities will have at least doubled (i.e., 84 and 44, respectively) and then triple (i.e., 126 and 66) after 2017 when Phase 2 hatchery improvements are completed. It is estimated that 57 adult bull trout could be killed at the Upper Baker fish passage facility and 14 at the Lower Baker facility over the 50-year license period.

The option to install a temporary weir and trap on Sulphur Creek may incur some additional effects and greater risk to bull trout, especially since this stream supports a local population. In some instances, the installation of weirs have been noted to have various effects to upstream

spawners, the most significant being the delay or deterrence of upstream migration, the redistribution of typical spawn sites upstream of the weir to downstream of the weir, the impingement of adults on the weir that "fall back" or are migrating back downstream, and multiple trapping and handling of individuals that may fallback early. Some of these effects can be minimized through the implementation of appropriate operational procedures at the weir. We do not expect the weir to completely deter upstream migration of adults due to the limited number of spawning streams available for bull trout in Lake Shannon. Although the weir will likely result in delays in upstream migration, we do not anticipate significant impacts (e.g., stranding, temperature stress) to bull trout due to the relatively stable nature of base flows within Sulphur Creek. We do not anticipate a significant redistribution of spawning sites below the weir since the current spawning distribution seems to be highly influenced by the presence of a large spring located upstream. All bull trout within Sulphur Creek spawn upstream of this spring. Finally, it is uncertain whether predation rates on staging bull trout could increase by installing a weir at this location; however, operational procedures at the weir could be developed to address this issue should it be detected as a problem. The location for the proposed weir is near the artificial spawning beaches for sockeye salmon, which may in fact deter predation due to the existing level of maintenance and operational activity at this facility.

The Fish Connectivity Implementation Plan will ultimately be developed in consultation with the FWS and NMFS, as well as with WDFW and the Tribes, providing the opportunity to fully minimize and/or avoid potential adverse affects to bull trout related to an upstream fish passage facility. In the long-term, establishing upstream passage over Upper Baker Dam will benefit bull trout by allowing any Baker Lake origin fish currently confined to Lake Shannon a means to return to their natal streams. It will also benefit bull trout through maintenance and enhancement of diverse life history forms (especially anadromy) and continued opportunity for genetic exchange or refounding with other local populations. In the interim period prior to completion of upstream passage at Upper Baker Dam, bull trout from Baker Lake will continue to be "trapped" within Lake Shannon where they will either spawn in Sulphur Creek, continue maturing in the lake, or migrate below Lower Baker Dam. Any fish that migrate below Lower Baker Dam could eventually be transported back to Baker Lake.

Downstream Fish Passage

Under Article 105, improved downstream passage facilities will be constructed to meet 95 percent passage efficiency and 98 percent downstream survival standards (FERC and ACOE 2006). However, in the event such standards are not achieved, Puget will implement facility adjustments and modifications as directed by the FWS pursuant to the Agreement in an effort to achieve those standards. No injury or mortality of bull trout has ever been observed during collection with the existing floating surface collectors (FSCs) and related downstream transport (PSE 2002b). Therefore, at the improved downstream passage facilities we expect high survival and very low to no injury of captured individuals. However, for the purpose of this biological opinion we assume downstream passage survival through the FSC could be as low as 98 percent.

For the 5 percent of bull trout "smolts" that are not captured and become entrained, we expect that about 65 and 35 percent of those bull trout smolts to survive travel through the turbines or over the spillways at each project, respectively. This would lead to an overall estimate of 51 and

176 juvenile bull trout mortalities during the 50-year license period at the Upper and Lower Baker Dams, respectively. Numeric estimates of mortality are based on the average number of bull trout smolts captured annually at the FSC between 1994-2001 at each project (i.e., 5.9 and 5.3 at Upper and Lower Baker, respectively) and survival estimates for sockeye salmon smolts through the turbines and over the spillways (PSE 2002b) (also see Effects of Spill section). Although measured survival rates for coho through the facilities were higher, we believe use of this lower rate or the average rate between sockeye and coho salmon does not adequately capture a worse-case scenario. The benefits of downstream passage improvements will not be fully realized until the new downstream FSCs are installed in spring of 2008 at Upper Baker and in spring 2012 at Lower Baker (Appendix 1 Project Description and Effects). Therefore, annual mortality related to spill effects and turbine effects will remain at current percentages until these dates (see Effects of Spill and Effects of Turbine Passage sections below).

In order to complete a mortality estimate for the proposed project, we assume the average number of bull trout outmigrants will stay similar to the current average (i.e., 8.3 and 23 from Upper and Lower Baker Dams, respectively) only up until the time that FSC upgrades are completed at Lower Baker Dam in spring 2012. By 2012, proposed Phase 1 hatchery improvements are also scheduled to have been completed and sockeye production significantly increased. With an anticipated corresponding increase in bull trout population abundance, it is uncertain whether this increase in sockeye production will encourage juvenile outmigrants to remain adfluvial or express more anadromy. In order to assume a worst-case scenario, we anticipate more anadromous outmigrants from these populations with the increase in sockeye production. Therefore, after 2012 we assume the number of bull trout outmigrants at Upper and Lower Baker Dams will have at least doubled (i.e., 16.6 and 45.8, respectively), and then triple (i.e., 24.9 and 68.7) after 2017 when Phase 2 hatchery improvements are completed. These assumptions are reflected in our estimates of take from the project, shown in Appendix 2 Take estimates for bull trout.

Effects of Spill

The existing effects of downstream passage through spillways will persist until the new downstream FSCs are installed in 2008 at Upper Baker and in 2012 at Lower Baker (Appendix 1 Project Description and Effects). However, periodic downstream passage or entrainment of bull trout over spillways will continue indefinitely at the Lower and Upper Baker Dams, since FSC guide nets will be unable to operate during all spill events and no spillway modifications are planned by this proposed action. Spillway crest elevation for the Lower Baker Dam is 424.8 ft, whereas the spillway crest at Upper Baker Dam is even higher at 694 ft. As stated in the DEIS, "a substantial proportion of fish spilled over the dams may not survive." During the 1950s, researchers identified that sockeye and coho smolts passing over the spillway at Lower Baker Dam sustained a mortality rate of 64 percent and 54 percent, respectively (Hamilton and Andrew 1954). The mortality rate associated with spill events at Upper Baker Dam is expected to be at least equal if not greater than at Lower Baker Dam, given the greater spill height.

A theoretical estimate of downstream passage efficiency and fate of bull trout moving downstream through the Baker River Project was developed by Puget based on guidance efficiencies and passage survival for sockeye and coho (PSE 2002b). Using an average between

the estimated sockeye and coho passage mortality rate (i.e., 59 percent), and assuming that bull trout passage success through the downstream fish passage facilities is similar to the average for juvenile Pacific salmon (i.e., 71 percent efficiency, with the remaining 29 percent split between spillway and turbine passage), Puget estimated 1.3 bull trout smolts (0.7 and 0.6 killed at Upper and Lower Baker, respectively) are killed annually at the Upper and Lower Baker Dams as a result of spill (see Table 5-3 in PSE 2002b). Using the higher measured sockeye mortality rate (i.e., 64 percent), we currently estimate that a maximum of 1.5 smolts (0.8 and 0.7 killed at Upper and Lower Baker, respectively) are killed annually. However, this still likely underestimates the number of bull trout potentially killed at the Lower Baker Dam, since studies of the collection facility suggest that the system in this reservoir is far less effective at capturing smolts (i.e., approximately 23 percent efficiency) (FERC and ACOE 2006). This would suggest that passage through the spillway and the turbines at Lower Baker is each approximately 38.5 percent. This would increase the estimated number of juvenile bull trout annually killed by spill at Lower Baker to 5.2 individuals, for a total of 6.5 individuals (0.8 and 5.7 killed at Upper and Lower Baker, respectively) at both facilities. Three key assumptions to either of these estimates are: 1) that fish passage efficiency for juvenile/subadult bull trout is similar to sockeye and coho salmon, 2) that the true bull trout mortality rate from spill is similar to that reported for coho or sockeye salmon, and 3) that the bull trout population abundance and therefore percentage of individuals entrained overtime will remain unchanged. Bull trout do have general behavioral differences from other salmonids, since they generally exhibit a more benthic existence. These differences could influence the gulper efficiency at capturing most bull trout. Additionally, population abundance levels for bull trout may significantly increase as one of their key forage base, sockeye salmon and residual sockeye (i.e., "kokanee"), increases overtime as a result of nutrient enhancements and increased propagation. Therefore, this would likely increase the average number of juvenile outmigrants leaving the lakes in later years.

There are no estimates for the number of adult bull trout that may be entrained over the spillway. Given that the Baker Lake local population currently appears to primarily express an adfluvial life history, we might expect adult bull trout to migrate no further downstream than their lake of origin after spawning. However, there are a number of examples of migration/entrainment of adult "adfluvial" bull trout through dams in systems that were historically more riverine in nature and previously supported a fluvial life history (O'Brien 2001; Salow and Hostettler 2004; Hintz and Lockard 2006). Some level of entrainment from spill is anticipated in the Baker system, especially during spill events that fall outside of the peak spawning migration period (i.e., August to October). Outside of this period, adult bull trout from Baker Lake or Lake Shannon may migrate downstream to locate alternate foraging and overwintering areas or be attracted downstream by high flows. A bull trout tagged in Lake Shannon was later located in the Skagit River estuary, its downstream passage only possible over the spillway or through the turbines since no adults were captured in the downstream smolt passage facility. Entrainment mortality of adults is likely higher than for juveniles given the larger size of individuals that must survive passage over the spillway.

Although no modifications to the spillways are proposed, the future operation under the proposed action will reduce the frequency of spill at the two dams, and therefore, reduce the number of bull trout entrained during the license period. At Lower Baker Dam, the frequency will go from 3.7 to 3.1 events per year, and at Upper Baker Dam it will go from about one event every 1.2

years to one event every 1.7 years. Under the proposed action, the new downstream fish passage facilities will significantly increase their efficiency and may be able to operate at some level of spill without risk of damage to the barrier/guide nets, further reducing the potential number of bull trout entrained through the spillways.

Effects of Turbine Passage

The existing effects of downstream passage through turbines will persist until the new downstream FSCs are installed in 2008 at Upper Baker and in 2012 at Lower Baker (Appendix 1 Project Description and Effects). According to the Agreement, these facilities will be built to certain performance standards including an overall downstream passage performance of 95 percent and an overall downstream passage survival of 98 percent. No injury or mortality of bull trout has been observed during collection with the existing FSCs and related downstream transport (PSE 2002b). Currently, the estimated annual loss (mortality) through turbine entrainment will be approximately one (0.4 and 0.3 bull trout at Upper Baker Dam and Lower Baker Dam, respectively) bull trout. After 2008 and until 2012 of the new license, it is estimated that annual loss through turbine entrainment is approximately one (0.1 and 0.3 bull trout at Upper Baker Dam and Lower Baker Dam, respectively) bull trout smolt every other year. However, as previously described under the effects of spill, this likely underestimates the number of bull trout potentially killed at the Lower Baker Dam due to the lower efficiency estimate for the collection facility. Taking this into account, and using the measured sockeye salmon smolt mortality rate, this would increase the estimate of the number of juvenile bull trout initially killed on an annual basis through the turbine at Lower Baker to 3.0 individuals, for a total of 3.4 individuals at both facilities. Again, three key assumptions to any of these estimates are: 1) that fish passage efficiency for juvenile/subadult bull trout is similar to sockeye and coho salmon; 2) that the true bull trout mortality rate from spill is similar to that reported for coho and sockeye salmon; and 3) that the population abundance and therefore the total number of individuals entrained on an annual basis will remain unchanged. Bull trout do have general behavioral differences from other salmonids, since they generally exhibit a more benthic existence. This difference could decrease the gulper efficiency at capturing most bull trout. Additionally, population abundance levels for bull trout may significantly increase as one of their key prey species in this system, sockeye salmon and residual sockeye (i.e., “kokanee”), increases over time as a result of nutrient enhancements and increased propagation. Therefore, we believe using the higher sockeye smolt mortality rate and assuming increasing population size over the period of the license are appropriate adjustments to the cumulative mortality estimate. Once the new downstream passage facilities are in place, the improved capture efficiencies will reduce the number of individuals entrained by spill.

As with spillway entrainment, there are no estimates for the number of adult bull trout that may be entrained through the turbines. Entrainment of adult bull trout through the turbines may be higher than for juvenile bull trout given their greater range of movements within the water column. In addition, mortality rate of adults through the turbines could be higher than for juveniles given the larger size of the individual fish that must survive passage through the turbines. However, there are no adult mortality rate estimates for the Baker Project’s Francis-style turbines. Fish length has been identified as one of the important variables in determining injury or mortality of fish passing through turbines (Ferguson 2005). Mortality rates through the

15-blade Francis turbines at Noxon Rapids Dam were predicted to be 35 percent for bull trout from 440 to 600 millimeters in length and greater than 50percent for fish greater than 750 millimeters (Hintz and Lockard 2006).

It is anticipated that subsequent to installation of the new FSCs and guide nets, risk and incidence of entrainment of juvenile to adult life stages through the turbines will be significantly limited. The guide nets, which are designed to prevent entrainment of sockeye fry, will remain in place year-round during operations with the exception of spill events. This would limit when potential injury and mortality of individuals through the turbines would take place to the periods of spill when fish could migrate past the guide nets. Under the proposed action, the new downstream fish passage facilities may be able to operate at some level of spill without risk of damage to the barrier/guide nets, further reducing the number of bull trout that may get past and enter the turbine intakes.

Genetic Implications for Fish Passage

Current trap-and-haul operations may have significant effects on gene flow between the Baker system local populations and/or between other Lower Skagit core area local populations. Fish that enter the Lower Baker Dam fish passage facility are currently transported upstream to upper Baker River. The current lack of a comprehensive genetic baseline for the Baker system, as well as for the rest of the Lower Skagit core area, prevents clear differentiation between the bull trout from Baker Lake, Sulphur Creek, and other local populations. The location of the Lower Baker Dam fish passage facility (i.e., near the confluence with the Skagit River) makes it highly probable that bull trout from other local populations within the Lower Skagit core area are "dipping-in" the lower Baker River to forage or to take refuge. An introduction of dip-ins into the upper Baker River watershed may have facilitated greater rates of genetic exchange than previously occurred under pre-dam conditions. It is uncertain whether this higher rate of exchange has adversely affected the Baker Lake population other than perhaps modifying its distinctness within the larger population structure. Based on the genetic analyses and population structure assessments done to date across the range of bull trout, we would expect the Baker Lake local population to be significantly distinct from other local populations within the Lower Skagit core area. In fact, because the Baker Lake local population is actually a complex of streams, it could conceivably contain more than one genetically distinct local population.

Because of the uncertainty about the significance of effects to bull trout genetics from the current trap and haul operations, we are assuming that any improvement to the system that increases connectivity for migrating bull trout would be beneficial.

Summary of Fish Passage

Bull trout will likely continue to be injured and/or killed during downstream and upstream passage through the Baker facilities. Injury and mortality rates through spillways and turbines during downstream passage are expected to be highest prior to installation of the new FSC and associated guide nets. Post-installation injury and mortality rates are anticipated to be significantly reduced, with the risk of injury or mortality being primarily limited to major spill events when guide nets will typically need to be lowered to avoid damage to the FSC. Although

we can calculate fair estimates for juvenile/subadult mortality associated with downstream passage through the facilities, we can only make a coarse estimate of the potential injury and mortality rates for adults.

We estimate 23 juvenile/subadult and 27 adult mortalities at the Upper Baker facility, and 58 juvenile/subadult and 26 adult mortalities at the Lower Baker facility due to incidental injury associated with operation of the FSC over the 50-year license period. We estimate 28 juvenile/subadult and 47 adult mortalities at the Upper Baker facility, and 118 juvenile/subadult and 68 adult mortalities at the Lower Baker facility due to entrainment and subsequent passage over spillways and through turbines over the 50-year license period. These numbers reflect a worst-case scenario.

We expect little subadult or adult injury or mortality associated with the upgraded upstream fish passage facility for Lower Baker Dam due to the proposed state-of-the-art design, handling and transport procedures, and lack of injuries or mortality identified during past operation of the existing facility. Although we also expect little adult mortality at the new upstream passage facility for Upper Baker Dam, we do anticipate some injury and/or disruption of behavior to result from the placement of the facility in Sulphur Creek and the likelihood of additional handling and greater fallback behavior at this weir. We estimate 57 adult mortalities at the Upper Baker facility and 14 adult mortalities at the Lower Baker facility due to incidental injury associated with operation of the FSC over the 50-year license period. These numbers reflect a worst-case scenario; observed mortality will likely be lower based on the lack of mortality actually observed to date.

Although access to FMO habitats within the Baker River system will continue to be limited if not eliminated for bull trout natal to other areas within the Lower Skagit core area, we anticipate that the appropriate amount of gene flow into the Baker River system can be corrected or maintained as necessary. The improved sorting capabilities, in conjunction with population identification studies, and the development of new sorting protocols at both the Lower and Upper Baker fish passage facilities are anticipated to result in the appropriate levels of internal and external gene flow to the bull trout populations within the Baker River system.

Research and Monitoring

Part of the implementation of articles 103, 104 and 104 includes a number of studies and/or monitoring efforts requiring the direct capture and handling of bull trout, and subsequent bio-sampling and/or tagging. This will result in significant disruption of essential behaviors of captured individuals and could lead to incidental injury or mortality of individuals in some cases. Research associated with the FERC's relicensing and conducted prior to issuance of the new license was covered under a section 10(a)(1)(A) Recovery Permit (TE-005113) held by R2 Resource Consultants, Inc. Direct capture and handling, and subsequent bio-sampling and/or tagging associated with research during the new license period will be covered under this biological opinion.

Research methodologies may include, seining, hook and line sampling (angling), tagging (internal and external), non-lethal tissue sampling, snorkeling, and electrofishing. Research

studies under the Agreement do not propose any targeted lethal sampling of individuals. No more than five bull trout of all life history stages combined are anticipated to be lethally injured in a single year. During most years, no individuals are expected to be lethally injured during research activities. Over the past 4 years (2002-2005), research efforts conducted on the Baker River project have captured and handled an average of approximately eight adult (31 total) bull trout in Lake Shannon, one juvenile (4 total) bull trout in Sulphur Creek, 12 adult (47 total) and 2two (10 total) juvenile bull trout in the Baker Lake/Upper Baker River, and 25 adult (101 total) at Lower Baker Dam a year (R2 2005b; R2 2006). Only one adult bull trout (i.e., 0.5 percent) has been incidentally killed (or seriously injured) (E. Greenberg, R2 Resource Consultants, *in litt.* 2003) during this time period. In 2006, electrofishing surveys directed at collecting non-lethal genetic tissue samples in Sulphur Creek and upper Baker River captured 34 and 97 juvenile bull trout, respectively (N. Verretto, Puget Sound Energy, *in litt*. 2006), and resulted in two mortalities.

Previous capture and handling levels are unlikely to be an accurate predictor of what may occur under future research activities; therefore, we can only coarsely estimate the number of individuals that could be captured and handled, marked and tagged, and potentially injured or killed during these activities. Based on past capture and handling procedures at the facility (D. Bruland, Puget Sound Energy, *in litt*. 2006a), it is likely that many if not most adult bull trout entering upstream fish passage facilities would be tagged (e.g., with floy, radio, acoustic, or pit tags) and potentially biosampled (e.g., measured, weighed, tissue sampled) for monitoring purposes. In addition, most juvenile/subadult outmigrants could be tagged (e.g., with pit tags) for long-term monitoring purposes and/or to facilitate future sorting at upstream passage facilities. Electrofishing, seining, and trapping (e.g., minnow, fyke) may be used to capture bull trout intermittently over the license period. These sampling methods would be used to conduct bull trout research activities such as non-lethal tissue sampling for genetic analysis, stomach content collection for diet analysis, and population monitoring. Taking into consideration this range of various research and monitoring activities likely to take place and the low number of mortalities incurred in past years, for this biological opinion we estimate that no more than 3,989 juvenile and 8,487 adult bull trout captured and handled during fish passage operations could be marked and tagged. Based on the past 5 years of effort, we estimate on average, no more than 37 juvenile and 10 adult bull trout will be annually captured and handled during research and monitoring activities. We estimate that no more than five adults and 18 juveniles (based on an approximate 0.5 percent adult and 1.0 percent juvenile mortality rate observed during past sampling efforts) will be incidentally killed (or seriously injured) as a result of these research and monitoring activities (excludes activities at fish passage facilities) during the 50-year license period.

The following aquatics articles may affect, but are not likely to adversely affect bull trout. Articles 109 and 110 are also beneficial in the long-term.

- Article 108 Gravel Augmentation
- Article 109 Large Woody Debris
- Article 110 Shoreline Erosion

<u>Gravel Augmentation</u>

Article 108 provides for gravel augmentation below Lower Baker Dam if it is determined that geomorphic function needs to be maintained or improved. The placement of the two project dams has disrupted sediment transport in the lower Baker River. There has been an 86 to 88 percent reduction (approximately 12,500 tons of gravel and 2,500 to 4,300 tons of cobble) in the total sediment load delivered over unregulated conditions. Sediments still accumulate in the lower reach of the Baker River during high flows in the Skagit River, when backwater effects allow sediments to deposit (FERC and ACOE 2006). Although there has been a significant reduction of the sediment supply from the Baker River system, recent assessments of the Skagit River downstream from the town of Concrete (confluence of Baker River) indicate that this reach of the Skagit River has actually aggraded over the last several decades (R2 2004 as cited in FERC and ACOE 2006).

The reduction in sediment supply in the lower-most reach (below the fish collection weir) of the Baker River, in addition to past dredging and straightening of the channel, has resulted in a coarse armor-layer of bed sediments that remain stable even at high flows (FERC and ACOE 2006). Historically, bull trout used this reach for FMO (USFWS 2004), therefore, the continued loss of finer sediments have likely not significantly altered the overall function of this habitat for the species. The historic delta structure and side channels in the lower Baker River likely provided substantially better and more abundant habitat for bull trout forage species (e.g., juvenile salmonids, sculpin) and refugia habitat for bull trout juveniles/smolts. The historic channel morphology was likely more conducive for the recruitment of LWD jams at this location, which would have created excellent salmonid habitat. In addition, the pre-dam condition likely supported greater productivity in this reach. However, the deeper channel and coarse sediments that are sustained today likely provide greater or equivalent holding habitat for adult and subadult bull trout and interstitial habitat for bull trout juveniles/smolts than previously existed.

Most bull trout juveniles/smolts from the Baker River are likely utilizing this lower reach only for a relatively short duration as they continue their migration downstream to the mainstem Skagit River and into Puget Sound to mature. Given that the reach of the Skagit River immediately downstream of the Baker River confluence continues to maintain sediment levels, we believe bull trout use of this reach of the Skagit River has not been significantly altered by the reduced recruitment of sediment from the Baker River. We do not anticipate any bull trout injury or mortality related to the maintenance of current conditions within either of these reaches. Over the life of the license, the proposed gravel augmentation will prevent any significant loss of function for bull trout within these reaches of the lower Baker River and Skagit River through maintaining and/or improving geomorphic function. If gravel augmentation is implemented, there is a low risk of exposure to juvenile/subadult bull trout and some potential for mortality via bedload movement and filling of interstitial spaces. Exposure will likely depend on when and where gravel will be placed into the system. It is anticipated that with appropriate construction timing and site selection by the Aquatics Resources Group, of which the FWS is a member, that mortality can largely be avoided. Therefore, we expect the effects to bull trout to be discountable.

<u>Large Wood Debris Removal</u>

Article 109 provides for the collection and placement of large woody debris in the reservoirs for use in restoration projects. Within the Baker River system, the downstream movement of LWD has largely been eliminated by the project dams. Historically, LWD would have been recruited from throughout streams with the watershed and transported downstream overtime along the Baker River and ultimately to the Skagit River during high flow events. The historic Baker Lake likely retained a significant proportion of the LWD recruited from the upper Baker River. Today, LWD from the upper Baker River watershed and various tributary systems to the lakes is transported downstream into Baker Lake and Lake Shannon during high flows. Most of this LWD remains trapped within these reservoirs, except for a proportion that passes downstream during spill events and a portion that is removed by Puget to ensure safe project operations. However, the actual quantity of LWD transported downstream during spill events is currently unknown (FERC and ACOE 2006).

With the creation of the reservoirs, LWD within these inundated reaches of the Baker River no longer performs the same role it did when these reaches were largely riverine. In river systems, LWD plays an important role in the control of channel morphology, the storage and routing of sediment and organic matter, and the creation of fish habitat (Bisson et al. 1987; Bilby and Ward 1991). LWD within the lakes largely creates habitat for fish and other lake biota in the upper Baker River delta and along sections of the reservoirs' margins where it collects. A proportion may also help capture sediments and stabilize eroding shorelines in those locations. The LWD recruitment to the lower Baker River and the lower Skagit River has also largely been eliminated, reducing the amount of LWD historically entering and maintained in these river reaches. Although this has contributed to the overall loss of LWD in the lower mainstem Skagit River, a history of log jam removal, diking, and past channel modifications have significantly reduced the ability of the lower Skagit to retain large wood (Collins 1998).

Since LWD recruited from the Baker River system remains largely within the reservoirs, under Article 109, a proportion of this accumulated LWD would be collected from the lakes over a 20-year period and stockpiled for habitat restoration projects within the Skagit River Basin. Given the LWD management plan will only target the removal of pieces that are or would be free floating when the reservoirs are at full pool (J. Venard, PSE, *in litt*. 2006), it is not anticipated that this LWD removal will result in any lake habitat alterations that would lead to bull trout injury or measurably impair the ability for bull trout to forage, rear, or spawn. Therefore, the effects to bull trout are expected to be insignificant. We expect that as stockpiled LWD is used to restore stream habitat within the basin, that bull trout throughout the Skagit River system will benefit through improved habitats utilized by them and their prey species.

Shoreline Erosion Control

Article 110 provides for a shoreline erosion control plan to cover both reservoirs. Annual changes in lake elevation have contributed to increased erosion along some sections of the shorelines of Baker Lake and Lake Shannon. Erosion was rated "severe" along 0.8 mile (2.5 percent) and 0.7 mile (2.8 percent) of Baker Lake and Lake Shannon, respectively, while 2.7 miles (8.5 percent) and 2.8 miles (11.5 percent) was rated as "high" (AESI 2003 cited in FERC and ACOE 2006). The high erosion sites are primarily located along the western side of the

reservoirs--wave action is thought to be responsible. Additional "high" erosion sites were identified in the drawdown zone of both reservoirs and the drawdown of Baker Lake was determined to cause incision of the upper Baker River delta at the transition point from the river to the reservoir (Puget 2003c as cited in FERC and ACOE 2006). The proposed action would result in a similar range of Baker Lake water levels compared to current conditions, although lake levels would tend to remain higher than current conditions approximately 70 percent of the time, with little change in daily water level fluctuations (FERC and ACOE 2006). It is anticipated that the proposed action will have no effect on the rate of ongoing shoreline erosion or ongoing erosion in the drawdown zone. Within Lake Shannon, water levels under the proposed action have been modeled to be higher than current conditions just over half of the time and would slightly reduce the frequency of daily water level fluctuations in the 1 to 5-ft range (FERC and ACOE 2006). It is projected that these reduced levels could slightly reduce ongoing erosion along project shorelines (FERC and ACOE 2006). To ensure that ongoing shoreline erosion and ongoing erosion in drawdown areas are addressed, under Article 110, Puget would develop a Reservoir Shoreline Erosion Control Plan which would evaluate individual eroding sites, propose site-specific treatment measures, prioritize sites for treatment, monitor treated and untreated sites, and update the plan every 5 years.

We do not anticipate that future erosion control measures under the proposed action will result in any lake habitat alterations that would lead to bull trout injury or measurably impair the ability for bull trout to forage, rear, or spawn. Bull trout and most of their major prey species (with the exception of sculpin) in this system do not use the shallow littoral zone of the lake to spawn, so are not vulnerable to the direct effects of proposed erosion treatment along the littoral zone. Therefore, direct effects to bull trout are expected to be insignificant or discountable.

Although erosion may lead to the development of useable shallow shoreline habitats overtime, frequent erosion likely limits benthic macroinvertebrate diversity and production within these areas of the littoral zone and could potentially limit the reproductive success (e.g., due to burial, loss of interstitial habitat) of prey species such as sculpin that may spawn in the vicinity of these "severe" to "high" erosion sites. The proposed erosion treatment would be beneficial at many of these sites, since it would enable these shoreline habitats to become more stable. In the long-term, proposed treatment of erosion sites will allow habitats to stabilize and establish more diverse benthic communities which will provide benefits to bull trout and their prey species. Therefore, indirect effects to bull trout are expected to be insignificant.

Recreation and Terrestrial

The following recreation and terrestrial articles were not well-defined in the FEIS and have a potential to adversely affect bull trout:

- Article 303 Baker Lake Resort Redevelopment
- Article 308 Managing Dispersed Campsites
- Article 309 Bayview Campground Redevelopment
- Article 310 Upper Baker Trail and Trailhead Construction
- Article 312 Developed Recreation Monitoring
- Article 316 USFS Road Maintenance and Paving

- Article 505 Aquatic Riparian Habitat

These recreation projects will be funded by Puget and undertaken by the USFS. At this time these projects have not been adequately designed to anticipate the precise effects to bull trout. Due to the uncertainty associated with the exact impact of these projects (i.e., number of individuals actually affected by each aspect of these future project activities) to the species, we can only address the overall potential affect that these projects may have with respect to the likelihood of jeopardizing the species. We defer the assessment of actual levels of adverse effects to bull trout (i.e., number of individuals disturbed, injured and/or killed, and amount of habitat degraded and/or lost) until such time that these projects have been fully designed and the associated site-specific minimization measures have been described by the USFS or Puget.

Please note that although we have fully analyzed the effects of the Baker Lake Resort Redevelopment (Article 303) on bald eagles, marbled murrelets and NSOs later in this biological opinion, we do not have site maps and specific project plans about this project to quantify effects to bull trout.

Construction of Recreational Facilities

All recreation and terrestrial articles indicated above requiring construction have the potential to deliver sediment to waterbodies as a result of post-construction runoff from disturbed sites, or generate turbidity from in-channel construction. Most construction-related (including demolition) sediment releases are expected to be small (i.e., localized) in magnitude and short (i.e., hours to days) in duration due to the anticipated erosion control measures typically implemented by the USFS at campground and trail sites. Localized short-term increases in turbidity are likely to occur during dispersed recreation management (i.e., barrier rock placement and erosion control to harden shoreline campsites), campground rehabilitation (i.e., erosion control), Baker Lake Resort redevelopment (i.e., site clearing/demolition and erosion control). In all cases, short-term increases in the rate of delivery (i.e., pulses) of fine sediment to Baker Lake or the Baker River will likely occur as a result of each of these activities. Although the short-term effects from these construction activities may result in sub-lethal impacts to bull trout and/or temporary alteration to bull trout habitat parameters, neither lethal impacts to individuals nor permanent adverse alterations to habitat are anticipated. Depending upon the specific site plans and BMPs applied to these projects, future section 7 consultation may be necessary.

Road maintenance and construction (Article 316) could result in stormwater runoff and increased turbidity to streams used by bull trout. The USFS has completed section 7 consultation for road maintenance activities and construction through 2007. Depending upon site specific plans for this type of work in the future, additional section 7 consultations may be necessary.

The aquatic and riparian habitat enhancement projects that will be funded under Article 505 may cause short-term adverse effects to bull trout due to increased turbidity, but are expected to result in long-term benefits for habitat for bull trout. Depending upon the type of enhancement projects selected for funding and the site-specific plans of those projects, future section 7 consultation may be necessary.

Although demolition and construction will largely occur on preexisting disturbed sites, riparian vegetation removal may result during some construction activities. Effects from riparian vegetation removal will range from long-term (i.e., generally the period of time until regrowth of vegetation reaches equivalent value to what was lost has occurred) to permanent. These impacts are not expected to occur to an extent that will significantly alter the level of use of these lake or stream habitats by bull trout. Depending upon site specific plans, future section 7 consultation may be necessary.

Recreation Use Effects on Lake and Stream Habitats

With the installation and upgrade of recreational facilities and associated infrastructure (i.e., trails and roads) along Baker Lake as described in the recreation articles above, it is anticipated that recreational impacts at these location will increase after construction. Although the most significant impacts to stream and shoreline habitats will occur from the initial construction, use of these recreational facilities and infrastructure will likely produce additional impacts to the site and to surrounding areas. Recreation activities associated with the site have the potential to affect water quality (i.e., from sedimentation and contaminants) and to affect physical habitat along banks and shorelines (i.e., from heavy use).

The most likely sources of increased inputs of contaminants into the lakes will be from boat use (i.e., fuel and oil spills, submerged boat trailers, other boat-related chemical products) and from impervious surfaces of roads and parking facilities (i.e., contaminated stormwater runoff). Although the likelihood of inputs are expected to increase with increased recreation, we do not expect the levels to result in injury or mortality of bull trout due to the low quantities of contaminants likely to be introduced, the large water volume of the lake, the ephemeral nature of most of the anticipated contaminants, and the overall low likelihood of bull trout exposure. Facility and infrastructure design may include features that treat stormwater runoff to help protect water quality, and therefore, further reduce any anticipated contaminant impacts to aquatic habitats adjacent to the site.

Physical impacts to habitat will likely occur in the form of exposed soils, erosion, and vegetation removal. Use of popular recreational sites can result in habitat impacts on the periphery of harden designated-use areas (e.g., defined trails/paths, parking areas, day-use sites) even under the most regulated conditions (e.g., national parks and wilderness). Although we expect these impacts to occur at this site, we do not anticipate that these habitat impacts will rise to the level that would result in modified behavior, injury, or mortality of bull trout. The amount of shoreline habitat being affected is small, is common in nature, and there is a large amount of similar intact FMO habitat remaining and available adjacent to the site and within the lake as a whole. Depending upon the specific plans for each of the above recreational and terrestrial articles, future section 7 consultation may be necessary.

The following recreation article may affect, but is not likely to adversely affect bull trout:

- Article 305 Lower Baker Developed Recreation

Lower Baker Developed Recreation

Construction of the boat ramp within Lake Shannon (Article 305) will permanently alter that portion of the existing shoreline FMO habitat within the ramp's footprint. Effects from this permanent alteration in shoreline to bull trout are not expected to be measurable because of the small amount of shoreline habitat being altered, the common nature of the habitat being altered, and the total amount of similar FMO habitat remaining and available adjacent to the site and within the whole lake. Therefore, the effects to bull trout are expected to be insignificant.

Increased Fishing Pressure

With improvements (i.e., additional amenities) and increased capacity of recreational facilities, we anticipate recreational fishing pressure to increase, possibly resulting in increased levels of bycatch of bull trout in the reservoirs and tributaries. Bull trout are known to be susceptible to angling pressures. However, angling, and the potential bycatch or harvest of bull trout, is managed through the Washington State Fishing Regulations, therefore, this potential indirect effect and any associated injury or mortality will not be addressed in this biological opinion as it is regulated by other means. However, it is anticipated that support for visitor information facilities, interpretive services, information boards, and development of a law enforcement plan as part of the Agreement will have indirect benefits to bull trout through the display of conservation information and fishing regulations for bull trout. This should significantly reduce any angler impacts incurred through increased recreational pressures.

Impacts to Lake Habitats

With the installation of a new boat ramp and associated facilities in Lake Shannon (Article 305), it is anticipated that recreational impacts at this location will increase after construction. Although the most significant impacts to shoreline habitats will occur from the initial construction, use of this recreational facility will likely produce additional impacts to the site and to surrounding areas. Recreation activities associated with the site have the potential to result in effects to water quality (i.e., from contaminants) and to the physical habitat along the shoreline (i.e., from heavy use).

The most likely sources of increased inputs of contaminants into Lake Shannon will be from boat use (i.e., fuel and oil spills, submerged boat trailers, other boat-related chemical products) and from impervious surfaces of the parking facilities (i.e., contaminated stormwater runoff). Although inputs are expected to increase with increased recreation, we do not expect the levels to result in injury or mortality of bull trout due to the low quantities of contaminants likely to be introduced, the large water volume of the lake, the ephemeral nature of most of the anticipated contaminants, and the overall low likelihood of bull trout exposure. Design of the boat ramp facility may include features that treat stormwater runoff to help protect water quality, and therefore, further reduce any anticipated contaminant impacts to aquatic habitats adjacent to the site. Therefore, the effects to bull trout are expected to be insignificant.

Physical impacts to habitat in and around Lake Shannon will likely occur in the form of exposed soils, erosion, and vegetation removal. Use of popular recreational sites can result in habitat impacts on the periphery of hardened designated-use areas (e.g., defined trails/paths, parking areas, day-use sites) even under the most regulated conditions (e.g., national parks and wilderness areas). Although we expect these impacts to occur at this site, we do not anticipate that these habitat impacts will rise to the level that would result in modified behavior, injury, or mortality of bull trout. The amount of shoreline habitat being affected is small, is common in nature, and there is a large amount of similar intact FMO habitat remaining and available adjacent to the site and within the lake as a whole. Therefore, the effects to bull trout are expected to be insignificant.

The following recreation articles will be wholly beneficial to bull trout:

- Article 307 Upper Baker Visitor Interpretive Services
- Article 318 Law Enforcement
- Article 401Water Quality
- Article 602 Contingency Funds
- Article 603 Adaptive Management

These articles benefit bull trout by either increasing visitor knowledge about bull trout protection or by providing long-term conservation for this species.

The following articles will have no effect on bull trout. They are reporting or planning tasks that would occur in an office type setting and their implementation would have no effect on bull trout.

- Article 102 Aquatics Reporting
- Article 201 Programmatic Agreement
- Article 301 Recreation Management Report
- Article 304 Baker Reservoir Recreation Water Safety
- Article 501 Terrestrial Resource Management Plan
- Article 514 Use of Habitat Evaluation Procedures
- Article 601 Baker River Coordinating Committee

The activities associated with the following articles would not occur within or adjacent to streams occupied by bull trout and instead would occur within previously developed areas where facilities or infrastructure are currently in place. These articles would refurbish or enhance these developed areas for public access and benefit and would have no effect on bull trout. These articles will have no effect on bull trout:

- Article 302 Aesthetics Management Plan
- Article 306 Upper Baker Visitors Information Services
- Article 311 Lower Baker Trail Construction
- Article 313 Upper Baker Developed Recreation Maintenance
- Article 314 Upper Baker Trail and Trailhead Maintenance
- Article 315 Lower Baker Trail Maintenance

- Article 317 Access to Baker Lake

The following terrestrial articles are designed to enhance habitat for several species of birds and plants in and adjacent to the reservoirs. We do not anticipate that enhancement activities would be conducted along riparian areas of waters containing bull trout. Therefore, the following articles would have no effect on bull trout:

- Article 502 Deciduous Forest Habitat
- Article 503 Elk Habitat
- Article 504 Wetland Habitat
- Article 506 Osprey Nest Structures
- Article 507 Loon Floating Nest Platforms
- Article 508 Noxious Weeds
- Article 509 Special Status Plants
- Article 510 *Carex flava* (yellow sedge)
- Article 511 Decaying and Legacy Wood
- Article 512 Bald Eagle Night Roost Surveys
- Article 513 Bald Eagle Management Plans
- Article 515 Late Seral Forest
- Article 516 Mountain Goats
- Article 517 Road Closures for Grizzly Bears

CUMULATIVE EFFECTS – Bull Trout

Cumulative effects include the effects of future State, Tribal, local or private actions that are reasonably certain to occur in the action area. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

Cumulative effects to bull trout may result from recreation and land development in the action area not associated with Federal or Puget-owned lands (FERC and ACOE 2006). Timber harvest related to land conversion and land development have the potential to increase the peak-to-base flow ratio and to deliver sediment to streams used by bull trout and impact shoreline riparian areas of Lake Shannon. Land conversion and road building could have effects on bull trout habitats in the lake and its tributaries as well as increase overall access to the lower watershed. The timberlands surrounding Lake Shannon are currently owned by private timber companies (Puget 2005).

Conversion of privately-held timberlands to residential use is a resource concern in Washington State. The FWS issued a biological opinion recently for the Washington State Forest Practices Rules governing timber practices and their effects on bull trout and anadromous salmon that discusses this phenomenon in its cumulative effects section. The biological opinion states that several assumptions can be made about growth in western Washington: a) that growth of residential development is likely to be high around the peripheries of the existing population

centers, and b) that developed areas in western Washington are expected to expand east toward the Cascade foothills (USFWS 2006).

The immigration of telecommuters and retirees will result in growth outside of transportation corridors and urban centers. New technologies have created the opportunity for residential development of rural areas, followed by the development of support services (USFWS 2006). The Puget Sound Action Team estimates that Skagit County will experience a 50 percent growth rate by 2025 (USFWS 2006). From 1992 through 1997, rural lands in Washington were developed at the rate of 48,200 acres per year, half of which was converted forest land (USFWS 2006). For example, this conversion of forestland to residential use is currently occurring on land north of Swift reservoir, the most remote of the Lewis Hydroelectric Projects in Skamania County, Washington, and near the Nisqually Hydroelectric Project in Pierce County, Washington. These lands were historically managed for timber production.

Increased development or recreation not associated with Federal lands has the potential to affect bull trout and their habitat. Bull trout may be subject to increased angling pressure as a result of increased access and lake use associated with land conversion and development. Habitat effects from conversion and development include large wood removal resulting from initial site/view corridor clearing; on site firewood collection, hazard tree removal, and view corridor clearing by homeowners; changes in peak and base stream flows from increases in impervious surfaces; and increases in erosion, sedimentation, and contaminant inputs into the lake or along streams discharging into the lake from homeowner construction, maintenance, recreation, and transportation. On private lands surrounding Lake Shannon, bull trout have been reported to use Bear Creek (R2 2003) and have also been observed in the lake near the mouth of Thunder Creek (D. Huddle, Washington Department of Fish and Wildlife, pers. comm. 2003).

Development restrictions and critical area ordinances may reduce or minimize the potential for some of the negative impacts associated with development. Currently, areas east of the Mount Baker National Forest Boundary in Whatcom County are designated as “conservancy” lands. This designation typically requires any residential development to have a shoreline setback of 100 to 150 ft (Whatcom County Planning and Development Services Department 1998). In Skagit County, lands along Lake Shannon area also designated as “conservancy” lands (PSE 2002a). This designation typically requires any residential development to have a shoreline setback of 75 to 175 ft depending on type and height of unit (Skagit County 1983).

We expect that climate change will alter the ecosystem that supports bull trout during the term of the license. Effects of climate change may alter the geographic range of bull trout, the availability of cold water, may affect their forage species, and may affect bull trout in ways that are currently unknown.

CONCLUSION – Bull Trout

After reviewing the best scientific and commercial data available, the current status of bull trout, the environmental baseline for the action area, the effects of the proposed Baker River Hydroelectric Project Relicensing, and the cumulative effects, it is the FWS's biological opinion that the Baker River Hydroelectric Project Relicensing, as proposed, is not likely to jeopardize the continued existence of the bull trout. In evaluating this proposed action's risk to cause jeopardy to bull trout, it is essential to evaluate the effects of the action at several population scales (i.e., local population, core area, population segment, and coterminous entity). Because the likely loss of a reproductive unit is unquestionably one of the greatest detriments to the persistence of bull trout both at a local and range-wide level, one must first determine this proposed action's consequences to the local populations within the Baker River system and within the greater Lower Skagit core area. If, under the proposed action, a loss is considered unlikely to occur now or in the future, then jeopardy to bull trout is highly unlikely to result from the action. Only if a loss is considered likely, would a progressive analysis of large scales be necessary to make an ultimate determination of jeopardy or no jeopardy for the coterminous population.

The Baker River Project will result in a range of effects to bull trout and their habitat, some that are largely beneficial, and others that will lead to the injury and mortality of individuals from the Baker Lake and Sulphur Creek (Lake Shannon) local populations within the Baker River system of the Lower Skagit core area. Effects of the action are typically phased throughout the duration of the license period, with benefits phasing in and the level of adverse effects generally phasing out over time. The duration of beneficial effects is largely long-term in nature, while the duration of adverse effects ranges from short to long-term. Individuals from other local populations that are external to the Baker River system, but within the Lower Skagit core area, could also be injured or killed. However, injury or mortality of these individuals is typically expected to be uncommon, since individuals from local populations outside of the Baker River system have a much lower likelihood of exposure to most of the effects of the proposed action. Because of this rarity; the large number of "external" local populations within the Lower Skagit core area from which an individual may come; and the generally strong status of the majority of these local populations; we have concluded that this minor amount of injury and/or mortality will not significantly affect any one of these "external" local populations nor the core population as a whole.

At the individual level, effects of the proposed action are expected to reduce current project operation mortality rates of individual bull trout, improve the habitat connectivity both within and outside of the Baker River system, facilitate migratory movements of the anadromous life history form, and increase forage availability within FMO habitats (i.e., Baker Lake and Lake Shannon). At the local population level, effects to bull trout from this proposed action are anticipated to help increase adult/population abundance, contribute to a more positive long-term trend in adult abundance, and help maintain life history diversity (especially the anadromous form) within the two local populations of the Baker River system. These beneficial aspects of the proposed action will be realize through the establishment of upstream fish passage facilities at Upper Baker Dam, the improvement of existing fish passage facilities at both Upper and Lower Baker Dams, the improvement of facility operation and maintenance (e.g., improved instream flows, ramping rates), and implementation of fish propagation and habitat/nutrient enhancement measures. The maximum benefits to bull trout from the proposed action will

largely be obtained upon completion and full implementation of most actions in approximately 2015.

Consequences of Impacts to Habitat

Current bull trout habitat within the Baker River system is largely intact and protected. The majority of spawning and rearing habitat for the Baker Lake local population is on lands under USFS and NPS ownership. This habitat largely lies in areas under a protected status. Although available spawning and rearing habitat for bull trout is presumably less than what existed prior to construction of the project facilities, it is not known whether this reduction specifically accounts for the apparent decline in the inferred historic population size of the Baker Lake and Sulphur Creek local populations. Currently available spawning and rearing habitat does not appear to be at capacity, suggesting other factors may be largely responsible for this past decline. Although the reduction of rearing habitat in Sulphur Creek will be permanent in the footprint of an upstream fish passage facility, it is not expected to significantly impact the local population. Based on recent surveys (R2 and PSE 2006), habitat in this lower reach of Sulphur Creek appears to support only low levels of use by juvenile bull trout compared to upstream reaches. This suggests that this reach is primarily used as a migratory corridor for outmigrating juveniles and is not a reach preferred by juveniles for long-term residency.

FMO habitats within the Baker River system are now primarily provided by the larger Baker Lake and the Lake Shannon reservoir, which actually represent a significant increase over the amount of lacustrine habitat that would have been historically available to bull trout. For some bull trout populations, impounded lakes and reservoirs have been known to more than compensate for the riverine FMO habitats that were inundated, at least in the short-term (e.g., Lake Koocanusa and Lake Billy Chinook) (MBTSG 1998; Beauchamp and Van Tassell 2001; Cope 2006), while other reservoirs do not provide sufficient compensatory habitat (e.g., Noxon and Cabinet Gorge reservoirs) (MBTSG 1998). FMO habitat in Lake Shannon is vulnerable to future land conversion and development impacts on private lands. However, we anticipate that current shoreline designations under the Shorelines Management Act and related development restrictions will help minimize, although not necessarily eliminate impacts. With the current and proposed listings of several salmonids in the Puget Sound region (i.e., bull trout, Chinook, steelhead), the heightened concern over their population status and the recognition of the Skagit River watershed as a cornerstone to their recovery and long-term conservation is anticipated to at least maintain, if not broaden, any future restrictions on development within these areas of the Baker River system.

Other FMO habitats (i.e., Skagit River system and Puget Sound nearshore) historically used by Baker River system bull trout are still largely available, however, their overall quality has been degraded in a number of locations, some which affect all anadromous bull trout. In some cases (e.g., Skagit mainstem side channels), the quantity of historically available habitat has been significantly reduced. Although the Baker River Project has contributed (i.e., through alteration of flow regime and loss of LWD recruitment) to the degradation of habitats in the lower Skagit River mainstem, the current condition of this habitat is in large part attributable to other impacts (e.g., forestry, agriculture, transportation, and development) that have occurred independent of the initial construction and operation of the project. Because the proposed action will continue to

largely maintain the existing quantity and quality of the habitat within the Baker River system, especially spawning and rearing habitats within the Baker Lake and Sulphur Creek local populations, we do not expect the short-term impacts to habitat to lead to jeopardy of the bull trout. In fact, we expect some habitat conditions to generally improve with implementation of the new license agreement.

Consequences of Injury and Mortality

Although habitat impacts from the proposed action are not expected to significantly affect the two Baker River system local populations, there are a number of aspects of the proposed action that will result in additional or continued direct injury and mortality of individuals from these local populations. This will result in the direct removal of individuals from the Baker Lake and Sulphur Creek local populations. It is anticipated that most injuries and mortalities will occur to juvenile and subadult (i.e., age 0+ to 3+) bull trout, although some lesser amount of injury and mortality to egg and adult life stages are also expected.

Injury and mortality to bull trout in the short-term is primarily expected from fish passage construction within Sulphur Creek and side-channel construction in Channel Creek; however, ongoing operation of the facilities also continues to incur mortality in the short and long-term (see discussion that follows). The low levels of injury and mortality in the short-term are not expected to significantly reduce the likelihood of persistence of the Baker Lake and Sulphur Creek local populations. The total amount of injury and mortality is anticipated to be substantially minimized through the implementation of BMPs and by the limited exposure (i.e., location and duration) to these activities. Although facing no anthropogenic injury or mortality would be ideal for maximizing abundance within these local populations, the juvenile life stages of bull trout are typically more abundant and inherently have a higher natural mortality rate compared to older life stages, so the limited loss of juveniles in this case is expected to have a less consequential impact to the population as a whole.

Long-term injury and mortality will result primarily from the operation of the facilities, with the current injury and mortality rates expected to continue at each facility until improvements to downstream fish passage are completed for the Lower and Upper Baker Dams, in 2008 and 2012, respectively. Injury and mortality rates are expected to decrease significantly after completion of downstream fish passage improvements, but are not expected to go to zero because of regularly-occurring, unavoidable spill events, continued stranding risk from ramping events, and continued risk to some bull trout redds (i.e., eggs) from Baker Lake drawdowns. Annual stranding mortalities from ramping events are expected to be low since juvenile/subadult bull trout primarily use the lower Baker River and Skagit River for foraging and migration so are not expected to take up long-term residency within these reaches. The potential annual loss of a redd, although much more significant than the loss of an individual juvenile bull trout, is not expected to increase the vulnerability of the Baker Lake local population to local extirpation. Some loss of redds occurred naturally prior to development of the Baker facilities, although likely under higher population levels. The loss of bull trout redds within the Baker River delta has likely occurred periodically since the completion of Upper Baker Dam, and the proposed action is unlikely to alter this periodic loss. Although this ongoing loss has contributed to a

lower than expected potential production within the system, it does not appear to be below self-sustaining levels.

Because juvenile mortality rates in salmonids are typically high; existing mortality rates through the facilities have generally been unchanged for decades; and current population levels, although moderate, appear to be relatively stable; we do not expect the continuation of these rates, and subsequently the reduction of these rates for the remaining period of the license, to result in a significant reduction in local population adult abundance and productivity. Further, it is expected that adult abundance will actually increase once the current injury and mortality rates have been reduced beginning in 2008 and then increase further with additional reductions in 2012. Access between spawning and rearing habitats and FMO habitats is also expected to improve with the proposed action. Although these improvements will not fully restore volitional passage, it is expected to facilitate and encourage greater anadromous migration and allow for safer migration of juveniles and adults for the period of the license. Consequently, we do not anticipate a reduction in the likelihood of survival and recovery of bull trout in the Lower Skagit core area or in the coterminous range as a result of the proposed action.

MARBLED MURRELET

STATUS OF THE SPECIES—Marbled Murrelet

Legal Status

The marbled murrelet was federally listed as a threatened species in Washington, Oregon, and northern California effective September 28, 1992 (57 FR 45328 [October 1, 1992]). The final rule designating critical habitat for the marbled murrelet (61 FR 26256 [May 24, 1996]) became effective on June 24, 1996. The FWS recently proposed a range-wide revision to the 1996 murrelet critical habitat designation (71 FR 53838 [September 12, 2006]). A final rule is expected in September 2007. The species' decline has largely been caused by extensive removal of late-successional and old-growth coastal forests which serve as nesting habitat for marbled murrelets. Additional listing factors included high nest-site predation rates and human-induced mortality in the marine environment from gillnets and oil spills.

The FWS determined that the California, Oregon, and Washington distinct population segment of the marbled murrelet does not meet the criteria set forth in the FWS's 1996 Distinct Population Segment policy (61 FR 4722 [May 24, 1996]). However, the marbled murrelet retains its listing and protected status as a threatened species under the Act until the original 1992 listing decision is revised through formal rule-making procedures, involving public notice and comment.

Critical habitat was designated for the marbled murrelet to addresses the objective of stabilizing the population size. To fulfill that objective, the Marbled Murrelet Recovery Plan (U.S. Fish and Wildlife Service 1997a) (Recovery Plan), focuses on protecting adequate nesting habitat by maintaining and protecting occupied habitat and minimizing the loss of unoccupied but suitable habitat (U.S. Fish and Wildlife Service 1997a:119). The Recovery Plan identified six

Conservation Zones throughout the listed range of the species: Puget Sound (Conservation Zone 1), Western Washington Coast Range (Conservation Zone 2), Oregon Coast Range (Conservation Zone 3), Siskiyou Coast Range (Conservation Zone 4), Mendocino (Conservation Zone 5), and Santa Cruz Mountains (Conservation Zone 6).

As explained in the Endangered Species Consultation Handbook (U.S. Fish and Wildlife Service and National Marine Fisheries Service 1998) and clarified by Memorandum (U.S. Fish and Wildlife Service 2006), jeopardy analyses must always consider the effect of proposed actions on the survival and recovery of the listed entity. In the case of the marbled murrelet, the FWS jeopardy analysis will consider the effect of the action on the long-term viability of the murrelet in its listed range (Washington, Oregon, and northern California), beginning with an analysis of the action's effect on Conservation Zones 1 and 2 (described below).

Conservation Zone 1

Conservation Zone 1 includes all the waters of Puget Sound and most waters of the Strait of Juan de Fuca south of the U.S.-Canadian border and extends inland 50 mi from the Puget Sound, including the north Cascade Mountains and the northern and eastern sections of the Olympic Peninsula. Forest lands in the Puget Trough have been predominately replaced by urban development and the remaining suitable habitat in Zone 1 is typically a considerable distance from the marine environment, lending special importance to nesting habitat close to Puget Sound (U.S. Fish and Wildlife Service 1997a).

Conservation Zone 2

Conservation Zone 2 includes waters within 1.2 mi of the Pacific Ocean shoreline south of the U.S.-Canadian border off Cape Flattery and extends inland to the midpoint of the Olympic Peninsula. In southwest Washington, the Zone extends inland 50 mi from the Pacific Ocean shoreline. Most of the forest lands in the northwestern portion of Zone 2 occur on public (State, county, city, and Federal) lands, while most forest lands in the southwestern portion are privately owned. Extensive timber harvest has occurred throughout Zone 2 in the last century, but the greatest loss of suitable nest habitat is concentrated in the southwest portion of Zone 2 (U.S. Fish and Wildlife Service 1997a). Thus, marbled murrelet conservation is largely dependent upon Federal lands in northern portion of Zone 2 and non-Federal lands in the southern portion.

Life History

Marbled murrelets are long-lived seabirds that spend most of their life in the marine environment, but use old-growth forests for nesting. Detailed discussions of the biology and status of the marbled murrelet are presented in the final rule listing the murrelet as threatened (57 FR 45328 [October 1, 1992]), the Recovery Plan, Ecology and Conservation of the Marbled murrelet (Ralph et al. 1995), the final rule designating marbled murrelet critical habitat (61 FR 26256 [May 24, 1996]), and the Evaluation Report in the 5-Year Status Review of the Marbled Murrelet in Washington, Oregon, and California (McShane et al. 2004).

Physical Description

The marbled murrelet is taxonomically classified in the family Alcidae (alcids), a family of Pacific seabirds possessing the ability to dive using wing-propulsion. The plumage of this relatively small (9.5 in to 10 in) seabird is identical between males and females, but the plumage of adults changes during the winter and breeding periods providing some distinction between adults and juveniles. Breeding adults have light, mottled brown under-parts below sooty-brown upperparts contrasted with dark bars. Adults in winter plumage have white under-parts extending to below the nape and white scapulars with brown and grey mixed upperparts. The plumage of fledged young is similar to the adult winter plumage (U.S. Fish and Wildlife Service 1997a).

Distribution

The range of the marbled murrelet, defined by breeding and wintering areas, extends from the northern terminus of Bristol Bay, Alaska, to the southern terminus of Monterey Bay in central California. The listed portion of the species' range extends from the Canadian border south to central California. Marbled murrelet abundance and distribution has been significantly reduced in portions of the listed range, and the species has been extirpated from some locations. The areas of greatest concern due to small numbers and fragmented distribution include portions of central California, northwestern Oregon, and southwestern Washington (U.S. Fish and Wildlife Service 1997a).

Reproduction

Marbled murrelet breeding is asynchronous and spread over a prolonged season. In Washington, the murrelet breeding season occurs between April 1 and September 15 (Figure 1). Egg laying and incubation occur from late April to early August and chick rearing occurs between late May and late August, with all chicks fledging by early September (Hamer et al. *in litt.* 2003).

Marbled murrelets lay a single-egg clutch (Nelson 1997), which may be replaced if egg failure occurs early (Hebert et al. 2003; McFarlane Tranquilla et al. 2003). However, there is no evidence a second egg is laid after successfully fledging a first chick. Adults typically incubate for a 24-hour period, then exchange duties with their mate at dawn. Hatchlings appear to be brooded by an adult for 1 to 2 days and are then left alone at the nest for the remainder of the rearing period, except during feedings. Both parents feed the chick, which receives one to eight meals per day (Nelson 1997). Most meals are delivered early in the morning while about a third of the food deliveries occur at dusk and intermittently throughout the day (Nelson and Hamer 1995a). Chicks fledge 27 to 40 days after hatching. The initial flight of a fledgling appears to occur at dusk and parental care is thought to cease after fledging (Nelson 1997).

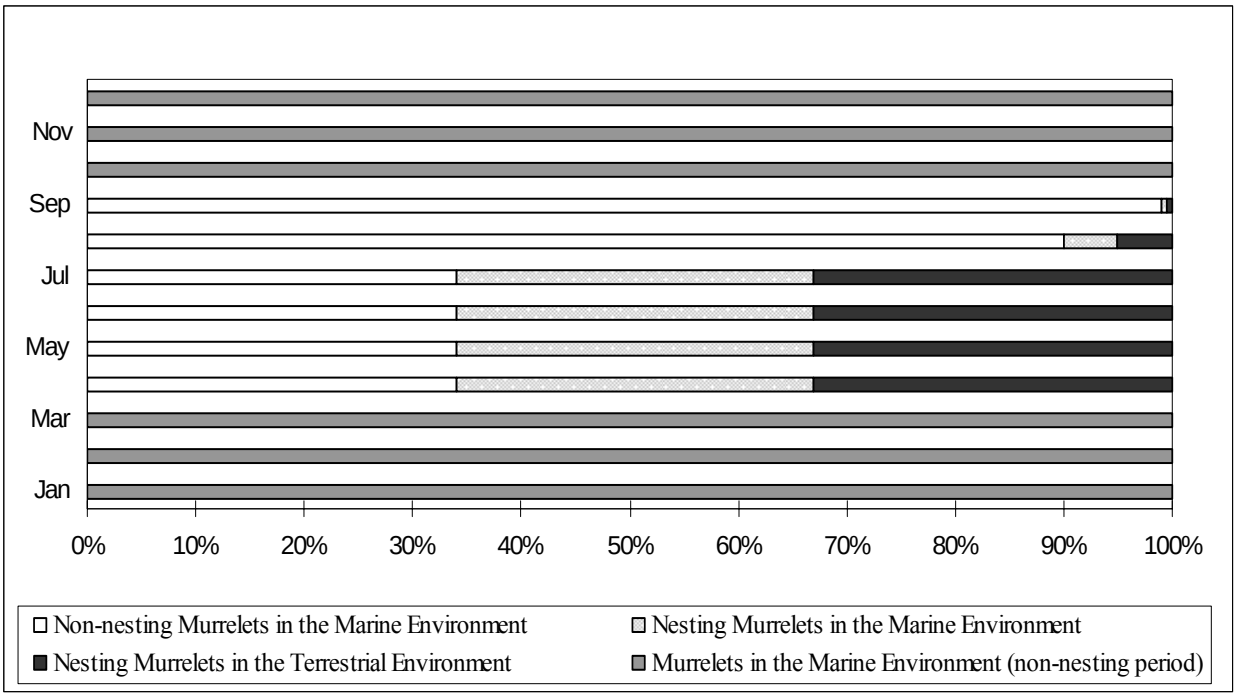

Figure 1. The seasonal changes in the relative proportion of breeding and non-breeding marbled murrelets in the marine and terrestrial environments[3] within Washington State (Conservation Zones 1 and 2)

Vocalization

Marbled murrelets are known to vocalize between 480 Hertz and 4.9 kilohertz and have at least 5 distinct call types (Suzanne Sanborn, pers. comm. 2005). Marbled murrelets tend to be more vocal at sea compared to other alcids (Nelson 1997). Individuals of a pair vocalize after surfacing apart from each other, after a disturbance, and during attempts to reunite after being separated (Strachan et al. 1995).

MURRELETS IN THE MARINE ENVIRONMENT

Courtship, foraging, loafing, molting, and preening occur in near-shore marine waters. Beginning in early spring, courtship continues throughout summer with some observations even noted during the winter period (Speckman 1996; Nelson 1997). Observations of courtship occurring in the winter suggest that pair bonds are maintained throughout the year (Speckman 1996; Nelson 1997). Courtship involves bill posturing, swimming together, synchronous diving, vocalizations, and chasing in flights just above the surface of the water. Copulation occurs both inland (in the trees) and at sea (Nelson 1997).

[3] Demographic estimates were derived from Peery et al. (2004) and nesting chronology was derived from Hamer and Nelson (1995) and Bradley et al. (2004) where April 1 is the beginning of the nesting season, September 15 is the end of the nesting season, and August 6 is the beginning of the late breeding season when an estimated 70 percent of the murrelet chicks have fledged.

Loafing

When marbled murrelets are not foraging or attending a nest, they loaf on the water, which includes resting, preening, and other activities during which they appear to drift with the current, or move without direction (Strachan et al. 1995). Strachan et al. (1995) noted that vocalizations occurred during loafing periods, especially during the mid-morning and late afternoon.

Molting

Marbled murrelets go through two molts each year. The timing of molts varies temporally throughout their range and are likely influenced by prey availability, stress, and reproductive success (Nelson 1997). Adult (after hatch-year) marbled murrelets have two primary plumage types: alternate (breeding) plumage and basic (winter) plumage. The pre-alternate molt occurs from late February to mid-May. This is an incomplete molt during which the birds lose their body feathers but retain their ability to fly (Carter and Stein 1995; Nelson 1997). A complete pre-basic molt occurs from mid-July through December (Carter and Stein 1995; Nelson 1997). During the pre-basic molt, marbled murrelets lose all flight feathers somewhat synchronously and are flightless for up to 2 months (Nelson 1997). In Washington, there is some indication that the pre-basic molt occurs from mid-July through the end of August (Chris Thompson, WDFW, pers. comm. 2003).

Flocking

Strachan et al. (1995) defines a flock as three or more birds in close proximity which maintain that formation when moving. Various observers throughout the range of the marbled murrelet report flocks of highly variable sizes. In the southern portion of the murrelet's range (California, Oregon, and Washington), flocks rarely contain more than 10 birds. Larger flocks usually occur during the later part of the breeding season and may contain juvenile and subadult birds (Strachan et al. 1995).

Aggregations of foraging marbled murrelets are probably related to concentrations of prey. In Washington, marbled murrelets are not generally found in interspecific feeding flocks (Strachan et al. 1995). Strong et al. (in Strachan et al. 1995) observed that marbled murrelets avoid large feeding flocks of other species and presumed that the small size of murrelets may make them vulnerable to kleptoparasitism or predation in mixed species flocks. Strachan et al. (1995) point out that if marbled murrelets are foraging cooperatively, the confusion of a large flock of birds could reduce foraging efficiency.

Foraging Behavior

Marbled murrelets forage at all times of the day, but most actively in the morning and late afternoon (Strachan et al. 1995). Marbled murrelets typically forage in pairs, but have been observed to forage alone or in groups of three or more (Carter and Sealy 1990; Strachan et al. 1995; Speckman et al. 2003). Strachan et al. (1995) believe pairing enhances foraging success through cooperative foraging techniques. For example, pairs consistently dive together during

foraging and often synchronize their dives by swimming towards each other before diving (Carter and Sealy 1990) and resurfacing together on most dives. Strachan et al. (1995) speculate pairs may keep in visual contact underwater. Paired foraging is common throughout the year, even during the incubation period, suggesting that breeding marbled murrelets may temporarily pair up with other foraging individuals (non-mates) (Strachan et al. 1995; Speckman et al. 2003).

Marbled murrelets generally forage within 1.25 mi of shore (Strachan et al. 1995), but are also known to forage in freshwater lakes (Nelson 1997). Traditional feeding areas (nurseries) are used consistently on a daily and yearly basis (Carter and Sealy 1990). Activity patterns and foraging locations are influenced by biological and physical processes that concentrate prey, such as weather, climate, time of day, season, light intensity, up-wellings, tidal rips, narrow passages between islands, shallow banks, and kelp (*Nereocystis* spp.) beds (Ainley et al. 1995; Burger 1995; Strong et al. 1995; Speckman 1996; Nelson 1997).

Juveniles are found closer to shore than adults (rarely greater than 0.625 mi offshore) (Beissinger 1995) and forage without the assistance of adults (Strachan et al. 1995). Kuletz and Piatt (1999) found that in Alaska, juvenile murrelets congregated in kelp beds. Kelp beds are often with productive waters and may provide protection from avian predators (Kuletz and Piatt 1999). McAllister (*in litt.* in Strachan et al. 1995) found that juveniles were more common within 328 ft of shorelines, particularly, where bull kelp was present.

Marbled murrelets forage most frequently in nearshore water generally less than 98 ft (30 m) deep (Strachan et al. 1995). The most common foraging depths are not known. However, marbled murrelets are known to feed on small schools of fish within the upper 16.4 ft (5 m) of marine waters (Mahon et al. 1992). An alcid the size of a marbled murrelet is expected to have a maximum diving depth of about 154 ft (47 m) (Mathews and Burger 1998), although the deepest record of a marbled murrelet was from one captured at 89 ft (27 m) in a gill net off of California (Carter and Erickson 1992). Jodice and Collopy (1999) reported most diving in Oregon occurred in water less than 33 ft (10 m) deep.

The duration of dives appears to depend upon age (adults vs. juveniles), water depth, and prey depth. Reported dive durations are highly variable for marbled murrelets, ranging from 7 to 42 seconds, with an average of 14 seconds reported from observations in California (Strachan et al. 1995). Carter and Sealy (1990) reported that dive durations in British Columbia averaged 27.8 seconds and Thorensen (1989) reported dive durations in Washington ranged from 15 to 115 seconds.

Adults and subadults often move away from breeding areas prior to molting and must select areas with predictable prey resources during the flightless period (Carter and Stein 1995; Nelson 1997). During the non-breeding season, marbled murrelets disperse and can be found farther from shore (Strachan et al. 1995). Little is known about marine-habitat preference outside of the breeding season, but use during the early spring and fall is thought to be similar to that preferred during the breeding season (Nelson 1997). During the winter there may be a general shift from exposed outer coasts into more protected waters (Nelson 1997), for example many marbled murrelets breeding on the exposed outer coast of Vancouver Island appear to congregate in the more sheltered waters within the Puget Sound and the Strait of Georgia in fall and winter (Burger

1995). However, in many areas, marbled murrelets remain associated with the inland nesting habitat during the winter months (Carter and Erickson 1992) and throughout the listed range, murrelets do not appear to disperse long distances, indicating they are year-round residents (McShane et al. 2004).

Prey Species

Throughout their range, marbled murrelets are opportunistic feeders and utilize prey of diverse sizes and species. They feed primarily on fish and invertebrates in near-shore marine waters although they have also been detected on rivers and inland lakes (Carter and Sealy 1986; 57 FR 45328 [October 1, 1992]). In general, small schooling fish and large pelagic crustaceans are the main prey items. Pacific sand lance *(Ammodytes hexapterus)*, northern anchovy *(Engraulis mordax),* immature Pacific herring *(Clupea harengus)*, capelin *(Mallotus villosus)*, and surf smelt (Osmeridae) are the most common fish species taken and are eaten year round. Squid (*Loligo* spp.), euphausiids, mysid shrimp, and large pelagic amphipods are the main invertebrate prey and are primarily eaten during the non-breeding season, thus are not a significant part of a nestling's diet.

Marbled murrelets usually carry a single fish to their chicks and appear to select a relatively large (relative to body size), energy-rich fish such as large sand lance, immature herring, anchovy, smelt, and occasionally salmon smolts (Burkett 1995; Nelson 1997). This forces breeding adults to exercise more specific foraging strategies when feeding chicks. Freshwater prey appears to be important to some individuals during several weeks in summer and may facilitate more frequent chick feedings, especially for those that nest far inland (Hobson 1990). As a result, the distribution and abundance of prey suitable for feeding chicks may greatly influence the overall foraging behavior and location(s) during the nesting season. The availability of abundant forage fish during the nestling period may significantly affect the energy demand on adults by influencing both foraging time and number of trips inland required to feed nestlings (57 FR 45328 [October 1, 1992]).

Predators

At-sea predators include bald eagles (*Haliaeetus leucocephalus*), peregrine falcons (*Falco peregrinus*), western gulls (*Larus occidentalis*), and northern fur seals (*Callorhinus ursinus*) (McShane et al. 2004). California sea lions (*Zalophus californianus*), northern sea lions (*Eumetopias jubatus*), and large fish may occasionally prey on marbled murrelets (Burger 2002).

Marbled Murrelets in the Terrestrial Environment

Marbled murrelets are dependent upon old-growth forests, or forests with an older tree component, for nesting habitat (Hamer and Nelson 1995; Ralph et al. 1995; McShane et al. 2004). Sites occupied by marbled murrelets tend to have a higher proportion of mature forest age-classes than do unoccupied sites (Raphael et al. 1995). Specifically, marbled murrelets prefer high and broad platforms for landing and take-off, and surfaces which will support a nest cup (Hamer and Nelson 1995). The physical condition of a tree appears to be the important factor in determining the tree's suitability for nesting (Ralph et al. 1995); therefore, presence of

old-growth in an area does not assure the stand contains sufficient structures (i.e. platforms) for nesting. In Washington, marbled murrelet nests have been found in conifers, specifically, western hemlock (*Tsuga heterophylla*), Sitka spruce (*Picea sitchensis*), Douglas-fir (*Pseudotsuga menziesii*), and western red cedar (*Thuja plicata*) (Hamer and Nelson 1995; Hamer and Meekins 1999). Nests have been found intrees as small as 2.6 ft in diameter at breast height on limbs at least 65 ft from the ground and 0.36 ft in diameter (Hamer and Meekins 1999).

Marbled murrelet populations may be limited by the availability of suitable nesting habitat. Although no data are available, Ralph et al. (1995) speculate the suitable nesting habitat presently available in Washington, Oregon, and California may be at or near carrying capacity based on: 1) at-sea concentrations of marbled murrelets near suitable nesting habitat during the breeding season, 2) winter visitations to nesting sites, and 3) the limitation of nest sites available in areas with large amounts of habitat removal.

Marbled murrelets have been observed visiting nesting habitat during non-breeding periods in Washington, Oregon, and California (Nelson 1997; Naslund 1993) which may indicate adults are defending nesting sites and/or stands (Ralph et al. 1995). Other studies provide further insight to the habitat associations of breeding marbled murrelets, concluding that breeding murrelets displaced by the loss of nesting habitat do not pack in higher densities into remaining habitat (McShane et al. 2004). Thus, marbled murrelets may currently be occupying nesting habitat at or near carrying capacity in highly fragmented areas and/or in areas where a significant portion of the historic nesting habitat has been removed (Ralph et al. 1995).

Unoccupied stands containing nesting structures are important to the population for displaced breeders or first-time breeding adults. Even if nesting habitat is at carrying capacity, there will be years when currently occupied stands become unoccupied as a result of temporary disappearance of inhabitants due to death or to irregular breeding (Ralph et al. 1995). Therefore, unoccupied stands will not necessarily indicate that habitat is not limiting or that these stands are not marbled murrelet habitat (Ralph et al. 1995) and important to the species persistence.

Radar and audio-visual studies have shown marbled murrelet habitat use is positively associated with the presence and abundance of mature and old-growth forests, large core areas of old-growth, low edge and fragmentation, proximity to the marine environment, total watershed area, and increasing forest age and height (McShane et al. 2004). In California and southern Oregon, areas with abundant numbers of marbled murrelets were farther from roads, occurred more often in parks protected from logging, and were less likely to occupy old-growth habitat if it was isolated (more than 3 miles or 5 km) from other nesting murrelets (Meyer et al. 2002). Meyer et al. (2002) also found at least a few years passed before birds abandoned fragmented forests.

Marbled murrelets do not form dense colonies which is atypical of most seabirds. Limited evidence suggests they may form loose colonies or clusters of nests in some cases (Ralph et al. 1995). The reliance of marbled murrelets on cryptic coloration to avoid detection suggests they utilize a wide spacing of nests in order to prevent predators from forming a search image (Ralph et al. 1995). However, active nests have been seen within 328 ft (100 m) of one another in the North Cascades in Washington and within 98 ft (30 m) in Oregon (Kim Nelson, OSU, pers. comm. 2005). Estimates of marbled murrelet nest densities vary depending upon the method of

data collection. For example, nest densities estimated using radar range from 0.007 to 0.104 mean nests per acre (0.003 to 0.042 mean nests per ha), while nest densities estimated from tree climbing efforts range from 0.27 to 3.51 mean nests per acre (0.11 to 1.42 mean nests per ha) (Nelson 2005).

There is little data available regarding marbled murrelet nest site fidelity because of the difficulty in locating nest sites and observing banded birds attending nests. However, marbled murrelets have been detected in the same nesting stands for many years (at least 20 years in California and 15 years in Washington), suggesting murrelets have a high fidelity to nesting areas, most likely at the watershed scale (Nelson 1997). Use of the same nest platform in successive years as well as multiple nests in the same tree have been documented, although it is not clear whether the repeated use involved the same birds (Divoky and Horton 1995; Nelson and Peck 1995; Nelson 1997; Manley *in litt.* 2000; Hebert et al. 2003). The limited observed fidelity to the same nest depression in consecutive years appears to be lower than for other alcids, but this may be an adaptive behavior in response to high predation rates (Divoky and Horton 1995). Researchers have suggested fidelity to specific or adjacent nesting platforms may be more common in areas where predation is limited or the number of suitable nest sites are fewer because large, old-growth trees are rare (Nelson and Peck 1995; Singer et al. 1995; Manley 1999).

Ralph et al. (1995) speculated that the fidelity to nest sites or stands by breeding marbled marbled murrelets may be influenced by the nesting success of previous rearing attempts. Although marbled murrelet nesting behavior in response to failed nest attempts is unknown, nest failures could lead to prospecting for new nest sites or mates. Other alcids have shown an increased likelihood to relocate to a new nest in response to breeding failure (Divoky and Horton 1995). However, marbled murrelets likely remain in the same watershed over time as long as stands are not significantly modified (Ralph et al. 1995).

It is unknown whether juveniles disperse from natal breeding habitat (natal dispersal) or return to their natal breeding habitat after reaching breeding age (natal philopatry). Natal dispersal distance can be expected to be as high or higher than other alcids given 1) the reduced extent of the breeding range, 2) the overlap between the wintering and breeding areas, 3) the distance individuals are known to move from breeding areas in the winter, 4) adult attendance of nesting areas during the non-breeding season where, in theory, knowledge of suitable nesting habitat is passed onto prospecting non-breeders, and 5) the 3-year to 5-year duration required for the onset of breeding age allowing non-breeding marbled murrelets to prospect nesting and forage habitat for several years prior to reaching breeding age (Divoky and Horton 1995). Conversely, Swartzman et al. (1997 in McShane et al. 2004) suggested juvenile dispersal is likely to be low, as it is for other alcid species. Nevertheless, the presence of unoccupied suitable nesting habitat on the landscape may be important for first-time nesters if they disperse away from their natal breeding habitat.

Marbled murrelets generally select nests within 37 mi (60 kilometers (km)) of marine waters (Miller and Ralph 1995). However, in Washington, occupied habitat has been documented 52 mi (84 km) from the coast and marbled murrelets have been detected up to 70 mi (113 km) from the coast in the southern Cascade Mountains (Evans Mack et al. 2003).

When tending active nests during the breeding season (and much of the non-breeding season in southern parts of the range), breeding pairs forage within commuting distance of the nest site. Daily movements between nest sites and foraging areas for breeding marbled murrelets averaged 10 mi in Prince William Sound, Alaska (McShane et al. 2004), 24 mi in Desolation Sound, British Columbia, Canada (Hull et al. 2001), and 48 mi in southeast Alaska. In California, Hebert and Golightly (2003) found the mean extent of north-south distance traveled by breeding adults to be about 46 mi.

Marbled murrelet nests have been located at a variety of elevations from sea level to 5,020 ft (Burger 2002). However, most nests have been found below 3,500 ft. In Conservation Zone 1, marbled murrelets have exhibited "occupied" behaviors up to 4,400 ft elevation and have been detected in stands up to 4,900 ft in the north Cascade Mountains (Peter McBride, WDNR, pers. comm. 2005). On the Olympic Peninsula, survey efforts for nesting marbled murrelets have encountered occupied stands up to 4,000 ft within Conservation Zone 1 and up to 3,500 ft within Conservation Zone 2. Surveys for marbled murrelet nesting at higher elevations on the Olympic Peninsula have not been conducted. However, recent radio-telemetry work detected a murrelet nest at 3,600 ft elevation on the Olympic Peninsula in Conservation Zone 1 (Martin Raphael, USFS, pers. comm. 2005).

Population Status in the Coterminous United States

Population Abundance

Research on marbled murrelet populations in the early 1990s estimated marbled murrelet abundance in Washington, Oregon, and California at 18,550 to 32,000 (Ralph et al. 1995). However, consistent population survey protocols were not established for marbled murrelets in the coterminous United States until the late 1990s following the development of the marine component of the Environmental Monitoring (EM) Program for the NWFP (Bentivoglio et al. 2002). As a consequence, sampling procedures have differed and thus the survey data collected prior to the EM Program is unsuitable for estimating population trends for the marbled murrelet (McShane et al. 2004).

The development of the EM Program unified the various at-sea monitoring efforts within the 5 Conservation Zones encompassed by the NWFP. These efforts along with efforts in Conservation Zone 6 have resulted in annual estimates of marbled murrelet abundance for each Conservation Zone (Bentivoglio et al. 2002; Peery et al. *in litt.* 2002; Huff et al. 2003; Lance 2004), with the annual overall population estimated at 18,097 (2000), 22,200 (2001), 23,700 (2002), and 22,300 (2003).

Population Trend

Estimated population trends within each Conservation Zone or for the entire coterminous population are not yet available from the marine survey data. Trend information will eventually be provided through the analysis of marine survey data from the EM Program (Bentivoglio et al. 2002) and from survey data in Conservation Zone 6 once a sufficient number of survey years have been completed. Depending on the desired minimum power (80 or 95 percent), at least 8 to

10 years of successive surveys are required for an overall population estimate and thus detection of an annual decrease, while 7 to 16 years are required for Conservation Zones 1 and 2 (Huff et al. 2003).

In the interim, demographic modeling has aided attempts to analyze and predict population trends and extinction probabilities of marbled murrelets. Incorporating important population parameters and species distribution data (Beissinger 1995; Beissinger and Nur 1997 in U.S. Fish and Wildlife Service 1997a; Cam et al. 2003; McShane et al. 2004), demographic models can provide useful insights into potential population responses from the exposure to environmental pressures and perturbations. However, weak assumptions or inaccurate estimates of population parameters such as survivorship rates, breeding success, and juvenile-to-adult ratios (juvenile ratios), can limit the use of models. Thus, a cautious approach is warranted when forecasting long-term population trends using demographic models.

Most of the published demographic models used to estimate marbled murrelet population trends employ Leslie Matrix modeling (McShane et al. 2004). Two other more complex, unpublished models (Akcakaya 1997 and Swartzman et al. 1997 in McShane et al. 2004) evaluate the effect of nest habitat loss on marbled murrelets in Conservation Zone 4 (McShane et al. 2004). McShane et al. (2004) developed a stochastic Leslie Matrix model (termed "Zone Model") to project population trends in each murrelet Conservation Zone. The Zone Model was developed to integrate available demographic information for a comparative depiction of current expectations of future population trends and probability of extinction in each Conservation Zone (McShane et al. 2004). Table 1 lists rangewide marbled murrelet demographic parameter values from four studies all using Leslie Matrix models.

Table 1. Rangewide murrelet demographic parameter values based on four studies all using Leslie Matrix models

Demographic Parameter	Beissinger 1995	Beissinger and Nur 1997*	Beissinger and Peery *in litt.* 2003	McShane et al. 2004
Juvenile Ratios	0.10367	0.124 or 0.131	0.089	0.02 - 0.09
Annual Fecundity	0.11848	0.124 or 0.131	0.06-0.12	(See nest success)
Nest Success			0.16-0.43	0.38 - 0.54
Maturation	3	3	3	2 - 5
Estimated Adult Survivorship	85% – 90%	85% – 88%	82% - 90%	83% – 92%

*in Fish and Wildlife Service 1997a

Regardless of model preference, the overall results of modeling efforts are in agreement, indicating marbled murrelet abundance is declining (McShane 2004:6-27). The rates of decline are highly sensitive to the assumed adult survival rate used for calculation (Beissinger and Peery *in litt.* 2003). The most recent modeling effort using the "Zone Model" (McShane et al. 2004) suggests the marbled murrelet zonal sub-populations are declining at a rate of 3.0 to 6.2 percent per year.

Estimates of breeding success are best determined from nest site data, but difficulties in finding nests has led to the use of other methods, such as juvenile ratios and radio-telemetry estimations, each of which have biases. The nest success data presented in Murrelet Table 1 under McShane et al. (2004) was derived primarily from radio telemetry studies; however the nests sampled in these studies were not representative of large areas and specifically did not include Washington or Oregon. In general, telemetry estimates are preferred over juvenile ratios for estimating breeding success due to fewer biases (McShane et al. 2004), but telemetry data are not currently available for Washington or Oregon. Therefore, it is reasonable to expect that juvenile ratios derived from at-sea survey efforts best represent marbled murrelet reproductive success in Washington, Oregon, and California.

Beissinger and Peery (*in litt.* 2003) performed a comparative analysis using data from 24 bird species to predict the juvenile ratios for marbled murrelets of 0.27 (confidence intervals ranged from 0.15 to 0.65). Demographic models suggest marbled murrelet population stability requires a minimum of 0.18 to 0.28 chicks per pair per year (Beissinger and Nur 1997 in U.S. Fish and Wildlife Service 1997a). The lower confidence intervals for both the predicted juvenile ratio (0.15) and the stable population juvenile ratio (0.18) are greater than the juvenile ratios observed for any of the Conservation Zones (0.02 to 0.09 chicks per pair) (Beissinger and Nur 1997 in U.S. Fish and Wildlife Service 1997a; Beissinger and Peery *in litt.* 2003). Therefore, the juvenile ratios observed in the Conservation Zones are lower than predicted and are too low to obtain a stable population in any Conservation Zone. This indicates marbled murrelet populations are declining in all Conservation Zones and will continue to decline until reproductive success improves.

Demographic modeling, the observed juvenile ratios, and adult survivorship rates suggests that the number of marbled murrelets in Washington, Oregon, and California are too low to sustain a murrelet population. The rate of decline for marbled murrelets throughout the listed range is estimated to be between 2.0 to 15.8 percent (Beissinger and Nur 1997 in U.S. Fish and Wildlife Service 1997a; McShane et al. 2004).

<u>Marbled Murrelets in Washington (Conservation Zones 1 and 2)</u>

Population Estimates

Historically, marbled murrelets in Conservation Zones 1 and 2 were “common” (Rathbun 1915 and Miller et al. 1935 in U.S. Fish and Wildlife Service 1997a), “abundant” (Edson 1908 and Rhoades 1893 in U.S. Fish and Wildlife Service 1997a), or “numerous” (Miller et al. 1935 in McShane et al. 2004). Conservation Zone 1, encompassing the Puget Sound in northwest Washington, contains one of the larger murrelet populations in the species’ listed range, and supports an estimated 41 percent of the marbled murrelets in the coterminous United States (Huff et al. 2003). The 2003 population estimate (with 95 percent confidence intervals) for Conservation Zone 1 is 8,500 (6,000 – 11,300) and Conservation Zone 2 is 3,400 (2,000 – 4,900) (Huff et al. 2003). In Conservation Zone 2, a higher density of marbled murrelets occurs in the northern portion of the Zone (Huff et al. 2003) where the majority of available nesting habitat occurs. In Conservation Zone 1, higher densities of marbled murrelets occur in the Straits of

Juan de Fuca, the San Juan Islands, and the Hood Canal (Huff et al. 2003), which are in proximity to nesting habitat on the Olympic Peninsula and the North Cascade Mountains.

Although population numbers in Conservation Zones 1 and 2 are likely declining, the precise rate of decline is unknown. The juvenile ratio derived from at-sea survey efforts in Conservation Zone 1 is 0.09. The juvenile ratios was not collected in Conservation Zone 2; however, the juvenile ratio for Conservation Zone 3 is 0.08. Therefore, it is reasonable to infer that the juvenile ratio for Conservation Zone 2 is likely between 0.08 and 0.09. These low juvenile ratios infer there is insufficient juvenile recruitment to sustain a murrelet population in Conservation Zones 1 and 2. Beissinger and Peery (*in litt.* 2003) estimated the rate of decline for Conservation Zone 1 to be between 2.0 to 12.6 percent and between 2.8 to 13.4 percent in Conservation Zone 3. It is likely that the rate of decline in Conservation Zone 2 is similar to that of Conservation Zones 1 and 3.

Juvenile ratios in Washington may be skewed by marbled murrelets coming and going to British Columbia. At-sea surveys are timed to occur when the least number of marbled murrelets from British Columbia are expected to be present. However, recent radio-telemetry information indicates: 1) marbled murrelets nesting in British Columbia forage in Washington waters during the breeding season (Martin Raphael, USFS, pers. comm. 2005) and could be counted during at-sea surveys; and 2) adult murrelets foraging in Washington during the early breeding season moved to British Columbia in mid-June and mid-July (Bloxton and Raphael 2004) and would not have been counted during the at-sea surveys. The movements of juvenile murrelets in Washington and southern British Columbia are unclear. Therefore, until further information is obtained to define the impact of exchange of marbled murrelets between British Columbia and Washington, we will continue to rely on the at-sea derived juvenile ratios to evaluate the population status in Conservation Zones 1 and 2.

Habitat Abundance

Estimates on the amount of available suitable nesting habitat vary as much as the methods used for estimating marbled murrelet habitat. McShane et al. (2004) estimates murrelet habitat in Washington State at 1,022,695 acres, representing approximately 48 percent of the estimated 2,223,048 acres remaining suitable habitat in the listed range. McShane et al. (2004) caution about making direct comparisons between current and past estimates due to the evolving definition of suitable habitat and methods used to quantify habitat. As part of the ongoing pursuit to improve habitat estimates, information was collected and analyzed by the FWS in 2005 resulting in an estimated 751,831 acres in Conservation Zone 1 and 585,821 acres in Conservation Zone 2 (Table 2).

Table 2. Estimated acres of suitable nesting habitat for the marbled murrelet managed by the Federal and non-Federal land managers in Conservation Zones 1 and 2

Conservation Zone	Estimated acres of suitable marbled murrelet habitat by land management category *				
	Federal	State	Private*	Tribal	Total
Puget Sound (Zone 1)	650,937	98,036	2,338	520	751,831
Western Washington Coast Range (Zone 2)	485,574	82,349	9,184	8,714	585,821
Total	1,136,511	180,385	11,522	9,234	1,337,652

*Estimated acres of private land represents occupied habitat. Additional suitable nesting habitat considered unoccupied by nesting marbled murrelets is not included in this estimate.

Estimated acreages of suitable habitat on Federal lands in Table 2 are based on modeling and aerial photo interpretation and likely overestimate the actual acres of suitable marbled murrelet habitat because 1) most acreages are based on models predicting NSO nesting habitat which include forested lands that do not have structures suitable for murrelet nesting, and 2) neither modeling or aerial photo interpretation can distinguish microhabitat features, such as nesting platforms or the presence of moss, that are necessary for murrelet nesting. The amount of high quality marbled murrelet nesting habitat available in Washington, defined by the FWS as large, old, contiguously forested areas not subject to human influences (e.g., timber harvest or urbanization) is expected to be a small subset of the estimated acreages in Table 2. Marbled murrelets nesting in high-quality nesting habitat are assumed to have a higher nesting success rate than murrelets nesting in fragmented habitat near humans.

Other Recent Assessments of Marbled Murrelet Habitat in Washington

Two recent assessments of marbled murrelet potential nesting habitat were developed for monitoring the Northwest Forest Plan (Raphael et al. 2005). This study provides a provincial-scale analysis of marbled murrelet habitat derived from vegetation base maps, and includes estimates of habitat on State and private lands in Washington for the period of 1994 to 1996. Using vegetation data derived from satellite imagery, Raphael et al. (2005) developed two different approaches to model habitat suitability. The first model, or the Expert Judgment Model, is based on the judgment of an expert panel that used existing forest structure classification criteria (e.g., percent conifer cover, canopy structure, quadratic mean diameter, forest patch size) to classify forests into four classes of habitat suitability, with Class 1 indicating the least suitable habitat and Class 4 indicating the most highly suitable habitat. Raphael et al. (2005) found that across the murrelet range, most habitat-capable land (52 percent) is classified as Class 1 (lowest suitability) habitat and 18 percent is classified as Class 4 (highest suitability) habitat. In Washington, they found that there were approximately 954,200 acres of Class 4 habitat in between 1994 and 1996 (Table 3). However, only 60 percent of known nest sites in their study area were located in Class 4 habitat.

The second habitat model developed by Raphael et al. (2005) used the Biomapper Ecological Niche-Factor Analysis model developed by Hirzel et al. (2002). The resulting marbled murrelet habitat suitability maps are based on both the physical and vegetative attributes adjacent to

known murrelet occupied polygons or nest locations for each Northwest Forest Plan province. The resulting raster maps are a grid of 269 ft^2-cells (25 m^2-cells) (0.15 acres per pixel). Each cell in the raster is assigned a value of 0 to 100. Values closer to 100 represent areas that match the murrelet nesting locations while values closer to 0 are likely unsuitable for nesting (Raphael et al. 2005). These maps do not provide absolute habitat estimates, but rather a range of habitat suitability values, which can be interpreted in various ways. Raphael et al. (2005) noted that the results from the Ecological Niche Factor Analysis (ENFA) are not easily compared to results from the Expert Judgment Model because it was not clear what threshold from the habitat suitability ranking to use. Raphael et al. (2005) elected to display habitat suitability scores greater than 60 (HS >60) as a "generous" portrayal of potential nesting habitat and a threshold greater than 80 (HS >80) as a more conservative estimate. In Washington, there were over 2.1 million acres of HS >60 habitat, but only 440,700 acres of HS >80 habitat (Table 3). It is important to note that HS >60 habitat map captures 82 percent of the occupied nests sites in Washington, whereas the HS >80 habitat map only captures 36 percent of the occupied nests in Washington.

Table 3. Comparison of different habitat modeling results for the Washington nearshore zone (0 to 40 mi inland or Northwest Forest Plan Marbled Murrelet Zone 1)

Marbled Murrelet Habitat Model	Habitat Acres on Federal Reserves (LSRs, Natl.Parks)	Habitat Acres on Federal, Non-Reserves (USFS Matrix)	Total Habitat Acres on Federal Lands	Total Habitat Acres on Non-Federal Lands (City, State, Private, Tribal)	Total Habitat Acres - All Ownerships	Percent of Total Habitat Acres on Non-Federal Lands	Percent of Known Marbled Murrelet Nest Sites in Study Area Occurring in this Habitat Classification
ENFA* HS >80	284,300	18,600	302,900	137,800	440,700	31%	36%
EJM* Class 4	659,200	40,700	699,900	254,300	954,200	11%	60%
EJM Class 3 and Class 4	770,600	54,700	825,300	535,200	1,360,500	16%	65%
ENFA HS >60	927,000	85,300	1,012,300	1,147,100	2,159,400	53%	82%

*ENFA = Ecological Niche Facto Analysis. EJM = Expert Judgment Model. Results were summarized directly from Tables 4 and 5 and Tables 9 and 10 in Raphael et al (2005). All habitat estimates represent 1994-1996 values.

Because the HS >60 model performed best for capturing known marbled murrelet nest sites, Raphael et al. (2005) suggest that the ENFA HS >60 model yields a reasonable estimate of potential murrelet nesting habitat. However, we found that large areas in southwest Washington identified in the HS >60 model likely overestimates the actual suitable habitat in this landscape due to a known lack of old-forest in this landscape. Despite the uncertainties associated with interpreting the various map data developed by Raphael et al. (2005), it is apparent that there is a significant portion of suitable habitat acres located on non-Federal lands in Washington, suggesting that non-Federal lands may play a greater role in the conservation needs of the

species than has previously been considered. Using the most conservative criteria developed by Raphael et al. (2005) the amount of high-quality marbled murrelet nesting habitat on non-Federal lands in Washington varies from 11 percent to as high as 31 percent (Table 3).

Raphael et al. (2005) note that the spatial accuracy of the map data are limited and that the habitat maps are best used for provincial-scale analysis. Due to potential errors in vegetation mapping and other potential errors, these maps are not appropriate for fine-scale project mapping. These data have not been published in their final form yet, although they have been available on the internet for public review and use since May 2005.

Conservation Zone 1

The majority of suitable marbled murrelet habitat in Conservation Zone (Zone) 1 occurs in northwest Washington and is found on USFS and NPS lands, and to a lesser extent on State lands. The majority of the historic habitat along the eastern and southern shores of the Puget Sound has been replaced by urban development resulting in the remaining suitable habitat further inland from the marine environment (U.S. Fish and Wildlife Service 1997a).

Conservation Zone 2

Marbled murrelet nesting habitat north of Gray's Harbor in Zone 2 occurs largely on State, USFS, NPS, and Tribal lands, and to a lesser extent, on private lands. Alternatively, the majority of habitat in the southern portion of Zone 2 occurs primarily on State lands, with a small amount on private lands.

Threats

Marbled murrelets remain subject to a variety of anthropogenic threats within the upland and marine environment. They also face threats from low population numbers, low immigration rates, high predation rates, and disease.

Threats in the Marine Environment

Threats to marbled murrelets in the marine environment include declines in prey availability, mortality associated with exposure to oil spills, gill net and other fisheries, contaminants suspended in marine waters, and visual or sound disturbance from recreational or commercial watercrafts (57 FR 45328 [October 1, 1992]; U.S. Fish and Wildlife Service 1997a; Ralph et al. 1995; McShane et al. 2004).

Prey Availability

Many fish populations have been depleted due to overfishing, reduction in the amount or quality of spawning habitat, and pollution. Primary marbled murrelet prey species have little commercial fishery value and, in general, there is little geographic overlap between marbled murrelet distribution and areas of commercial harvest (McShane et al. 2004). However, there are several fisheries for herring and surf smelt in Puget Sound and for anchovy in Grays Harbor,

Willapa Bay, and along the outer coast (Bargmann 1998). The extent of the effects of these fisheries on marbled murrelets is unknown, but is presumed to be minor.

In addition to fishing pressure, oceanographic variation can influence prey availability. While the effects to marbled murrelets from events such as El Niño have not been well documented, El Niño events are thought to reduce overall prey availability and several studies have found that El Niño events can influence the behavior of marbled murrelets (McShane et al. 2004). Even though changes in prey availability may be due to natural and cyclic oceanographic variation, these changes may exacerbate other threats to marbled murrelets in the marine environment.

Shoreline development has affected and will continue to effect coastal processes. Shipping, bulkheads, and other shoreline developments have contributed to the reduction in eelgrass beds and other spawning and rearing areas for forage fish such as herring. Pacific herring and other small marine fish, such as sand lance and surf smelt, are important prey species. They make up a large part of the diet of marbled murrelets.

There are 19 known stocks of Pacific herring in Puget Sound[4]. Of these populations, 15 are considered healthy or moderately healthy, three are considered depressed or critical, and the status of the remaining stock is unknown. Herring spawning stocks decreased from over 20,000 tons in the 1970s to less than 10,000 tons in recent years. Cherry Point, within the Strait of Georgia, supports the largest herring stock in Washington and has experienced a precipitous decline. The decline of this stock may be affecting the forage base for marbled murrelets in this region of Puget Sound. There is a moderate likelihood that organic contaminants are incrementally affecting this stock. Past research has shown that exposure to contamination reduces reproductive capability, growth rates, and resistance to disease, and may lead to lower survival for salmon.

Following the Exxon-Valdez oil spill, a study was initiated in Prince William Sound that included a comparison of oiled areas with unoiled areas and also compared pre-spill populations with post-spill populations (Klosiewski and Laing 1994). That study indicated that marbled murrelets decreased in both oiled and unoiled areas. Total population estimates declined from 304,400 in 1972-73 to 98,400 in 1989-1991. In the conclusion of that study, which also addressed many other bird species, it was noted that a number of bird species feeding on small fish have decreased in the past several decades, while bird species feeding on benthic organisms did not decrease similarly.

Oil Spills

Marbled murrelet mortality from oil pollution is a conservation issue in Washington (U.S. Fish and Wildlife Service 1997a). Most oil spills and chronic oil pollution that can affect marbled murrelets occur in areas of high shipping traffic, such as the Strait of Juan de Fuca and Puget Sound. There have been at least 47 oil spills of 10,000 gal or more in Washington since 1964 (WDOE 2004). However, the number of oil spills has generally declined since passage of the U.S. Oil Pollution Act in 1990. The estimated annual mortality of marbled murrelets from oil

[4] A spawning ground at Wollochet Bay was not included in surveys prior to 2002. In previous publications, the number of stocks of Pacific herring has been reported at 18 (PSAT 2005).

spills in Washington has decreased from 3 to 41 birds per year (between 1977 and 1992) to 1 to 2 birds per year (between 1993 and 2003) (McShane et al. 2004).

Since the marbled murrelet was listed, the amount of oil tanker and shipping traffic has continued to increase (U.S. Fish and Wildlife Service 1997a; Burger 2002). Large commercial ships, including oil tankers, cargo ships, fish processing ships, and cruise ships, enter Washington waters more than 7,000 times each year, bound for ports in Puget Sound, British Columbia, Grays Harbor, and the Columbia River (WDOE 2004). Additionally, 4,500 tank-barge transits, 160,000 ferry transits, and military vessel traffic occur in these same waters each year (WDOE 2004). Individually these vessels may carry up to 33 M gal of crude oil or refined petroleum products, but collectively, they carry about 15.1 B gal across Puget Sound waters each year (WDOE 2004). These numbers are expected to increase as the human population and commerce continues to grow. Currently, there are State and Federal requirements for tug escorts of laden oil tankers transiting the waters of Puget Sound east of Dungeness Spit. However, the Federal requirements do not apply to double-hulled tankers and will no longer be in effect once the single-hull tanker phase-out is complete (WDOE 2005). Washington State is considering revising their tug escort requirements (WDOE 2005); however, the current tug escort requirements remain in place until the Washington State Legislature makes a change.

The U.S. Coast Guard rated the Dungeness area in the Strait of Juan de Fuca as being in the top five high-risk areas of the United States for being impacted by oil spills (U.S. Fish and Wildlife Service 2005). Therefore, even though the threat from oil spills appears to have been reduced since the marbled murrelet was listed, the risk of a catastrophic oil spill remains, and could severely impact adult and/or juvenile murrelets in Conservation Zones 1 and 2.

Gillnets

Marbled murrelet mortality from gillnet fishing has been considered a conservation issue in Washington (U.S. Fish and Wildlife Service 1997a; Melvin et al. 1999). Marbled murrelets can also be killed by hooking with fishing lures and entanglement with fishing lines (Carter et al. 1995). There is little information available on marbled murrelet mortality from net fishing prior to the 1990s, although it was known to occur (Carter et al. 1995). In the mid 1990s, a series of fisheries restrictions and changes were implemented to address mortality of all species of seabirds, resulting in a lower mortality rate of murrelets (McShane et al. 2004). Fishing effort has also decreased since the 1980s because of lower catches, fewer fishing vessels, and greater restrictions (McShane et al. 2004), although a regrowth in gill net fishing is likely to occur if salmon stocks increase. In most areas, the threat from gill net fishing has been reduced or eliminated since 1992, but threats to adult and juvenile murrelets are still present in Washington nearshore zones due to gill net mortality (McShane et al. 2004).

Marine Contaminants

The primary consequence from the exposure of marbled murrelets to contaminants is reproductive impairment. Reproduction can be impacted by food web bioaccumulation of organochlorine pollutants and heavy metals discharged into marine areas where marbled murrelets feed and prey species concentrate (Fry 1995). However, marbled murrelet exposure is

likely a rare event because murrelets have widely dispersed foraging areas and they feed extensively on transient juvenile and subadult midwater fish species that are expected to have low pollutant loads (McShane et al. 2004). The greatest exposure risk to marbled murrelets may occur at regular feeding areas near major pollutant sources, such as those found in Puget Sound (McShane et al. 2004).

Disturbance

In coastal and offshore marine environments, vehicular disturbance (e.g., boats, airplanes, personal watercraft) is known to elicit behavioral responses in marbled murrelets of all age classes (Kuletz 1996; Speckman 1996; Nelson 1997). Aircraft flying at low altitudes and boating activity, in particular motorized watercraft, are known to cause murrelets to dive and are thought to especially affect adults holding fish (Nelson 1997). It is unclear to what extent this kind of disturbance affects the distribution and movements of marbled murrelets. However, it is unlikely this type of disturbance has decreased since 1992 because the shipping traffic and recreational boat use in the Puget Sound and Strait of Juan de Fuca has continued to increase.

Marine projects that include seismic exploration, pile driving, detonation of explosives and other activities that generate percussive sounds can expose marbled murrelets to elevated underwater sound pressure levels (SPLs). High underwater SPLs can have adverse physiological and neurological effects on a wide variety of vertebrate species (Yelverton et al. 1973; Yelverton and Richmond 1981; Stevens et al. 1999; Fothergill et al. 2001; Cudahy and Ellison 2002; U.S. Department of Defense 2002; Popper 2003). High underwater SPLs are known to injure and/or kill fish by causing barotraumas (pathologies associated with high sound levels including hemorrhage and rupture of internal organs), as well as causing temporary stunning and alterations in behavior (Turnpenny and Nedwell 1994; Turnpenny et al. 1994; Popper 2003; Hastings and Popper 2005). During monitoring of seabird response to pile driving in Hood Canal, Washington, a pigeon guillemot (*Cepphus columba*) was observed having difficulty getting airborne after being exposed to underwater sound from impact pile driving (Entranco and Hamer Environmental 2005). In controlled experiments using underwater explosives, rapid change in SPLs caused internal hemorrhaging and mortality in submerged mallard ducks (*Anas platyrhnchos*) (Yelverton et al. 1973). Risk of injury appears related to the effect of rapid pressure changes, especially on gas filled spaces in the bodies of exposed organisms (Turnpenny et al. 1994). In studies on ducks (*Anas spp.*) and a variety of mammals, all species exposed to underwater blasts had injuries to gas filled organs including eardrums (Yelverton and Richmond 1981). These studies indicate that similar effects can be expected across taxonomical species groups.

Physical injury may not result in immediate mortality. If an animal is injured, death may occur several hours or days later, or injuries may be sublethal. Sublethal injuries can interfere with the ability of an organism to carry out essential life functions such as feeding and predator avoidance. Diving birds are able to detect and alter their behavior based on sound in the underwater environment (Ross et al. 2001) and elevated underwater SPLs may cause marbled murrelets to alter normal behaviors, such as foraging. Disturbance related to elevated underwater SPLs may reduce foraging efficiency resulting in increased energetic costs to all

marbled murrelet age classes in the marine environment and may result in fewer deliveries or lower quality food being delivered to nestlings.

Threats in the Terrestrial Environment

Habitat

Extensive harvest of late-successional and old-growth forest was the primary reason for listing the marbled murrelet as threatened. Due primarily to extensive timber cutting over the past 150 years, at least 82 percent of the old-growth forests existing in western Washington and Oregon prior to the 1840s have been harvested (Booth 1991; Teensma et al. 1991; Ripple 1994; Perry 1995). About 10 percent of pre-settlement old-growth forests remain in western Washington (Norse 1990; Booth 1991). Although the Northwest Forest Plan has reduced the rate of habitat loss on Federal lands, the threat of continued loss of suitable nesting habitat remains on Federal and non-Federal lands through timber harvest and natural events such as wildfire, insect outbreaks, and windthrow.

Natural disturbance has the potential to affect the amount and quality of marbled murrelet nesting habitat. Wildfire and windthrow result in immediate loss of habitat and can also influence the quality of adjacent habitat. Global warming, combined with long-term fire suppression on Federal lands, may result in higher incidences of stand-replacing fires in the future (McShane et al. 2004). As forest fragmentation increases, the threat of habitat loss due to windthrow is likely to increase. In addition, insects and disease can kill complete stands of habitat and can contribute to hazardous forest fire conditions.

Between 1992 and 2003, the loss of suitable marbled murrelet habitat totaled 22,398 acres in Washington, Oregon, and California combined, of which 5,364 acres resulted from timber harvest and 17,034 acres resulted from natural events (McShane et al. 2004). The data presented by McShane represented losses primarily on Federal lands, and did not include data for most private lands within the murrelets' range. Habitat loss and fragmentation is expected to continue in the near future, but at an uncertain rate (McShane et al. 2004). Raphael et al. (2005) recently completed a change analysis for marbled murrelet habitat on both Federal and non-Federal lands for the period from 1992 to 2003, based on stand disturbance map data developed by Healey et al. (2003). Raphael et al. (2005) estimated that habitat loss ranging from 60,000 acres up to 278,000 acres has occurred across the listed range of the species, with approximately 10 percent of habitat loss occurring on Federal lands, and 90 percent occurring on non-Federal lands. The variation in the acreage estimates provided by Raphael et al. (2005) are dependant upon the habitat model used (Table 3) to evaluate habitat change over time.

Gains in suitable nesting habitat are expected to occur on Federal lands over the next 40 to 50 years, but due to the extensive historic habitat loss and the slow replacement rate of marbled murrelets and their habitat, the species is potentially facing a severe reduction in numbers in the coming 20 to 100 years (U.S. Forest Service and U.S. Fish and Wildlife Service 1994b; Beissinger 2002). In addition to direct habitat removal, forest management practices can fragment marbled murrelet habitat; this reduces the amount and heterogeneous nature of the habitat, reduces the forest patch sizes, reduces the amount of interior or core habitat, increases

the amount of forest edge, isolates remaining habitat patches, and creates "sink" habitats (McShane et al. 2004). There are no estimates available for the amount of suitable habitat that has been fragmented or degraded since 1992. However, the ecological consequences of these habitat changes to murrelets can include effects on population viability and size, local or regional extinctions, displacement, fewer nesting attempts, failure to breed, reduced fecundity, reduced nest abundance, lower nest success, increased predation and parasitism rates, crowding in remaining patches, and reductions in adult survival (Raphael et al. 2002).

Predation

Predation is expected to be the principal factor limiting marbled murrelet reproductive success and nest site selection (Nelson and Hamer 1995b; Ralph et al. 1995). Marbled murrelets are believed to be highly vulnerable to nest predation compared to other alcids and forest nesting birds (Nelson and Hamer 1995b; U.S. Fish and Wildlife Service 1997a). Marbled murrelets have no protection at nest sites other than the ability to remain hidden. Nelson and Hamer (1995b) hypothesized that small increases in murrelet predation will have deleterious effects on murrelet population viability due to their low reproductive rate (one egg clutches).

Known predators of adult marbled murrelets in the forest environment include the peregrine falcon (*Falco peregrinus*), sharp-shinned hawk (*Accipiter striatus*), common raven (*Corvus corax*), northern goshawk (*Accipiter gentilis*), and bald eagle (*Haliaeetus leucocephalus*). Common ravens and Stellar's jays (*Cyanocitta stelleri*) are known to take both eggs and chicks at the nest, while sharp-shinned hawks have been found to take chicks. Common ravens account for the majority of egg depredation, as they appear to be the only predator capable of flushing incubating or brooding adults from a nest (Nelson and Hamer 1995b). Suspected nest predators include great horned owls (*Bubo virginianus*), barred owls (*Strix varia*), Cooper's hawks (*Accipiter cooperi*), northwestern crows (*Corvus caurinus*), American crows (*Corvus brachyrhynchos*), and gray jays (*Perisoreus canadensis*) (Nelson and Hamer 1995b; Nelson 1997; Manley 1999). Predation by squirrels and mice has been documented at artificial nests and these animals cannot be discounted as potential predators on eggs and chicks (Luginbuhl et al. 2001; Raphael et al. 2002; Bradley and Marzluff 2003).

Losses of eggs and chicks to avian predators have been determined to be the most important cause of nest failure (Nelson and Hamer 1995b; McShane et al. 2004). The risk of predation by avian predators appears to be highest in complex structured landscapes in proximity to edges and human activity, where many of the corvid (e.g., crows, ravens) species are in high abundance. Predation rates are influenced mainly by habitat stand size, habitat quality, nest placement (on the edge of a stand versus the interior of a stand), and proximity of the stand to human activity centers. The quality of marbled murrelet nest habitat decreases in smaller stands because forest edge increases in relation to the amount of interior forest, while forest stands near human activity centers (less than 0.62 mi or 1 km), regardless of size, are often exposed to a higher density of corvids due to their attraction to human food sources (Marzluff et al. 2000). The loss of nest contents to avian predators increases with habitat fragmentation and an increase in the ratio of forest edge to interior habitat (Nelson and Hamer 1995b; McShane et al. 2004). For example, Nelson and Hamer (1995b) found successful nests were farther from edges (greater than 55 m) and were better concealed than unsuccessful nests.

The abundance of several corvid species has increased dramatically in western North America as a result of forest fragmentation, increased agriculture, and urbanization (McShane et al. 2004). It is reasonable to infer that as predator abundance has increased, predation on murrelet chicks and eggs has also increased, and murrelet reproductive success has decreased. It is also reasonable to assume that this trend will not be interrupted or reversed in the near future, as forest fragmentation, agriculture, and urbanization continue to occur.

Other Threats

Marbled murrelets are subject to additional threats from diseases, genetics, low population numbers, and low immigration rates. To date, inbreeding (mating between close genetic relatives) and/or hybridizing (breeding with a different species or subspecies) have not been identified as threats to marbled murrelet populations. However, as abundance declines, a corresponding decrease in the resilience of the population to disease, inbreeding or hybridization, and other perturbations may occur. Additionally, marbled murrelets are considered to have low recolonization potential because their low immigration rate makes the species slow to recover from local disturbances (McShane et al. 2004).

The emergence of fungal, parasitic, bacterial, and viral diseases has affected populations of seabirds in recent years. West Nile virus disease has been reported in California which is known to be lethal to seabirds. While the amount of negative impact this disease may bring is unknown, researchers agree that it is only a matter of time before West Nile virus reaches the Washington seabird population. Effects for marbled murrelets from West Nile virus and other diseases are expected to increase in the near future due to an accumulation of stressors such as oceanic temperature changes, overfishing, and habitat loss (McShane et al. 2004).

Marbled murrelets may be sensitive to human-caused disturbance due to their secretive nature and their vulnerability to predation. There are little data concerning the marbled murrelet's vulnerability to disturbance effects, except anecdotal researcher observations that indicate murrelets typically exhibit a limited, temporary behavioral response (if any) to noise disturbance at nest sites and are able to adapt to auditory stimuli (Singer et al. 1995 in McShane et al. 2005; Long and Ralph 1998; Golightly et al. 2002). In general, responses to auditory stimuli at nests sites have been modifications of posture and on-nest behaviors (Long and Ralph 1998). While the unique breeding biology of the marbled murrelet is not conducive to comparison of the reproductive success of other species, studies on other alcid and seabird species have revealed detrimental effects of disturbance to breeding success and the maintenance of viable populations (Cairns 1980; Pierce and Simons 1986; Piatt et al. 1990; Beale and Monaghan 2004).

Research on a variety of other species, including other seabirds, indicate an animal's response to disturbance follows the same pattern as its response to encountering predators, and anti-predator behavior has a cost to other fitness enhancing activities, such as feeding and parental care (Frid and Dill 2002). Some authors indicate disturbance stimuli can directly affect the behavior of individuals and indirectly affect fitness and population dynamics through increased energetic costs (Carney and Sydeman 1999; Frid and Dill 2002). Responses by marbled murrelet adults and chicks to calls from corvids and other potential predators include no response, alert

posturing, aggressive attack, and temporarily leaving a nest (adults only) (McShane et al. 2004). However, the most typical behavior of chicks and adults in response to the presence of a potential predator is to flatten against a tree branch and remain motionless (Nelson and Hamer 1995b; McShane et al. 2004). Therefore, researcher's anecdotal observations of little or no physical response by marbled murrelets are consistent with the behavior they will exhibit in response to a predator. In addition, there may have been physiological responses researchers cannot account for with visual observations. Corticosterone studies have not been conducted on marbled murrelets, but studies on other avian species indicate chronic high levels of this stress hormone may have negative consequences on reproduction or physical condition (Wasser et al. 1997; Marra and Holberton 1998 in McShane et al. 2004).

Although detecting effects of sub-lethal noise disturbance at the population level is hindered by the breeding biology of the marbled murrelet, the effect of noise disturbance on murrelet fitness and reproductive success should not be completely discounted (McShane et al. 2004). In recently completed analyses, the FWS concluded the potential for injury associated with disturbance (visual and sound) to murrelets in the terrestrial environment includes flushing from the nest, aborted feeding, and postponed feedings (U.S. Fish and Wildlife Service 2003). These responses by individual marbled murrelets to disturbance stimuli can reduce productivity of the nesting pair, as well as the entire population (U.S. Fish and Wildlife Service 1997a).

Conservation Needs

The Recovery Plan outlines the conservation strategy for the species. In the short-term, specific actions necessary to stabilize the population include maintaining occupied habitat, maintaining large blocks of suitable habitat, maintaining and enhancing buffer habitat, decreasing risks of nesting habitat loss due to fire and windthrow, reducing predation, and minimizing disturbance.

Long-term conservation needs include increasing productivity (abundance, the ratio of juveniles to adults, and nest success) and population size; increasing the amount (stand size and number of stands), quality, and distribution of suitable nesting habitat; protecting and improving the quality of the marine environment; and reducing or eliminating threats to survivorship by reducing predation in the terrestrial environment and anthropogenic sources of mortality at sea. The FWS estimates recovery of the marbled murrelet will require at least 50 years (U.S. Fish and Wildlife Service 1997a).

The Recovery Plan states that four of the six Conservation Zones (Zones) must be functional in order to effectively recover the marbled murrelet in the short- and long-term; that is, to maintain viable populations that are well-distributed. However, based on the new population estimates, it appears only three of the Zones contain relatively robust numbers of marbled murrelets (Zones 1, 3, and 4). Zones 1 and 4 contain the largest number of marbled murrelets compared to the other four Zones. This alone would seem to indicate a better condition there, but areas of concern remain. For example, the population in Zone 4 was impacted when oil spills killed an estimated 10 percent of the population (Bentivoglio et al. 2002; Ford et al. 2002), small oil spills continue to occur in Zone 1, and the juvenile ratios in both of these Zones continue to be too low to establish stable or increasing populations (Beissinger and Peery *in litt.* 2003).

Marbled murrelets in Zones 3, 5, and 6 have suffered variously from past oil spills which killed a large number of murrelets (Zone 3) (Ford et al. 2001), extremely small population sizes (Zones 5 and 6), and alarmingly low reproductive rates (Zone 6) (Peery et al. *in litt.* 2002). These factors have brought the status of the species to a point where recovery in Zones 5 and 6 may be precluded (Beissinger 2002). The poor status of marbled murrelet populations in the southern Zones emphasizes the importance of supporting murrelet populations in Zones 1 and 2 in order to preserve the opportunity to achieve murrelet recovery objectives.

Conservation Strategy

Marine Environment

Protection of marine habitat is also a component of the recovery strategy. The main threat to marbled murrelets in the marine environment is the loss of individuals through death or injury, generally associated with oil spills and gill-net entanglements. The recovery strategy recommends managing all waters within 1.2 mi of shore within the Puget Sound and Strait of Juan de Fuca, and along the Pacific Coast from Cape Flattery to Willapa Bay in such a way as to reduce or eliminate murrelet mortality (U.S. Fish and Wildlife Service 1997a). Management strategies could include exclusion of vessels, stricter hull requirements, exclusion of net fisheries, or modification of fishing gear.

In Washington State, the Washington Fish and Game Commission requires the use of alternative gear (i.e., visual alerts within the upper 7 ft of a multifilament net), prohibits nocturnal and dawn fishing for all non-treaty gill-net fisheries, and closes areas to gill-net fishing in order to reduce by-catch of marbled murrelets. The Olympic Coast National Marine Sanctuary was established in 1994 along the outer Washington coast from Cape Flattery south to approximately the Copalis River and extending between 25 mi and 40 mi offshore. Oil exploration and development are prohibited within this Sanctuary (National Marine Fisheries Service 1993).

Terrestrial Habitat Management

The loss of nesting habitat (old-growth/mature forest) has generally been identified as the primary cause of the marbled murrelet population decline and disappearance across portions of its range (Ralph et al. 1995). Logging, urbanization, and agricultural development have all contributed to the loss of habitat, especially at lower elevations.

The recovery strategy for the marbled murrelet is contained within the Marbled Murrelet Recovery Plan (Recovery Plan) (U.S. Fish and Wildlife Service 1997a) relies heavily on the Northwest Forest Plan (NWFP) to achieve recovery on Federal lands in Washington, Oregon, and California. However, the Recovery Plan also addresses the role of non-Federal lands in recovery, including HCPs, State forest practices, and lands owned by Native American Tribes. The importance of non-Federal lands in the survival and recovery of marbled murrelets is particularly high in Conservation Zones, where Federal lands, and privately held conservation lands (e.g., The Nature Conservancy Teal Slough, Ellsworth, Washington), within 50 mi of the coastline are sparse, such as the southern half of Conservation Zone 2.

Lands considered essential for the recovery of the marbled murrelet within Conservation Zones 1 and 2 are 1) any suitable habitat in a Late Successional Reserve (LSR), 2) all suitable habitat located in the Olympic Adaptive Management Area, 3) large areas of suitable nesting habitat outside of LSRs on Federal lands, such as habitat located in the Olympic National Park, 4) suitable habitat on State lands within 40 mi of the coast, and 5) habitat within occupied marbled murrelet sites on private lands (U.S. Fish and Wildlife Service 1997a).

Northwest Forest Plan

When the USFS and Bureau of Land Management incorporated the NWFP as the management framework for public lands, a long-term habitat management strategy for marbled murrelets (U.S. Forest Service and Bureau of Land Management 1994a,b) was established. The NWFP instituted pre-project surveys of marbled murrelet habitat in areas planned for timber harvest and the protection of existing habitat at sites determined through surveys to be occupied by marbled murrelets.

In the short-term, all known-occupied sites of marbled murrelets occurring on USFS or Bureau of Land Management lands under the NWFP are to be managed as Late Successional Reserves (LSRs). In the long-term, unsuitable or marginally suitable habitat occurring in LSRs will be managed, overall, to develop late-successional forest conditions, thereby providing a larger long-term habitat base into which marbled murrelets may eventually expand. Thus, the NWFP approach offers both short-term and long-term benefits to the murrelet.

Over 80 percent of marbled murrelet habitat on Federal lands in Washington occurs within land management allocations that protect the habitat from removal or significant degradation. Scientists predicted implementation of the NWFP would result in an 80 percent likelihood of achieving a well-distributed murrelet population on Federal lands over the next 100 years (U.S. Forest Service and U.S. Fish and Wildlife Service 1994b). Although the NWFP offers protection of known-occupied murrelet sites, concerns over the lingering effects of the historic widespread removal of suitable habitat will remain until the habitat recovers to late-successional characteristics. Habitat recovery will require over 100 years in many LSRs.

Habitat Conservation Plans

Four HCPS addressing marbled murrelets in Washington have been completed for private/corporate forest land managers within the range of the murrelet: West Fork Timber Corporation (Murray Pacific Corporation 1993, 1995; U.S. Fish and Wildlife Service 1995) (Mineral Tree Farm HCP); Plum Creek Timber Company (Plum Creek Timber Company 1996, 1999; U.S. Fish and Wildlife Service 1996b, 1999) (Cascades HCP; I-90 HCP); Port Blakely Tree Farms, L.P. (Port Blakely Tree Farms 1996; U.S. Fish and Wildlife Service 1996c) (R.B. Eddy Tree Farm HCP); and Simpson Timber Company (Simpson Timber Company 2000; U.S. Fish and Wildlife Service 2000a) (Olympic Tree Farm HCP). HCPs have also been completed for two municipal watersheds, City of Tacoma (Tacoma Public Utilities 2001; U.S. Fish and Wildlife Service 2001) (Green River HCP) and City of Seattle (U.S. Fish and Wildlife Service 2000b; City of Seattle 2001) (Cedar River HCP), and the Washington Department of Natural Resources (U.S. Fish and Wildlife Service 1997b) (WDNR HCP). The HCPs which address

marbled murrelets cover approximately 500,000 acres of non-Federal (private/corporate) lands, over 100,000 acres of municipal watershed, and over 1.6 million acres of State-managed lands. However, only a portion of these lands contain suitable murrelet habitat.

The WDNR HCP addresses marbled murrelets in Conservation Zones 1 and 2. All of the others address murrelets in Conservation Zone 1. Most of the marbled murrelet HCPs in Washington employ a consistent approach for murrelets by requiring the majority of habitat to be surveyed prior to timber management. Only poor-quality marginal habitat (with a low likelihood of occupancy) is released for harvest without survey. All known occupied habitat is protected to varying degrees, but a "safe-harbor-like" approach is used to address stands which may be retained as, or develop into, suitable habitat and become occupied in the future. This approach would allow future harvest of habitat which is not currently nesting habitat.

Washington State Forest Practices Regulations

Under Washington Forest Practices Rules, which apply to all non-Federal lands not covered by an HCP (WAC 222-12-041; Washington Forest Practices Board 2005), surveys for marbled murrelets are required prior to the harvest of suitable nesting habitat. These criteria vary depending on the location of the stand. For stands found to be occupied or known to be previously occupied, the WDNR makes a decision to issue the permit based upon a significance determination. If a determination of significance is made, preparation of a State Environmental Policy Act Environmental Impact Statement is required prior to proceeding. If a determination of non-significance or mitigated determination of non-significance is reached, the action can proceed without further environmental assessment. (A more detailed discussion of the Washington Forest Practices regulations is provided in the marbled murrelet Environmental Baseline).

Tribal Management

The management strategy of the Bureau of Indian Affairs for the marbled murrelet focuses on working with Tribal governments on a government-to-government basis to develop management strategies for reservation lands and trust resources. The Bureau of Indian Affairs' management strategy typically focus on avoiding harm to murrelets when feasible, to facilitate the trust responsibilities of the United States. However, other factors must be considered. Strategies must foster Tribal self-determination, and must balance the needs of the species and the environmental, economic, and other objectives of Indian Tribes within the range of the marbled murrelet (Renwald *in litt*. 1993). For example, one of the Bureau of Indian Affairs' main goals for murrelet protection includes assisting Native American Tribes in managing habitat consistent with tribal priorities, reserved Indian rights, and legislative mandates.

Summary

Demographic modeling results indicate marbled murrelet populations are declining within each Conservation Zone and throughout the listed range. The juvenile to adult ratios observed at sea in the Conservation Zones are too low to obtain a stable population in any Conservation Zone, which indicates murrelet abundance in all Conservation Zones will continue to decline until

reproductive success improves. In other words, there is insufficient recruitment of juveniles to sustain a murrelet population in the listed range of the species.

Some of the threats to the marbled murrelet population may have been reduced as a result of the species' listing under the Act, such as the passage of the Oil Pollution Act and implementation of the NWFP. However, no threats have been reversed since listing and in some areas threats, such as predation and West Nile Virus, may be increasing or emerging. Threats continue to contribute to murrelet population declines through adult and juvenile mortality and reduced reproduction. Therefore, given the current status of the species and background risks facing the species, it is reasonable to assume that murrelet populations in Conservation Zones 1 and 2 and throughout the listed range have little resilience to deleterious population-level effects and are at high risk of extirpation.

Considering the life history characteristics of the marbled murrelet, with the aggregate effects of inland habitat loss and fragmentation and at-sea mortality, the species' capability to recover from lethal perturbations at the population or metapopulation (Conservation Zone) scale is extremely low. The low observed reproductive rates make the species highly susceptible to local extirpations when exposed to repeated perturbations at a frequency which exceeds the species' loss-replacement rate. Also troublesome is the ineffectiveness of recovery efforts at reversing the ongoing lethal consequences in all demographic classes from natural and anthropogenic sources. Despite the relatively long potential life span of adult marbled murrelets, the annual metapopulation replacement rates needed for long-term metapopulation maintenance and stability is currently well below the annual rate of individuals being removed from each metapopulation. As a result, marbled murrelet metapopulations are currently not self-sustaining or self-regulating.

Accordingly, the FWS concludes the current environmental conditions for marbled murrelets in the coterminous United States appear to be insufficient to support the long-term conservation needs of the species. Although information is not sufficient to determine whether murrelets are nesting at or near the carrying capacity in the remaining nest habitat, activities which degrade the existing conditions of occupied nest habitat or reduce adult survivorship and/or nest success of murrelets will be of greatest consequence to the species. Actions resulting in the further loss of occupied nesting habitat, mortality to breeding adults, eggs, or nestlings will reinforce the current murrelet population decline throughout the coterminous United States.

ENVIRONMENTAL BASELINE—Marbled Murrelet

Status of the Species in the Action Area

Prior to the listing of marbled murrelets in 1992, very little information existed on marbled murrelets in the Baker River watershed. In anticipation of the listing, surveys for breeding habitat or use by murrelets were conducted in 1991 and 1992 by Beak Consultants, Inc. (Hamer Environmental 2003) as part of the small hydroelectric site evaluations being conducted for Hydro West Group, Inc. Surveys were conducted near Anderson Creek on the east shore and Park Creek on the west shore of Baker Lake (Hamer Environmental 2003). The objectives of the

surveys were to determine if the areas contained potential marbled murrelet nesting habitat that would be removed as a result of the hydroelectric project or whether the areas have potential nesting habitat in such close proximity that nesting marbled murrelets might be disturbed by the hydroelectric project or its construction.

The Anderson Creek surveys were conducted in 1991 in conjunction with the USFS. One station near the mouth of Anderson Creek on Baker Lake ranged from three to seven marbled murrelet detections. The second station was on an old logging spur road approximately 2 miles (3.23 km) upstream of the mouth of Anderson Creek and ranged from two to five detections (Hamer Environmental 2003). Marbled murrelet surveys were repeated at Anderson Creek in 1992 following the protocol developed by the Pacific Seabird Group at that time. The survey included six sites with a total of 22 stations and occupancy was determined at three of the six sites. Park Creek marbled murrelet surveys were conducted in 1991 following the survey methods described in Paton et al. (1990). Marbled murrelets were detected during all four visits and ranged from 12 detections on the first visit to one detection on the second (Hamer Environmental 2003). Surveys were repeated at Park Creek in 1992 following the protocol of the Pacific Seabird Group. The survey included eight sites with a total of 29 stations. Occupied marbled murrelet behavior was observed at four of the eight sites.

The WDFW maintains a database of species information called the Priority Habitats and Species database. The database identifies eight occupied marbled murrelet sites located within the Baker River Watershed (database accessed in January 2007). Four of the occupied sites are near Park Creek on the west shore of Baker Lake. Three sites are near Anderson Creek on the east shore of Baker Lake. The remaining site is near Thunder Creek on the southeast shore of Baker Lake. The database also includes 35 sites with marbled murrelet detection observations. Twenty-two of these detection observations were made on the west side of Baker Lake along the creeks that drain into the lake. Eleven of the detection observations were made on the east side of Baker Lake along the creeks that drain into the lake. The remaining two detection observations were made near Lake Shannon, one on the west side and one on the east side of the lake.

The North Cascades National Park Service Species database contains observation records for the marbled murrelet. Observations were recorded in the area of the North Cascades National Park Service complex, located adjacent to and to the east of Baker Lake. Two observations were made in 1991 near Anderson Creek and Noisy Creek just outside of the west park boundary. The other observation was made in 1994 on Ross Lake on the far east side of the park (Bob Kuntz, North Cascades National Park, pers. comm. January 8, 2007). While this observation is well outside of the Baker River watershed, it is noteworthy in that the land between the west and east boundaries of the park which has not been surveyed has a high likelihood of marbled murrelet occupancy. The North Cascades National Park recently acquired funding to begin marbled murrelet surveys in the park in 2008 using radar survey methods (B. Kuntz, pers. comm. 2007).

The most recent data available on marbled murrelets in the Baker River watershed comes from unpublished inventory surveys conducted by the WDNR as part of the implementation of the WDNR HCP (WDNR 1997). One observation of marbled murrelet occupancy was approximately 3 miles to the southeast of Baker Dam and the other observation of occupancy was approximately 6 miles to the west of Baker Dam, both surveyed in 2001-2002. Data from

WDNR surveys conducted in 2005 and 2006 consist of four new visual and audio detections and one observation of occupancy. All of these inventory survey data detections and occupancy observations were made at higher elevations of 1,036 to 1,494 m (3,400 to 4,900 ft) (Peter McBride, Washington Department of Natural Resources, E-Mail Communication to Mark Ostwald, FWS, December 15, 2006).

Conservation Role of the Action Area

The action area for the Baker River Hydroelectric Relicensing Project is within Conservation Zone 1 for marbled murrelets. As described in the Status of the Species section for marbled murrelets, Conservation Zone 1 contains one of the larger marbled murrelet populations in the species' listed range. However, juvenile-to-adult ratios are low and indicate there is insufficient juvenile recruitment to sustain a murrelet population in Conservation Zone 1 (see Status of Species for a full discussion of juvenile-to-adult ratios).

The action area (i.e, the Baker River watershed) has approximately 39,276 acres of suitable marbled murrelet nesting habitat. We defined suitable habitat using the Expert Judgment Model (Raphael et al. 2006) that is based on the judgment of an expert panel that used existing forest structure classification criteria (e.g., percent conifer cover, canopy structure, quadratic mean diameter, forest patch size, etc.) to classify forests into four classes of habitat suitability, with Class 1 indicating the least suitable habitat and Class 4 indicating the most suitable habitat. We chose the Expert Judgment Model outputs of Class 3 (moderately suitable) and Class 4 (highly suitable) to depict marbled murrelet habitat because this model output represents the median of the range of possible values derived from the habitat models developed by Raphael et al. (2005). The Expert Judgement Model Class 3 and 4 output is consistent with our current view of the distribution of known marbled murrelet observations on that landscape and provides a reasonable estimate of suitable marbled murrelet nesting habitat in the action area.

The action area is adjacent to relatively undisturbed, unfragmented, suitable marbled murrelet nesting habitat within the North Cascades National Park (east of the Baker River watershed). According the Status of the Species and the conservation needs of marbled murrelets, the FWS has determined that it is necessary to maintain large blocks of suitable habitat for the short-term stabilization of the marbled murrelet population. Further, the FWS considers large areas of suitable nesting habitat outside of LSRs (e.g., North Cascades National Park) as land that is essential for the recovery of the marbled murrelet in Conservation Zone 1. The adjacency of the action area with North Cascades National Park provides unfragmented, high quality marbled murrelet nesting habitat that is important to stabilize the marbled murrelet population in the short-term and to contribute to their long-term recovery.

Condition of the Action Area

The Baker River watershed consists of 156,545 acres of Federal land, 3,498 acres of State land, 6,931 acres of private industrial forestland, and 1,608 acres of unknown ownership. The majority of Federal land is adjacent to Baker Lake while the majority of State and private land is adjacent to Lake Shannon. The following is a discussion of these different land ownerships.

The Mt. Baker-Snoqualmie National Forest is managed under the Northwest Forest Plan, and approximately 50 percent of the land is designated as riparian reserve and another approximately 35 percent is designated as late-successional reserve (LSR) (USDA and USDI 1994). The objective of LSRs, under the Northwest Forest Plan, is to protect and enhance conditions of late-successional and old-growth forest ecosystems, which serve as habitat for late-successional and old-growth related species such as marbled murrelets. The majority of the national forest land within the Baker River watershed consists of unfragmented old-growth forest. A variety of activities take place on national forest lands within the Baker River watershed. These activities include forest management (i.e., commercial thinning) for the purpose of enhancing and accelerating forest stands under the age of 80 to achieve late-successional and old-growth stand characteristics, road construction and maintenance for forest management, and recreational use (e.g., camping, backpacking, hiking, picnicking, hunting, and fishing). It is assumed that all forest management activities are conducted to avoid the marbled murrelet nesting season. However, the public's recreational activities and also road maintenance activities conducted by the Mt. Baker-Snoqualmie National Forest would be expected to occur throughout the calendar year. These activities have the potential to create visual and sound disturbances and increase the risk of predation from corvids associated with recreational activities, to nesting marbled murrelets. A programmatic consultation on these types of activities, that included an analysis of effects on marbled murrelets and marbled murrelet critical habitat, was completed in 2002 for the Mt. Baker-Snoqualmie National Forest (FWS Reference Number 1-3-02-F-1583). The 2002 consultation expires at the end of 2007.

North Cascades National Park was established in 1968 to protect wild land and glaciers within the Cascade Mountain range. The majority of the forest land within the park, within the Baker River watershed, consists of unfragmented old-growth forest. Activities within the North Cascades National Park, within the Baker River watershed, include recreation activities such as backpacking and hiking. There are no established campgrounds in this vicinity of the park. The only named trail within this area of the park is the Baker River Trail that begins at the northeastern end of Baker Lake and proceeds in a northeastern direction following the mainstem of Baker River into the park. The Sulphide Creek Camp site, located at the end of Baker River Trail 2.5 miles north of the trailhead, is the only overnight destination for backpackers managed by the NPS in this area. Use is restricted to two parties (8 persons maximum per party) per night. The NPS data indicates that in 1999, 25 parties representing 68 people visited the campsite, with 101 visitor nights (Ann Dunphy, USFS, pers. comm. January 18, 2007). In addition to the backcountry camping, we assume that there is a moderate amount of day hiking activity from the Baker River Trail that extends into the park only during the late spring to early fall due to elevation and expected snow levels at other times of the year. These activities could potentially result in visual and sound disturbance, and increase the risk of predation from corvids associated with recreational activities, to nesting marbled murrelets in the vicinity.

The State of Washington owns and manages 3,498 acres within the Baker River watershed. These lands were given by the Federal government to the State in the late 1800s and are managed primarily for timber production to generate income for the construction of schools, institutions, and other buildings of the State. The State-owned forest lands within the Baker River watershed occur on the east side of Lake Shannon and consist of a mix of seral stages from young to mature forest stands interspersed with privately-owned forest stands managed for

commercial timber production. The WDNR, the department that manages the State-owned land in the watershed, conducts a variety of activities. Forest management activities are managed under the WDNR HCP (WDNR 1997) and are conducted to conserve marbled murrelets and their habitat. The WDNR is currently working on under an interim strategy and is beginning development of a long-term conservation strategy for marbled murrelets in their North Puget Planning Region which includes the Baker River watershed. Forest activities include forest management (i.e., timber harvest, commercial thinning), road construction and maintenance, and fire suppression. Also, these lands are open for public recreation including camping, backpacking, hiking, biking, and picnicking. These activities have the potential to create visual and sound disturbances, and increase the risk of predation from corvids associated with recreational activities, to nesting marbled murrelets.

There are private lands within the Baker River watershed, and the majority of these lands are owned by companies that manage their land for commercial timber production. Other private lands are assumed to range from small family forest ownerships, home sites, and other developments. The privately-owned forest lands within the Baker River watershed occur on the east side of Lake Shannon and consist of a mix of seral stages from young to mature forest stands interspersed with State-owned forest stands managed for commercial timber production. All of the activities on private lands that are near suitable marbled murrelet habitat would be expected to create visual and sound disturbances to marbled murrelets and affect the condition of suitable habitat.

The land that was inundated with water when the Upper and Lower Baker Dams were installed (i.e., Baker Lake and Lake Shannon) would have primarily supported unfragmented old-growth forest, suitable for marbled murrelet nesting habitat, prior to dam installation. This land area (approximately 2,412 acres for Baker Lake and 1,380 acres for Lake Shannon) represents a loss of occupied and suitable murrelet habitat (Shelley 2007). The result of the creation of Baker Lake and Lake Shannon provides an opportunity for marbled murrelets to forage for prey. As noted in the Status of the Species section, marbled murrelets have been observed foraging in freshwater lakes (Nelson 1997; Carter and Sealy 1986). However, there is no information available that documents whether or not marbled murrelets forage in Baker Lake or Lake Shannon.

As a part of the environmental baseline, Puget has conducted a variety of activities in the Baker River watershed within and near the Baker Lake and Lake Shannon reservoirs. These activities include dam operations for power generation and flood control, fish propagation, and the operation of a visitor's center. Also, a variety of recreational facilities and sites (i.e., Baker Lake Resort, other established campgrounds, dispersed campsites, and recreational trails) are associated with the Baker Lake and Lake Shannon reservoirs, but occur on USFS land. All of these ongoing activities are part of the action under this consultation and have the potential to affect marbled murrelets and their habitat. These activities are discussed in detail in the Effects of the Action.

In summary, the action area (i.e., the Baker River watershed) surrounding Baker Lake consists of relatively unfragmented, old-growth forest of high quality to nesting marbled murrelets. The area surrounding Lake Shannon is a mix of ownerships, management objectives, and forest seral

stages of varying qualities to nesting marbled murrelets. Acknowledging a lack of recent marbled murrelet surveys in the action area, we assume marbled murrelet occupancy would be higher in the unfragmented, old-growth forests than in the mix of forest seral stages. Therefore, when activities are conducted that 1) alter suitable marbled murrelet nesting habitat, 2) create visual and/or sound disturbances, or 3) increase the risk of predation, we expect a higher risk of adversely affecting marbled murrelets in areas of higher marbled murrelet occupancy.

EFFECTS OF THE ACTION – Marbled Murrelet

The following discussion of the effects of the action on marbled murrelets describes the Agreement articles in terms of effects to individual marbled murrelets from visual and/or sound disturbance, predation, or alterations of suitable marbled murrelet habitat. Discussions of visual and/or sound disturbance rely on an analysis we completed of the potential for injury associated with disturbance (visual and sound) to marbled murrelets (U.S. Fish and Wildlife Service 2003). In this analysis, we concluded that behaviors indicating potential injury to marbled murrelets are flushing from the nest, aborted feeding, and postponed feeding. These disturbance responses could lead to an increased risk of egg or chick mortality at the nest site. Reduced feedings of the chick at the nest may increase the risk of fledging mortality as they attempt to reach the ocean. During the incubation and brooding periods, we concluded that activities that generate loud sounds within certain threshold distances may cause a disturbance response resulting in potential injury to marbled murrelets. The potential injury threshold distances are based on anecdotal observations documented by marbled murrelet researchers of marbled murrelet flush responses to the presence of people, loud sounds, etc. (U.S. Fish and Wildlife Service 2003). Based on these observations of nesting marbled murrelets, we determined the potential injury threshold distance for heavy equipment (e.g., excavators) is 32 m (105 ft) and from impact pile driving, jackhammering, or rock drilling is 55 m (180 ft). The FWS notes that scientific data related to injury threshold distances associated with sound and visual disturbance is limited, and we continue to collect pertinent data related to the issue.

Predation is a major factor limiting murrelet reproductive success and nest site selection (Nelson and Hamer 1995b; Ralph et al. 1995). Marbled murrelets are believed to be highly vulnerable to nest predation compared to other forest nesting birds (Nelson and Hamer 1995b; USDI 1997). Marbled murrelets have no protection at nest sites other than the ability to remain hidden. Known predators of adult marbled murrelets in the forest environment include the peregrine falcon (*Falco peregrinus*), sharp-shinned hawk (*Accipiter striatus*), common raven (*Corvus corax*), northern goshawk (*Accipiter gentilis*), and bald eagle (*Haliaeetus leucocephalus*). Common ravens and Stellar's jays (*Cyanocitta stelleri*) are known to take both eggs and chicks at the nest, while sharp-shinned hawks have been found to take chicks. Common ravens account for the majority of egg depredation, as they appear to be the only predator capable of flushing incubating or brooding adults from a nest (Nelson and Hamer 1995b). Other suspected nest predators include great horned owls (*Bubo virginianus*), barred owls (*Strix varia*), Cooper's hawks (*Accipiter cooperi*), northwestern crows (*Corvus caurinus*), American crows (*Corvus brachyrhynchos*), and gray jays (*Perisoreus canadensis*) (Nelson and Hamer 1995b; Nelson 1997; Manley 1999).

Losses of eggs and chicks to avian predators have been determined to be the most important cause of nest failure (Nelson and Hamer 1995b; McShane et al. 2004). The risk of predation by avian predators appears to be highest in complex structured landscapes in proximity to edges and human activity, where corvids (e.g., crows, ravens) are in high abundance. Predation rates are influenced mainly by habitat stand size, habitat quality, nest placement (on the edge of a stand versus the interior of a stand), and proximity of the stand to human activities. The quality of marbled murrelet nest habitat decreases in smaller stands because forest edge increases in relation to the amount of interior forest, while forest stands near human activities (less than 0.62 mi or 1 km), regardless of size, are often exposed to a higher density of corvids due to their attraction to human food sources (Marzluff et al. 2000). The loss of nest contents to avian predators increases with habitat fragmentation and an increase in the ratio of forest edge to interior habitat (Nelson and Hamer 1995b; McShane et al. 2004). For example, Nelson and Hamer (1995b) found successful nests were farther from edges (greater than 55 m (180 ft)) and were better concealed than unsuccessful nests. Raphael et al. (2002) found rates of predation on nesting marbled murrelets were higher within 50 m (164 ft) of forest edge. Based on these studies of forest fragmentation and predation on nesting marbled murrelets, we expect a higher risk of predation within 55 m (180 ft) of the forest edge (e.g., old-growth forest adjacent to harvested or young seral forest).

Project Facilities, Operations, and Flood Control

The following article will adversely affect marbled murrelets:

- Article 107 Flood Control

One of the activities that would occur under the new license would be the regulation of the water levels of the Baker Lake and Lake Shannon reservoirs for flood control and for the generation of hydroelectric power (Article 107 – Flood Control). The land inundated by the damming of the Baker River (i.e., Baker Lake and Lake Shannon) is an existing condition and is described under the environmental baseline section for marbled murrelets. The active control of the water levels between the minimum and maximum pool levels has occurred since the dams became operational; this ongoing action will continue into the future and is, therefore, considered an effect of the action under this section 7 consultation. The fluctuation zone of active control is estimated to be 2,380 acres (963 hectares) surrounding Baker Lake and 832 acres (337 hectares) surrounding Lake Shannon. Prior to the construction of the two Baker River dams, a portion of this land would have supported old-growth forest considered to have been suitable as marbled murrelet nesting habitat. Under this action, the natural succession is disrupted, and the development of 2,343 total acres (948 hectares) of suitable marbled murrelet nesting habitat, 1,751 acres (709 hectares) surrounding Baker Lake and 592 acres (240 hectares) surrounding Lake Shannon (Shelley 2007) will be delayed. The continued delay in the development of habitat adversely affects marbled murrelets by delaying their use of this land for a 50-year license term.

The following article relates to flow regulation in the Baker and Skagit Rivers below Lower Baker Dam. This article will have no effect on marbled murrelets.

- Article 106 Flow Implementation

Aquatics

The following article is not well-defined in the FEIS and has the potential to adversely affect marbled murrelets. This activity would also be beneficial.

- Article 110 Shoreline Erosion

Shoreline Erosion

Article 110 calls for the development of a shoreline erosion control plan to identify measures to control erosion along the shorelines of Baker Lake and Lake Shannon. The project locations and specific treatments have not yet been identified for Article 110. However, we anticipate heavy equipment will be necessary to treat at least some of the sites. Sound generated by heavy equipment and increased human activity during construction could temporary disturb marbled murrelets. Suitable habitat close to the water's edge may need to be removed prior to stabilizing the banks. If only a few large trees are removed per site, effects to the availability of suitable marbled murrelet nesting habitat are expected to be minimal. However, the removal of several large trees per site could have a greater effect on the availability of suitable nesting habitat. We recognize that stabilizing areas of chronic erosion can prevent other large trees from falling into the reservoirs and such actions could preserve stands of trees suitable for marbled murrelet nesting that would otherwise be lost to shoreline erosion, so that the long-term effect would be beneficial. Once treated, stabilized sites are not expected to further limit or preclude marbled murrelets from nesting in close proximity to these areas in the future. Additional section 7 consultations with the USFS may be necessary once specific sites and treatments are known.

The following aquatics articles may affect, but are not likely to adversely affect marbled murrelets:

- Article 101 Fish Propagation
- Article 103 Upstream Fish Passage Implementation Plan
- Article 104 Fish Connectivity Between Reservoirs
- Article 105 Downstream Fish Passage

Fish Propagation and Fish Passage

This section relates to articles 101, 103, 104 and 105. There is no information available that documents the use of Baker Lake or Lake Shannon by marbled murrelets foraging for prey. Marbled murrelets primarily feed in marine waters; however, marbled murrelets are also known to feed at inland lakes (Carter and Sealy 1986). In the absence of known marbled murrelet foraging behavior at Baker Lake or Lake Shannon, it is assumed for the purposes of this analysis that marbled murrelets may forage at Baker Lake and Lake Shannon because of its close

proximity to occupied and suitable marbled murrelet nesting habitat. These articles are designed primarily to propagate sockeye salmon and improve fish passage for salmon and bull trout and could potentially affect marbled murrelets by affecting available forage prey (i.e., species of fish) or foraging opportunities (i.e., availability of fish). Although there is some uncertainty what the effects of the implementation of these articles would be on marbled murrelet foraging behavior, since marbled murrelets are known to forage on sockeye salmon fingerlings (Carter and Sealy 1986) it is assumed that these articles would be beneficial to individual marbled murrelets foraging in Baker Lake and Lake Shannon.

Article 101 includes improvements to spawning beach 4, at the mouth of Sulphur Creek at the break between Baker Lake and Lake Shannon, and the construction of a hatchery facility at that same site. Article 101 also includes decommissioning spawning beaches 1, 2, and 3 at the upper end of Baker Lake. All of these spawning beach activities and the construction of a hatchery facility have the potential to create visual and sound disturbances to nesting marbled murrelets in nearby suitable habitat.

The improvements to spawning beach 4 include removing existing fabric curtains between the sections of the watered pond and replacing them with concrete walls. This work would involve the use of heavy equipment (e.g., track hoe) and would occur for up to 2 months in May and June, during the marbled murrelet breeding season (April 1 through September 15). The construction of the hatchery facility, also on the same site, would involve the use of heavy equipment and possibly some impact drilling and would occur throughout the calendar year for approximately 2 years. There are approximately 0.05 acres of fragmented, suitable marbled murrelet nesting habitat within 55 m (180 ft) of the project site. Because of the small acreage of suitable habitat and the distance to unfragmented suitable habitat, we do not expect marbled murrelets to occupy these stands for nesting. Therefore, effects to marbled murrelets from construction at spawning beach 4 and the hatchery site are expected to be discountable.

The decommissioning of spawning beaches 1, 2, and 3 involves the excavation and removal of all manmade structures on the site and the construction of an ephemeral, meandering stream at approximately the same site, connecting to Baker Lake. These activities involve the use of heavy equipment (e.g., excavators) and would occur for approximately 2 months between June and October, overlapping most of the marbled murrelet breeding season (April 1 through September 15). There are approximately 0.01 acres of fragmented, suitable marbled murrelet nesting habitat within 32 m (105 ft) of the project site. Because of the small acreage of suitable habitat and the distance to unfragmented suitable habitat, we do not expect marbled murrelets to occupy these stands for nesting. Therefore, effects to marbled murrelets from the decommissioning of spawning beaches 1, 2, and 3 are expected to be discountable.

The construction of the fish passage facilities (articles 103, 104 and 105) is expected to have insignificant effects on marbled murrelets. The locations of these facilities and construction sites are outside of suitable habitat, and in addition they are outside of any zone of influence for disturbance to marbled murrelets.

The following aquatics articles relate to maintaining the integrity of the reservoirs for the protection or enhancement of fish habitat. The implementation of these articles would have no effect on marbled murrelets.

- Article 108 Gravel Augmentation
- Article 109 Large Woody Debris

Recreation

The following recreation article will adversely affect marbled murrelets:

- Article 303 Baker Lake Resort Redevelopment

Baker Lake Resort Redevelopment

Article 303, unlike most of the recreational articles, has been planned in sufficient detail to anticipate the effects to marbled murrelets. This section will complete the assessment of actual levels of adverse effects to marbled murrelets.

According to the Recreation Capacity and Suitability Analysis (R11) and Recreational Trail Analysis (R15) Final Draft Study Report (Puget Sound Energy 2004a), the redevelopment of the Baker Lake Resort may affect up to 22.89 acres, including the area that is currently developed. Article 303 indicates that the current resort structures will be decommissioned and that up to 50 campsites will be constructed on the site. The R11 and R12 Reports also indicate that about half of the Baker Lake Resort site is occupied by old-growth forest, which is assumed to be suitable habitat for nesting marbled murrelets, although it may not be the most desirable habitat in terms of proximity to the current Baker Lake Resort development.

The USFS's Final 4(e) Terms and Conditions document (U.S. Forest Service 2006) indicates that the Baker Lake Resort will be redeveloped to a "level 3" campground[5] Vegetation management on the site would include thinning for overstory health and vegetation removal to open views to the lake. The Baker Lake Resort site would be reconfigured to decrease the overall campsite density from four campsite units per acre to three campsite units per acre (7.4 campsites per hectare). Roads and parking areas on the site would be reconfigured to improve circulation patterns. Individual campsites would be rehabilitated to include tables, fire pits, and tent pads. The dock and boat ramp would be upgraded to current accessibility standards. The Baker Lake Resort site would include the development or refurbishment of shelters suitable for interpretive or educational programs. Also, the water system would be reconstructed to include an additional six communal water sources plus distribution lines and the installation of a generator to run the well and water system.

[5] Level 3 Definition: Site modification moderate. Facilities about equal for protection of natural site and comfort of users. Contemporary/rustic design of improvements is usually based on use of native materials. Inconspicuous vehicular traffic controls usually provided. Roads may be hard surfaced and trails formalized. Development density about 3 family units per acre. Primary access may be over high standard roads. Definition from: Meaningful measures for quality recreation management – developed sites costing instructions. U.S. Forest Service. February 2002.

The redevelopment of the Baker Lake Resort, as described above, would be expected to affect most of the 22.89 potential development acres (9.3 hectares). To accommodate up to 50 campsites at a density of 3 campsites per acre (7.4 sites per hectare), that would require approximately 17 acres (7 hectares) just for the campsites. The other structures (i.e., restrooms, generator, shelters, etc.) would be expected to affect much of the remaining 5.89 acres (2.4 hectares). For our analysis, we assume that the back half of the development area that is in old-growth will be thinned to accommodate campsites. Also, we assume that existing roads and trails will be utilized and refurbished to the extent possible in favor of building new roads and trails.

Vegetation removal and thinning operations, to accommodate campsites and other facilities within the 22.89 acres (9.3 hectares) subject to development, is expected to affect 8.8 acres (3.6 hectares) determined to be suitable marbled murrelet nesting habitat (Shelley 2007). Although thinning operations are intended to improve the remaining overstory health, this alteration of habitat has the potential to remove suitable marbled murrelet nesting trees. Habitat alteration would also reduce the quality of the remaining nesting habitat, by exposing marbled murrelets to an increase in forest fragmentation and thus an increase in avian predation. This exposure to predation risk would be expected within the 8.8 acres (3.6 hectares) of suitable habitat as well as for the 2.3 acres (0.9 hectares) of suitable habitat within 55 m (180 ft) of the development site. The 55 m (180 ft) distance is based on research by Nelson and Hamer (1995b) and Raphael et al. (2002) that studied nest predation related to forest edges (see the beginning of the Effects of the Action on Marbled murrelets for more discussion on predation). During the thinning operations, nesting marbled murrelets within the 8.8 acres (3.6 hectares) of suitable nesting habitat, as well as marbled murrelets within the 1.4 acres (0.6 hectares) of suitable habitat within 32 m (105 ft) of the development site would also be subject to visual and sound disturbance. This disturbance increases the likelihood of nesting adult marbled murrelets flushing from the nest and aborting or postponing juvenile feeding attempts. The total affected area from overstory thinning operations is 11.1 acres (4.5 hectares) of suitable marbled murrelet nesting habitat.

The decommissioning of the existing structures on the Baker Lake Resort site and the construction of new structures described above have the potential to generate visual and sound disturbances due to the use of heavy equipment and the felling of trees and other vegetation. Nesting adult marbled murrelets that are exposed to these disturbances may flush from the nest or abort or postpone juvenile feeding attempts. The affected disturbance area is the 8.8 acres (3.6 hectares) of suitable marbled murrelet habitat within development site, as well as 1.4 acres (4.5 hectares) within a 32-m (105-ft) border of this area (Shelley 2007). The combined acres subject to disturbance from the redevelopment effort is 10.2 acres (4.1 hectares) which is inclusive within the 11.1 acres (4.5 hectares) identified above.

The ongoing recreational use (i.e., human activity) of the redeveloped Baker Lake Resort site would continue to create visual and sound disturbances from the same combined 10.2 acres (4.1 hectares) that were identified directly above. Also, the use of the area would continue to expose nesting marbled murrelet adults, eggs, and chicks to avian predators (i.e., ravens and crows) because human activities tend to encourage the presence of these types of predators (Raphael et al. 2002). Additionally, the redevelopment effort expands the amount of forest edge habitat and

increases the potential for even more nest predation compared to the current situation. Forest edge habitat and subsequent increases in avian predators have been demonstrated through various studies to decrease marbled murrelet nest success (USDI 1997; McShane et al. 2004). We consider the risk of predation to include the 8.8 acres (3.6 hectares) of suitable marbled murrelet nesting habitat on the development site and also extend the risk beyond that area to suitable habitat within 55 m (180 ft) (Nelson and Hamer 1995b; Raphael et al. 2002). This surrounding area is estimated to be 2.3 acres (0.9 hectares) of suitable marbled murrelet nesting habitat. The combined acres subject to predation risk from the redevelopment effort is the same 11.1 acres (4.5 hectares) already identified above.

Overall, the redevelopment of the Baker Lake Resort may significantly disrupt normal behaviors (i.e., nest visits and feeding attempts) through disturbance and may significantly impair essential behaviors (i.e., nesting, fledging success) through increased predation or loss of habitat of nesting marbled murrelets. It is expected that there could be a stand-level effect on the marbled murrelet nesting population near the Baker Lake Resort, however, it is not expected that there would a significant effect on the population in the action area (i.e., the Baker River watershed). Further, there would not be a significant effect on the marbled murrelet species rangewide from the redevelopment of the Baker Lake Resort.

The following recreation articles are not well-defined in the FEIS and have the potential to adversely affect marbled murrelets:

- Article 302 Aesthetics Management Plan
- Article 306 Upper Baker Visitor's Information Center
- Article 308 Managing Dispersed Campsites
- Article 309 Bayview Campground Redevelopment
- Article 310 Upper Baker Trail and Trailhead Construction Funding
- Article 312 Developed Recreation Monitoring
- Article 313 Upper Baker Developed Recreation Maintenance
- Article 314 Upper Baker Trail and Trailhead Maintenance
- Article 316 USFS Road Maintenance and Paving

The implementation of these recreation articles are considered to pose the greatest risk to individual nesting marbled murrelets under this section 7 consultation. However, these projects have not been sufficiently designed to anticipate the effects to marbled murrelets. Due to the uncertainty associated with the exact impacts of these projects (i.e., number of individuals actually affected by each of these future project activities) to the species, we can only address the overall potential effect that these projects may have with respect to the likelihood of jeopardizing the species. We defer the assessment of actual levels of adverse effects to marbled murrelets (i.e., number of individuals disturbed, injured and/or killed, and amount of habitat degraded and/or lost) until such time that these projects have been fully designed and the associated site-specific minimization measures have been described by the USFS.

Several assumptions were made about recreation to conduct this effects analysis. These assumptions are as follows:

1. Human population growth will continue at high levels during the foreseeable future (i.e., the next 20 years). This increasing population will continue to use the Baker Lake and Lake Shannon reservoirs and surrounding area for recreation.

2. Recreation use at existing campgrounds and other facilities will increase due to the implementation of the above recreational articles. Recreation use at dispersed campsites will decrease slightly because of the enhancements to established campgrounds from the implementation of the above recreational articles.

3. Existing campgrounds, some that will be refurbished or enhanced through the implementation of the above recreational articles, will continue to be used to "over capacity" and at least part of the recreational visitors will turn to dispersed camping as the result of full campgrounds.

4. Some dispersed campers will continue to use dispersed camp sites regardless of whether established campgrounds are full or not.

5. The refurbishment or enhancement of recreational facilities will follow existing policies under the Northwest Forest Plan for the Mt. Baker-Snoqualmie National Forest.

6. All developed campgrounds and hardened dispersed campsites will have regular trash pickup and wildlife resistant trash containers will be installed.

7. Under Article 312, any new trails that will be developed will be between campgrounds that are already developed.

Aesthetics Management Plan

Article 302 would provide funds to the USFS to implement vegetation management at developed campgrounds. The specific vegetation management measures to be implemented at the USFS sites, and the two to four locations averaging less than one-quarter acre, are not identified in the proposed article. Sound from equipment and increased human activity during vegetation management could temporarily disturb nesting marbled murrelets. Removal of overstory trees could occur at five known sites and at an additional two to four sites not yet identified. Overstory tree removal could have localized effects on the number of trees available for nesting marbled murrelets. Additional section 7 consultation with the USFS may be necessary once specific sites are identified and vegetation management measures at each site are known.

Upper Baker Visitor Information Services

Article 306 would provide funds to the USFS for constructing and operating an Upper Baker Visitor Information Services Station (VIS) with parking, information kiosks, and sanitation facilities at Baker Lake. Construction could generate sound and involve increased human activity. Overstory trees may be removed to accommodate the VIS. Short-term effects may include the displacement of marbled murrelets that could nest in the vicinity of the construction site. Removal of overstory trees could have a localized effect on the number of nest trees

available for marbled murrelets. A developed site with increased human presence may limit or preclude marbled murrelets from nesting in the vicinity of the VIS in the future. Depending on the location of the VIS, future section 7 consultation with the USFS may be necessary.

Other Recreation Articles

This section analyzes articles 308, 309, 310, 312, 313, 314, and 316. Article 308 provides funding to improve and harden three to six dispersed recreational camping sites. These activities would occur at up to 6 of the existing 213 sites identified in the Dispersed Site Inventory Study (Study R12) Final Draft Report (Puget Sound Energy 2004b). However, it is unknown at this time which of these six sites would be improved. Article 309 provides funding for the reconstruction and rehabilitation of the existing Bayview Campground to a development "level 4"[6] campground. Article 310 provides funding for the development of up to 6 miles of new multi-season, multi-use, non-motorized trails. These trails are expected to be developed within and between existing campgrounds and other developments such as 1) West Pass Dike to Horseshoe Cove Campground, 2) Bayview South to Bayview North campgrounds, and 3) Panorama Point Campground to Baker Lake Resort. Article 313 provides funding for maintenance of the following developed recreational sites: Shannon Creek, Panorama Point, Bayview, Horseshoe Cove, Maple Grove, and Baker Lake Resort. Article 314 provides funding for the operation, maintenance, and facility maintenance of the Baker River Trail, the Baker Lake Trail, and the Baker Lake North and South trailheads.

All of the above campsite, trail, and maintenance activities would likely create sound and/or visual disturbances to marbled murrelets nesting in adjacent, suitable habitat due to construction and maintenance work and subsequently the ongoing recreational use of the campsites and trails. Marbled murrelet nest success would also likely decline with the increase in recreational activity at these sites because of the increase in forest edge habitat and the higher risk of avian predation associated with recreational use and human activity. There also is some potential for the removal of suitable marbled murrelet nesting habitat; however, it is assumed that the USFS would evaluate all potential sites and trails to minimize or avoid the removal of any suitable marbled murrelet nesting habitat because the area is designated as LSR (see the Introduction to Species Effects section).

Article 312 provides funding to monitor site use and occupancy levels at the following campgrounds: Horseshoe Cove, Panorama Point, Bayview, Shannon Creek, and Baker Lake Resort. There is the potential for additional recreational development if these existing campgrounds meet or exceed 60 percent combined site occupancy during July and August for 2 consecutive years. This increase in recreational development would likely create visual and sound disturbances and increase the risk of avian predation on nesting marbled murrelets adults, eggs, and chicks. There also is some potential for the removal of suitable marbled murrelet nesting habitat. We assume that the USFS would evaluate potential sites for additional

[6] Level 4 Definition: Site heavily modified. Some facilities designed strictly for comfort and convenience of users. Luxury facilities not provided. Facility design may incorporate synthetic materials. Extensive use of artificial surfacing of roads and trails. Vehicular traffic controls usually obvious. Primary access usually over paved roads. Development density 3-5 family units per acre. Plant materials usually native. Interpretive services often formal or structured.

recreational development and minimize or avoid adverse effects to suitable marbled murrelet nesting habitat because the area is designated as LSR (see the Introduction to Species Effects section).

Article 316 provides funding for the maintenance of up to 25 miles of the following roads: Forest Roads 11 (Baker Lake Highway), 1106 (Depression Lake), 1107 (Anderson Road), 1118 (Horseshoe Cover and Bayview), 1122 (Lower Sandy Creek), 1136 (Lower Boulder Creek), 1137 (Panorama Point), 1142 (Baker Lake Resort), 1150 (Shannon Creek Campground), and 1168 (Baker River Trailhead North). Article 316 also includes funding for the paving of USFS road 1106. These roads are interspersed throughout occupied and suitable marbled murrelet habitat. The USFS has completed section 7 consultation for road maintenance and construction through 2007. Depending upon site specific plans for this type of work in the future, additional section 7 consultations may be necessary.

In addition to the potential effects described above for the recreation articles, there is the potential to affect marbled murrelet foraging behavior on Baker Lake and Lake Shannon. As noted in the Environmental Baseline, there is no information available that documents the use of the reservoirs by marbled murrelets foraging for prey. However, in this analysis we are assuming that they may forage at the reservoirs. Since the above recreation articles may increase recreational activities at the reservoirs, there may be increased motorized water craft (e.g., boat) use on the reservoirs. This may create visual and sound disturbances for foraging marbled murrelets. However, the use of the reservoirs by foraging marbled murrelets is not expected to be commonplace, as evidenced by the lack of any documentation of that behavior. Also, we expect foraging marbled murrelets to be most active during the early morning and late afternoon hours when boat use would be expected to be less than during the middle portion of the daytime. Therefore, effects to marbled murrelets from the potential increase in boat use are expected to be discountable.

Due to the uncertainty associated with the exact impacts of these projects (i.e., number of individuals actually affected by each of these future project activities) to the species, we can only address the overall potential effect that these projects may have with respect to the likelihood of jeopardizing the species. We defer the assessment of actual levels of adverse effects to marbled murrelets (i.e., number of individuals disturbed, injured and/or killed, and amount of habitat degraded and/or lost) until such time that these projects have been fully designed and the associated site-specific minimization measures have been described by the USFS. In general, road maintenance activities would likely create sound and/or visual disturbances to marbled murrelets nesting in adjacent suitable habitat. Forest edge habitat is expected to remain unchanged as no new roads are anticipated with Article 316 and, therefore, no increase in predation risk is expected. The removal of trees through road maintenance activities is expected to be minimal and not likely to remove suitable marbled murrelet nesting habitat.

Terrestrial

The following terrestrial articles are not well-defined in the FEIS and have the potential to adversely affect marbled murrelets. All the articles except 516 should provide long-term benefits to marbled murrelets:

- Article 502 Deciduous Forest Habitat
- Article 505 Aquatic Riparian Habitat
- Article 516 Mountain Goats
- Article 517 Road Closures for Grizzly Bears

Overall, the projects that will be conducted under these terrestrial articles are expected to have either neutral or long-term beneficial effects on marbled murrelets and their habitat. However, there is the potential for some short-term effects from the implementation of some of the articles. Due to the uncertainty associated with the exact impacts of these projects (i.e., number of individuals actually affected by each of these future project activities) to the species, we can only address the overall potential effect that these projects may have with respect to the likelihood of jeopardizing the species. We defer the assessment of actual levels of adverse effects to marbled murrelets (i.e., number of individuals disturbed, injured and/or killed, and amount of habitat degraded and/or lost) until such time that these projects have been fully designed and the associated site-specific minimization measures have been described by the USFS.

Article 502 provides funding for deciduous habitat acquisition and habitat enhancement activities for the benefit of deciduous forest-dwelling species. We assume that habitat enhancement activities could include silvicultural and vegetation management activities. These activities may create visual and sound disturbances to nesting marbled murrelets in adjacent, suitable habitat. However, the acquisition of land to set aside for forest-dwelling species is expected to be a neutral or beneficial effect to marbled murrelets in the long-term.

Article 505 provides funding for the acquisition, protection, and enhancement of low-elevation bottomland ecosystem habitat in the Skagit River basin for the benefit of anadromous salmonids, other aquatic species, and riparian-dependent birds and amphibians. We assume that habitat enhancement activities could include silvicultural and vegetation management activities. These activities may create visual and sound disturbances to nesting marbled murrelets within and adjacent to the acquired land. However, the acquisition of land to set aside for bottomland ecosystem species is expected to be a neutral or beneficial effect to marbled murrelets in the long-term.

Article 516 provides funding for habitat enhancements for up to 194 acres of high-elevation mountain goat habitat. Habitat enhancement would primarily be achieved through prescribed burning of mountain hemlock forests on the northern end of Baker Lake in several small patches. Burning would occur in spring and early summer which overlaps the beginning of the marbled murrelet breeding season. Also, recent survey data described in the environmental baseline section indicates marbled murrelet occupancy at higher elevations adjacent to Baker Lake. Therefore, prescribed burning and smoke effects may create a disturbance to nesting marbled murrelets in suitable habitat on the north end of Baker Lake.

Article 517 provides funding for a road closure program to reduce human use disturbances in the North Cascades Grizzly Bear Recovery Area of the Mt. Baker-Snoqualmie National Forest to improve grizzly bear habitat. Implementation of this article may include the installation of gates, berms, jersey barriers, ecology blocks, or boulders to block vehicular access. Heavy equipment

such as a backhoe is expected to be used in creating some of the blockages. These activities may have short-term adverse effects on nesting marbled murrelets in the vicinity. However, we expect a long-term beneficial effect to marbled murrelets as this article should increase the quality of marbled murrelet nesting habitat by reducing the amount of vehicular traffic and human activity that could otherwise disturb nesting marbled murrelets. The section 7 consultation for this article has already been done by the USFS.

The following terrestrial article may affect, but are not likely to adversely affect marbled murrelets.

- Article 503 Elk Habitat

Article 503 provides funding for the acquisition, enhancement, and management of approximately 300 acres of elk habitat in the core and peripheral area of the Nooksack Elk Herd or the Sauk Game Management Unit. We assume that in the selection of land, suitable marbled murrelet habitat would not occur within the land acquisition area or, if it does, it would not be subject to alteration or disturbance from enhancement or management activities. This assumption is explained in the Introduction to Species Effects section. Therefore, we anticipate effects to marbled murrelets from the implementation of this article to be either insignificant or discountable.

The following terrestrial articles will be wholly beneficial to marbled murrelets:

- Article 511 Decaying and Legacy Wood
- Article 513 Bald Eagle Management Plans
- Article 515 Late Seral Forest

Article 511 provides funding for the protection and management of snags, logs, and residual live trees for the purpose of enhancing habitat for snag and log-dependent species. Only beneficial effects to marbled murrelets and their habitat are expected from the implementation of this article as the protection of these features is consistent with suitable marbled murrelet nesting habitat.

Article 513 provides for planning and long-term protection of and management of bald eagle nest sites and communal winter night roosts. Only beneficial effects to marbled murrelets and their habitat are expected from the implementation of this article as the features of bald eagle habitat are consistent with suitable marbled murrelet nesting habitat.

Article 515 provides funding for thinning up to 321 acres of second-growth forest on USFS lands in the Baker River watershed. The intent of this article is to reduce edge effects by enhancing the acceleration of late-seral forest growth, which may increase the nesting success and/or survival of federally-listed NSOs and marbled murrelets. The noncommercial thinning operations would be timed to occur outside the nesting season for stands within 35 meters of suitable nesting habitat (J. Vanderheyden, pers. comm. 2007). We expect the effects from this pre-commercial thinning, therefore to be wholly beneficial to marbled murrelets and should increase the quality of marbled murrelet nesting habitat.

The following articles are reporting or planning tasks that would occur in an office type setting and would therefore have no effect on marbled murrelets:

- Article 102 Aquatics Reporting
- Article 201 Programmatic Agreement
- Article 301 Recreation Management Report
- Article 304 Baker Reservoir Recreation Water Safety
- Article 307 Upper Baker Visitor Interpretive Services
- Article 501 Terrestrial Resource Management Plan
- Article 514 Use of Habitat Evaluation Procedures
- Article 601 Baker River Coordinating Committee

Activities associated with the following recreation articles would not occur within or adjacent to marbled murrelet occupied or suitable nesting habitat. Instead, these activities would occur within previously developed areas where facilities or infrastructure are currently in place. These articles would refurbish or enhance these developed areas for public access and benefit and would have no effect on marbled murrelets.

- Article 305 Lower Baker Developed Recreation
- Article 311 Lower Baker Trail Construction
- Article 315 Lower Baker Trail Maintenance
- Article 317 Access to Baker Lake

The following article relates to maintaining water quality. It will have no effect on marbled murrelets:

- Article 401 Water Quality

The following terrestrial articles are designed to enhance habitat for several species of birds and plants in and adjacent to the reservoirs. The implementation of these articles would have no effect on marbled murrelets.

- Article 504 Wetland Habitat
- Article 506 Osprey Nest Structures
- Article 507 Loon Floating Nest Platforms
- Article 508 Noxious Weeds
- Article 509 Special Status Plants
- Article 510 *Carex flava* (yellow sedge)
- Article 512 Bald Eagle Night Roost Surveys

The following articles relate to the long-term success of the Agreement but would have no effect on marbled murrelets:

- Article 318 Law Enforcement
- Article 602 Contingency Funds
- Article 603 Adaptive Management

CUMULATIVE EFFECTS – Marbled murrelet

Cumulative effects include the effects of future State, Tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

The land surrounding Baker Lake is almost entirely in Federal ownership and the majority of that land consists of late-successional forest, of which a large portion is suitable marbled murrelet nesting habitat. The land surrounding Lake Shannon is a mix of ownerships with various land management objectives. Commercial timber harvest would create the most significant cumulative effect on marbled murrelets by limiting or precluding the development of late-successional forest characteristics and thus suitable marbled murrelet nesting habitat. Timber harvest would likely increase forest edge habitat and increase the risk of avian predation on marbled murrelet adults, eggs, and chicks. Timber harvest operations would also create short-term visual and/or sound disturbances to nesting marbled murrelets in the vicinity. The Washington Forest Practices Rules which regulate State and private forestland would provide some measures to minimize or avoid adverse effects on marbled murrelets.

Other activities on non-Federal lands including road construction and maintenance, vehicular travel, and recreation would likely create visual and/or sound disturbances to nesting marbled murrelets in the vicinity. Road construction could also increase forest edge habitat, increase the risk of avian predation, and possibly remove suitable marbled murrelet nesting habitat. With the projected increase in human population for Washington State, recreational activities may pose the greatest risk to marbled murrelets in the future.

We expect that climate change will alter the ecosystem that supports marbled murrelets during the term of the license. Effects of climate change may alter the geographic or elevation range of marbled murrelets, the availability of nesting habitat and forage species, and may affect marbled murrelets in ways that are currently unknown.

CONCLUSION – Marbled Murrelet

After reviewing the current status of the marbled murrelet, the environmental baseline for the action area, the effects of the proposed action and the cumulative effects, it is the FWS's biological opinion that implementation of the proposed action is not likely to jeopardize the continued existence of the marbled murrelet.

The activities associated with project operations and the implementation of flood control (Article 107) have resulted in a loss of 2,343 total acres (948 hectares) of occupied and/or suitable marbled murrelet nesting habitat, attributed to the active fluctuation zone, and this historic loss of habitat precludes the continued use of this land for individual nesting marbled murrelets. Although flood control, and the active fluctuation zone, is considered part of the action in this biological opinion, the loss of the 2,343 acres (948 hectares) of suitable marbled murrelet nesting habitat occurred at the time the dams were originally installed. The effect of flood control is the

continued preclusion of the development and use of this habitat by nesting marbled murrelets into the future and this is likely to adversely affect marbled murrelets. However, this effect does not reduce the likelihood of the survival and recovery of marbled murrelets in the action area because this historic loss of habitat would not reduce the current murrelet population in terms of reproduction capability, numbers of birds, or their distribution.

Implementation of the fish propagation and fish passage articles (i.e., 101, 103, 104, and 105) has the potential for a beneficial effect on marbled murrelets by providing greater foraging opportunities in the way of increased sockeye salmon production, a known forage prey species of marbled murrelets. The spawning beach activities have the potential to affect marbled murrelets, however, because of the limited size of suitable nesting marbled murrelet habitat adjacent to the spawning beach activities and the distance to unfragmented suitable marbled murrelet nesting habitat, these activities are not likely to adversely affect marbled murrelets. The effect of these articles would not reduce the reproduction capability, numbers, or distribution of marbled murrelets in the action area.

The redevelopment of the Baker Lake Resort (Article 303) includes overstory thinning and vegetation management to accommodate up to 50 campsites and associated facilities. These activities may remove trees in 8.8 acres (3.6 hectares) of suitable marbled murrelet nesting habitat. Other redevelopment activities including building decommissioning, road and trail work, campsite development, and the ongoing recreational use of the area may disturb nesting marbled murrelets and increase the risk of predation in 11.1 acres (4.5 hectares) of suitable marbled murrelet nesting habitat. These effects to habitat and individual birds may be in the form of sub-lethal effects such as flushing from the nest and aborted or postponed feeding attempts or in the form of lethal effects such as reproductive failure and unsuccessful fledging. Overall, the redevelopment of the Baker Lake Resort is likely to adversely affect marbled murrelets. However, the adverse effect would only be in the immediate vicinity of the resort where the reproduction capability, numbers, or distribution of marbled murrelets would be slightly reduced.

The other recreation, road maintenance, and terrestrial habitat enhancement articles (i.e., 302, 306, 308, 309, 310, 312, 313, 314, 316, 502, 503, 505, 511, 513, 515, 516, and 517) range from beneficial effects to the potential for adverse effects depending on how those projects are designed in the future. However, based on what we know of these articles at this point in time, we expect the majority of any adverse effects to be sub-lethal effects such as flushing from the nest and aborted or postponed feeding attempts. We expect lethal effects such as reproductive failure and unsuccessful fledging to be minimized because of the objectives and guidelines within the LSR on the Mt. Baker-Snoqualmie National Forest. Any adverse effects from these articles would be localized near the specific sites where recreational developments, road maintenance work, and habitat enhancement work would be conducted. Marbled murrelets would not experience an appreciable reduction in the likelihood of both their survival and recovery because we expect there to be only a slight reduction in their reproduction capability, numbers, and their distribution in these localized work areas.

The remaining articles (102, 106, 108, 109, 201, 301, 304, 305, 307, 311, 315, 317, 318, 401, 501, 504, 506, 507, 508, 509, 510, 512, 514, 601, 602, and 603) have been determined to have no

effect on marbled murrelets because they are either office or planning tasks, or because they are not near occupied or suitable marbled murrelet nesting habitat.

MARBLED MURRELET CRITICAL HABITAT

STATUS OF DESIGNATED CRITICAL HABITAT—Marbled Murrelet

Critical habitat is defined in section 3(5)(A) of the Act as "the specific area within the geographic area occupied by the species on which are found those physical and biological features essential to the conservation of the species, and that may require special management considerations or protection, and specific areas outside the geographical area occupied by a species at the time it is listed, upon determination that such areas are essential for the conservation of the species." The Act defines conservation as the procedures necessary to bring about the recovery of a listed species.

This BO does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat within 50 CFR 402.02. Instead, we have relied upon the statutory provisions of the Act to complete the following analysis with respect to critical habitat.

Legal Status

The final rule designating critical habitat for the marbled murrelet (61 FR 26256 [May 24, 1996]) became effective on June 24, 1996. The principle factor affecting the marbled murrelet and the main cause of its population decline has been the loss of older forests and associated nest sites (57 FR 45328:45330 [October 1, 1992]). Critical habitat was designation for the marbled murrelet to addresses the objective of stabilizing population size.

Thirty-two critical habitat units (CHUs) totaling 3,887,800 acres were designated on Federal, State, county, city, and private lands in Washington, Oregon, and California. Approximately 1,631,100 acres (or 42 percent) were designated in Washington State (Table 4) (61 FR 26255:26269[May 24, 1996]). The majority of these CHUs (78 percent) occur on Federal lands, 21 percent occurs on State lands, 1.2 percent occurs on private lands, 0.2 percent occurs on county lands, and 0.003 percent occurs on city lands. Critical Habitat Units do not include non-Federal lands covered by a legally operative incidental take permit for marbled murrelets (61 FR 26255 [May 24, 1996]). Therefore, critical habitat designations were excluded on State lands upon completion of the WDNR Habitat Conservation Plan. The FWS did not include any of the marine environment in critical habitat, but instead relied on other existing regulations for protection of this area. Therefore, about 99.8 percent of the critical habitat in Washington State is on Federal lands.

Although most of the areas designated as marbled murrelet critical habitat occur on Federal lands (National Forest Late Successional Reserves [LSRs]), the FWS designated selected non-Federal lands that met the selection criteria where Federal lands were insufficient to provide suitable nesting habitat for the recovery of the species. The designated CHUs are distributed more or less evenly across the range of the species in Washington and Oregon, and less so in California.

In Washington State, there is a clear reliance on Federal lands to fulfill the functions for which critical habitat was designated. These functions are also met by non-designated Federal lands in National Parks, Wilderness Areas, and portions of Adaptive Management Areas and Matrix lands found to be occupied.

Table 4. The amount of critical habitat designated in Washington administrated by Federal and non-Federal management (61 FR 26255:26269[May 24, 1996]). Acreage totaled 1,204,500 (1,631,300 - 426,800 = 1,204,500) after suspension of WDNR-managed lands.

Ownership	Designation	Designated Critical Habitat (Acres)
Federal	Congressionally Withdrawn	1,800
	Late-Successional Reserve	1,200,200
	Federal total	1,202,000
Non-Federal	State*	426,800
	Private, City, and County	2,500
	Non-Federal total	429,300
	Overall total	**1,631,300**

*Some lands managed by WDNR were originally designated as critical habitat, but designation was suspended following approval of the WDNR HCP. The total acreage of critical habitat in Washington is 1,204,500 (1,631,300 - 426,800 = 1,204,500) due to the suspension of critical habitat on WDNR-managed lands.

Eleven CHUs totaling 1,631,300 acres were originally designated in Washington State (Table 4). Of these, nine units included Federal lands, seven units included WDNR-managed lands, and portions of two units occurred on private lands. The following selection criteria were considered in choosing areas for inclusion in marbled murrelet critical habitat: 1) suitable nesting habitat, 2) survey data, 3) proximity to marine foraging habitat, 4) large, contiguous blocks of nesting habitat, 5) range-wide distribution, and 6) adequacy of existing protection and management. There was a reliance on LSRs in the selection of CHUs.

Primary Constituent Elements

In the 1996 final rule designating critical habitat for the marbled murrelet (61 FR 26255 [May 24, 1996]), the FWS identified two primary constituent elements (PCEs) essential to provide and support suitable nesting habitat for successful reproduction. These are: 1) individual trees with potential nesting platforms, and 2) forested areas within 0.5 mi of individual trees with potential nesting platforms and a canopy height of at least one-half the site-potential tree height. This includes all such forests, regardless of contiguity. Areas with one or both PCEs are, by definition, considered critical habitat. These PCEs were deemed essential for providing suitable nesting habitat for successful reproduction of the marbled murrelet, and thus its conservation. PCEs require special management considerations.

Distribution of Critical Habitat

The designated critical habitat lands includes 695 of the over 807 known-occupied sites at the time of listing (sites in Redwood National Park had not been entered into the database at the time) on Federal lands, and 218 of the 354 known-occupied sites on non-Federal lands. Although most of the areas designated as marbled murrelet critical habitat occur on Federal lands (National Forest LSRs), the FWS designated selected non-Federal lands that met the above selection criteria where Federal lands were insufficient to provide suitable nesting habitat for the recovery of the species. The vast majority of non-Federal lands originally designated as CHUs in Washington are managed by WDNR.

Current Condition of Critical Habitat

The quality of forests occurring within the boundaries of the CHUs ranges from non-habitat (e.g., young plantations) to high-quality habitat (i.e., large blocks of old-growth forest). While significant amounts of high-quality marbled murrelet habitat are present in some of the CHUs, much of the habitat in CHUs, particularly on non-Federal lands, is of lesser quality due to its occurrence in smaller, more fragmented blocks. Some of the highest quality marbled murrelet habitat occurs in National Parks and designated Wilderness Areas where harvest historically has not occurred. Given the high quality of this habitat and reduced threat of habitat loss or modification due to management objectives, designation of critical habitat was deemed unnecessary in National Parks and Wilderness Areas.

Activities that May Affect PCEs

The final rule (61 FR 26255:26271[May 24, 1996]) states that "A variety of ongoing or proposed activities that disturb or remove primary constituent elements may adversely affect, though not necessarily 'adversely modify' marbled murrelet critical habitat as that term is used in section 7 consultations. Examples of such activities include, but are not limited to, 1) forest management activities which greatly reduce stand canopy closure, appreciably alter the stand structure, or reduce the availability of nesting sites, 2) land disturbance activities such as mining, sand and gravel extraction, construction of hydroelectric facilities and road building, and 3) harvest of certain types of commercial forest products (e.g. moss)." Ultimately, actions may alter PCEs if they remove or degrade forest habitat, or prevent or delay future attainment of suitable habitat. The scope of analysis for evaluating the impacts of an action on marbled murrelet critical habitat is the conservation zone and not each individual acres.

Summary

Marbled murrelet critical habitat was designated in 1996 due to the high rate of nesting habitat loss and fragmentation. The objective of the designation was to stabilize the murrelet population size. Washington contains 11 CHUs and totals 1,204,000 acres, the majority of which is on Federal land. The FWS identified two primary constituent elements for the CHU, specifically, 1) individual trees with potential nesting platforms, and 2) forested areas within 0.5 mi of individual trees with potential nesting platforms and a canopy height of at least one-half the site-potential tree height. Most of the areas designated as marbled murrelet critical habitat occur on Federal

land. The highest quality critical habitat occurs on National Parks and Wilderness areas where harvest historically has not occurred. Designating critical habitat in these areas was deemed unnecessary. The final rule describes activities that may adversely affect though not "necessarily modify" murrelet critical habitat and includes forest management activities, land disturbance activities, and harvest of certain types of commercial forest products.

ENVIRONMENTAL BASELINE –Marbled Murrelet Critical Habitat

Marbled murrelet critical habitat is designated on all Mt. Baker-Snoqualmie National Forest lands within the action area (i.e., the Baker River watershed), consisting of one critical habitat unit (WA-07-c). These forest lands are managed under the Northwest Forest Plan and the majority of these lands consist of unfragmented old-growth forest. Almost all of the land surrounding Baker Lake is national forest land designated as critical habitat. In contrast, Lake Shannon is surrounded by a mix of non-Federal ownerships and these lands are not designated as critical habitat. The national forest lands are contiguous with old-growth forest within the North Cascades National Park. These combined lands provide relatively unfragmented old-growth forest that is high quality habitat for nesting marbled murrelets in northwest Washington. The primary management activities on the national forest lands include silvicultural activities to enhance late-successional forest conditions, recreation activities, and road maintenance.

EFFECTS OF THE ACTION – Marbled Murrelet Critical Habitat

Project Facilities, Operations and Flood Control

The following articles would have no effect on marbled murrelet critical habitat:

- Article 106 Flow Implementation
- Article 107 Flood Control

The activities associated with project operations and the implementation of flood control (Article 107), as described in the effects of the action on the species, do not occur within designated critical habitat. These project operations occur on land owned by Puget. Operations including flood control would not affect adjacent critical habitat on national forest lands, as the fluctuating water level would not significantly affect the growth or maintenance of adjacent forested land that is critical habitat.

Aquatics

The following aquatics article may affect but is not likely to adversely affect marbled murrelet critical habitat. The long-term effect would be beneficial.

- Article 110 Shoreline Erosion

Treatment of erosion sites under Article 110 may involve some removal of trees for access, but the effects to the availability of suitable marbled murrelet nesting habitat are expected to be minimal. Stabilizing areas of chronic erosion can prevent other large trees from falling into the reservoirs and such actions could preserve stands of trees suitable for marbled murrelet nesting that would otherwise be lost to shoreline erosion, so that the long-term effect would be beneficial. The effects of shoreline erosion control on marbled murrelet critical habitat are therefore expected to be insignificant as well as beneficial in the long-term.

The following aquatics articles would have no effect on marbled murrelet critical habitat:

- Article 101 Fish Propagation
- Article 103 Upstream Fish Passage
- Article 104 Fish Connectivity Between Reservoirs
- Article 105 Downstream Fish Passage
- Article 108 Gravel Augmentation
- Article 109 Large Woody Debris

Implementation of the aquatics articles would not affect critical habitat as the activities under these articles primarily affect fish within the Baker Lake and Lake Shannon reservoirs, and in the Baker and Skagit Rivers, but not upland habitat.

Recreation

The following recreation article will adversely affect marbled murrelet critical habitat:

- Article 303 Baker Lake Resort Redevelopment

<u>Baker Lake Resort Redevelopment</u>

The Baker Lake Resort is within critical habitat on the Mt. Baker-Snoqualmie National Forest. Refer to the Effects of the Action-Recreation section for a discussion on the redevelopment activities (Article 303) as they pertain to marbled murrelets. The redevelopment of the resort includes overstory thinning to accommodate up to 50 campsites and associated facilities. This activity may affect the primary constituent elements (PCE) identified for marbled murrelet critical habitat. The PCEs are 1) individual trees with potential nesting platforms, and 2) forested areas within 0.5 mile of individual trees with potential nesting platforms, and with a canopy height of at least one-half the site-potential tree height. This includes all such forest, regardless of contiguity. These PCEs have been determined to be essential to provide and support suitable nesting habitat for successful reproduction of the marbled murrelet.

The overstory thinning associated with the redevelopment effort of Baker Lake Resort could remove individual trees with potential nesting platforms (PCE 1) and forested areas within 0.5 mile of individual trees with potential nesting platforms, and with a canopy height of at least one-half the site-potential tree height (PCE 2). This adverse effect on the PCEs, however, when added to the environmental baseline in the action area, does not represent a significant loss that would appreciably diminish the capability of the surrounding critical habitat on the Mt. Baker-

Snoqualmie National Forest to satisfy the essential requirements of nesting marbled murrelets at the critical habitat unit level.

The following recreation articles are not well-defined in the FEIS and have the potential to adversely affect marbled murrelet critical habitat:

- Article 302 Aesthetics Management Plan
- Article 306 Upper Baker Visitor's Information Center
- Article 308 Managing Dispersed Campsites
- Article 309 Bayview Campground Redevelopment
- Article 310 Upper Baker Trail and Trailhead Construction Funding
- Article 312 Developed Recreation Monitoring
- Article 313 Upper Baker Developed Recreation Maintenance
- Article 314 Upper Baker Trail and Trailhead Maintenance
- Article 316 USFS Road Maintenance and Paving

These articles have the potential to affect individual marbled murrelets and also have the potential to affect designated critical habitat by affecting the two PCEs. Vegetation management for aesthetic purposes and recreational development and expansion (articles 302, 306, 309, and 312) particularly associated with the established campgrounds (e.g., Bayview Campground) could remove individual trees with potential nesting platforms (PCE 1) and forested areas within 0.5 mile of individual trees with potential nesting platforms, and with a canopy height of at least one-half the site-potential tree height (PCE 2). Also, trail development (Article 310) could affect the two PCEs by removing trees to accommodate new trails. The hardening of the three to six dispersed campsites (Article 308) is expected to occur within the boundaries of the already established campsites and may involve minimal timber harvest. Sound and/or visual disturbances and ongoing recreational use of the sites could affect the two PCEs. We expect the effects of the recreation articles on marbled murrelet critical habitat to be revisited in the future as specific project designs are available. The potential effects to the PCEs are not expected to appreciably diminish the capability of the surrounding critical habitat because any removal of trees would be within the bounds of the LSR designation on the national forest critical habitat (see the Introduction to Species Effects for a detailed discussion on the LSR objective and standards and guidelines for forest activities).

The implementation of articles 313, 314, and 316 include facility and road maintenance activities could affect marbled murrelet critical habitat by affecting the two PCEs. Although maintenance activities generally would be expected to affect developed areas, road surface and road ditches, vegetation management may be necessary, during the 50-year license term, to maintain these facilities and roads in a safe condition. Therefore, it is expected that an occasional, individual tree may be removed during maintenance activities. These trees could meet the criteria for PCE 1 (i.e., trees with nesting platforms), but more likely these trees could meet the criteria for PCE 2 (i.e., trees within 0.5 mile of trees with nesting platforms). These potential effects, when added to the environmental baseline, are not expected to appreciably diminish the capability of the surrounding critical habitat because tree removal would likely be very limited (i.e., an isolated tree adjacent to a facility or road that needed to be removed because it was encroaching the area or it represented a hazard). Also, any tree removal would be within the bounds of the objective

and standards and guidelines for LSRs (see the Introduction to Species Effects). We expect the effects of these maintenance articles on marbled murrelet critical habitat to be revisited in the future as specific project designs are available. The USFS has completed section 7 consultation for road maintenance and construction (Article 316) through 2007. Depending upon site specific plans for this type of work in the future, additional section 7 consultations may be necessary.

Terrestrial

The following terrestrial articles are not well-defined in the FEIS and have the potential to adversely affect marbled murrelet critical habitat. Articles 502 and 505 would also provide long-term benefit.

- Article 502 Deciduous Forest Habitat
- Article 505 Aquatic Riparian Habitat
- Article 516 Mountain Goats

These terrestrial habitat enhancement articles (articles 502, 505, and 516), described in the Effects of the Action on the species, have a potential to adversely affect the two PCEs within marbled murrelet critical habitat. These articles could affect trees that meet the criteria for PCE 1 (i.e., trees with nesting platforms) or PCE 2 (i.e., trees within 0.5 mile of trees with potential nesting platforms and with a canopy height of at least one half the site potential tree height). Based on the information we have received about Article 516, the burn locations appear to be forested and/or adjacent to forested areas; therefore, the effects of smoke during nesting season could affect critical habitat. Acquisition of land to set aside for forest-dwelling species is a neutral or beneficial effect on marbled murrelet critical habitat. Depending upon the specific project designs for activities that will occur under these articles, future section 7 consultations may be necessary.

The following terrestrial article may affect, but is not likely to adversely affect marbled murrelet critical habitat.

- Article 503 Elk Habitat

Article 503 provides funding for acquisition, enhancement and management of approximately 300 acres of elk habitat. As explained in our discussion on the effects of this article to marbled murrelets, we assume marbled murrelet habitat would not occur on lands to be acquired for elk habitat, and if it is, it would not be subject to alteration. We therefore expect the effects from acquisition, enhancement, and management of elk habitat on marbled murrelet critical habitat to be either insignificant or discountable.

The following terrestrial articles will be wholly beneficial to marbled murrelet critical habitat:

- Article 511 Decaying and Legacy Wood
- Article 513 Bald Eagle Management Plans
- Article 515 Late Seral Forest
- Article 517 Road Closures for Grizzly Bears

Article 511 would manage snags, logs and residual live trees on project lands which would protect old growth characteristics. Article 513 would implement management plans for bald eagle nest and night roost sites and would be expected to provide additional protection for marbled murrelet critical habitat. Non-commercial thinning provided under article 515 will take place in stands that are 35 years old or less and would be conducted outside marbled murrelet nesting season. This article is expected to reduce forest edge effects and increase the quality of late-successional forests, including marbled murrelet critical habitat, and is expected to be a beneficial effect. Article 517 involves road closures for grizzly bears and would be expected to provide additional protection for areas of critical habitat.

The following articles are reporting or planning tasks that would occur in an office-type setting and would therefore have no effect on marbled murrelet critical habitat:

- Article 102 Aquatics Reporting
- Article 201 Programmatic Agreement
- Article 301 Recreation Management Report
- Article 304 Baker Reservoir Recreation Water Safety
- Article 307 Upper Baker Visitor Interpretive Services
- Article 501 Terrestrial Resource Management Plan
- Article 514 Use of Habitat Evaluation Procedures
- Article 601 Baker River Coordinating Committee

Activities associated with the following recreation articles would not occur within or near marbled murrelet critical habitat and therefore would have no effect on marbled murrelet critical habitat.

- Article 305 Lower Baker Developed Recreation
- Article 311 Lower Baker Train Construction
- Article 315 Lower Baker Trail Maintenance
- Article 317 Access to Baker Lake

The following article relates to maintaining water quality. It will have not effect on marbled murrelet critical habitat.

- Article 401 Water Quality

The following terrestrial articles are designed to enhance habitat for several species of birds and plants in and adjacent to the reservoirs. The implementation of these articles would have no effect on marbled murrelet critical habitat.

- Article 504 Wetland Habitat
- Article 506 Osprey Nest Structure
- Article 507 Loon Floating Nest Platforms
- Article 508 Noxious Weeds

- Article 509 Special Status Plants
- Article 510 *Carax Flava* (yellow sedge)
- Article 512 Bald Eagle Night Roost Surveys

The following articles relate to the long-term success of the Agreement but would have no effect on marbled murrelet critical habitat.

- Article 318 Law Enforcement
- Article 602 Contingency Funds
- Article 603 Adaptive Management

CUMULATIVE EFFECTS – Marbled Murrelet Critical Habitat

Future State and private timber harvest on the south and southwest side of Baker Lake could affect designated critical habitat on the Mt. Baker-Snoqualmie National Forest. Timber harvest on these non-Federal forestlands adjacent to designated critical habitat could affect PCE 2 (i.e., trees within 0.5 mile of trees with nesting platforms), especially when considering the 50-year term of the license. The effect on PCE 2 would occur at the outer boundaries of designated critical habitat since the designated land is a relatively contiguous block of forestland and is only bordered by these non-Federal forestlands and not intermixed with them. Because of this spatial arrangement, the effect on PCE 2 would be limited to the outer boundary of designated critical habitat within 0.5 mile of the boundary. The vast majority of the designated critical habitat would not be affected by reasonably foreseeable, future non-Federal actions. To the northwest, northeast, and southeast, the designated critical habitat within the action area (i.e., the Baker River watershed) is bordered by the North Cascades National Park and other designated critical habitat on the Mt. Baker-Snoqualmie National Forest outside of the action area. Therefore, cumulative effects on designated critical habitat are relatively limited and do not appreciably diminish the capability of the critical habitat to satisfy essential requirements of the marbled murrelet at the critical habitat unit level and moreover at the range-wide scale.

We expect that climate change will alter the ecosystem that supports marbled murrelets during the term of the license. Effects of climate change may alter the geographic or elevation range of marbled murrelets, and the availability of nesting habitat and their forage species or affect marbled murrelet critical habitat in ways that are currently unknown.

CONCLUSION – Marbled Murrelet Critical Habitat

The action of implementing the Agreement articles is not likely to result in the destruction or adverse modification of critical habitat because the effect on marbled murrelet critical habitat PCEs is only expected at the stand scale and not at the critical habitat unit level. This effect on critical habitat PCEs, combined with the objective and standards and guidelines for LSRs (described in the Introduction to Species Effects section), does not represent an appreciable diminishment in the capability of the critical habitat to satisfy essential requirements of the marbled murrelet.

NORTHERN SPOTTED OWL

STATUS OF THE SPECIES—Northern Spotted Owls

Legal Status

The NSO was listed as threatened on June 26, 1990. It was listed due to widespread habitat loss across its entire range and the inadequacy of existing regulatory mechanisms to provide for its conservation (USDI FWS 1990a).

Life History

Here we provide a life history summary that is relevant to section 7 consultations. More detailed accounts of the taxonomy, ecology, and reproductive characteristics of the NSO are found in the 1987 and 1990 U.S. Fish and Wildlife Service Status Reviews (USDI FWS 1987, 1990b), the 1989 Status Review Supplement (USDI FWS 1989), the Interagency Scientific Committee (ISC) Report (Thomas et al. 1990), the Forest Ecosystem Management Assessment Team (FEMAT) Report (Thomas and Raphael 1993), the final rule designating the NSO as a threatened species (USDI FWS 1990a), and the Scientific Evaluation of the Status of the Northern Spotted Owl (Courtney et al. 2004).

Taxonomy

The NSO is one of three subspecies of spotted owls currently recognized by the American Ornithologists' Union. The taxonomic separation of these three subspecies is supported by genetic (Barrowclough and Gutiérrez 1990), morphological (Gutiérrez et al. 1995) and biogeographic information (Barrowclough and Gutiérrez 1990).

Physical Description

The NSO is a medium-sized owl, approximately 46-48 cm in length and weighs approximately 490-850 g (Gutiérrez et al. 1995) and is the largest of the three subspecies (Gutiérrez et al. 1995). It is dark brown with a barred tail and white spots on the head and breast, and has dark brown eyes that are surrounded by prominent facial disks. Three age classes can be distinguished on the basis of plumage characteristics (Forsman 1981, Moen et al. 1991). The NSO superficially resembles the barred owl (*Strix varia*), a species with which it occasionally hybridizes (Kelly et al. 2003). Hybrids exhibit characteristics of both species (Hamer et al. 1994).

Current and Historical Range

The current range and distribution of the NSO extends from southern British Columbia through western Washington, Oregon, and California, as far south as Marin County (USFWS 1990b). The southeastern boundary of its range is the Pit River area of Shasta County, California. The range of the NSO is partitioned into 12 physiographic provinces (provinces), based upon recognized landscape subdivisions exhibiting different physical and environmental features

(Thomas et al. 1993). These provinces are distributed across the range as follows: 4 provinces in Washington (Washington Cascades East, Olympic Peninsula, Washington Cascades West, Western Lowlands); 5 provinces in Oregon (Oregon Coast Range, Willamette Valley, Oregon Cascades West, Oregon Cascades East, Klamath Mountains); and 3 provinces in California (California Coast, California Klamath, California Cascades)(Figure 2). The current range of the NSO is similar to its historical range where forested habitat still exists. The relatively contiguous distribution of habitat is influenced by the natural insularity of habitat patches within geographic province, and by natural and man-caused fragmentation of vegetation. The NSO is extirpated or uncommon in certain areas such as southwestern Washington and British Columbia. Timber harvest activities have eliminated, reduced or fragmented NSO habitat sufficiently to decrease overall population densities across its range, particularly within the coastal provinces where habitat reduction has been concentrated (Thomas and Raphael 1993).

Behavior

NSOs are territorial. However, home ranges of adjacent pairs overlap (Forsman et al. 1984, Solis and Gutiérrez 1990) suggesting that the area defended is smaller than the area used for foraging. Territorial defense is primarily effected by hooting, barking and whistle type calls.

NSOs are monogamous and usually form long-term pair bonds. "Divorces" occur but are relatively uncommon. There are no known examples of polygyny in this owl, although associations of three or more birds have been reported (Gutiérrez et al. 1995).

Habitat Relationships

Home Range. NSO home range size varies by province. Home range generally increases from south to north, which is likely in response to decreasing habitat quality (USFWS 1990b). Home range size is linked to habitat type, availability, and abundance of prey (Zabel et al. 1995).

Based on available radio-telemetry data (Thomas et al. 1990), the FWS estimated median annual home range size for the NSO by province throughout the range of the spotted owl. Because the actual configuration of the home range is rarely known, the estimated home range of a NSO pair is represented by a circle centered upon a NSO activity center, with an area approximating the provincial median annual home range. For example, estimated home range area varies from 3,340 acres (based on a 1.3-mile radius area) in California to 14,271 acres (based on a 2.7-mile radius circle) in Washington. The FWS uses a 0.7-mile radius circle (984 acres) to delineate the area most heavily used (core area) by NSOs during the nesting season. Variation in the size of the actual core area also varies geographically. For example, NSOs in northern California focused their activities in core areas that ranged from about 167 to 454 acres, with a mean of about 409 acres; approximately half the area of the 0.7-mile radius circle (Bingham and Noon 1997). NSOs maintain smaller home ranges during the breeding season and often dramatically increase their home range size during fall and winter (Forsman et al. 1984, Sisco 1990).

Although differences exist in natural stand characteristics that influence provincial home range size, habitat loss and forest fragmentation effectively reduce habitat quality in the home range.

A reduction in the amount of suitable habitat reduces NSO abundance and nesting success (Bart and Forsman 1992, Bart 1995).

Habitat Use. Forsman et al. (1984) report that NSOs have been observed in the following forest types: Douglas-fir (*Pseudotsuga menziesii*), western hemlock (*Tsuga heterophylla*), grand fir (*Abies grandi*s), white fir (*Abies concolor*), ponderosa pine (*Pinus ponderosa*), Shasta red fir (*Abies magnifica shastensis*), mixed evergreen, mixed conifer hardwood (Klamath montane) and redwood (*Sequoia sempervirens*). Use of these types coincides with appropriate forest structure (see below). In parts of the Oregon Coast Range, NSOs have been recorded in pure hardwood stands (Glenn et al. 2004). In California, NSOs are found from near sea level in coastal forests to approximately 2130 m in the Cascades (Gutiérrez 1996). The upper elevation limit at which NSOs occur, decreases gradually with increasing latitude in Oregon and Washington (Lint 2005). In all areas, the upper elevation limit at which NSOs occur corresponds to the transition to subalpine forest, which is characterized by relatively simple structure and severe winter weather (Gutiérrez 1996).

Roost sites selected by NSOs have more complex vegetation structure than forests generally available to them (Barrows and Barrows 1978, Forsman et al. 1984, Solis and Gutiérrez 1990). These habitats are usually multi-layered forests having high canopy closure and large diameter trees in the overstory.

NSOs nest almost exclusively in trees. Like roosts, nest sites are found in forests having complex structure dominated by large diameter trees (Forsman et al. 1984, Hershey et al. 1998). Even in forests that have been previously logged, NSOs select forests having a structure (i.e., larger trees, greater canopy closure) different than forests generally available to them (Folliard 1993, Buchanan et al. 1995, Hershey et al. 1998).

Foraging habitat is the most variable of all habitats used by territorial NSOs (Thomas et al. 1990). Descriptions of foraging habitat have ranged from complex structure (Solis and Gutiérrez 1990) to forests with lower canopy closure and smaller trees than forests containing nests or roosts (Gutiérrez 1996).

Habitat Selection. NSOs generally rely on older forested habitats because they contain the structures and characteristics required for nesting, roosting, foraging, and dispersal. These characteristics include the following: a multi-layered, multi-species canopy dominated by large overstory trees; moderate to high canopy closure; a high incidence of trees with large cavities and other types of deformities, especially dwarf mistletoe brooms; numerous large snags; an abundance of large, dead wood on the ground; and open space within and below the upper canopy for NSOs to fly (Thomas et al. 1990, USFWS 1990b). Forested stands with high canopy closure also provide thermal cover (Weathers et al. 2001), as well as protection from predation. Recent landscape-level analyses in portions of the Klamath Province suggest that a mosaic of late-successional habitat interspersed with other vegetation types may benefit NSOs more than large, homogeneous expanses of older forests (Zabel et al. 2003, Franklin et al. 2000, Meyer et al. 1998).

Dugger et al. (2005) found that apparent survival and reproduction was positively associated with the proportion of older forest near the territory center in the Klamath Province. Survival decreased dramatically when the amount of nonhabitat exceeded approximately 50 percent (Dugger et al. 2005). NSO territories with habitat fitness potentials (i.e., expressed as a lambda estimate for the territory) of less than 1.0 were generally characterized by less than 40 to 50 percent old forest habitat near the territory center (Dugger et al. 2005). The authors conclude that they found no support for either a positive or negative direct effect of intermediate-aged forest on either survival or reproduction.

Olson et al. (2004) found that survival in the Oregon Coast Range had a quadratic relationship with the amount of late-and mid-seral forest near nesting centers. Reproductive rates fluctuated biennially and were positively related to the amount of edge between late- and mid- seral forests and other habitat classes. Olson et al. (2004) conclude that their result indicate that while mid- and late-seral forests are important to owls, a mixture of these forest types with younger forest and nonforest may be best for owl survival and reproduction in their study area.

In redwood forests along the coast range of California, NSOs may be found in younger forest stands with structural characteristics of older forests (Thomas et al. 1990). However, NSOs do not generally appear to select for stands of intermediate or younger ages (Solis and Gutiérrez 1990, Thomas et al. 1990).

In mixed conifer forests of the Eastern Cascades, Washington, 27 percent of nest sites were in old-growth forests, 57 percent in the understory reinitiation phase of stand development, and 17 percent in the stem exclusion phase (Buchanan et al. 1995). In the Western Cascades, Oregon, 50 percent of NSO nests were in late-seral/old-growth stands (> 80-yrs-old) and none were found in stands less than 40-yrs-old (Irwin et al. 2000).

Ward (1990) found NSOs foraged in areas that had lower variance in prey densities (prey were more predictable in occurrence) within older forests and near ecotones of old forest and brush seral stages. Zabel et al. (1995) showed that NSO home ranges are larger where flying squirrels (*Glaucomys sabrinus*) are the predominant prey and, conversely, are smaller where woodrats (*Neotoma* spp.) are the predominant prey.

In the Western Washington Cascades, NSOs used mature/old forests dominated by trees greater than 50 cm diameter-at-breast height (dbh) with greater than 60 percent canopy closure more often than expected for roosting during the non-breeding season and used young forest (trees 20-50 cm dbh with > 60% canopy closure) less often than expected based on availability (Herter et al. 2002).

Reproductive Biology

NSOs exhibit high adult annual survival rates and are relatively long-lived (USDI FWS 1992a). NSOs do not typically reach sexual maturity until after 2 years of age (Miller et al. 1985 and Thomas et al. 1990). Adult females lay an average of 2 eggs per clutch with a range of 1 to 4 eggs. NSO pairs do not typically nest every year, nor are nesting pairs successful every year (USDI FWS 1990b). The small clutch size, temporal variability in nesting success, and

somewhat delayed maturation all contribute to the relatively low reproductive rate of this species (Gutiérrez 1996).

Nest sites are usually located within stands of old-growth and late-successional forest dominated by Douglas-fir (*Pseudotsuga menziesii*), and they contain structures such as cavities, broken tree tops, or mistletoe (*Arceuthobium* spp.) brooms (Forsman et al. 1984, Blakesley et al. 1992, LaHaye and Gutiérrez 1999). In general, courtship and nesting behavior begins in February to March with nesting occurring from March to June; however, timing of nesting and fledging varies with latitude and elevation (Forsman et al. 1984). After young fledge from the nest, they depend on their parents until they are able to fly and hunt on their own. Parental care continues post-fledging into September (USFWS 1990a), and sometimes into October (Forsman et al. 1984). During this time the adults may not roost with their young during the day, but they respond to begging vocalizations by bringing food to the young (Forsman et al. 1984).

Some NSOs are not territorial but either remain as residents within the territory of a pair or move among territories (Gutiérrez 1996). These birds are referred to as "floaters." Floaters have special significance in NSO populations because they may buffer the territorial population from decline (Franklin 1992). Little is known about floaters other than that they exist and typically do not respond to calls as vigorously as territorial birds (Gutiérrez 1996).

Dispersal Biology

Natal dispersal of NSOs from Oregon and Washington typically begins from mid- to late-September, and it is remarkably synchronous across broad areas (Forsman et al. 2002). When data from many dispersing NSOs are pooled, the direction of dispersal away from the natal site appears random (Miller 1989, Ganey et al. 1998, Forsman et al. 2002). Dispersal direction from individual territories, however, may be non-random in response to the local distribution of habitat and topography (Forsman et al. 2002). Natal dispersal occurs in stages, with juvenile NSOs settling in temporary home ranges between bouts of dispersal (Forsman et al. 2002). Median natal dispersal distance is about 10 miles for males and 15.5 miles for females (Forsman et al. 2002, see also Miller 1989, Ganey et al. 1998). Successful dispersal of juvenile NSOs may depend on their ability to locate unoccupied suitable habitat in close proximity to other occupied sites (LaHaye et al. 2001).

Breeding dispersal occurs among a small proportion of adult NSOs; these movements were more frequent among females and unmated individuals (Forsman et al. 2002). Breeding dispersal distances were shorter than natal dispersal distances and also are apparently random in direction (Forsman et al. 2002). Large non-forested valleys are apparent barriers to natal and breeding dispersal. Forested foothills between valleys may provide the only opportunities for dispersal (Forsman et al. 2002). The degree to which water bodies, such as the Columbia River and Puget Sound, function as barriers to dispersal is unclear. Analysis of genetic structure of NSO populations suggests adequate rates of gene flow may occur across the Puget Trough between the Olympic Mountains and Washington Cascades and across the Columbia River between the Olympic Mountains and the Coast Range of Oregon (Haig et al. 2001). Both telemetry and genetic studies indicate inbreeding is rare.

Dispersing juvenile NSOs experience high mortality rates, exceeding 70 percent in some studies (USDI FWS 1990a, Miller 1989). Leading known causes of mortality are starvation, predation, and accidents (Miller 1989, USFWS 1990a, Forsman et al. 2002). Parasitic infection may contribute to these causes of mortality (Forsman et al. 2002). In a study on habitat use by dispersing juvenile NSOs in the Oregon Coast Range, Klamath and Western Oregon Cascades Provinces (Miller et al. 1997), mature and old-growth forest were used slightly more than expected based on availability during the transient phase and nearly twice its availability during the colonization phase. Closed pole-sapling-sawtimber habitat was used roughly in proportion to availability in both phases; open sapling and clearcuts were used less than expected based on availability during colonization.

Lint (2005) reported that nearly half of the Federal forest acres are providing dispersal habitat for NSOs. Their analysis showed that owl movement with resighting points inside NWFP land allocations where logging is restricted (reserved blocks) accounted for 51 percent of juvenile movement records. Over 30 percent of juvenile movements were into reserved blocks from points outside of reserves. The movement records provide evidence that NSOs are dispersing across the landscape under the NWFP and genetic or demographic isolation of local populations is not likely because dispersal between reserves is likely to be a common occurrence even if the landscapes between the reserves consists of highly fragmented forests (Lint 2005; Forsman et al. 2002).

Food Habits

Composition of prey in theNSOs diet varies regionally, seasonally, annually, and locally, which is likely in response to prey availability (Laymon 1988, Ganey 1992, Verner et al. 1992, Carey 1993, Ward and Block 1995, Forsman et al. 2001). NSOs are mostly nocturnal (Forsman et al. 1984), but they may forage opportunistically during the day (Laymon 1991, Sovern et al. 1984). Northern flying squirrels and woodrats are usually the predominant prey both in biomass and frequency (Barrows 1980; Forsman et al. 1984; Ward 1990; Bevis et al. 1997; Forsman et al. 2001, 2004) with a clear geographic pattern of diet, paralleling differences in habitat (Thomas et al. 1990). Northern flying squirrels are generally the dominant prey item in the more mesic Douglas-fir/western hemlock forests characteristic of the northern portion of the range, whereas woodrats are generally the dominant prey item in the drier mixed conifer/mixed evergreen forests typically found in the southern portion of the range (Forsman et al. 1984, Thomas et al. 1990, Ward et al. 1998, reviewed by Courtney et al. 2004). These prey items were found to be co-dominant in the southwest interior of Oregon (Forsman et al. 2001, 2004).

Other prey species such as the red tree vole (*Arborimus longicaudus),* red-backed voles (*Clethrionomys gapperi),* mice, rabbits and hares, birds, and insects) may be seasonally or locally important (reviewed by Courtney et al. 2004). For example, Rosenberg et al. (2003) showed a strong correlation between annual reproductive success of NSOs (number of young per territory) and abundance of deer mice (*Peromyscus maniculatus*) ($r^2 = 0.68$), despite the fact they only made up 1.6±0.5 percent of the biomass consumed. However, it is unclear if the causative factor behind this correlation was prey abundance or a synergistic response to weather (Rosenberg et al. 2003). Ward (1990) also noted that mice were more abundant in areas selected for foraging by owls. Nonetheless, NSOs deliver larger prey to the nest and eat smaller food

items to reduce foraging energy costs; therefore, the importance of smaller prey items, like *Peromyscus*, in the NSO diet should not be underestimated (Forsman et al. 1984, 2001, 2004).

Population Dynamics

The NSO is a relatively long-lived bird; produces few, but large young; invests significantly in parental care; experiences later or delayed maturity; and exhibits high adult survivorship. TheNSOs long reproductive life span allows for some eventual recruitment of offspring, even if recruitment does not occur each year (Franklin et al. 2000).

Annual variation in population parameters for NSOs has been linked to environmental influences at various life history stages (Franklin et al. 2000). In coniferous forests, mean fledgling production of the California spotted owl (*Strix occidentalis occidentalis*), a closely related subspecies, was higher when minimum spring temperatures were higher (North et al. 2000), a relationship that may be a function of increased prey availability. Across their range, spotted owls have previously shown an unexplained pattern of alternating years of high and low reproduction, with highest reproduction occurring during even-numbered years (e.g., Franklin et al. 1999). Annual variation in breeding may be related to weather (i.e., temperature and precipitation) (Wagner et al. 1996 and Zabel et al. 1996 *In*: Forsman et al. 1996) and fluctuation in prey abundance (Zabel et al. 1996).

A variety of factors may regulate spotted owl population levels. These factors may be density-dependent (e.g., habitat quality, habitat abundance) or density-independent (e.g., climate). Interactions may occur among factors. For example, as habitat quality decreases, density-independent factors may have more influence on survival and reproduction, which tends to increase variation in the rate of growth (Franklin et al. 2000). Specifically, weather could have increased negative effects on spotted owl fitness for those owls occurring in relatively lower quality habitat (Franklin et al. 2000). A consequence of this pattern is that at some point, lower habitat quality may cause the population to be unregulated (have negative growth) and decline to extinction (Franklin et al. 2000).

Olson et al. (2005) used open population modeling of site occupancy that incorporated imperfect and variable detectability of spotted owls and allowed modeling of temporal variation in site occupancy, extinction, and colonization probabilities (at the site scale). The authors found that visit detection probabilities average less than 0.70 and were highly variable among study years and among their three study areas in Oregon. Pair site occupancy probabilities declined greatly on one study area and slightly on the other two areas. However, for all owls, including singles and pairs, site occupancy was mostly stable through time. Barred owl presence had a negative effect on these parameters (see barred owl discussion in the New Threats section below). However, there was enough temporal and spatial variability in detection rates to indicate that more visits would be needed in some years and in some areas, especially if establishing pair occupancy was the primary goal.

Threats

Reasons for Listing

The NSO was listed as threatened throughout its range "due to loss and adverse modification of suitable habitat as a result of timber harvesting and exacerbated by catastrophic events such as fire, volcanic eruption, and wind storms" (USDI FWS1990a). More specifically, significant threats to the NSO included the following: low populations, declining populations, limited habitat, declining habitat, distribution of habitat or populations, isolation of provinces, predation and competition, lack of coordinated conservation measures, and vulnerability to natural disturbance (USDI FWS 1992a). These threats were characterized for each province as severe, moderate, low, or unknown. Declining habitat was recognized as a severe or moderate threat to the NSO in all 12 provinces, isolation of provinces within 11 provinces, and declining populations in 10 provinces. Consequently, these three factors represented the greatest concern range-wide to the conservation of the NSO. Limited habitat was considered a severe or moderate threat in 9 provinces, and low populations a severe or moderate concern in 8 provinces, suggesting that these factors are a concern throughout the majority of the range. Vulnerability to natural disturbances was rated as low in 5 provinces.

The degree to which predation and competition might pose a threat to the NSO was unknown in more provinces than any of the other threats, indicating a need for additional information. Few empirical studies exist to confirm that habitat fragmentation contributes to increased levels of predation on spotted owls (Courtney et al. 2004). However, great horned owls (*Bubo virginianus*), an effective predator on NSOs, are closely associated with fragmented forests, openings, and clearcuts (Johnson 1992, Laidig and Dobkin 1995). As mature forests are harvested, great horned owls may colonize fragmented forests, thereby increasing NSO vulnerability to predation.

New Threats

Barred Owls (Strix varia). Since the listing of the NSO under the Act, new information suggests that hybridization with the barred owl is less of a threat (Kelly and Forsman 2004) and competition with the barred owl is a greater threat than previously anticipated (Courtney et al. 2004). Since 1990, the barred owl has expanded its range south into Marin County, California, and the central Sierra Nevada Mountains, such that it is now roughly coincident with the range of the NSO (Courtney et al. 2004). Further, notwithstanding the likely bias in survey methods towards underestimating actual barred owl numbers (Courtney et al. 2004), barred owl populations appear to be increasing throughout the Pacific Northwest, particularly in Washington and Oregon (Zabel et al. 1996, Dark et al. 1998, Wiedemeier and Horton 2000, Kelly et al. 2003, Pearson and Livezey 2003, Anthony et al. 2004a). Barred owl numbers now may exceed NSO numbers in the northern Washington Cascades (Kuntz and Christopherson 1996) and British Columbia (Dunbar et al. 1991) and appear to be approaching NSO numbers in several other areas (e.g., Redwood National and State Parks in California [Schmidt 2003]). Barred owl populations in the Pacific Northwest appear to be self-sustaining based on current density estimates and apparent distribution (Courtney et al. 2004).

Barred owls apparently compete with NSOs through a variety of mechanisms: prey overlap (Hamer et al. 2001), habitat overlap (Hamer et al. 1989, Dunbar et al. 1991, Herter and Hicks 2000, Pearson and Livezey 2003), and agonistic encounters (Leskiw and Gutiérrez 1998, Pearson and Livezey 2003). New information on encounters between barred owls and NSOs comes primarily from anecdotal reports which corroborate initial observations that barred owls react more aggressively towards NSOs than the reverse (Courtney et al. 2004). There is also limited circumstantial evidence of barred owl predation on NSOs (Leskiw and Gutiérrez 1998, Johnston 2002). Information collected to date indicates that encounters between these two species tend to be agonistic in nature, and that the outcome is unlikely to favor the NSO (Courtney et al. 2004).

Although barred owls were initially thought to be more closely associated with early successional forests than NSOs from studies conducted on the west slope of the Cascades in Washington, (Hamer 1988, Iverson 1993), recent studies conducted elsewhere in the Pacific Northwest indicate that barred owls utilize a broader range of habitat types than do NSOs (Courtney et al. 2004). For example, a telemetry study conducted on barred owls in the fire prone forests of eastern Washington showed that barred owl home ranges were located on lower slopes or valley bottoms, in closed canopy, mature, Douglas-fir forest (Singleton et al. 2005). In contrast, NSO sites were characterized by closed canopy, mature, ponderosa pine or Douglas-fir forest, on southern or western exposure, mid-elevation areas (Singleton et al. 2005).

The only study comparing NSO and barred owl food habits in the Pacific Northwest indicated that barred owl diets overlapped strongly (greater than 75 percent) with NSO diets (Hamer et al. 2001). However, barred owl diets were also more diverse than NSO diets, including species associated with riparian and other moist habitats, and more terrestrial and diurnal species.

Evidence that barred owls are causing the displacement of NSOs is largely indirect, based primarily on retrospective examination of long-term data collected on NSOs. Correlations between local NSO declines and barred owl increases have been noted in the northern Washington Cascades (Kuntz and Christopherson 1996, Herter and Hicks 2000, Pearson and Livezey 2003), on the Olympic peninsula (Wiedemeier and Horton 2000; Gremel 2000, 2003), in the southern Oregon Cascades (e.g., Crater Lake National Park [Johnston 2002]), and in the coastal redwood zone in California (e.g., Redwood National and State Parks [Schmidt 2003]).

NSO occupancy was significantly lower in spotted owl territories where barred owls were detected within 0.8 km (0.5 mi) of the NSO territory center than in spotted owl territories where no barred owls were detected (Kelly et al. 2003). Kelly et al. (2003) also found that in NSO territories where barred owls were detected, NSO occupancy was significantly lower ($P < 0.001$) after barred owls were detected within 0.8 km of the territory center. Occupancy was "only marginally lower" ($P = 0.06$) if barred owls were located more than 0.8 km from NSO territory centers. In a Roseburg, Oregon study area, 46 percent of NSOs moved more than 0.8 km, and 39 percent of NSOs were not relocated again in at least 2 years after barred owls were detected within 0.8 km of the territory center. Observations provided by Gremel (2000) from the Olympic National Park are consistent with those of Kelly et al. (2003); he documented significant displacement of NSOs following barred owl detections "coupled with elevational changes of NSO sites on the east side of the Park" (Courtney et al. 2004). Pearson and Livezey (2003) reported similar findings on the Gifford Pinchot National Forest where unoccupied NSO

sites were characterized by significantly more barred owl sites within 0.8-km, 1.6-km, and 2.9-km from the territory center than in occupied NSO sites. Because barred owl presence is increasing within the range of NSOs, Olson et al. (2005) suggest that further declines in the proportion of sites occupied by NSOs are likely.

At two study areas in Washington, investigators found relatively high numbers of territories previously occupied by NSOs that are now apparently not occupied by either spotted or barred owls (e.g., 49 of 107 territories in the Cascades [Herter and Hicks 2000]; 23 of 33 territories in the Olympic Experimental State Forest [Wiedemeier and Horton 2000]). Given that habitat was still present in these vacant territories, some factor(s) may be reducing habitat suitability or local abundance of both species. For example, weather conditions could cause prolonged declines in abundance of both species (Franklin et al. 2000). Because NSOs have been anecdotally reported to give fewer vocalizations when barred owls are present, it is possible that these supposed vacant territories are still occupied by NSOs that do not respond to surveys. Likewise, survey protocols for NSOs are believed to under-detect barred owls (Courtney et al. 2004). Olson et al. (2005) showed that barred owl presence had a negative effect on NSO detection probabilities, and it had either a positive effect on local-extinction probabilities (at the territory scale) or a negative effect on colonization probabilities for 3 study areas in Oregon. Olson et al. (2005) conclude that future analyses of NSOs must account for imperfect and variable detectability and barred owl presence to properly interpret results. Thus, some proportion of seemingly vacant territories may be an artifact of reduced detection probabilities. Nonetheless, previously occupied territories apparently vacant of both *Strix* species suggests that factors other than barred owls alone are contributing to declines in NSO abundance and territorial occupancy (Courtney et al. 2004).

Two studies (Kelly 2001, Anthony et al. 2004a) attempted to determine whether barred owls affected fecundity of NSOs in the long-term demographic study areas. Neither study was able to clearly do so, although the Wenatchee and Olympic demographic study areas showed possible effects (Anthony et al. 2004a). However, both studies described the shortfalls of their methods to adequately test for this effect. Iverson (2004) reported no effect of barred owl presence on NSO reproduction, but his results could have been influenced by small sample size (Livezey 2005). Barred owls had a negative effect on NSO survival on the Wenatchee and Olympic study areas and possibly an effect on the Cle Elum study area (Anthony et al. 2004a). Olson et al. (2005) found a significant (but weak) negative effect of barred owl presence on NSO reproductive output but not on survival at a Roseburg, Oregon study area (Courtney et al. 2004).

Uncertainties associated with methods, analyses, and possible confounding factors such as effects of past habitat loss and weather warrant caution in interpretation of the patterns emerging from the data and information collected to date on interactions between barred and NSOs (Courtney et al. 2004). Further, data are currently lacking that would allow accurate prediction of how barred owls will affect NSOs in the southern, more xeric provinces in California and Oregon Klamath regions. In spite of these uncertainties, the preponderance of the evidence gathered thus far is consistent with the hypothesis that barred owls are playing some role in NSO population decline, particularly in Washington and portions of Oregon and the northern coast of California (Courtney et al. 2004).

Although the barred owl currently constitutes a significantly greater threat to the NSO than originally thought at the time of listing (Courtney et al. 2004), at present it is unclear whether forest management influences the outcome of interactions between barred and NSOs (Courtney et al. 2004, summarized by Lint 2005). Some of the most recent summaries compiled on the barred owl (Courtney et al. 2004, Lint 2005, USDI FWS 2004) do not provide recommendations about how to deal with this potential threat. However, Buchanan et al. (December 2005) offer research and management options to address inter-specific relationships between barred and NSOs. In the status review, the FWS (USDI FWS 2004a) did not consider the increased risk to NSO populations due to the uncertainties surrounding barred owls and other factors sufficient to reclassify the subspecies as endangered.

Wildfire. The short-term affects of wildfires on NSO demography is an important consideration for resources managers. Bond et al. (2002) examined the demography of NSOs post wildfire, in which wildfire burned through NSO nest and roost sites in varying degrees of severity. Depending on the severity of the burn, wildfires may have relatively little short-term impact on NSO demography (i.e., survival, reproduction and site fidelity). In a preliminary study conducted by Anthony and Andrews (2004b) in the Klamath Province of Oregon, their sample of NSOs appeared to be using a variety of habitat types within the Timbered Rock Fire, including areas which had experienced moderate burning. In 1994, the Hatchery Complex wildfires burned 17,603 ha in the Wenatchee National Forest, eastern Cascades, Washington, affecting six NSO activity centers (Gaines et al. 1997). NSO habitat within a 2.9 km radius of the activity centers was reduced by 8 to 45 percent (mean = 31%) due to direct effects of the fire and by 10 to 85 percent (mean = 55%) due to delayed mortality of fire-damaged trees and insect caused tree mortality. NSO habitat loss was greater on mid to upper slopes (especially south-facing) than within riparian areas or on benches (Gaines et al. 1997). Direct mortality of NSOs was assumed to have occurred at one site. Data were too sparse for reliable comparisons of site occupancy or reproductive output between sites affected by the fires and other sites on the Wenatchee National Forest. Two wildfires burned in the Yakama Indian Reservation, eastern Cascades, Washington, in 1994, affecting home ranges of two radio-tagged NSOs (King et al. 1997). Although the amount of home ranges burned was not quantified, NSOs were observed using areas that received low and medium intensity burning. No direct mortality of NSOs was observed even though thick smoke covered several NSO site centers for a week.

At the time of listing there was recognition that large-scale wildfire posed a threat to the NSO and its habitat (USDI FWS 1990a). New information suggests fire may be more of a threat than previously thought. In particular, the rate of habitat loss in the relatively dry East Cascades and Klamath provinces has been greater than expected (see "Habitat Trends" below). Moeur et al. (2005) suggested that12 percent of late-successional forest rangewide would likely be negatively impacted by wildfire during the first 5 decades of the Northwest Forest Plan. Currently, the overall total amount of habitat affected by wildfires has been relatively small (Lint 2005). It may be possible to influence through silvicultural management how fire prone forests will burn and the extent of the fire when it occurs. Silvicultural management of forest fuels are currently being implemented throughout theNSOs range, in an attempt to reduce the exceptional levels of fuels that have accumulated during nearly 100 years of effective fire suppression. However, our ability to protect NSO habitat and viable populations of NSOs from large fires through risk-reduction endeavors is uncertain (Courtney et al. 2004). The NWFP recognized wildfire as an

inherent part of managing NSO habitat in certain portions of the range. The distribution and size of reserve blocks as part of the NWFP design may help mitigate the risks associated with large-scale fire (Lint 2005).

West Nile Virus. WNV has killed millions of wild birds in North America since it arrived in 1999 (McLean et al. 2001, Caffrey 2003, Marra et al. 2004). Mosquitoes are the primary carriers (vectors) of the virus that causes encephalitis in humans, horses, and birds. Mammalian prey may also play a role in spreading WNV among predators, like NSOs. Owls and other predators of mice can contract the disease by eating infected prey (Garmendia et al. 2000, Komar et al. 2001). Recent tests of tree squirrels from Los Angeles County, California, found over 70 percent were positive for WNV (R. Carney, pers. comm. 2004, cited in USDI FWS 2004a). One captive NSO in Ontario, Canada, is known to have contracted WNV and died.

Health officials expect that WNV will eventually spread throughout the range of the NSO (Courtney et al. 2004), but it is unknown how WNV will ultimately affect NSO populations. Susceptibility to infection and mortality rates of infected individuals vary among bird species, even within groups (Courtney et al. 2004). Owls appear to be quite susceptible. For example, breeding Eastern screech owls (*Megascops asio*) in Ohio experienced 100 percent mortality (T. Grubb, pers. comm. cited in Courtney et al. 2004). Barred owls, in contrast, showed lower susceptibility (B. Hunter, pers. comm. cited in Courtney et al. 2004). Some level of innate resistance may occur (Fitzgerald et al. 2003), which could explain observations in several species of markedly lower mortality in the second year of exposure to WNV (Caffrey and Peterson 2003). Wild birds also develop resistance to WNV through immune responses (Deubel et al. 2001). The effects of WNV on bird populations at a regional scale have not been large, even for susceptible species (Caffrey and Peterson 2003), perhaps due to the short-term and patchy distribution of mortality (K. McGowan, pers. comm., cited in Courtney et al. 2004) or annual changes in vector abundance and distribution.

Courtney et al. (2004) offer competing propositions for the likely outcome of NSO populations being infected by WNV. One proposition is that NSOs can tolerate severe, short-term population reductions due to WNV, because NSO populations are widely distributed and number in the several hundreds to thousands. An alternative proposition is that WNV will cause unsustainable mortality, due to the frequency and/or magnitude of infection, thereby resulting in long-term population declines and extirpation from parts of the NSOs current range. Thus far, no mortality in wild, NSOs has been recorded; however, WNV is a potential threat of uncertain magnitude and effect (Courtney et al. 2004).

Sudden Oak Death. Sudden oak death was recently identified as a potential threat to the NSO (Courtney et al. 2004). This disease is caused by the fungus-like pathogen, *Phytopthora ramorum* that was recently introduced from Europe and is rapidly spreading. At the present time, sudden oak death is found in natural stands from Monterey to Humboldt Counties, California, and has reached epidemic proportions in oak (*Quercus* spp.) and tanoak (*Lithocarpus densiflorus*) forests along approximately 300 km of the central and northern California coast (Rizzo et al. 2002). It has also been found near Brookings, Oregon, killing tanoak and causing dieback of closely associated wild rhododendron (*Rhododendron* spp.) and evergreen huckleberry (*Vaccinium ovatum*) (Goheen et al. 2002). It has been found in several different

forest types and at elevations from sea level to over 800 m. Sudden Oak death poses a threat of uncertain proportion because of its potential impact on forest dynamics and alteration of key prey and NSO habitat components (e.g., hardwood trees - canopy closure and nest tree mortality); especially in the southern portion of theNSOs range (Courtney et al. 2004).

Inbreeding Depression, Genetic Isolation, and Reduced Genetic Diversity. Inbreeding and other genetic problems due to small population sizes were not considered an imminent threat to the NSO at the time of listing. Recent studies show no indication of reduced genetic variation and past bottlenecks in Washington, Oregon, or California (Barrowclough et al. 1999, Haig et al. 2004, Henke et al. unpublished). However, in Canada, the breeding population is estimated to be less than 33 pairs and annual population decline may be as high as 35 percent (Harestad et al. 2004). Canadian populations may be more adversely affected by issues related to small population size including inbreeding depression, genetic isolation, and reduced genetic diversity (Courtney et al. 2004). Low and persistently declining populations throughout the northern portion of the species range (see "Population Trends" below) may be at increased risk of losing genetic diversity.

Climate Change. Climate change, a potential additional threat to NSO populations, is not explicitly addressed in the NWFP. Climate change could have direct and indirect impacts on NSOs and their prey. However, the emphasis on maintenance of seral stage complexity and related organismal diversity in the Matrix under the NWFP should contribute to the resiliency of the Federal forest landscape to the impacts of climate change (Courtney et al. 2004). There is no indication in the literature regarding the direction (positive or negative) of the threat.

Based upon a global meta-analysis, Parmesan and Yohe (2003) discussed several potential implications of global climate change to biological systems, including terrestrial flora and fauna. Results indicated that 62 percent of species exhibited trends indicative of advancement of spring conditions. In bird species, trends were manifested in earlier nesting activities. Because the NSO exhibits a limited tolerance to heat relative to other bird species (Weathers et al. 2001), subtle changes in climate have the potential to affect this. However, the specific impacts to the species are unknown.

Disturbance-Related Effects. The effects of noise on NSOs are largely unknown, and whether noise is a concern has been a controversial issue. The effect of noise on birds is extremely difficult to determine due to the inability of most studies to quantify one or more of the following variables: 1) timing of the disturbance in relation to nesting chronology, 2) type, frequency, and proximity of human disturbance, 3) clutch size, 4) health of individual birds, 5) food supply, and 6) outcome of previous interactions between birds and humans (Knight & Skagen 1988). Additional factors that confound the issue of disturbance include the individual bird's tolerance level, ambient sound levels, physical parameters of sound and how it reacts with topographic characteristics and vegetation, and differences in how species perceive noise. Although information specific to behavioral responses of NSOs to disturbance is limited, research indicates that recreational activity can cause Mexican spotted owls (*Strix occidentalis lucida*) to vacate otherwise suitable habitat (Swarthout & Steidl 2001) and helicopter overflights can reduce prey delivery rates to nests (Delaney et al. 1999). Additional effects from disturbance, including

altered foraging behavior and decreases in nest attendance and reproductive success, have been reported for other raptors (White & Thurow 1985; Andersen et al. 1989; McGarigal et al. 1991).

NSOs may also respond physiologically to a disturbance without exhibiting a significant behavioral response. In response to environmental stressors, vertebrates secrete stress hormones called corticosteroids. Although these hormones are essential for survival, extended periods with elevated stress hormone levels may have negative effects on reproductive function, disease resistance, or physical condition (Carsia & Harvey 2000; Saplosky et al. 2000). In avian species, the secretion of corticosterone is the primary non-specific stress response (Carsia & Harvey 2000). The quantity of this hormone in feces can be used as a measure of physiological stress (Wasser et al. 1997). Recent studies of fecal corticosterone levels of NSOs indicate that low intensity noise of short duration and minimal repetition does not elicit a physiological stress response (Tempel & Gutiérrez 2003; Tempel & Gutiérrez 2004). However, prolonged activities, such as those associated with timber harvest, may increase fecal corticosterone levels depending on their proximity to NSO core areas (see Wasser et al. 1997; Tempel & Gutiérrez 2004).

Post-harvest fuels treatments may also create above-ambient smoke or heat. Although it has not been conclusively demonstrated, it is anticipated that nesting NSOs may be disturbed by heat and smoke intrusion into the nest grove.

Conservation Needs of the Northern Spotted Owl

Based on the above assessment of threats, the NSO has the following habitat-specific and habitat-independent conservation (i.e., survival and recovery) needs:

Habitat-specific Needs

1. Large blocks of suitable habitat to support clusters or local population centers of NSOs (e.g., 15 to 20 breeding pairs) throughout the owl's range.

2. Suitable habitat conditions and spacing between local NSO populations throughout its range to facilitate survival and movement.

3. Suitable habitat distributed across a variety of ecological conditions within theNSOs range to reduce risk of local or widespread extirpation.

4. A coordinated, adaptive management effort to reduce the loss of habitat due to catastrophic wildfire throughout the NSOs range, and a monitoring program to clarify whether these risk reduction methods are effective and to determine how owls use habitat treated to reduce fuels.

5. In areas of significant population decline, sustain the full range of survival and recovery options for this species in light of significant uncertainty.

Habitat-independent Needs

1. A coordinated research and adaptive management effort to better understand and manage competitive interactions between spotted and barred owls.

2. Monitoring to better understand the risk that WNV and sudden oak death pose to NSOs and, for WNV, research into methods that may reduce the likelihood or severity of outbreaks in NSO populations.

Conservation Strategy

Since 1990, various efforts have addressed the conservation needs of the NSO and attempted to formulate conservation strategies based upon these needs. These efforts began with the ISC's Conservation Strategy (Thomas et al. 1990); they continued with the designation of critical habitat (USDI FWS 1992a, the Draft Recovery Plan (USDI FWS 1992b)), and the Scientific Analysis Team report (Thomas et al. 1993), report of the Forest Ecosystem Management Assessment Team (Thomas and Raphael 1993); and they culminated with the NWFP (USDA/USDI 1994a). Each conservation strategy was based upon the reserve design principles first articulated in the ISC's report, which are summarized as follows.

> Species that are well distributed across their range are less prone to extinction than species confined to small portions of their range.
>
> Large blocks of habitat, containing multiple pairs of the species, are superior to small blocks of habitat with only one to a few pairs.
>
> Blocks of habitat that are close together are better than blocks far apart.
> Habitat that occurs in contiguous blocks is better than habitat that is more fragmented.
>
> Habitat between blocks is more effective as dispersal habitat if it resembles suitable habitat.

Federal Contribution to Recovery

The NWFP is the current conservation strategy for the NSO on Federal lands. It is designed around the conservation needs of the NSO and based upon the designation of a variety of land-use allocations whose objectives are either to provide for population clusters (i.e., demographic support) or to maintain connectivity between population clusters. Several land-use allocations are intended to contribute primarily to supporting population clusters: LSRs, Managed Late-Successional Areas (MSLAs), Congressionally Reserved Areas (CRAs), and Managed Pair Areas and Reserve Pair Areas. The remaining land-use allocations [Matrix, AMAs, Riparian Reserves (RRs), Connectivity Blocks, and Administratively Withdrawn Areas (AWAs)] provide connectivity between habitat blocks intended for demographic support.

The range-wide system of LSRs set up under the NWFP captures the variety of ecological conditions within the 12 different provinces to which NSOs are adapted. This design reduces the

potential for extinction due to large catastrophic events in a single province. Multiple, large LSRs in each province reduce the potential that NSOs will be extirpated in any individual province and reduce the potential that large wildfires or other events will eliminate all habitat within a LSR. In addition, LSRs are generally arranged and spaced so that NSOs may disperse to two or more adjacent LSRs. This network of reserves reduces the likelihood that catastrophic events will impact habitat connectivity and population dynamics within and between provinces.

FEMAT scientists predicted that NSO populations would decline in the Matrix over time, while populations were expected to stabilize and eventually increase within LSRs, as habitat conditions improve over the next 50 to 100 years (Thomas and Raphael 1993, USDA/USDI 1994a and 1994b). Based on the results of the first decade of monitoring, it cannot be determine if the declining population trend will be reversed because not enough time has passed to provide the necessary measure of certainty (Lint 2005). However, the results from the first decade of monitoring do not provide any reason to depart from the objective of habitat maintenance and restoration as described under the NWFP (Lint 2005). Other stressors that operate in intact suitable habitat, such as barred owls (already occurring) and West Nile virus (yet to occur) may complicate the conservation of theNSO. Recent reports about the status of the NSO offer few management recommendations to deal with the emerging threats. The arrangement and distribution and resilience of the NWFP land use allocation system may prove to be the most appropriate strategy in responding to these unexpected challenges (Courtney et al. 2004).

Under the NWFP, the agencies anticipated a decline of NSO populations during the first decade of implementation. Recent reports (Courtney et al. 2004, Anthony et al. 2004a) identified greater than expected NSO declines in Washington and northern portions of Oregon, and more stationary populations in southern Oregon and northern California. The reports did not find a direct correlation between habitat conditions and changes in vital rates of NSOs at the meta-population scale. However, at the territory scale, there is evidence of negative effects to NSO fitness due to reduced habitat quantity and quality. Also, there is no evidence to suggest that dispersal habitat is currently limiting (Courtney et al. 2004, Lint 2005). Even with the population decline, Courtney et al (2004) noted that there is little reason to doubt the effectiveness of the core principles underpinning the NWFP conservation strategy.

The current scientific information, including information showing NSO population declines, indicates that the NSO continues to meet the definition of a threatened species (USDI FWS 2004a). That is, populations are still relatively numerous over most of its historic range, which suggests that the threat of extinction is not imminent, and that the subspecies is not endangered; even though, in the northern part of its range population trend estimates are showing a decline.

Conservation Efforts on Non-Federal Lands

FEMAT noted that limited Federal ownership in some areas constrained the ability to form an extensive reserve network to meet conservation needs of the NSO. Thus, non-Federal lands were an important contribution to the range-wide goal of achieving conservation and recovery of the NSO. The FWSs primary expectations for private lands are for their contributions to demographic support (pair or cluster protection) to and/or connectivity with lands. In addition,

timber harvest within each state is governed by rules that may provide protection of spotted owls and/or their habitat to varying degrees.

There are 16 current or completed HCPs with incidental take permits issued for NSOs, eight in Washington, three in Oregon, and four in California. They range in size from 40 acres to over 1.6 million acres, though not all acres are included in the mitigation for NSOs because some HCP cover multiple species. In total, the HCPs cover approximately 2.9 million of the 32 million acres of non-Federal forest lands in the range of the NSO. Most HCPs are of fairly long duration, though they range from only 5 years to 100 years. While each HCP is unique, there are several general approaches to mitigation of incidental take, including: 1) reserves of various sizes, some associated with adjacent Federal reserves, 2) forest harvest that maintains or develops suitable habitat, 3) forest management that maintains or develops dispersal habitat, and 4) deferral of harvest near specific sites. Individual HCPs may employ one or more of these mitigation measures. Similarly the conservation objectives of individual plans vary from specified numbers of breeding owls, with specified levels of reproductive success, to management objectives for nesting/roosting/foraging habitat or dispersal habitat (Courtney et al. 2004).

Washington: In 1996, the State Forest Practices Board adopted rules (Forest Practices Board 1996) that would "contribute to conserving the NSO and its habitat on non-Federal lands" based on recommendations from a Science Advisory Group which identified important non-Federal lands and recommended roles for those lands in NSO conservation (Hanson et al. 1993, Buchanan et al. 1994). The 1996 rules designated 10 NSO special emphasis areas (SOSEAs) in Washington that comprise over 1.5 million acres of State and private lands where owl protections on non-Federal lands would be emphasized. Within SOSEAs, all suitable habitat within 0.7 mile of NSO activity centers, and 40 percent of suitable habitat within the provincial median home range circle surrounding an occupied activity center is protected from timber harvest. Until recently, these habitat protections could be lifted if a NSO activity center was determined to be unoccupied. In 2005, the Forest Practices Board adopted emergency rules to protect suitable habitat in owl circles within SOSEAs regardless of site occupancy. Under the 1996 Forest Practice rules, suitable NSO habitat located on non-Federal lands outside of owl management circles or located outside of a SOSEA boundary is not protected from timber harvest, unless the habitat is protected by an approved HCP. Spotted owl-related HCPs in Washington cover over 1.92 million acres and generally provide both demographic and connectivity support as recommended in the draft NSO recovery plan (USFWS 1992b).

Oregon: The Oregon Forest Practices Act provides for protection of 70-acre core areas around known NSO nest sites, but it does not provide for protection of spotted owl habitat beyond these areas (ODF 2000). In general, no large-scale NSO habitat protection strategy or mechanism currently exists for non-Federal lands in Oregon. The four spotted owl-related HCPs currently in effect cover over 300,000 acres of non-Federal lands. These HCP's will provide some nesting habitat and connectivity over the next few decades.

California: In 1990, State Forest Practice Rules (FPRs), which govern timber harvest on private lands, were amended to require surveys for NSOs in suitable habitat and to provide protection around activity centers (CDF 2001). Under the FPRs, no timber harvest plan (THP) can be

approved if it is likely to result in incidental take of federally-listed species, unless authorized by a Federal HCP. The California Department of Fish and Game initially reviewed all THPs to ensure that take was not likely to occur; the FWS took over that review function in 2000. Several large industrial owners operate under Spotted Owl Management Plans that have been reviewed by the FWS; the plans specify basic measures for NSO protection. Four HCP's authorizing take of NSOs have been approved covering over 669,000 acres of non-Federal lands. Implementation of these plans will provide for NSO demographic and connectivity support to NWFP lands.

Current Condition of the Northern Spotted Owl

The current condition of the species incorporates the effects of all past human activities and natural events that led to the present-day status of the species and its habitat (USDI FWS and NMFS 1998).

Range-wide Habitat and Population Trends

Habitat Baseline. The 1992 Draft Spotted Owl Recovery Plan estimated approximately 8.3 million acres of spotted owl habitat remained range-wide (USDI 1992). However, reliable habitat baseline information for non-Federal lands is not available (Courtney et al. 2004). The FWS has used information provided by the USFS, Bureau of Land Management, and NPS to update the habitat baseline conditions on Federal lands for spotted owls on several occasions since the NSO was listed in 1990. The estimate of 7.4 million acres used for the NWFP in 1994 (USDA/USDI 1994a) was believed to be representative of the general amount of spotted owl habitat on these lands. This baseline has been used to track relative changes over time in subsequent analyses, including those presented here.

In 2005 a new map depicting suitable spotted owl habitat throughout the range of the spotted owl was produced as a result of the NWFP's effectiveness monitoring program (Lint 2005). However, the spatial resolution of this new habitat map currently makes it unsuitable for tracking habitat effects at the scale of individual projects. The FWS is evaluating the map for future use in tracking habitat trends. Additionally, there continues to be no reliable estimates of NSO habitat on non-Federal lands; consequently, consulted-on acres can be tracked, but not evaluated in the context of change with respect to a reference condition on non-Federal lands. The production of the monitoring program habitat map does, however, provide an opportunity for future evaluations of trends in non-Federal habitat.

NWFP Lands Analysis 1994 – 2001. In 2001, the FWS conducted an assessment of habitat baseline conditions, the first since implementation of the NWFP (USDI FWS 2001). This range-wide evaluation of habitat, compared to the FSEIS, was necessary to determine if the rate of potential change to NSO habitat was consistent with the change anticipated in the NWFP. In particular, the FWS considered habitat effects that were documented through the section 7 consultation process since 1994. In general, the analytical framework of these consultations focused on the reserve and connectivity goals established by the NWFP land-use allocations (USDA/USDI 1994a), with effects expressed in terms of changes in suitable NSO habitat within

those land-use allocations. The FWS determined that actions and effects were consistent with the expectations for implementation of the NWFP from 1994 to June, 2001 (USDI FWS 2001).

Range-wide Analysis 1994 – January 17, 2007. This section updates the information considered in USDI FWS (2001), relying particularly on information in documents the FWS produced pursuant to section 7 of the Act and information provided by NWFP agencies on habitat loss resulting from natural events (e.g., fires, windthrow, insect and disease).

In 1994, about 7.4 million acres of suitable NSO habitat were estimated to exist on Federal lands managed under the NWFP. As of January 17, 2007, the FWS had consulted on the proposed removal of approximately 198,803 acres (Table 5) or 2.6 percent of 7.4 million acres (Table 6) of NSO habitat occurred on Federal lands. Of the total Federal acres consulted on for removal, approximately 167,134 acres or 2.3 percent of 7.4 million acres of NSO habitat were removed as a result of timber harvest. These changes in suitable NSO habitat are consistent with the expectations for implementation of the NWFP (USDA/USDI 1994a, p. 46).

April 13, 2004 marked the start of the second decade of the NWFP. Decade specific baselines and summaries of effects by State, physiographic province and land use function from proposed management activities and natural events are not provided here, but can be calculated using the FWS Consultation Effects Tracking system.

Habitat loss from Federal lands due to timber harvest has varied among the individual provinces with most of the impacts concentrated within the Non-Reserve (174,391acres impacted) relative to the Reserve (12,915 acres impacted) land-use allocations (Table 2). Overall by State, the most pronounced habitat losses have occurred within Oregon (84 percent), especially within its Klamath Mountains (49 percent) and Cascades (East and West) (33 percent) Provinces (Table 2), followed by much smaller habitat losses in Washington (7 percent) and California (9 percent) (Table 2 - calculated by percent Range-wide Affected column). When habitat loss is evaluated as a proportion of provincial baselines, the Oregon Klamath Mountains (22 percent), Cascades West (7 percent), and the California Cascades (5 percent) all have proportional losses greater than the range-wide mean (4.8 percent) (Table 2) (these values calculated by summing State provincial totals per column 8 divided by the sum of State provincial totals per column 4, Table 2).

From 1994 through January 17, 2007, habitat lost due to natural events was estimated at approximately 167,894 acres range-wide (Table 2). About two-thirds of this loss was attributed to the Biscuit Fire that burned over 500,000 acres in southwest Oregon (Rogue River basin) and northern California in 2002. This fire resulted in a loss of approximately 113,451 acres of NSO habitat, including habitat within five LSRs (Table 2[8]). Approximately 18,630 acres of NSO habitat were lost due to the B&B Complex and Davis Fires in the East Cascades Province of Oregon (Table 2[9]).

Because there is no comprehensive NSO habitat baseline for non-Federal lands, there is little available information regarding NSO habitat trends on non-Federal lands. Yet, we do know that internal FWS consultations conducted since 1992, have documented the eventual loss of 403,145 (Table 5) acres of habitat on non-Federal lands. Most of these losses have yet to be realized because they are part of large-scale, long-term HCPs. Combining effects on Federal and non-

Federal lands, the FWS had consulted on the proposed removal of approximately 612,765 acres of NSO habitat range-wide, resulting from all management activities, as of January 17, 2007, (Table 5).

Other Habitat Trend Assessments. In 2005, the Washington Department of Wildlife released the report, "An Assessment of Spotted Owl Habitat on Non-Federal Lands in Washington between 1996 and 2004" (Pierce et al. 2005). This study estimates the amount of NSO habitat in 2004 on lands affected by State and private forest practices. The study area is a subset of the total Washington forest practice lands, and statistically-based estimates of existing habitat and habitat loss due to fire and timber harvest are provided. In the 3.2-million acre study area, Pierce et al. (2005) estimated there was 816,000 acres of suitable NSO habitat in 2004, or about 25 percent of their study area. Based on their results, Pierce et al. (2005) estimated there were less than 2.8 million acres of NSO habitat in Washington on all ownerships in 2004. Most of the suitable owl habitat in 2004 (56 percent) occurred on Federal lands, and lesser amounts were present on State-local lands (21 percent), private lands (22 percent) and tribal lands (1 percent). Most of the harvested NSO habitat was on private (77 percent) and State-local (15 percent) lands. A total of 172,000 acres of timber harvest occurred in the 3.2 million-acre study area, including harvest of 56,400 acres of suitable NSO habitat. This represented a loss of about 6 percent of the owl habitat in the study area distributed across all ownerships (Pierce et al. 2005). Approximately 77 percent of the harvested habitat occurred on private lands and about 15 percent occurred on State lands. Pierce et al. (2005) also evaluated suitable habitat levels in 450 NSO management circles (based on the provincial annual median spotted owl home range). Across their study area, they found that owl circles averaged about 26 percent suitable habitat in the circle across all landscapes. Values in the study ranged from an average of 7 percent in southwest Washington to an average of 31 percent in the east Cascades, suggesting that many owl territories in Washington are significantly below the 40 percent suitable habitat threshold used by the State as a viability indicator for NSO territories (Pierce et al. 2005).

Moeur et al. 2005 estimated an increase of approximately 1.25 to 1.5 million acres of medium and large older forest (greater than 20 inches dbh, single and multi-storied canopies) on Federal lands in the Northwest Forest Plan area between 1994 and 2003. The increase occurred primarily in the lower end of the diameter range for older forest. Net area in the greater than 30 inch dbh size class increased by only an estimated 102,000 to 127,000 acres. The estimates were based on change-detection layers for losses due to harvest and fire and remeasured inventory plot data for increases due to ingrowth. Transition into and out of medium and large older forest over the 10-year period was extrapolated from inventory plot data on a subpopulation of USFS land types and applied to all Federal lands. Because size class and general canopy layer descriptions do not necessarily account for the complex forest structure often associated with NSO habitat, the significance of these acres to NSO conservation remains unknown.

Northern Spotted Owl Numbers, Distribution, and Reproduction Trends. There are no estimates of the historical population size and distribution of the NSO within preferred habitat, although NSOs are believed to have inhabited most old-growth forests throughout the Pacific Northwest prior to modern settlement (mid-1800s), including northwestern California (USDI FWS 1989). According to the final rule listing the NSO as threatened (USDI FWS 1990a), approximately 90 percent of the roughly 2,000 known spotted owl breeding pairs were located on federally

managed lands, 1.4 percent on State lands, and 6.2 percent on private lands; the percent of NSOs on private lands in northern California was slightly higher (Forsman et al. 1984, USDI FWS 1989, Thomas et al. 1990).

Using data from 1986-1992, Gutiérrez (1994) tallied 3,753 known pairs and 980 singles throughout the range of theNSO. At the time the NWFP was initiated (July 1, 1994), there were 5,431 known locations of, or site centers of spotted owl pairs or resident singles: 851 sites (16 percent) in Washington, 2,893 (53 percent) in Oregon, and 1,687 (31 percent) in California (BLM 1995). The actual population of spotted owls across the range was believed to be larger than either of these counts because some areas were, and remain, unsurveyed (USDI FWS 1992a, Thomas et al. 1993).

Because existing survey coverage and effort are insufficient to produce reliable population-size estimates, researchers use other indices, such as demographic data, to evaluate trends in NSO populations. Analysis of demographic data can provide an estimate of the rate and direction of population growth [i.e., lambda (λ)]. A λ of 1.0 indicates a stationary population (i.e., neither increasing nor decreasing), a λ less than 1.0 indicates a declining population, and a λ greater than 1.0 indicates a growing population. Demographic data are analyzed during workshops that occur at 5-year intervals.

In January 2004, two meta-analyses modeled rates of population change for up to 18 years using the re-parameterized Jolly-Seber method (λ_{RJS}). One meta-analysis modeled all 13 long-term study areas excluding the Marin study area (Table 5), while the other modeled the eight study areas that are part of the effectiveness monitoring program of the NWFP (Anthony et al. 2006). Data were analyzed separately for individual study areas, as well as across all study areas in a meta-analysis.

Point estimates of λ_{RJS} ranged from 0.896 to 1.005 for the 13 long-term study areas, and in all study areas but one—the Tyee study area—these estimates were less than 1.0 (Anthony et al. 2006). There was strong evidence that populations in the Wenatchee, Cle Elum, Warm Springs, and Simpson study areas decreased during the period of study. There also was evidence that populations in the Rainier, Olympic, Oregon Coast Range, and HJ Andrews study areas were decreasing. The precision of the λ_{RJS} estimates for Rainier and Olympic study areas was poor and not sufficient to detect a statistically significant difference from 1.00; however, the estimate of λ_{RJS} for the Rainier study area (0.896) was the lowest of all of the areas. Populations in the Tyee, Klamath, South Oregon Cascades, Northwest California, and Hoopa study areas appeared to be stationary during the study, but there was some evidence that the spotted owl population in the Northwest California study area was decreasing (λ_{RJS} = 0.959 to 1.011).

The weighted mean λ_{RJS} for all of the study areas was 0.963 (standard error [SE] = 0.009, 95 percent confidence interval [CI] = 0.945 to 0.981), suggesting that populations over all of the study areas decreased by about 3.7 percent per year from 1985 to 2003. The mean λ_{RJS} for the eight demographic monitoring areas that are part of the effectiveness monitoring program of the NWFP was 0.976 (SE = 0.007, 95 percent CI = 0.962 to 0.990), and the mean λ_{RJS} for the other five study areas was 0.942 (SE = 0.016, 95 percent CI = 0.910 to 0.974), yielding average declines of 2.4 and 5.8 percent per year, respectively. These data suggest that demographic rates

for NSO populations on Federal lands were better than elsewhere; however, the interspersion of non-Federal land in study areas, and the likelihood that NSOs use habitat on multiple ownerships in some demography study landscapes confound this comparison.

The number of populations that declined and the rate at which they have declined are noteworthy, particularly the precipitous declines in the Wenatchee, Cle Elum, and Rainier study areas in Washington and the Warm Springs study area in Oregon. Estimates of population declines in these areas ranged from 40 to 60 percent during the study period of 1990 to 2003 (Anthony et al. 2006). Decreases in apparent adult survival rates were an important factor contributing to decreasing population trends. Survival rates decreased over time in 5 of the 14 study areas: four study areas in Washington, which showed the sharpest declines, and one study area in the California Klamath Province of northwest California (Anthony et al. 2006). In Oregon, there were no time trends in apparent survival for four of six study areas, and remaining areas had weak, non-linear trends. In California, three study areas showed no trend and one showed a significant linear decrease (Anthony et al. 2006). Like the trends in annual rate of population change, trends in the rate of adult survival showed clear decreases in some areas but not in others.

Loehle et al. (2005) sampled a small portion of the range of the species and questioned the accuracy of lambda estimates computed in Anthony et al. (2004), suggesting that the estimates were biased low by 3 to 4 percentage points. Loehle et al. (2005) contend the lambda estimates in Anthony et al. (2004) do not accurately account for NSO emigration. Therefore, more of the NSO demography study areas would have a lambda closer to 1.0, a stationary population. This criticism is unwarranted, given that Anthony et al. (2004) used the Pradel reparameterized Jolly-Seber method to compute survival and lambda estimates, a method devised to avoid the biases described by Loehle et al. (2005).

British Columbia has a small population of NSOs. This population is relatively isolated from populations in Washington and appears to be declining sharply; NSOs are absent from large areas of apparently suitable habitat (Chutter et al. 2004). Breeding populations have been estimated at fewer than 33 pairs and may be declining by as much as 35 percent per year (Chutter et al. 2004). The amount of interaction between NSOs in Canada and the United States is unknown (Chutter et al. 2004). The Canadian population has now reached the point at which it is vulnerable to random, naturally occurring demographic events that could cause further declines and perhaps extirpation. Chutter et al. (2004) suggest that immediate action is required to improve the likelihood of recovering that population in British Columbia.

Table 5. Changes to NRF[1] habitat acres from activities addressed in section 7 consultations (both formal and informal) and other causes range-wide from 1994 to January 17, 2007.

Northwest Forest Plan (NWFP) Group / Ownership		Consulted On Habitat Changes[2]		Other Habitat Changes[3]	
		Removed/ Downgraded	Degraded	Removed/ Downgraded	Degraded
Federal - Northwest Forest Plan	Bureau of Land Management	85372	29057	760	0
	Forest Service	95414	452696	29832	5481
	National Park Service	2842	3302	3	0
	Multi-agency[4]	15175	23314	137299	0
	NWFP Subtotal	198803	508369	167894	5481
Other Management and Conservation Plans (OMCP)	Bureau of Indian Affairs and Tribes	107256	28349	2398	0
	Habitat Conservation Plans	295889	14430	0	0
	OMCP Subtotal	403145	42779	2398	0
Other Federal Agencies & Lands[5]		241	466	28	70
Other Public & Private Lands[6]		10576	880	30240	20949
TOTAL Changes		612765	552494	200560	26500

[1] Nesting, roosting, foraging habitat. In California, suitable habitat is divided into two components; nesting – roosting (NR) habitat, and foraging (F) habitat. The NR component most closely resembles NRF habitat in Oregon and Washington. Due to differences in reporting methods, effects to suitable habitat compiled in this, and all subsequent tables include effects for NRF for 1994-6/26/2001. After 6/26/2001, suitable habitat includes NRF for Washington and Oregon but only nesting and roosting (NR) for California.

[2] Includes both effects reported by USDI FWS (2001) and subsequent effects compiled in the Spotted owl Consultation Effects Tracker (web application and database).

[3] Includes effects to NRF habitat (as documented through technical assistance) resulting from wildfires (not from suppression efforts), insect and disease outbreaks, and other natural causes, private timber harvest, and land exchanges not associated with consultation.

[4] The 'Multi-agency' grouping is used to lump a variety of NWFP mixed agency or admin unit consultations that were reported together prior to 6/26/2001, and the acres of habitat loss to natural events that can not be split out by administrative unit.

[5] Includes lands that are owned or managed by other Federal agencies not included in the NWFP.

[6] Includes lands not covered by HCPs that are owned or managed by States, counties, municipalities, and private entities. Effects that occurred on private lands from right-of-way permits across USFS lands are included here.

Table 6: Acres of suitable (NRF[1]) habitat loss on Federal lands from 1994 to January 17, 2007, from proposed management activities and natural events: baseline and summary of effects by State, physiographic province and land use function.

	Physiographic Province[4]	Evaluation Baseline[2]			Habitat Removed/Downgraded[3]				% Provincial Baseline Affected	% of Range-wide Effects
		Reserves[5]	Non-reserves[6]	Total	Reserves[5]	Non-reserves[6]	Habitat loss to natural events[7]	Total		
WA	Olympic Peninsula	548483	11734	560217	867	24	299	1190	0.21	0.33
	Eastern Cascades	506340	200509	706849	1795	4242	5754	11791	1.67	3.32
	Western Cascades	864683	247797	1112480	1181	11001	0	12182	1.09	3.43
	Western Lowlands	0	0	0	0	0	0	0	0.00	0.00
OR	Coast Range	422387	94190	516577	399	4074	66	4539	0.88	1.28
	Klamath Mountains	448509	337789	786298	1998	71957	101676[8]	175631	22.34	49.44
	Cascades East	247624	196035	443659	1243	11152	19547[9]	31942	7.20	8.99
	Cascades West	1012426	1033337	2015763	3581	57863	24583	86027	4.27	24.22
	Willamette Valley	593	5065	5658	0	0	0	0	0.00	0.00
CA	Coast	47566	3928	51494	381	69	100	550	1.06	0.15
	Cascades	61852	26385	88237	0	4808	0	4808	5.45	1.35
	Klamath	734103	345763	1079866	1470	9201	15869	26540	2.46	7.47
Total		4894566	2502532	7397098	12915	174391	167894	355200	4.80	100.0

[1] Nesting, roosting, foraging habitat. In California, suitable habitat is divided into two components; nesting – roosting (NR) habitat, and foraging (F) habitat. The NR component most closely resembles NRF habitat in Oregon and Washington. Due to differences in reporting methods, effects to suitable habitat compiled in this, and all subsequent tables include effects for NRF for 1994-6/26/2001. After 6/26/2001, suitable habitat includes NRF for Washington and Oregon but only nesting and roosting (NR) for California.

[2] 1994 FSEIS baseline (USDA and USDI 1994).

[3] Includes consulted-on effects reported by USDI FWS (2001) and subsequent effects compiled in the NSO Consultation Effects Tracking System database.

[4] Defined by the NWFP as the twelve physiographic provinces, as presented in Figure 3&4-1 on page 3&4-16 of the FSEIS.

[5] Land-use allocations intended to provide large blocks of habitat to support clusters of breeding pairs

[6] Land-use allocations intended to provide habitat to support movement of spotted owls among reserves.

[7.] Acres for all physiographic provinces, except the Oregon Klamath Mountains and Oregon Cascades East, are from the Scientific Evaluation of the Status of the Northern Spotted Owl (Courtney et al. 2004).

[8] Acres are from the biological assessment entitled: Fiscal year 2006-2008 programmatic consultation: re-initiation on activities that may affect listed species in the Rogue-River/South Coast Basin, Medford BLM, and Rogue-Siskiyou National Forest.

[9] Acres are from the Scientific Evaluation of the Status of the Northern Spotted Owl (Courtney et al. 2004) and data in the NSO Consultation Effects Tracking Database.

Demographic Study Area	Land Ownership	# Owls Banded	Fecundity	Apparent Survival	λ_{RJS}	Population Trend Based on $\Delta\lambda$
Washington						
Wenatchee (WEN)	Private	1,200	Stable	Declining	0.917	Declining
Rainer (RAI)	USFS	217	Stable	Declining	0.896	Declining
Olympic (OLY)	NPS & USFS	985	Stable	Declining	0.956	Declining
Cle Elum (CLE)	USFS	724	Declining[1]	Declining?[2]	0.938	Declining
Oregon						
Oregon Coast Range (COA)	USFS & BLM	1,025	Declining?[1]	Stable	0.968	Declining
Tyee (TYE)	BLM & Private	1,032	Increasing	Stable	1.005	Stationary
South Oregon Cascades (CAS)	USFS & BLM	881	Declining	Stable	0.974	Stationary
H.J. Andrews (HJA)	USFS	1,095	Stable?[3]	Stable	0.978	Declining
Klamath (KLA)	BLM & Private	1,147	Stable	Stable	0.997	Stationary
Warm Springs (WSR)	Tribal	381	Stable	Stable	0.908	Declining
California						
Marin (MAR)	NPS	96	Stable	Stable	NA	NA
Simpson (SIM)	Private	1,344	Declining[1]	Stable	0.970	Declining
Hoopa (HUP)	Tribal	279	Increasing	Stable	0.980	Stationary
NW California (NWC)	USFS	1,026	Declining	Declining	0.985	Declining?[4]

[1] Best model included age and even-odd year effects, but a competing model had a negative time effect on productivity.
[2] Variable among years, but with a declining trend.
[3] Decreasing in early years, increase in last 5 years, stable overall.
[4] Gradual declines in fecundity and apparent survival, plus estimates of realized population change suggest a decline in last 8 years.

Figure 2. Physiographic provinces, NSO demographic study areas, and demographic trends (Anthony et al. 2004a).

ENVIRONMENTAL BASELINE – Northern Spotted Owl

There are substantial differences in land management in the areas surrounding Baker Lake and Lake Shannon that have the potential to influence NSO habitat. Baker Lake is within the Mt. Baker-Snoqualmie National Forest, and except for a small area near Depression Lake, is surrounded entirely by national forest lands. Lake Shannon is predominantly surrounded by State forest lands (managed by Washington Department of Natural Resources) and private timber company lands. The differences in land ownership in the vicinity of the two reservoirs have influenced forest management, and as a result, the amounts and distribution of mature and older forests that may provide habitat for NSOs.

The area surrounding Baker Lake is national forest and has been designated a LSR. The goals of LSRs include conserving old forest and the species that may occupy those forests, including NSOs. The area surrounding Baker Lake has extant patches of old growth forest (Figure 2-11, Recreational Sites and Old Growth Forest; and Vegetation Mapping in the Project Area and Wetland Inventory, Figure 2) that are providing habitat for NSOs. The old growth patches are interspersed with younger stands regenerated following timber harvest.

There have been occurrences of hemlock looper (*Lambdina fiscellaria*) attacking old hemlock trees in the Baker Lake watershed. Hemlock looper is a native moth to North America, and outbreaks normally last about 3 years (Mellon et al. 2006 see DecAid cite). Heavy defoliations of large, old hemlock trees have contributed to tree mortality in the Baker watershed (Meeting Notes of Western North American Defoliator Working Group and the Hemlock Looper Committee, 2002). Hemlock looper may be degrading suitable NSO habitat in the Baker watershed through loss of canopy trees.

The land surrounding Lake Shannon is primarily owned by private timber companies and the WDNR. The WDNR has some relatively small parcels next to the lake that they manage according to their HCP. These WDNR lands are managed for dispersal habitat conditions for NSOs which require the WDNR to maintain 50 percent of their lands in dispersal habitat by watershed administrative unit. There are also several very small parcels in proximity to the reservoir that are also designated as NRF habitat. On these lands, the WDNR is required to maintain 50 percent NRF habitat by watershed administrative unit.

Lake Shannon occurs within the Finney Block Northern Spotted Owl Special Emphasis Area (Washington Administrative Code 222-16-086). This Spotted Owl Special Emphasis Area (SOSEA) has a dual strategy of dispersal and demographic support for NSOs. The area immediately adjacent to Lake Shannon is meant to provide dispersal support; other areas further from Lake Shannon within the SOSEA are intended to provide demographic support. Timberlands immediately adjacent to Lake Shannon will be managed to meet the goals of the SOSEA.

NSO have been documented in the Baker watershed, however, to our knowledge there have been no recent surveys. Surveys in the watershed to locate and determine NSO occupancy were conducted in the 1980s and early 1990s. A Western Washington Fish and Wildlife Office GIS search documented 7 historic NSO territories (status 1 and 2 occcupancy) located less than 3.5

miles from Baker Lake. NSO status is defined as the follows: 1 = one pair; 2 = two birds, pair status unknown; 3 = territorial single. In the vicinity of the Baker Lake our GIS data documented the following NSO sites: Anderson Creek, Noisy Creek, Shuksan Lake Creek, Swift Creek, Park Creek, Little Sandy Creek, and Sandy Creek. Of the 7 NSO sites in the vicinity of Baker Lake, all have been documented as a pair of birds (status 1), other than the Park Creek Site, which was documented as two birds, pair status unknown (status 2). No NSO sites are identified in proximity to Shannon Lake. Due to the absence of recent NSO surveys, the historic site centers may or may not reflect current occupancy. Although habitat conditions are similar to conditions in the early 1990s, other factors may have contributed to changes in occupancy patterns in the watershed.

NSO historically established home ranges in the upper portions of these creek drainages where steep topography limited timber harvest and old-growth forest is present (Hamer et al. 1989). With the exception of some acres of suitable habitat lost due to hemlock looper and limited timber harvests from the early 1990s to now, NSO habitat in the Baker watershed is probably fairly similar in quality and quantity now as it was when NSOs were last documented. With the implementation of the Northwest Forest Plan in 1994, conservation of NSOs and their habitat has been emphasized in this watershed. As such, removal of suitable NSO habitat has been significantly reduced since the listing of the NSO in 1990 and implementation of the Northwest Forest Plan in 1994.

The Baker LSR is approximately 82,100 acres and surrounds Baker Lake. The USFS estimates that there are 10,541 acres of mature coniferous forest and 41,735 acres of old growth on national forest land in the watershed (FEIS 3-156). Remaining mature and old-growth forest at low to mid elevations on the west side of Baker Lake have been highly fragmented due to timber harvest and road building. Fragmentation of mature and old-growth forest is less extensive on the east side of Baker Lake. Before implementation of the LSR and in an intensively surveyed area of 74,000 acres near Baker Lake, the USFS identified 35,000 acres of NSO habitat with 9 NSO pairs (Hanson et al. 1993). The majority of mature and old-growth forests within the watershed are expected to provide habitat suitable for NSO NRF.

The great horned owl and the barred owl are also found in the Baker watershed. In a study by Hamer et al. (1989) great horned owls were found at higher densities in the Baker watershed than expected, and except in one case, a great horned owl was found within 2.1 miles of every NSO core area in the Baker Reservoir area. In 1989, 17 years after their initial detection in the Baker Lake area, barred owls were two times more abundant than NSOs (Hamer et al. 1989). Barred and great horned owls may influence NSO behavior and habitat use in the Baker watershed through competition for resources and aggression towards NSOs (see Status section above).

EFFECTS OF THE ACTION – Northern Spotted Owl

For purposes of determining which Agreement articles might contribute to negative effects to NSOs, we evaluated each article in relation to the following criteria: nature and activities associated with the article; the proximity (<1/4 mile) to suitable NSO habitat; historic NSO site

center locations in relation to the activities described in the article; and overall landscape characteristics that could influence NSOs. A brief discussion of the criteria is below.

Articles ranged from monitoring and reporting efforts to on-the-ground construction. Many of the articles are for planning purposes and don't involve on-the-ground construction. For example, Article 318 is for law enforcement activities and has no potential to negatively affect NSOs. Many similar articles have no likelihood of harming NSOs because they are for planning or monitoring, and these were not evaluated for their potential to affect NSOs (see Appendix 1). Conversely, articles that involve on-the-ground construction may have a chance of affecting NSOs due to the potential to degrade NSO habitat. These articles were then considered in the next criteria.

Articles that might involve ground-disturbing activities were then evaluated in relation to the proximity of the described activities to suitable NSO habitat. We used available forest cover maps to assist us in locating potential owl habitat. Some articles that involve ground-disturbing activities are not in proximity to suitable NSO habitat. For example, Article 315 is for trail maintenance near the city of Concrete and will involve construction. However, suitable NSO habitat is not near this project. Because of the lack of habitat involved with this project, it was taken out of consideration of potentially affecting NSOs (see Appendix 1). Similar articles requiring ground-disturbing activities that will not take place in proximity to suitable habitat were also eliminated as having potential to affect NSOs. Articles that involve on-the-ground construction, and are in proximity to suitable NSO habitat, were considered to have a chance of affecting NSOs and were then further evaluated. The activities described in some articles will be planned in the future, and for these, we lacked specific information needed to make a determination. Often, the eventual location of the activity has not yet been decided.

Articles that might occur in proximity to, or within, suitable NSO habitat, were then assessed relative to historic NSO site centers. Although the owl survey data is relatively old, it was the only available information we had on NSO locations in the watershed. Due to the age of the survey data, it might not be conclusive as to NSO locations. Some of the NSO nest sites may have shifted over the years and now occur somewhere else in the territory. Alternatively, a territory may be vacant with no resident owls. Territories may also now occur where they previously did not. As such, historic owl locations can give some indication of potential effects of specific articles; however, due to the age of the data, this approach has limitations. Because of these limitations we included all articles that were within a NSO territory as having the potential to adversely affect northern NSOs.

Historic NSOs sites are generally located at higher elevations in the watershed. Most of the activities described in the articles will take place at lower elevations, near the two lakes. Some of the activities will take place next to the lakes and within the 1.8 mile home range radius of a NSO territory. Generally, these activities are at the outer perimeter of the radius. If historic locations represent where NSOs currently reside, and would reside in the future, those articles could be expected to have less of an impact than an activity in close proximity to the NSO site center. This is because NSOs more frequently use habitats that are closer to the nest site (within 0.7 mile) than those further away (Bingham and Noon 1997).

We also considered overall landscape character and ownership relative to effects to NSOs. The Environmental Baseline above provides estimates of old growth, mature forest, and NSO habitat in the Baker watershed. Because the NSO location data is relatively old, and may not reflect current occupancy patterns, the amount of habitat in the watershed can also be used for evaluating effects to NSOs from the articles. It is important to note that most of the articles that have the potential to impact NSOs occur over a small area when compared to a NSO home range.

Activities occurring in association with Lake Shannon have a lower chance of negatively affecting NSOs (now and in the future) because the forests are generally young and do not support NSOs. Also, we would expect future NSOs to use the areas surrounding Lake Shannon less frequently than around Baker Lake due to land management obligations. The goals of the SOSEA next to Lake Shannon are for dispersal habitat, not nesting. Future opportunities for NSO nesting near Lake Shannon are considered to be low. Conversely, activities in proximity to Baker Lake have a higher chance of affecting NSOs due to current and future habitat conditions, and overall land management objectives (LSR objectives). It is important to note that the USFS has agreed to future ESA consultations as they refine specific details of certain articles.

Considering the evaluation criteria described above with the currently available data sources, we determined that the following articles have a chance of adversely affecting NSOs (see Appendix 1).

Project Facilities, Operations, and Flood Control

The following article will adversely affect NSO:

- Article 107 Flood Control

For purposes of this opinion, we are addressing the effects of precluding future development of NSO habitat in the area of the reservoirs (Lake Shannon and Baker Lake) that are seasonally inundated by water for flood control and power generation. When the water levels in the reservoirs are low, exposed and unvegetated sediments are present. High water levels submerge these areas. We are calling this area the fluctuation zone. Due to this normal variation in water levels, natural vegetation is precluding from developing in the fluctuation zone. If the water level was kept at minimum elevations, over time, forest vegetation could be expected to return to this area, and given enough time, return to NSO habitat.

We assume that if the two reservoirs were annually kept at minimum pool elevations (Baker Lake – 678 ft, Lake Shannon – 389 ft), site-capable vegetation would recover. Most of the area would return to conifer forest that, given enough time, would eventually develop into habitat for NSOs. For this analysis we are also assuming that, where site conditions are favorable, conifer trees would be planted at an appropriate density to facilitate eventual development into NSO habitat.

Information from two studies included in the license application for the Baker River Hydroelectric Project, Historic Vegetation of the Baker River Project Area (Relicense Study T7)

and Potential Future Vegetation of the Baker River Project Area (Relicense Study T7-B), were used for our assessment. In addition, a GIS assessment to determine acreage in the fluctuation zone was done for each reservoir (Tony Fuchs pers. comm. 2006).

It is likely that prior to dam construction and filling of the reservoirs, the fluctuation zone provided forests capable of providing habitat for NSOs. Stochastic events, and some early timber harvest, may have affected patterns of owl habitat in what is now the fluctuation zone of the two reservoirs. However, we think it is reasonable to assume that NSO habitat did occur in the fluctuation zone. The predominant cover types were coniferous and mixed forest (Historic Vegetation of the Baker River Project Area, 2003). Wetlands, and other cover types with a reduced chance of eventually developing into NSO habitats, were substantially less abundant.

The upper Baker development, beginning at RM 9.35, was constructed from 1956 through 1959 (FEIS 2-1). The 9 mile-long Baker Lake has a surface area of 4,980 acres. Baker Lake is held near full pool during the summer, and minimum reservoir levels occur between November and April. The fluctuation zone totals 2,380 acres (Tony Fuchs pers. comm.) of which approximately 1,751 acres could potentially grow suitable habitat for NSOs (Shelley 2007).

The lower Baker development, (Lake Shannon), beginning at RM 0.6, was constructed between 1924 and 1925. In 1927 Lower Baker dam was raised to its current elevation (FEIS 2-2). This dam forms a 7 mile-long reservoir named Lake Shannon and has a surface area of 2,278 acres. The fluctuation zone totals approximately 832 acres (Tony Fuchs pers. comm. 2006) of which approximately 592 acres could potentially grow suitable habitat for NSOs (Shelley 2007).

A total of approximately 2,343 acres within the fluctuation zones of both reservoirs could provide habitat for NSOs if allowed to recover. However, even if these zones were planted with conifer trees and periodically thinned with eventual NSO habitat as a goal, they would not develop into suitable NSO habitat within the 50-year term of the license. The structural diversity necessary for NSO habitat – snags, coarse woody debris, canopy layering, dominant trees – would not develop within 50 years. With proper management, lower quality habitat might start to develop within two to three decades following year 50. At longer time frames (>50 years) continuing to limit the development of NSO habitat over 2,343 acres would continue to have adverse affects to NSOs.

If mature forest occurred over the 2,343 acre fluctuation zone, NSOs would potentially use it if other factors (other species, etc.) didn't inhibit use. If the NSO distribution stayed static in the watershed (which is unlikely), any habitat that would eventually form would be no closer than 1.5 miles from an existing site center. It is not unusual for NSOs to change site centers, though, so over long durations a fluctuation zone comprised of suitable NSO habitat might become more valuable if owls moved closer to the reservoirs. Depending on NSO distribution, an increase of 2,343 acres of suitable habitat could positively influence multiple NSO sites. Under this action, the natural succession is disrupted, and the development of 2,343 total acres of suitable habitat for nesting, roosting, and foraging NSOs will be delayed. The continued delay in the development of habitat adversely affects NSOs by delaying their use of this land for a 50-year license term.

The following article provides instream flows protective of fish and will have no effect on NSO:

- Article 106 Flow Implementation

Aquatics

The following aquatic article will adversely affect NSO:

- Article 101 Fish Propagation

Fish Propagation

Article 101 provides for the construction of fish propagation facilities, including a new hatchery, upgrades of spawning beach 4, enhancement projects, and decommissioning of spawning beaches 1, 2, and 3 at the upper end of Baker Lake. Effects to NSO are expected to be minimal for all of the projects except the latter because construction of these facilities will not take place in or adjacent to NSO suitable habitat. There is suitable NSO habitat in close proximity to spawning beaches 1, 2, and 3. It is our understanding that decommissioning these beaches will not involve removal or degradation of suitable NSO habitat. Any potential adverse affects to NSOs would be expected to occur during the de-construction of these spawning beaches. The operation of machinery and equipment could potentially disturb NSOs, should they be in close proximity. Feeding or roosting efficiency could be temporally reduced, although no mortality of young or adults is expected. Should a NSO nest site be in close proximity, it could disturb adults and young and result in disrupted feeding or possibly nest abandonment. Any disturbance is expected to be short in duration and to occur only during the actual de-commission time. In the absence of current surveys, we assume a worst-case scenario and expect the effects from the construction of these facilities on nesting NSOs to be significant in the short-term. Once work at the beaches is finished, there should be no residual effects to NSOs.

The following aquatics article is not clearly defined in the FEIS and has the potential to adversely affect NSOs. The article is also expected to be beneficial to NSOs.

- Article 110 Shoreline Erosion

Shoreline Erosion

This article calls for site-specific plans to be developed for erosion control, erosion prevention, and remediation activities wherever USFS lands or resources may be affected. Erosion control measures may include vegetation, anchored logs, riprap, rock walls, crib walls, perched beach and drift sills. These control activities are intended to protect a recreation site, cultural site, and any sites affecting facilities or resources.

It is not unusual for erosion control projects to require heavy machinery and an access road for equipment. If an access road is constructed through NSO habitat it could degrade habitat through the loss of canopy trees, snags, down logs, and understory vegetation. The loss or

degradation of these elements could reduce foraging and roosting habitat in a limited area. If a NSO nest site were in the vicinity, the nest core could be affected by construction due to disturbance. No mortality of adults or young is expected. If NSOs were in the immediate area, the visual presence and noise associated with construction could disrupt foraging and roosting behavior in the immediate area, though this would only occur during the construction period. Stabilizing areas of chronic erosion can prevent other large trees from falling into the reervoirs, and such actions could preserve stands of trees suitable for NSO nesting, roosting, and foraging that would otherwise be lost to shoreline erosion. Therefore, the long-term effects from shoreline erosion to NSO could also be beneficial.

Any activities from this article are expected to be limited in scale, affecting no more than two or three acres due to an individual project. In some cases the erosion control measure may take place in an area where the habitat has already been degraded, as in a campground. We would expect fewer impacts to owls in this situation than in fully intact NSO habitat. Depending upon the specific project design, future section 7 consultation may be necessary.

The following aquatics articles will have no effect on NSO:

- Article 103 Upstream Fish Passage
- Article 104 Fish Connectivity Between Reservoirs
- Article 105 Downstream Fish Passage
- Article 108 Gravel Augmentation
- Article 109 Large Woody Debris

The effects from construction of the fish passage facilities (articles 103, 104 and 105) are expected to have no effect on NSO. The locations of these facilities and construction sites are outside of suitable habitat, and in addition they are outside of any zone of influence for disturbance to NSO. Articles 108 and 109 relate to maintaining the integrity of the reservoirs for the protection or enhancement of fish habitat. The implementation of these articles would have no effect on NSOs:

Recreation

The following recreation article will adversely affect nesting, roosting, and foraging NSOs:

- Article 303 Baker Lake Resort Redevelopment

<u>Baker Lake Resort Redevelopment</u>

This article calls for the decommissioning of the Baker Lake Resort and development of a campground on this site. The Baker Resort is primarily a series of small cabins, a boat dock, and small store. The intention is to remove the buildings and develop a “level 3” USFS

campground[7] for 30 to 50 campsites (FEIS A-38) over a 22.8 acre area (Recreation Capacity and Suitability Analysis, 2004).

This 22.8 acre area is approximately 2.5 miles from the nearest known NSO site center, so that it is outside the known 1.8-mile home range radius for NSOs. This information is relatively old and may not reflect current occupancy patterns, and a NSO site could now be much closer than the documented historic site. NSO use of the resort area has not been documented, although suitable habitat (mature and old growth forest) exists in the area (Vegetation Mapping in the Project Area and Wetland Inventory, Baker River Relicense Studies T2 and T5, 2004). As such, it may receive periodic use by NSOs.

Recreation use of the resort and immediate area is highest during the summer. The campground that is eventually developed here will likely continue that trend of high summer visitation with a substantial reduction during the winter. The high recreational use of this specific area in the past may have hindered its use by NSOs due to sound and visual disturbance from activities associated with the resort. The habitat quality is also probably degraded from removal of hazard trees, and the presence of access roads and cabins. These trends are expected to continue after the site is redeveloped as a campground. Campground construction and maintenance, with periodic hazard tree removal, is expected to keep the area in a sub-standard habitat condition. The reduction of snags, dominant trees, and understory vegetation will likely reduce foraging and roosting quality throughout the campground and the immediate vicinity. No mortality of young or adults is anticipated, however. The sound associated with a campground may also affect the use of the immediate area by NSOs.

In the absence of more current NSO surveys, we are assuming that a NSO pair may have relocated near the Baker Lake Resort site and will be disturbed by sound from construction. We doubt that NSOs would locate a nest in the resort area because of the continual disturbance on that site due to the regular presence of visitors. However, it is possible that a pair of NSOs may have nested in the vicinity since the last surveys and could be disturbed by the construction activities associated with this article to the point where nesting behavior would be significantly disrupting. Surveying for NSOs prior to construction would determine whether NSOs are present and help inform the development of measures to minimize disturbance effects to this species.

The following recreation articles are not clearly defined in the FEIS and have the potential to adversely affect nesting, roosting, and foraging NSO.

- Article 302 Aesthetics Management Plan
- Article 306 Upper Baker Visitor's Information Services
- Article 308 Managing Dispersed Campsites

[7] Level 3 Definition: Site modification moderate. Facilities about equal for protection of natural site and comfort of users. Contemporary/rustic design of improvements is usually based on use of native materials. Inconspicuous vehicular traffic controls usually provided. Roads may be hard surfaced and trails formalized. Development density about 3 family units per acre. Primary access may be over high standard roads. Definition from: Meaningful measures for quality recreation management – developed sites costing instructions. USFS. February 2002.

- Article 309 Bayview Campground Redevelopment
- Article 310 Upper Baker Trail and Trailhead Construction Funding
- Article 312 Developed Recreation Monitoring
- Article 313 Upper Baker Developed Recreation Maintenance
- Article 314 Upper Baker Trail and Trailhead Maintenance
- Article 316 USFS Road Maintenance and Paving

Determining the potential effects for these recreational articles was difficult because the location, exact plan or timing of the planned activities is unknown at this time. If the following activities occur outside of suitable NRF NSO habitat, the chance that they would affect NSOs is extremely low. If they occur in or near habitat, the chance of adverse effect is higher.

Aesthetics Management Plan

Article 302 would provide funds to the USFS to implement vegetation management at developed campgrounds and/or viewpoints, and Baker Lake in two to four yet-to-be identified locations averaging less than one-quarter acre in size. The specific vegetative management measures to be implemented at the USFS sites and the two to four locations averaging less than one-quarter acre in size are not identified in the proposed article. Sound from equipment and increased human activity during vegetation-management activities could temporarily disturb NRF behavior of NSO. Removal of overstory trees could occur at five known sites and at an additional two to four sites not yet identified. The two to four sites not yet identified could be as much as a quarter acre in size per site. Removal of overstory trees could have localized effects on the number of trees available for NRF NSO. Additional section 7 consultations with the USFS may be necessary once specific sites are identified and vegetation management activities at each site are known.

Upper Baker Visitors Information Services

Article 306 would provide funds to the USFS for constructing and operating an Upper Baker Visitor Information Services Station (VIS) with parking, information kiosks, and sanitation facilities at Baker Lake. Construction activities could generate noise and involve increased human activity. Construction is expected to last a relatively short duration. Overstory trees may be removed to accommodate the VIS. Short-term effects to NSO may include the displacement of NRF NSO from the vicinity of the construction site. Removal of overstory trees could have a localized effect on the number of sites available for NRF NSO. A developed site with increased human presence may limit or preclude NSO from NRF in the vicinity of the VIS in the future. Depending on the location of the VIS, future consultation with the USFS may be necessary.

Managing Dispersed Campsites

Under Article 308, funds will be made available to the USFS for the purpose of contributing to the preparation and implementation of a Dispersed Recreation Management Plan. Dispersed recreation sites are informal camp or picnic sites. This plan will implement hardening actions at three to six high-priority sites, which means developing the site into a formal recreation site. Hardening could potentially include installing pit toilets, picnic tables, trash cans, camping sites,

and other infrastructure that is commonly associated with a developed recreation site. These ground-disturbing activities may involve harvest of trees that may be contributing to NSO habitat. The USFS has agreed to consult with the FWS when they have decided on specific sites for hardening and plans are more complete for this action.

Historic visitor use of dispersed recreation sites along the shores of Baker and Shannon Lakes have been studied and mapped (Dispersed Site Inventory Study; Figure 3-1A, Figure 3-1B, Dispersed Campsite Locations). Dispersed sites range in size from the Baker River Trailhead North site, which contains 19 individual sites, to small sites that handle one vehicle or tent (Dispersed Site Inventory Study, Final Draft Report, February 2004). Some dispersed sites may receive more use and subsequently more habitat degradation as a result. Dispersed sites are located both below and above normal full-pool elevations. Dispersed sites below normal full pool are unlikely to affect NSOs because appropriate vegetation is absent.

The following dispersed recreation sites occur within the outer edge of a 1.8 mile NSO home range radius: BW12, BW11, BN1-4, BE 1 & 2, BE 15, and BN 1 – 4. The remainder of the dispersed sites is currently not within a known NSO home range radius, although this NSO site data is old and may not reflect current occupancy patterns. Some dispersed sites occur within suitable NSO habitat and others are not in habitat. Even if a dispersed site occurs outside the 1.8-mile home range radius, NSOs are known to vary the area they use seasonally, and potentially annually. As such, some dispersed recreation sites in suitable habitat that are currently outside a 1.8 mile home range radius may still contribute to habitat used by the species. Additionally, in the future, if a NSO pair changes nest location, it could potentially be closer to dispersed recreation sites.

Dispersed recreation sites will be attracting people predominately during the summer months. The activities associated with dispersed recreation sites may affect NSO behavior if owls are in the immediate area. Sound and visual disturbances could influence roosting and foraging behavior of NSOs. These effects are not expected to penetrate the forest beyond the immediate area. Increased visitation may also affect NSOs by increasing chance human interactions with the species, increasing background noise and sound, and increasing unregulated habitat degradation (for instance, illegal removal of down logs and trees for firewood).

Dispersed recreation sites in young or non-forest are not expected to affect NSO habitat in the near term. However, some dispersed sites in currently young forest are expected to mature into low quality NSO habitat over the 50-year time horizon. However, they are unlikely to become suitable habitat because of the long time frame it takes to reach suitable habitat. Approximately 60 percent of dispersed sites are located in young forest and about 30 percent in old forest (R12 site inventory study). Extremely limited effects are anticipated from those recreation sites in young forest, or non-forest, now or over the duration of the 50-year license period. Conversely, dispersed recreation sites that occur within NSO habitat may have both immediate and long-term effects to the species habitat, but at a very limited scale. NSOs have large home ranges (as described in the status of the species) and these individual recreation sites are proportionately a very minor percentage of land within those areas. The removal of snags, dominant trees, and LWD may all simplify the structural diversity of the recreation site and potentially reduce the effectiveness of the immediate area for NSOs. The loss of canopy may also favor competing

species (see status of species and baseline) which could further reduce the functionality of the habitat directly associated with the recreation sites. An increase in human visitation and the sound and presence of people will also likely reduce the effectiveness of the immediate area for NSOs. No mortality of young or adult NSOs is anticipated.

While the immediate habitat may be degraded, we expect that there will still be trees in association with recreation sites and still the potential for some use by NSOs, but likely reduced. Foraging may be reduced within the recreation site and the immediate vicinity. The chance of NSO nesting in the recreation site, or immediately adjacent, may also be reduced from the simplification of habitat, or the presence of people and their associated activities. Depending upon the specific sites selected for hardening and site-specific details of the work, future section 7 consultation with the USFS may be necessary.

Bayview Campground Rehabilitation

Under Article 309, funds will be made available to the USFS to contribute to the rehabilitation and reconstruction of the 28 unit Bayview Campground to a similar level of development as other USFS sites developed as "Level 4".[8] Bayview campground currently consists of two group campsites. This campground site is estimated to encompass approximately 20.75 acres (Recreation Capacity and Suitability Analysis (R11) and Recreational Trail Analysis (R15).

The Bayview Campground is not presently within a known NSO 1.8-mile home range radius. However, we acknowledge that the data is old and may not reflect current occupancy patterns in the watershed. Potentially, there could be an NSO territory closer to the campground than this historic site, or, NSOs could use the campground area as part of their larger annual home range.

The activities associated with the campground may affect NSO behavior if owls are in the immediate area. Noise and visual disturbances could influence roosting and foraging behavior of NSOs. These effects are not expected to penetrate the forest beyond the immediate area however.

Bayview campground has mature conifer forest that may have the capability to provide habitat for NSOs. Rehabilitating and maintaining the Bayview campground could lead to removal of canopy trees, removal of snags and down logs, and loss of understory. These elements contribute to NSO habitat and removing or degrading them could negatively affect habitat. Habitat degradation may reduce the effectiveness of the immediate area for NSOs to use for foraging, roosting, and nesting.

The habitat associated with the Bayview campground, and the immediate vicinity, will likely be further degraded due to this article. However, because of the large home range of NSOs, and the presence of large, old forest stands available in the LSRs, the potential degradation of the habitat

[8] Level 4 Definition: Site heavily modified. Some facilities designed strictly for comfort and convenience of users. Luxury facilities not provided. Facility design may incorporate synthetic materials. Extensive use of artificial surfacing of roads and trails. Vehicular traffic controls usually obvious. Primary access usually over paved roads. Development density 3-5 family units per acre. Plant materials usually native. Interpretive services often formal or structured.

in the campground area will only affect a small portion of a relatively large home range for NSOs. In addition, other areas in the LSR should be maturing into higher quality NSO habitat, which should further reduce any negative effects attributed to this campground. Depending upon the specific site plan and site-specific details of the work, future section 7 consultation with the USFS may be necessary.

Upper Baker Trail and Trailhead Construction

Under Article 310, funds will be made available to the USFS for contributing to trail-based recreation for up to 6 miles of new multi-season, multi-use, non-motorizied trails. The trailhead is located at the north end of Baker Lake. The Upper Baker River Trailhead is located within the outer edge of a 1.8 mile NSO home range radius. However, the owl site data is old and may not reflect current occupancy patterns. Considering the age of the data, the potential exists that a NSO site is closer to the trailhead than the historic data, or conversely, further. Irrespective of precise locations of NSO sites, the species may use the trailhead area as part of their annual home range.

The trailhead and associated infrastructure occupy (or may eventually occupy) approximately 16.5 acres (Recreation Capacity and Suitability Analysis (R11) and Recreation Trail Analysis (R15) Final Draft Study Report, Table 2-2). Riparian, and mature and older conifer forest occur at, and in the immediate vicinity of, the trailhead site. Due to the availability of suitable habitat, NSOs may use the site for their life history needs.

The activities associated with the trailhead may affect NSO behavior if NSOs are in the immediate area. Noise and visual disturbances could influence roosting and foraging behavior of NSOs. These effects are not expected to penetrate the forest beyond the immediate area.

The construction associated with this article might include the removal of dominant trees, removal of snags and down logs, and loss of understory vegetation. These elements contribute to NSO habitat, and removal of all or part of 16.5 acres of habitat could degrade it. Habitat degradation may reduce the effectiveness of the immediate area for NSOs to use for foraging, roosting, and nesting. Because of the limited size (16.5 acres) of this activity in relation to the large home range size of NSOs, effects are expected to be minimal, particularly in context with the larger blocks of mature and old-growth forest available within the watershed. These mature and old growth forests occur within the LSR and will be conserved for ecological purposes. Other second growth forest patches in the LSR are also expected to be maturing and developing NSO habitat characteristics over the 50-year license term. Depending upon the specific site plan and site-specific details of the work, future section 7 consultation with the USFS may be necessary.

Developed Recreation Monitoring

Article 312 provides funding to monitor site use and occupancy levels at the following campgrounds: Horseshoe Cove, Panorama Point, Bayview, Shannon Creek, and Baker Lake Resort. There is the potential for additional recreational development if these existing campgrounds meet or exceed 60 percent combined site occupancy during July and August for 2

consecutive years. The expansion of these recreational facilities would likely create visual and noise disturbances of NSOs within NRF habitat. There also is some potential for the removal of suitable NSO habitat. We assume that the USFS would evaluate potential sites for additional recreational development and minimize or avoid adverse effects to suitable NSO habitat because the area is designated as LSR (see the Introduction to Species Effects section). Depending upon the site specific plans that may develop as the result of monitoring, future section 7 consultation may be necessary.

Upper Baker Developed Recreation Maintenance and Trail and Trailhead Maintenance

Articles 313 and 314 relate to maintenance of recreational facilities and trails. Article 313 provides for maintenance of the following developed recreational sites: Shannon Creek, Panorama Point, Bayview, Horseshoe Cove, Maple Grove, and Baker Lake Resort. Article 314 provides funding for the operation, maintenance, and facility maintenance of the Baker River Trail, the Baker Lake Trail, and the Baker Lake North and South trailheads. All of the above campsite, trail, and maintenance activities would likely create noise and/or visual disturbances to NSOs NRF in adjacent suitable habitat due to construction and maintenance work and subsequently the ongoing recreational use of the campsites and trails. There also is some potential for the removal of suitable NSO NRF habitat; however, it is assumed that the USFS would evaluate all potential sites and trails to minimize or avoid the removal of any suitable NSO habitat because the area is designated as LSR (see the Introduction to Species Effects section). Depending upon the site-specific details of the maintenance work, future section 7 consultation with the USFS may be necessary.

USFS Road Maintenance and Paving

Article 316 provides funding for contributing to the routine maintenance of portions of up to 25 miles of existing forest roads, which is not expected to affect NSO habitat. Any negative effects that may happen from this article would be from visual and noise disturbance from equipment during maintenance operations. If a NSO is in the immediate vicinity, the activities may affect foraging and roosting capability. They may move from a roosting site to avoid the disturbance. Any effects from this article would be limited in duration, only happening during periods of construction. The USFS has completed section 7 consultation for these activities through 2007. Depending upon site specific plans for this type of work in the future, additional section 7 consultations may be necessary.

Terrestrial

Overall, projects that will be conducted under the terrestrial articles are expected to have either neutral or long-term beneficial effects on NSO and their habitat. However, there is the potential for some short-term effects from the implementation of some of these articles. Due to the uncertainty associated with the exact impacts of these projects (i.e., number of individuals or the amount of habitat actually affected by each of these future project activities) to the species, we can only address the overall potential effect that these projects may have with respect to the likelihood of jeopardizing the species. We defer the assessment of potential adverse effects to

NSO until such time that these projects have been fully designed and the associated site-specific minimization measures have been described by the USFS.

We assume that habitat enhancement activities could include silvicultural and vegetation management activities. If these activities occur inside of suitable NRF NSO habitat, they could adversely affect NSOs. If activities are outside NSO suitable habitat, there is little potential for adverse effect. The acquisition of land to be set aside for forest-dwelling and riparian species is expected to be a neutral or beneficial effect to NSO in the long-term.

The following terrestrial articles are not clearly defined in the FEIS and have the potential to adversely affect nesting, roosting, and foraging NSO in the short-term. We expect all of these articles to have a long-term benefit to NSO.

- Article 502 Deciduous Forest Habitat
- Article 505 Aquatic riparian habitat
- Article 517 Road Closures for Grizzly Bears

Article 502 provides funding for deciduous habitat acquisition and habitat enhancement for the benefit of deciduous forest-dwelling species. We assume that habitat enhancement could include silvicultural and vegetation management activities. These activities may create short-term visual and noise disturbances to NRF NSOs in adjacent suitable habitat. Disturbance can result in disruption of nesting behavior, feeding young and may result in nest abandonment. The acquisition and enhancement of land to set aside for forest-dwelling species is expected to be a beneficial effect to NSO in the long-term, by providing potential foraging opportunities for NSOs.

Article 505 provides funding for the acquisition, protection, and enhancement of low-elevation bottomland ecosystem habitat in the Skagit River basin for the benefit of anadromous salmonids, other aquatic species, and riparian-dependent birds and amphibians. We assume that habitat enhancement activities could include silvicultural and vegetation management activities. These activities may create short-term visual and sound disturbances to NRF NSOs within and adjacent to the acquired land. Disturbance can result in disruption of nesting behavior, feeding young and may result in nest abandonment. The acquisition of land to set aside for bottomland ecosystem species is expected to be a neutral or beneficial effect to NSOs in the long-term, by providing potential foraging opportunities for NSOs.

Article 517 provides funding for a road closure program to reduce human use disturbances in the North Cascades Grizzly Bear Recovery Area of the Mt. Baker-Snoqualmie National Forest to improve grizzly bear habitat. Implementation of this article may include the installation of gates, berms, jersey barriers, ecology blocks, or boulders to block vehicular access. Heavy equipment such as a backhoe is expected to be used in creating some of the blockages. These activities may cause short-term disturbance to NRF NSOs in the vicinity, which can result in disruption of foraging and nesting behaviors, feeding of young, and nest abandonment. We expect a long-term beneficial effect to NSOs as this article should increase the quality of NSO NRF habitat by reducing the amount of vehicular traffic and human activity that could otherwise disturb them. The USFS has already completed section 7 consultation on this activity.

The following terrestrial articles may affect, but are not likely to adversely affect NSOs:

- Article 503 Elk Habitat
- Article 515 Late Seral Forest
- Article 516 Mountain Goats

Article 503 provides funding for the acquisition, enhancement, and management of approximately 300 acres of elk habitat in the core and peripheral area of the Nooksack Elk Herd or the Sauk Game Management Unit. We assume that in the selection of land, suitable NSO habitat would not occur within the land acquisition area or, if it does, it would not be subject to alteration or disturbance from enhancement or management activities. This assumption is explained in the Introduction to Species Effects section. Therefore, effects to NSO from the implementation of this article are expected to be insignificant or discountable.

Article 515 provides funding for thinning up to 321 acres of second-growth forest on USFS lands in the Baker River watershed for the purpose of reducing edge effects by enhancing the acceleration of late-seral forest growth, which may increase the nesting success and/or survival of federally listed NSO and marbled murrelets. All stands are less than 35 years old and would not constitute suitable NSO habitat. The non-commercial thinning would occur outside nesting season for stands within 35 meters of suitable adjacent nesting habitat. The thinning may have short-term disturbance of dispersing NSO, which is expected to be insignificant. Overall, we expect a long-term beneficial effect to NSOs as this article should increase the quality of NSO NRF habitat.

Article 516 provides funding for habitat enhancements for up to 194 acres of high elevation mountain goat habitat. Habitat enhancement would primarily be achieved through prescribed burning of Mountain Hemlock forests on the northern end of Baker Lake in several small patches. Burning would occur in spring and early summer. Prescribed burning and smoke effects may create a disturbance to NRF NSOs in suitable habitat on the north end of Baker Lake; however, there is no suitable NSO habitat in these burn areas, and NSO are not known to nest at these elevations. Therefore, effects from prescribed burns are expected to be discountable to NRF NSOs.

The following terrestrial articles will be wholly beneficial to nesting, roosting, and foraging NSOs:

- Article 511 Decaying and Legacy Wood
- Article 513 Bald Eagle Management Plans

Article 511 provides funding for the protection and management of snags, logs, and residual live trees for the purpose of enhancing habitat for snag and log-dependent species. Only beneficial effects to NSOs and their habitat are expected from the implementation of this article as the protection of these features is consistent with suitable NSO nesting habitat.

Article 513 provides for planning and long-term protection of and management of bald eagle nest sites and communal winter night roosts. Only beneficial effects to NSOs and their habitat are expected from the implementation of this article as the features of bald eagle habitat are consistent with suitable NSO nesting habitat.

These articles are reporting or planning tasks that would occur in an office-type setting and their implementation would have no effect on NSOs:

- Article 102 Aquatics Reporting
- Article 201 Programmatic Agreement
- Article 301 Recreation Management Report
- Article 304 Baker Reservoir Recreation Water Safety
- Article 307 Upper Baker Visitor Interpretive Services
- Article 501 Terrestrial Resource Management Plan
- Article 514 Use of Habitat Evaluation Procedures
- Article 601 Baker River Coordinating Committee

The activities associated with the following recreation articles would not occur within or adjacent to NSO suitable habitat and instead would occur within previously developed areas where facilities or infrastructure are currently in place. These articles would refurbish or enhance these developed areas for public access and benefit and would have no effect on NSOs:

- Article 305 Lower Baker Developed Recreation
- Article 311 Lower Baker Trail Construction
- Article 315 Lower Baker Trail Maintenance
- Article 317 Access to Baker Lake

The following article relates to maintaining the water quality in the reservoir and will have no effect on NSO:

- Article 401 Water Quality

The following terrestrial articles are designed to enhance habitat for several species of birds and plants in and adjacent to the reservoirs. The implementation of these articles would have no effect on NSOs:

- Article 504 Wetland Habitat
- Article 506 Osprey Nest Structures
- Article 507 Loon Floating Nest Platforms
- Article 508 Noxious Weeds
- Article 509 Special Status Plants
- Article 510 *Carex flava* (yellow sedge)
- Article 512 Bald Eagle Night Roost Surveys

There following articles relate to the long-term success of the Agreement but would have no effect on NSOs:

- Article 318 Law Enforcement
- Article 602 Contingency Funds
- Article 603 Adaptive Management

CUMULATIVE EFFECTS – Northern Spotted Owl

Cumulative effects include the effects of future State, Tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

Cumulative effects to the NSO may result from habitat degradation due to development and timber harvest, and increasing visitor use in the action area. Land ownership and management in the watershed is dominated by Federal government holdings in the Mt. Baker-Snoqualmie National Forest (55.6 percent of the total watershed area) and in North Cascades National Park (30.4 percent), so development is not a significant concern over much of the watershed. Private and State holdings account for the remaining 14 percent of the watershed's area. Over 99 percent of the watershed above Upper Baker Dam (RM 9.35) consists of Federal lands. About 49 percent of the watershed is managed as wilderness, roadless areas, or national park. Recreation and management of lands for protection of natural values are the predominant land uses in the watershed. The private and State holdings are primarily confined to the lower watershed tributaries entering Lake Shannon and to the Lower Baker River downstream of Lake Shannon. Most of the 14 percent of land in private and State ownership has been extensively harvested and is managed for timber production. The land in private timber production could be sold for residential housing development.

The Baker River basin is accessible to more than 6.5 million people in northern Puget Sound and southern British Columbia via an approximately 2-hour drive (100 miles). The area is easily accessed by a system of county and USFS roads. The mountainous terrain, project reservoirs, and water courses offer spring, summer, and fall recreational opportunities including developed and dispersed camping, fishing, picnicking, swimming, hiking, boating, mountaineering, scenic driving, and environmental education and interpretation. Winter activities, such as cross-country skiing and snowmobiling, occur near the project. Long-term increases in human visitation are expected. Likely places that will experience this increase are campgrounds; both established and dispersed, trails, and roads. Increased visitation may cumulatively affect NSOs by increasing chance human interactions with the species, increasing background noise and increasing unregulated habitat degradation.

We expect that climate change will alter the ecosystem that supports NSO during the term of the license. Effects of climate change may alter the geographic or elevation range of NSO, the availability of nesting habitat and their forage species, and may affect NSO in ways that are currently unknown.

CONCLUSION – Northern Spotted Owl

After reviewing the best scientific and commercial data available, the current status of the NSO, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the FWS's biological opinion that implementation of the proposed action is not likely to jeopardize the continued existence of the NSO. Any localized effects to NSOs from the proposed action will not result in decreasing NSO reproduction, numbers, or distribution.

The USFS designated the 82,100 acre Baker LSR in the Baker watershed on national forest lands. The USFS estimates that there are 10,541 acres of mature coniferous forest and 41,735 acres of old growth on national forest land in the watershed (FEIS 3-156). The purpose of the LSR is to provide late successional and old growth forest for species that are dependant on those habitats. As such, the mature and old-forest currently in the watershed will be left intact. Any timber harvest that may occur will be in young forest with the silvicultural goal of eventual old forest habitat. Hemlock looper may continue to have periodic outbreaks and increase mortality of trees in the watershed, but these outbreaks do not normally persist for extensive durations. The quality and quantity of the NSO habitat in the watershed should improve over the duration of the permit period.

The management of private forest lands next to Lake Shannon under the Forest Practices Act should provide dispersal habitat conditions per the SOSEA goals. Lands managed under the 1997 WDNR HCP near Lake Shannon will also provide some habitat for dispersing NSOs. In addition, stream corridors managed under the 2006 Forest Practices HCP may also eventually provide some narrow corridors of NSO habitat. At longer time frames, mature forest along these riparian corridors may work synergistically with SOSEA conservation approaches for dispersing NSOs.

Barred and great horned owls are documented in the watershed and will likely predate and compete for resources with NSOs, and the outcome may be to the detriment of NSOs. This proposed action, however, is not expected to influence or magnify the effect to NSOs from these competing species over what is already occurring. Because of this, the proposed action is not expected to give a competitive advantage to the barred and great horned owl.

As described previously in this opinion, the data for NSO locations are not current. However, the general habitat patterns have not changed much since the owl locations were determined, so those areas may still be the most likely to support NSO sites. If those NSO sites are still occupied the effects from the proposed action are extremely minor to almost none, primarily due to the distance from the proposed actions. But other factors may have led to NSO occupancy changes over the intervening time frame and there is the possibility that some NSO sites could be closer to some of the activities described in the articles than original locations.

We do not expect the articles we have analyzed for effects to NSOs to have the potential for large-scale effects. On the contrary, we anticipate any effects attributable to individual articles to be very limited in scale relative to amounts of habitat that NSOs use annually. In addition, most of the articles that we considered will likely have some of the components of forest habitat after completion. We are not expecting total removal of all the habitat elements that comprise NSO habitat. For example, we do not believe that clearcut harvesting will occur in the recreation sites within suitable NSO habitat. Large trees would be retained that would provide a sub-standard habitat and some opportunity for NSO use.

The effect of flood control and the active fluctuation zone, is considered part of the action in this biological opinion. The effect of flood control is the continued preclusion of the development and use of this habitat by nesting, roosting, and foraging NSOs into the future and this is likely to adversely affect NSOs. However, this effect does not reduce the likelihood of the survival and recovery of NSO in the action area because this historic loss of habitat would not reduce the current NSO population in terms of reproduction capability, numbers of birds, or their distribution.

Because of the conservation commitments of the LSR for national forest lands, the SOSEA for private landowners, and the obligations of the WDNR HCP for State trust lands, the area has a landscape conservation strategy for NSOs. The minimization and mitigation measures associated with these different conservation approaches are expected to provide long-term benefits for NSOs. Any losses or degradation of suitable habitat is going to be minor relative to the amounts present in the watershed. Effects attributable from the proposed action are not expected to lead to direct loss of NSO individuals, and no anticipated loss of reproduction is expected due to disturbance. Therefore, we do not believe that the effects of the proposed actions are likely to result in a reduction of the survival or recovery of the NSO in the wild.

Due to the uncertainty of NSO site center locations in relation to some of the actions discussed previously, we are unable to evaluate the level of adverse effects to NSOs that are likely to occur from future actions. Therefore, we are deferring consultation until the USFS or Puget is able to plan for the development of these activities in the future. To assist in determining whether future consultations are required we are recommending that USFS or Puget conduct NSO surveys within a quarter mile of construction activities associated with specific activities within or close to suitable NSO habitat. NSO occupancy surveys of suitable habitat within a quarter mile of construction activities will provide site-specific information that could potentially reduce risk associated with old survey data, particularly because NSOs may have moved closer to the proposed action. It is our opinion that performing NSO surveys of suitable habitat within a quarter mile of construction activities will reduce the chance of an NSO nest core being affected. We recommend that NSO surveys be conducted early enough in the planning process so that current occupancy information could inform the site-specific details of the articles in question.

The proposed action will not reduce the quality of NSO habitat in the watershed, and it will not reduce the distribution of the habitat in the watershed. Large patches of habitat are unaffected by the proposed action. Increased competition and predation from barred owls and great horned owls are not expected to increase over the existing situation. The conservation commitments

implemented through the Northwest Forest Plan and the SOSEA next to Lake Shannon provide strategies for conserving NSOs in the area for long time periods. In summary, the proposed action will not jeopardize the continued existence of the NSO.

NORTHERN SPOTTED OWL CRITICAL HABITAT

STATUS OF NORTHERN SPOTTED OWL CRITICAL HABITAT

Legal Status

On January 15, 1992, the FWS designated critical habitat for the NSO within 190 CHUs which encompass nearly 6.9 million acres across Washington (2.2 million acres), Oregon (3.3 million acres), and California (1.4 million acres) (USDI FWS 1992b). The NSO critical habitat final rule states: "Section 7 analysis of activities affecting owl critical habitat should consider provinces, subprovinces, and individual CHUs, as well as the entire range of the subspecies (page 1823)." The rule goes on to assert the basis for an adverse modification opinion should be evaluated at the provincial scale (page 1823).

Primary Constituent Elements

Primary constituent elements (PCEs) are the physical and biological features of critical habitat essential to a species' conservation. PCEs identified in the NSO critical habitat final rule include those physical and biological features that support nesting, roosting, foraging, and dispersal (USFWS 1992b). Features that support nesting and roosting habitat typically include a moderate to high canopy (60 to 90 percent); a multi-layered, multi-species canopy with large [> 30 inches diameter at breast height] overstory trees; a high incidence of large trees with various deformities (e.g., large cavities, broken tops, mistletoe infections, and other evidence of decadence); large snags; large accumulations of fallen trees and other woody debris on the ground; and sufficient open space below the canopy for owls to fly (Thomas et al. 1990). Foraging habitat generally consists of attributes similar to those in nesting and roosting habitat, but may not always support successfully nesting pairs (USDI FWS 1992b). Dispersal habitat, at minimum, consists of stands with adequate tree size and canopy closure to provide protection from avian predators and at least minimal foraging opportunities: there may be variations over the owl's range (e.g., drier sites in the east Cascades or northern California) (USDI FWS 1992b).

Conservation Role of Critical Habitat

NSO critical habitat was designated based on the identification of large blocks of suitable habitat that are well distributed across the range of the NSO. Critical habitat units were intended to identify a network of habitats that provided the functions considered important to maintaining stable, self-sustaining, and interconnected populations over the range of the NSO, with each CHU having a local, provincial, and a range-wide role in NSO conservation. Most CHUs were expected to provide suitable habitat for population support, some were designated primarily for connectivity, and others were designated to provide for both population support and connectivity.

The NWFP was developed using conservation principles similar to those used to designate critical habitat and is considered the Federal contribution to the conservation of NSOs and its habitat in the United States. Specifically, late successional reserves (LSRs) were created under the NWFP to provide large blocks of suitable habitat capable of supporting multiple pairs of NSOs. Standards and Guidelines of the NWFP establish that LSRs will be managed to protect and enhance late-successional and old-growth forests ecosystems. Riparian Reserves and other NWFP land use allocations provide for connectivity between reserves. Approximately 70 percent of suitable habitat in CHUs overlaps with NWFP LSRs on a range-wide basis and will therefore be managed to protect and enhance habitat characteristics.

Current Condition of Critical Habitat

Rangewide

In 1994, the FSEIS for the NWFP established that 3,141,987 acres of NRF habitat existed within NSO CHUs on federally administered public lands. To assess changes to the baseline condition since implementation of the NWFP, the FWS relies on information in section 7 consultations and available information on natural events. Hereafter, effects to critical habitat refer to NRF habitat within NSO critical habitat.

Across the range of the NSO between 1994 and July 19, 2005, the FWS has consulted on the removal or downgrading of 46,945 acres[9] (1.49 percent) of critical habitat due to management-related activities (Table 6). The majority of these consulted-on effects, 33,008 acres, have been concentrated in the Oregon Cascades West and Oregon Klamath Mountains Provinces. In addition, natural events (including fire and insect outbreaks) have resulted in the removal or downgrading of approximately 39,078 acres (1.24 percent) of critical habitat extant in 1994 (Table 6). In general, fires have had more of an impact to NSO critical habitat in the interior provinces of Washington and California and the southern and interior provinces of Oregon than the coastal provinces. Over 50 percent of NSO critical habitat removed or downgraded by fire can be attributed to the 1999 Megram Fire that burned in north-central California and the 2002 Biscuit Fire that burned in southwestern Oregon and northern California.

Although most provinces within the range of the NSO have experienced some degree of habitat loss between 1994 and July 19, 2005, total effects have been disproportionately distributed. The majority of effects to critical habitat (approximately 98 percent) have been concentrated in just six physiographic provinces (Washington East Cascades, Washington West Cascades, Oregon Klamath Mountains, Oregon Cascades East, Oregon Cascades West, and California Klamath) (Table 6). Of the remaining six provinces, one (Oregon Willamette Valley) had no designated critical habitat, one (Washington Western Lowlands) had no suitable habitat within critical habitat, and four provinces (Olympic Peninsula, Oregon Coast Range, California Coast Range,

[9] Once a consultation is completed, the NWFP and Section 7 Consultation Effects Tracker database is updated to include the consulted-on acres. Additionally, once projects are completed, and monitoring reports submitted, the consulted-on acres in the NWFP and Section 7 Consultation Effects Tracker database are updated to account for action agency projects or portions of projects that were not implemented. Thus, consulted-on acres displayed in the database may increase or decrease and represent the best approximation of consulted-on effects that have and are expected to occur.

California Cascades) had less than 1.5 percent of their critical habitat removed or downgraded since 1994.

Provinces

Washington East Cascades. This province, which contains 18 CHUs, is located east of the Cascade Crest and provides the easterly extension of the NSO in Washington.

Between 1994 and, July19, 2005, approximately 8,492 acres of critical habitat, or 2.6 percent of its provincial baseline, have been removed or downgraded (Table 6). The majority of effects have been concentrated in the northern half of the province and resulted primarily from the Tyee, Needles, North 25 Mile, and Maple Fires. The largest of these fires, the Tyee, removed or downgraded approximately 3,600 acres of suitable habitat from WA-06, WA-09, and WA-11. The Maple Fire removed or downgraded an additional 300 acres of suitable habitat from to WA-06. The Needles and North 25 Mile Fires removed or downgraded approximately 2,500 acres (23 percent) and 474 acres (28 percent) of suitable habitat from WA-02 and WA-04, respectively. Collectively, the units impacted by these fires are important for the range-wide distribution of the NSO as they occur on the eastern and northeastern edge of the species range (Tehan 1991). Additionally, these CHUs provide essential habitat for intra-provincial connectivity (Tehan 1991).

Efforts continue to refine estimates of additional critical habitat lost due to wildfires during recent seasons. Preliminary estimates indicate that the actual total acres of NRF that may have been removed or downgraded from critical habitat units in this province due to natural events may be as much as 12,183 acres (nearly 3,700 acres more than the Table 6 value). This preliminary estimate needs to be finalized before it can be entered in the range-wide database for tracking effects on critical habitat.

Washington West Cascades. This province, which contains 23 CHUs and the most critical habitat of the Washington provinces, is located west of the Cascade Crest. It is characterized by significant differences in topography and distribution of habitat between its northern and southern portions.

Between 1994 and July 19, 2005, the removal or downgrading of approximately 4,994 acres of critical habitat within six CHUs, or one percent of its provincial baseline, has been consulted on since 1994. Although impacts to five of these units have been relatively minor (less than 2.5 percent of their baseline), WA-39 has had 1,776 acres of suitable habitat (46 percent) consulted-on for removal or downgrading. WA-39 is expected to provide connectivity between the Western Cascades and Western Lowlands Provinces and improve the distribution of spotted owls and habitat in the portion of the province impacted by the 1980, Mount Saint Helens eruption (Tehan 1991). Fire has not resulted in measurable impacts to NSO critical habitat in this province.

Oregon Klamath Mountains. The Oregon Klamath Mountains Province contains 16 CHUs and provides the link between the Oregon Cascades West and Oregon Coast Ranges Province south into California.

Between 1994 and July 19, 2005, this province has had more critical habitat removed or downgraded than any other province: 30,380 acres or approximately 10 percent (Table 6). In general, effects to critical habitat have been evenly distributed between those consulted upon (12,927 acres) and those attributable to fire (17,453 acres) effects. Although consulted-on effects were distributed across 11 CHUs, approximately 36 percent of consulted-on effects have occurred in two adjacent units (OR-74 and OR-75). Together, these units provide an east-west linkage in the southern portion of the Klamath Mountains Province and provide essential NRF, and dispersal habitat in a highly fragmented area (Tweten 1992). The majority of fire effects in this province can be attributed to the Biscuit Fire. This fire removed or downgraded approximately 23, 46, and 37 percent of the suitable habitat within OR-68, OR-69, and OR-70, respectively. These units were identified for their important contributions to inter- and intra-provincial connectivity and to provide essential NRF and dispersal habitat in areas where habitat is lacking (Tweten 1992).

Oregon Cascades West. This province is located in the geographic center of theNSOs range and contains more critical habitat (over 894,000 acres) than any other province. It provides links with the Washington Cascades, Oregon Coast Range, and Klamath Mountains Provinces.

Between 1994 and July 19, 2005, approximately 21,297 acres or 2.38 percent of its provincial baseline have been removed or downgraded (Table 6). Consulted-on effects have been widely dispersed within 26 of the 29 CHUs in this province. In general, this has resulted in relatively small impacts to individual units. However, two adjacent units, OR-23 and OR-24, have experienced relatively concentrated effects having 215 acres (14.3 percent) and 946 acres (48.8percent) removed or downgraded, respectively. Together these units were identified as being important inter-provincial links between the Coast Ranges and the Oregon Cascades West Provinces (Tweten 1992). Fire has had limited effects to NSO critical habitat in this province: 1,216 acres or less than 0.5 percent of the provincial baseline have been removed or downgraded by fire.

Oregon Cascades East. The Oregon Cascades East Province provides the easterly extension of the NSOs range in Oregon and contains all or portions of 10 CHUs.

Between 1994 and July 19, 2005, 8,584 acres or 6.18 percent of its provincial baseline have been removed or downgraded (Table 6). The majority of these acres, approximately 6,878, are a result of several fires during 2002 and 2003. The impacts of these fires were concentrated in the central portion of this province where approximately 20 percent of the extant suitable habitat in OR-3 and OR-4 and over 36 percent of the suitable habitat in OR-7 were removed or downgraded. OR-3 and OR-4 were designated to maintain suitable habitat and support dispersal along the eastern slope of the Oregon Cascades (Tweten 1992). OR-7 provides a north-south link within the province and an inter-provincial link with the Oregon Cascades West Province. Consulted-on effects have been evenly distributed, occurring in 8 of 10 CHUs, and have resulted

in less than a 5 percent reduction (through removal or downgrading) of suitable habitat within any individual CHU.

California Klamath. The California Klamath Province contains all or portions of 36 CHUs and over 85 percent of NSO critical habitat in California. Between 1994 and July 19, 2005, approximately 10,483 acres of critical habitat (3.0 percent of the provincial baseline) have been removed or downgraded (Table 6) from 14 CHUs within this province. The majority of effects to these acres can be attributed to the Megram Fire. This fire removed or downgraded 9,390 acres (22 percent) of the suitable habitat within CA-30; this CHU is located in the west/central portion of this province and links the interior subprovinces with the coastal provinces and is expected to provide for up to 24 NSO pairs overtime (Spangle 1992). Two other small CHUs, CA-10 (9,637 acres) and CA-35 (12,470 acres), have had approximately 20 percent of their suitable habitat removed or downgraded from consulted-on actions. The primary function of these CHUs is to provide intra-provincial connectivity in the eastern and south-central portion of this province, respectively (Spangle 1992).

ENVIRONMENTAL BASELINE –Northern Spotted Owl Critical Habitat

The action area for the Baker River Hydroelectric Project is the Baker River watershed located in Whatcom and Skagit Counties (FERC 2006, page xvi). About 5,207 acres of the 8,526.8 acres of total project lands (including submerged lands) are located within the boundary of the Mt. Baker-Snoqualmie National Forest. The 5,207 acres is also within the NSO CHU WA-21, Mt. Baker-Snoqualmie National Forest (Tehan 1992; USDA and USDI 1994b). This analysis will be conducted in the context of CHU WA-21.

Function and Description of Critical Habitat Unit WA-21

CHU WA-21 was developed around the Interagency Scientific Committee's (ISC) Habitat Conservation Area (HCA) W-9 and additional habitat that met the criteria and should support a cluster of NSO pairs by providing essential NRF, and dispersal habitat. These units provide essential breeding habitat and connectivity between CHUs WA-19, WA-22, WA-23, WA-24 and the North Cascades National Park. A critical habitat addition of suitable nesting habitat along the southern edge of the HCA will improve connectivity with adjacent CHU's across the Skagit River valley and increase the amount of nesting habitat in HCA W-9, since this area is well below the ISC pair target. Another critical habitat addition of contiguous nesting habitat at the northwest corner of the HCA will improve breeding habitat connectivity to WA-19 to the north. This is an important connection, as the Mt. Baker Wilderness constitutes a significant high elevation barrier to north-south NSO movement. This CHU is important for range-wide distribution of NSO habitat within the North Cascades area of concern identified in the ISC Plan for demographic and habitat distribution concerns, and because of the low number of NSO pairs (Tehan 1992). CHU WA-21 covers approximately 85,720 acres, with 84,221 CHU acres located on Federal lands of which 39,124 acres are functioning as NSO habitat (45.6 percent) (USDA and USDI 1994b).

NSO surveys were conducted in the Anderson and Park Creek drainages on Baker Lake during the late 1980s and early 1990s. Reproductive pairs of NSOs were located in Anderson Creek during 1989, 1991, and 1992 (Beak 1992d). Adult NSOs were located on Park Creek during the same years; however, reproductive status was not determined (Beak 1992d). Pairs of NSOs were also recorded in the Swift, Shuksan, Little Sandy, Sandy, and Noisy Creek drainages between 1989 and 1992 (WDFW 2004). The NPS surveyed NSOs in the North Cascades National Park from 1993 through 1996 (Kuntz and Christopherson 1996). A total of six NSO pairs and five single NSOs were located in the Park, which is located partially within the Baker River basin. WDFW data on priority habitats and species indicate eight NSO site centers are located within the Baker River watershed (WDFW 2004). Activity at these sites has not been verified in recent years, and the current status of the NSO population in the Baker River basin is largely unknown (FERC 2006, page 3-251).

Present Condition of Critical Habitat in the Action Area

Critical habitat for NSO in the Baker River basin is located on national forest lands surrounding Baker Lake. Congressionally reserved areas, including Wilderness and National Recreation Areas, are excluded from the critical habitat designation. The Northwest Forest Plan (USDA and USDI 1994a) serves recovery plan functions through specific management requirements, standards, and guidelines. The Northwest Forest Plan established a system of LSRs to provide habitat capable of supporting viable populations of species associated with late- and old-successional forest, including the NSO and marbled murrelet. In many cases, LSR was intended to replace the function of critical habitat. The Baker LSR is about 82,100 acres and almost completely surrounds Baker Lake. Additional habitat that may be suitable for NSO is located in adjacent CHUs, adjacent wilderness areas, the Mt. Baker National Recreation Area, and the North Cascades National Park. The Baker LSR is expected to be a major contributor to NSO recovery as a source of NSOs dispersing to the north, southeast, south, and east. The USFS (USDA 2002a) analyzed habitat suitability for NSOs within the LSR. Approximately 67 percent of the area is in the western hemlock and Pacific silver fir vegetation zones; the remaining 33 percent is in the mountain hemlock or non-forested zones, which do not provide NSO habitat. Only 17 percent of the LSR is in the western hemlock zone, which is the lowest elevation, highest productivity forest. Approximately 70 percent of the LSR is late and old-successional forest; about one-third of this amount is greater than 450 years old and provides optimum habitat for old-growth associated species. The size of old-growth stands is also important to the quality of NSO habitat. Throughout the Baker LSR, most patches of late successional and old-growth forest are greater than 620 acres. Old-growth forests have been fragmented into smaller blocks in the Rocky, Sandy, and Dillard creek drainages (FERC 2006, page 3-251).

EFFECTS OF THE ACTION – Northern Spotted Owl Critical Habitat

The following is a discussion of the overall effects of the action on NSO critical habitat within the CHU and then out to the province level. Further on in this document we will discuss the effects of individual Agreement articles to CHU WA-21. In the overall analysis, we have concluded that the continued operation of the Baker River Hydroelectric Project under the

Agreement is likely to adversely affect NSO critical habitat. The following section will analyze project effects to the PCEs in CHU WA-21.

Effects to Nesting, Roosting, and Foraging Habitat within CHU WA-21

The Baker River Hydroelectric Project is likely to adversely affect NSO critical habitat by removing or downgrading NRF habitat. While the percentage of suitable habitat removed or degraded by the proposed activities is expected to be very small, the exact number of acres affected is unknown due to the uncertainty associated with the exact impacts of some of the project's activities. Some of the project's activities will be beneficial to NSO PCEs, while other activities will have no effect. One activity consulted on in this biological opinion, Article 303 the Baker Lake Resort Redevelopment, was determined likely to adversely affect NSO critical habitat. Other activities have the potential to adversely affect NSO critical habitat and may need future consultation as we defer the assessment of actual levels of effect to NSO critical habitat until such time that these activities have been fully designed and the associated site-specific minimization measures have been described by the USFS.

Effects to Spotted Owl Dispersal and Habitat Connectivity

The proposed action could reduce overstory canopy cover of the CHU in the location of campsite development, redevelopment, and expansion, and the construction of facilities. However, removal of NSO habitat is anticipated to amount to stand thinning and occasional tree removal. Effects to dispersal habitat and connectivity are expected to be extremely minor. Although dispersal habitat would be degraded by the action, the retention of canopy cover on these acres is sufficient to maintain the dispersal habitat function in these stands. Stands with less than 40 percent canopy cover are not considered to be functioning dispersal habitat for NSO.

NSOs use NRF habitat and dispersal habitat for movements across the landscape. Conservation strategies for the NSO recommend maintaining at least 50 percent of the landscape with forest capable of supporting NSO dispersal (Thomas et al. 1990). The levels of impact of the activities consulted on are not anticipated to have an appreciable effect to connectivity within the action area or the CHU.

Other future activities, listed in this section and in Appendix 1 Project description and effects, have the potential to adversely affect NSO critical habitat and will need future consultation. Such activities include the construction of roads and trails. It is unknown where and how many miles of roads or trails within the CHU would be decommissioned as part of the activities. We defer the assessment of actual levels of effect to NSO critical habitat until such time that these activities have been fully designed and the associated site-specific minimization measures have been described by the USFS.

Effects to the Washington Western Cascades Subprovince

The overall Baker River Hydroelectric Project will result in a small percentage of NSO critical habitat removal from the Western Washington Cascade Subprovince. Other future activities may affect NSO critical habitat and will need future consultation. We have deferred the assessment

of actual levels of effect to NSO critical habitat until such time that these activities have been fully designed and the associated site-specific minimization measures have been described by the USFS.

As described above, the proposed action maintains dispersal and connectivity habitat of CHU WA-21. The proposed action will not result in a significant loss of NRF, and dispersal habitat or connectivity in the action area of the within the subprovince, and would not be expected to appreciably reduce the ability of the CHU or critical habitat within the subprovince to function as intended. For the reasons described above, the FWS does not believe the proposed action would diminish the ability to attain the critical habitat goals in the CHUs at a subprovince level for providing well-distributed NRF and dispersal habitats.

Effects to the Washington Western Cascade Province

For the reasons described above, the Baker River Hydroelectric Project is not expected to affect the function of the CHUs at the provincial scale, since a minute amount of acres of NSO critical habitat would be removed from the Western Washington Cascades province.

Project Facilities, Operations, and Flood Control

The following articles will have no effect on NSO critical habitat:

- Article 106 Flow Implementation
- Article 107 Flood Control

One of the proposed license articles would be the fluctuation of the water levels of the Baker Lake and Lake Shannon reservoirs for flood control and for power generation (FERC 2006, pages 2-11 and A-25). The land inundated by the damming of the Baker River (i.e., Baker Lake and Lake Shannon) and reservoir fluctuation is an existing condition. The fluctuation between high and low pool in the reservoirs is also an ongoing effect of project operation. This activity will have no effect on NSO critical habitat because the lake/reservoir below full pool is not designated as NSO critical habitat.

Article 106 provides instream flows and ramping rates that are protective of fish in the Baker and Skagit Rivers below the Lower Baker Dam. This article would have no effect on NSO critical habitat as it does not involve habitat modification.

Aquatics

The following aquatics article may affect but is not likely to adversely affect NSO critical habitat. The long-term effect would be beneficial.

- Article 110 Shoreline Erosion

Treatment of erosion sites under Article 110 may involve some removal of trees for access, but the effects to the availability of suitable NSO nesting, foraging, and roosting habitat are expected

to be minimal. Stabilizing areas of chronic erosion can prevent other large trees from falling into the reservoirs and such actions could preserve stands of trees suitable for NSO NRF habitat that would otherwise be lost to shoreline erosion, so that the long-term effect would be beneficial. The effects of shoreline erosion control on NSO critical habitat are therefore expected to be insignificant as well as beneficial in the long-term.

The following aquatics articles will have no effect on NSO critical habitat:

- Article 101 Fish Propagation
- Article 103 Upstream Fish Passage
- Article 104 Fish Connectivity between Reservoirs
- Article 105 Downstream Fish Passage
- Article 108 Gravel Augmentation
- Article 109 Large Woody Debris
- Article 401 Water Quality

Articles 101, 103, 104, and 105 are designed primarily to propagate sockeye salmon and improve fish passage for salmon and bull trout. Fish propagation would include modifying an existing spawning beach and decommissioning other spawning beaches, adding a hatchery and other enhancement programs. The upstream fish passage implementation plan would include upgrading a fish trap, sorting capabilities, having the capacity to accommodate run growth and operation and coordination protocols. Studies would be initiated to develop the connectivity between Lake Shannon and Baker Lake and develop facilities and programs to reconnect migratory corridors. A downstream fish passage implementation plan would provide floating surface collectors, stress-relief ponds, and test to document performance of percent fish passage and percent fish survival (FERC 2006, pages 2-10 and A-2 to A-16). These activities would have no effect to NSO critical habitat because the activities are not within NSO critical habitat.

Articles 108, 109, 110 and 401 relate to maintaining the integrity of the reservoirs for the protection or enhancement of fish habitat or water quality. Four of these articles address tracking gravel aggradation in Skagit River and releasing gravel into Baker River, gathering floating LWD from project reservoirs and stockpiling for habitat improvement projects and complying with and planning for improved Water Quality standards (FERC 2006, pages 2-11, 2-14, A-17 to A-28, and A59 to A61). These activities would have no effect to NSO critical habitat as they do not include habitat modification.

Recreation and Aesthetics

The following recreation article will adversely affect NSO critical habitat:

- Article 303 Baker Lake Resort Redevelopment

<u>Baker Lake Resort Redevelopment</u>

The Baker Lake Resort Redevelopment Plan is sufficiently designed to anticipate the effects to NSO critical habitat and complete the assessment of actual levels of effect to NSO critical habitat in this opinion. Article 303 is considered to pose the greatest risk to NSO critical habitat from the action under this section 7 consultation. The following discussion is a complete analysis of Article 303.

The Baker Lake Resort is a commercial facility located on national forest land on the northern shore of the lake about 6 miles north of Upper Baker Dam, at the "elbow" of the lake where it bends to the east (Puget R16 2004a, page 3-8). Currently, the resort location on the shoreline of Baker Lake is in an open, forested area containing day use sites, 9 group sites, 57 RV hookups, flush and vault restrooms, showers, a boat ramp, moorage, boat rentals, a store, and play equipment. It also has as a floating dock, 11 cabins along the reservoir shore, an office/store, and 90 campsites along the shore of Park Creek (FERC 2006, pages 2-12, 3-338, and A-38 to A-39; Puget R5 2004a, page A-3; Puget R16 2004a, page 3-8). The Baker Lake Resort currently has ample parking and several available day-use activities (Puget R16 2004a, page 3-12).

The Baker Lake Resort site started with the original resort located near the shoreline (1935 to about 1960), which was developed on the Ruth Homestead (1891). This site was then privately operated as a commercial resort under a special use permit from the USFS. In 1998, Puget acquired a USFS special use permit to operate the resort. Puget does not intend to operate the resort beyond the expiration of the current special use permit in 2008. Instead, Puget, under Article 303, would prepare a Baker Lake Resort Redevelopment Plan to convert the resort to a campground with between 30 and 50 sites. Further, Puget would provide funds to the USFS for implementing the plan. The USFS would operate and maintain the site with funding from Puget (FERC 2006, page 3-360).

The Baker Lake Resort Redevelopment Plan would include the following: 1) coordination of the removal of those structures and facilities associated with being a "resort" and retention of necessary facilities. This includes decommissioning current resort structures and developing the site into a "Level 3" campground[10]. The existing 11 cabins along the reservoir shore will be removed and the 90 existing campsites (along the shore of Park Creek) will be reduced to an estimated 30 to 50 campsites (FERC 2006, page 3-361). The spacing of camp units will be adjusted to three sites per acre to reduce effects on old-growth stands and shoreline areas (FERC 2006, page 3-360). Also included would be the development or refurbishment of shelters suitable for interpretive or educational programs, 2) vegetation management such as thinning for overstory health and vegetation removal to open views to the lake, 3) reconfiguration of roads and parking areas to improve circulation patterns, 4) replacement or rehabilitation of campsite features to include tables, fire pits, tent pads, docks and boat ramp, and 5) reconstruction of the water system to include an additional six communal water sources plus distribution lines and the installation of a generator to run the well and water system (FERC 2006, page 2-12).

[10] Level 3 Definition: Site modification moderate. Facilities about equal for protection of natural site and comfort of users. Contemporary/rustic design of improvements is usually based on use of native materials. Inconspicuous vehicular traffic controls usually provided. Roads may be hard surfaced and trails formalized. Development density about three family units per acre. Primary access may be over high standard roads. Definition from: Meaningful measures for quality recreation management – developed sites costing instructions. USFS. February 2002.

The Baker Lake Resort Redevelopment action area is located within CHU WA-21. The area is 22.89 acres in size and the plan's goal is to construct up to 50 campsites with three sites per acre (Puget 2004a, page 2-22). To do this there is a need for at least 16.67 acres out of the 22.89 acres for campsite construction, replacement or rehabilitation on the peninsula. The R11/R15 reports state that USFS review of the site noted the "back half" (half the project area equals 11.445 acres) of the Baker Lake Resort peninsula is occupied by old-growth forest (Puget 2004a, page 2-36). Also reported is a "steep" 48 percent slope of 11 acres (Puget 2004a, page 2-27). A closer GIS analysis looking at NSO critical habitat suitability indicates the "back half" of the action area is nesting, roosting, and foraging habitat, while the "front half," which is approximately 11.11 acres of the action area, appears to be roosting and foraging habitat. This low/low-medium critical habitat is mostly on the northeast to southeast shoreline section of the action area, specifically where there is low tree density and would be ideal for redevelopment of the "resort" to campgrounds etc. The analysis also showed a gradual slope going up to the northwest from where the old-growth trees are in the middle of the 22.89 acre action area. With that information, we make the assumptions of the Baker Lake Resort Redevelopment Plan below:

Assumptions:

- There will be thinning of trees including periodic hazard tree removal and a reduction of snags, dominant trees, and understory vegetation in the 22.89 acre action area.
- That Article 303 will follow the Northwest Forest Plan's LSR standards and guidelines for the Baker area.

Implementation of Article 303, the Baker Lake Resort Redevelopment is likely to adversely affect NSO critical habitat. The proposed action could reduce overstory canopy cover in the location of campsite development and the construction of the facilities. However, removal of NSO habitat is anticipated to amount to stand thinning and occasional tree removal and the effects to dispersal habitat and connectivity are expected to be extremely minor.

The following recreation articles are not well-defined in the FEIS and have the potential to adversely affect NSO critical habitat:

- Article 302 Aesthetics Management Plan
- Article 306 Upper Baker Visitor Information Services
- Article 308 Managing Dispersed Campsites
- Article 309 Bayview Campground Redevelopment
- Article 310 Upper Baker Trail and Trailhead Construction
- Article 312 Developed Recreation Monitoring
- Article 313 Upper Baker Developed Recreation Maintenance
- Article 314 Upper Baker Trail and Trailhead Maintenance
- Article 316 USFS Road Maintenance and Paving

Articles 302, 313, and 314 have the potential to affect designated NSO critical habitat through maintenance activities that may require vegetation management of existing developed recreation

sites and trails. Vegetation management associated with maintenance of established campgrounds could remove NSO suitable habitat for NRF. Therefore, it is expected that an occasional, individual tree may be removed during these maintenance activities. These potential effects, when added to the environmental baseline, are not expected to appreciably diminish the capability of the surrounding critical habitat because tree removal would likely be very limited (i.e., an isolated tree in a campsite or near a trail that needed to be removed because it represented a hazard for visitors). Also, any tree removal would be within the bounds of the standards and guidelines for LSRs (see the Introduction to Species Effects). We expect the effects of the facility and trail maintenance on NSO critical habitat critical habitat to be revisited in the future as specific plans become available. Depending upon site specific plans for this work in the future, additional section 7 consultations may be necessary.

Articles 306, 308, 309, 310, and 312 have the potential to adversely affect NSO critical habitat by the possible removal of dominant trees, snags, down logs, etc. These activities include planning, design, and construction of a small Upper Baker Visitor Information Services Station with a small parking area, information kiosks, and sanitation facilities. Other articles include the hardening three to six high-priority dispersed camping sites, rehabilitation and reconstruction of Bayview site, development of up to 6 miles of new trails in the Upper Baker project area, and expansion of developed sites when occupancy exceeds 60 percent of total available sites (FERC 2006, pages 2-12 to 2-13 and A-44 to A-54). Due to the uncertainty associated with the exact nature and location of these activities and impacts to NSO critical habitat, we can only address the overall potential effect that these activities may have, which, if it is designed properly, would result in limited tree removal, with minor effects to NSO PCEs. We defer the assessment of actual levels of effect to NSO critical habitat until such time that these activities have been fully designed and the associated site-specific minimization measures have been described by the USFS. Depending upon site specific plans for this type of work in the future, additional section 7 consultations may be necessary.

Article 316 provides routine maintenance for up to 25 miles of specific USFS roads serving project-related facilities, and contributing to the USFS paving FR 1106 (FERC 2006, pages 2-13 and A-56). The article may include the removal of an isolated tree along a road (i.e. because it encroaches on the roadway or it represents a hazard for drivers etc). Due to the uncertainty associated with the exact nature and location of these activities and impacts to NSO critical habitat, we can only address the overall potential effect that these activities may have, which, if it is designed properly, would result in limited tree removal, with minor effects to NSO PCEs. We defer the assessment of actual levels of effect to NSO critical habitat until such time that these activities have been fully designed and the associated site-specific minimization measures have been described by the USFS. The USFS has completed section 7 consultation for these activities through 2007. Depending upon what is planned for subsequent years, additional section 7 consultations may be necessary.

The following recreation articles will have no effect on NSO critical habitat:

- Article 305 Lower Baker Developed Recreation
- Article 307 Upper Baker Visitor Interpretive Services
- Article 311 Lower Baker Trail Construction

- Article 315 Lower Baker Trail Maintenance
- Article 317 Access to Baker Lake

Articles 305, 311, 315, and 317 include provisions for developing areas for public access on Lake Shannon, obtaining the license and constructing the Lower Baker Trail in Concrete and the maintenance of this trail, and providing public road access to the east side of Baker Lake on existing FR 1106 (FERC 2006, pages 2-12 to 2-13 and A-42-A-57). These activities would have no effect to NSO critical habitat because the activities are not located within NSO critical habitat and the activity involving the access road is an existing road.

Terrestrial

The following terrestrial articles are not well-defined in the FEIS and have the potential to adversely affect NSO critical habitat. These articles may have a long-term beneficial effect.

- Article 502 Deciduous Forest Habitat
- Article 505 Aquatic Riparian Habitat

Articles 502 and 505 include habitat enhancement activities that could remove trees that contribute to NRF habitat for NSO. Articles 502 and 505 provide for the acquisition, enhancement, and management of deciduous forest habitat and aquatic riparian habitat. We assume that habitat enhancement activities could include silvicultural and vegetation management. Due to the uncertainty associated with the exact location and therefore the impacts of these activities to NSO critical habitat, we can only address the overall potential effects that these activities may have, which, if it is designed properly, would result in limited tree removal, with minor effects to NSO PCEs. Acquisition of land to set aside for forest-dwelling species is a neutral or beneficial effect on NSO critical habitat because it increases foraging opportunities for NSO. We defer the assessment of actual level of effect to NSO critical habitat until such time that these activities have been fully designed and the associated site-specific minimization measures have been described by the USFS. Depending upon site-specific details of this work, additional section 7 consultations may be necessary.

The following terrestrial articles may affect, but are not likely to adversely affect NSO critical habitat:

- Article 503 Elk Habitat
- Article 515 Late Seral Forest
- Article 516 Mountain Goats

Article 503 provides funding for the acquisition, enhancement, and management of approximately 300 acres of elk habitat in the core and peripheral area of the Nooksack Elk Herd or the Sauk Game Management Unit. We assume that in the selection of land, suitable NSO habitat would not occur within the land acquisition area or, if it does, it would not be subject to alteration or disturbance from enhancement or management activities. This assumption is explained in the Introduction to Species Effects section. Therefore, effects to NSO critical habitat from the implementation of this article are expected to be insignificant or discountable.

Article 515 provides for thinning of up to 321 acres of second-growth forests which are in plantations of less than 35 years old. The effects are expected to be insignificant because the plantations are not suitable NRF NSO habitat, and noncommercial thinning will occur outside of nesting season for stands within 35 meters of suitable nesting habitat. Over the long-term, the activities implemented under Article 515 would reduce forest edge effects and increase the quality of late-successional forests, including NSO critical habitat, and therefore would be beneficial.

Article 516 provides habitat improvement for mountain goats in mountain hemlock stands through prescribed burns. Because NSO are not known to nest at higher elevations, the effects on NSO critical habitat due to smoke from the prescribed burns is expected to be discountable.

The following terrestrial articles will be wholly beneficial to NSO critical habitat:

- Article 511 Decaying and Legacy Wood
- Article 517 Road Closures for Grizzly Bears

Articles 511 and 517 provide for management of snags, logs, and residual live trees on project lands as habitat for decaying and legacy wood-dependent species and planning, reviewing, and implementing road closures to benefit grizzly bear recovery (FERC 2006, pages 2-14 to 2-15 and A-65 to A-88). These activities would be wholly beneficial to NSO critical habitat, as they would improve the quality and increase protection of NSO habitat. The USFS has already completed section 7 consultation on the road closures for grizzly bears.

The following terrestrial articles will have no effect on NSO critical habitat:

- Article 504 Wetland Habitat
- Article 506 Osprey Nest Structures
- Article 507 Loon Floating Nest Platforms
- Article 508 Noxious Weeds
- Article 509 Special Status Plants
- Article 510 *Carex flava* (yellow sedge)
- Article 512 Bald Eagle Night Roost Surveys
- Article 513 Bald Eagle Management Plans

Articles 512 and 513 provide benefits for bald eagles in the form of surveys of bald eagle nests and night roost sites on known project lands, and for acquired lands conducting surveys for communal night roost of bald eagle near the project.

Articles 504, 506, 507, 508, 509, and 510 provide for acquisition and management of wetland habitat, providing and maintaining artificial and natural osprey nest structures, installing and maintaining platforms for common loon nesting, managing project lands for the control of noxious weeds, and the managing for the protection of yellow sedge, and managing plants of special status (FERC 2006, pages 2-14 to 2-15 and A-71 to A-84). These activities would have no effect to NSO critical habitat as they would not modify NSO habitat.

The following articles will have no effect on NSO critical habitat:

- Article 102 Aquatics Reporting
- Article 201 Programmatic Agreement
- Article 301 Recreation Management Report
- Article 304 Baker Reservoir Recreation Water Safety
- Article 318 Law Enforcement
- Article 501 Terrestrial Resource Management Plan
- Article 514 Use of Habitat Evaluation Procedures
- Article 601 Baker River Coordinating Committee
- Article 602 Contingency Funds
- Article 603 Adaptive Management

These articles are reporting or planning tasks that would occur in an office type setting including aquatics reporting, a management plan for programmatic agreements and historic properties, a recreation management report, a plan for the interpretive FWS, terrestrial resource management, a Habitat Evaluation Procedures plan, and a Baker River Coordinating Committee and resource groups (FERC 2006, pages 2-10 to 2-16 and A-1 to A-95). Another reporting and planning article is water and boat safety, but will also include installing buoys for swimming areas. These activities would have no effect to NSO critical habitat because the activities do not remove or degrade NSO critical habitat.

Articles 318, 602, and 603 relate to the long-term success of the Agreement including law enforcement, contingency funding, and adaptive management (FERC 2006, pages 2-13, 2-16, A-58, and A-96 to A-103). These activities will have no effect to NSO critical habitat because these activities do not remove or degrade NSO critical habitat.

Summary of Effects to Northern Spotted Owl Critical Habitat

Of the above articles sufficiently described to anticipate the effects to NSO critical habitat and complete the assessment of actual levels of effect to NSO critical habitats in this opinion, the Baker River Hydroelectric project affects less than a total of 22.89 acres (the total acres of the Baker Lake Resort "potential development node") of NSO critical habitat. Due to the uncertainty associated with the exact impacts of some articles to NSO critical habitat, we can only address the overall potential effect that the articles may have. We defer the rest of the articles assessment of actual levels of effect to NSO critical habitat until such time that they have been fully designed and the associated site-specific minimization measures have been described by the USFS.

CUMULATIVE EFFECTS –Northern Spotted Owl Critical Habitat

Cumulative effects include the effects of future State, Tribal, local or private actions, not involving Federal activities, that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not

considered in this section because they require separate consultation pursuant to section 7 of the ESA.

Cumulative effects to NSO critical habitat in CHU WA-21 may result from recreation and land development in the action area not associated with Federal or utility-owned lands. Timber harvest related to land conversion, land development, and road building may have the potential for tree removal, and may destroy or downgrade NRF habitat, and dispersal habitat and connectivity.

Conversion of privately-held timberlands to residential use adjacent to NSO critical habitat is a resource concern in Washington State. The FWS issued a biological opinion recently for the Washington State Forest Practices Rules governing timber harvest. The biological opinion states that several assumptions can be made about population growth in western Washington: a) that growth of residential development is likely to be high around the peripheries of the existing population centers, and b) that development areas in western Washington are expected to expand east toward the Cascade foothills (USDI 2006).

The immigration of telecommuters and retirees will result in growth outside of transportation corridors and urban centers. New technologies have created the opportunity for residential development of rural areas, followed by the development of support services (USDI 2006). The Puget Sound Action team estimates that Skagit County will experience a 50 percent growth rate by 2025 (USDI 2006). For example, this conversion of forestland to residential use is currently occurring on land north of Swift reservoir, the most remote of the Lewis Hydroelectric Projects in Skamania County, Washington, and near Nisqually Hydroelectric Project in Pierce County, Washington. These lands were historically managed for timber production.

Increased development or recreation not associated with Federal lands may also have the potential for thinning and occasional tree removal and may destroy or downgrade NRF habitat, and may affect dispersal habitat and connectivity. These actions may effect adjacent critical habitat by isolating the unit and diminish its effectiveness to provide connectivity between CHUs.

Development restrictions and critical area ordinances may reduce or minimize the potential for some of the negative impacts associated with development. Currently, areas east of the Mt. Baker National Forest Boundary in Whatcom County are designated as “conservancy” lands. This designation typically requires any residential development to have a shoreline setback of 100 to 150 ft (Whatcom County Planning and Development Service Department 1998). In Skagit County, lands along Lake Shannon area also designated as “conservancy” lands (Puget 2002a). This designation typically requires any residential development to have a shoreline setback of 75 to 175 ft depending on type and height of unit (Skagit County 1983).

We expect that climate change will alter the ecosystem that supports NSO during the term of the license. Effects of climate change may alter the geographic or elevation range of NSO, the availability of nesting habitat and their forage species or affect NSO critical habitat in ways that are currently unknown.

CONCLUSION – Northern Spotted Owl Critical Habitat

After reviewing the current status of the critical habitat, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the FWS's biological opinion that the action, as proposed, is not likely to result in the destruction or adverse modification of NSO critical habitat. This conclusion is based on the rationale that although the proposed action would result in adverse affects to critical habitat within the action area, these effects would not appreciably affect the function of CHUs to maintain a stable, self-sustaining, and interconnected populations of NSO within the northern Washington Western Cascades subprovince, the Washington Western Cascades Province, and across the species' range.

INCIDENTAL TAKE STATEMENT

Section 9 of the ESA 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 defined by the FWS as an act which actually kills or injures wildlife. Such act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavior patterns, including breeding, feeding, or sheltering (50 CFR § 17.3). *Harass* is defined by the FWS as an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering (50 CFR § 17.3). 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 FERC and, in the case of one term and condition, the ACOE, as appropriate, so that they become binding conditions of any grant or permit issued to Puget, as appropriate, for the exemption in section 7(o)(2) to apply. The FERC and the ACOE have a continuing duty to regulate the activity covered by this Incidental Take Statement. If the FERC (1) fails to assume and implement the terms and conditions or (2) fails to require Puget to adhere to the terms and conditions of the Incidental Take Statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In the case of the single term and condition applicable to the ACOE, below, if the ACOE (1) fails to assume and implement the term and condition or (2) fails to adhere to the term and condition of the Incidental Take Statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the FERC, the ACOE, and/or Puget must report the progress of the action and its impact on the species to the FWS as specified in the incidental take statement [50 CFR §402.14(i)(3)].

AMOUNT OR EXTENT OF TAKE

Bald Eagle

We do not have enough site-specific information about some of the proposed projects to accurately assess the amount of incidental take. We assume that the FERC or the USFS will complete National Environmental Policy Act requirements and section 7 consultation on future activities that are likely to affect NSO once more site-specific plans are developed.

The FWS will not refer the incidental take of any migratory bird or bald eagle for prosecution under the Migratory Bird Treaty Act of 1918, as amended (16 U.S.C. §§ 703-712), or the Bald and Golden Eagle Protection Act of 1940, as amended (16 U.S.C. §§ 668-668d), if such take is in compliance with the terms and conditions (including amount and/or number) specified herein.

Bull Trout

The FWS anticipates 6,440 juvenile/subadult bull trout, 11,942 adult bull trout, and 87 bull trout redds could be taken as a result of this proposed action (See Appendix 2). The incidental take is expected to be primarily in the form of harass (i.e., disturbance, capture and handling), but there will also be harm (i.e., injury and mortality).

A number of quantitative take estimates for the individual aspects of this action were developed in our effects analysis and have been summarized in Appendix 2 bull trout take. These should not be considered precise estimates of take. We believe that our take estimates represent the maximum amount of incidental take that could occur from the proposed action.

We do not have enough site-specific information about some of the proposed projects to accurately assess the amount of incidental take. We assume that the FERC or the USFS will complete National Environmental Policy Act requirements and section 7 consultation on future activities that are likely to affect bull trout once more site-specific plans are developed.

Marbled Murrelet

We anticipate lethal take from habitat alteration and predation risk and sub-lethal take from visual and noise disturbance activities from the redevelopment of the Baker Lake Resort (Article 303). The amount (acres) of habitat that we anticipate to be altered or degraded is used as a surrogate for expressing the anticipated amount of incidental take in the form of harm (lethal) or harass (sub-lethal). We estimate that marbled murrelets occurring on 11.1 acres (4.5 hectares) of suitable marbled murrelet nesting habitat are subject to take from these sub-lethal and lethal forms of take.

We do not have enough site-specific information about some of the proposed projects to accurately assess the amount of incidental take. We assume that the FERC or the USFS will complete National Environmental Policy Act requirements and section 7 consultation on future activities that are likely to affect marbled murrelets once more site-specific plans are developed.

Northern Spotted Owl

We expect that the Baker Lake Resort redevelopment will take one pair of NSOs in the form of harassment due to disturbance and degradation of habitat.

We do not have enough site-specific information about some of the proposed projects to accurately assess the amount of incidental take. We assume that the FERC or the USFS will complete National Environmental Policy Act requirements and section 7 consultation on future activities that are likely to affect NSO once more site-specific plans are developed.

EFFECT OF THE TAKE

The FWS has determined that this level of incidental take is not likely to jeopardize the continued existence of the bald eagle, bull trout, NSO or marbled murrelet.

REASONABLE AND PRUDENT MEASURES

The FWS believes the following reasonable and prudent measures (RPM) are necessary and appropriate to minimize take of bald eagles, bull trout, marbled murrelets, and NSOs. Section 7 of the ESA requires the development of reasonable and prudent measures necessary or appropriate to minimize the level of incidental take. The RPMs can include only actions that occur within the action area and reduce the level of take associated with project activities. The test for reasonableness is whether the proposed measure would cause more than a minor change to the proposed location or would alter the basic design, location, scope, duration or timing of the proposed actions.

With implementation of these RPM, the FWS believes take of bald eagles, bull trout, marbled murrelets, and NSOs in the form of harm, harassment, or killing, from the applicants' project operations, will be reduced. As a consequence, the FWS believes the following RPMs are necessary and appropriate to minimize incidental take of these species in the Baker River system. The measures described below are non-discretionary, and must be undertaken by the FERC, the ACOE, and Puget and made binding conditions of any license or permit issued, as appropriate, for the exemption of section 7(o)(2) to apply. The FERC and the ACOE have a continuing duty to regulate the activity covered by this Incidental Take Statement. If the FERC and/or the ACOE 1) fails to assume and implement the terms and conditions, or 2) fails to require applicants to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or license document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the action agencies must report the progress of the action and its impact on the species to the FWS as specified in this Incidental Take Statement.

Bull Trout

RPM BT 1: Minimize the footprint and construction impacts of an upstream fish passage facility placed at Sulphur Creek.

RPM BT 2: Minimize negative effects of increased sockeye propagation on bull trout.

RPM BT 3: Minimize harm and harassment of bull trout as a result of research and monitoring, and capture and haul facilities.

RPM BT 4: Minimize unanticipated mortality of bull trout from project operation.

RPM BT 5: Minimize mortality of bull trout originating outside of project area.

Marbled Murrelet

RPM MM 1: Minimize adverse effects on nesting marbled murrelets in occupied marbled murrelet nesting habitat.

RPM MM 2: Minimize adverse effects on nesting marbled murrelets at the peak times of murrelet nest activity.

Northern Spotted Owl

RPM NSO 1: Minimize the effect of disturbance from redevelopment of the Baker Lake Resort on NSOs.

TERMS AND CONDITIONS

In order to be exempt from the prohibitions of section 9 of the ESA, the FERC must comply with the following terms and conditions, which implement the RPM described above. In the event that there are any inconsistencies or discrepancies between these terms and conditions and the FERC's final order approving the applications to amend the licenses, the FERC will comply with the ESA if Puget complies with the terms and conditions in this Incidental Take Statement. These terms and conditions are non-discretionary.

Bull Trout

<u>Implement RPM BT 1 -- Minimize the footprint and construction impacts of an upstream fish passage facility placed at Sulphur Creek.</u>

T&C BT 1.1: Removal of riparian vegetation at Sulphur Creek will be minimized. Areas disturbed during construction and not required for future access or for maintenance and operation will be replanted with native riparian vegetation to minimize the loss of function.

T&C BT 1.2: Concentrate instream work between the July 15 and August 20 part of the anticipated HPA work window to further minimize or avoid construction disturbance to juvenile bull trout outmigrants and return bull trout spawners.

T&C BT 1.3: Fully minimize size of the concrete sill for a weir spanning Sulphur Creek to reduce instream habitat loss to juvenile bull trout.

T&C BT 1.4: Ensure any contaminated water, remaining within the cofferdams after concrete curing, is pumped upland or into "baker tanks" for offsite/upland disposal.

Implement RPM BT 2 -- Minimize negative effects of increased sockeye propagation on bull trout.

T&C BT 2.1:
Consistent with the HERC fund under license Article 602 (Required Funding) and in coordination with the Aquatic Resources Group (ARG), the Licensee shall periodically monitor sockeye use of the upper Baker River mainstem for natural spawning (e.g., after Phase 1 and then again after Phase 2 hatchery improvements have been completed) to determine if there are increases in competitive interactions with bull trout for spawning sites or higher rates of redd superimposition than anticipated. If the ARG or the FWS determine that significant levels of competitive interactions are present, the Licensee shall work with fisheries co-managers to adjust the number of adult sockeye released into Baker Lake, or take other measures, as determined appropriate by the ARG or FWS, to minimize these interactions.

Implement RPM BT 3: Minimize harm and harassment of bull trout as a result of research and monitoring, and capture and handling at fish passage facilities.

T&C BT 3.1: The Licensee must understand and agree to abide by the General Conditions for Native Endangered and Threatened Wildlife Species Permits, 50 CFR Part 13, 50 CFR 17.22 (endangered wildlife) and 50 CFR 17.32 (threatened wildlife), as applicable. In addition, the Licensees must have all other applicable State and Federal permits prior to the commencement of activities authorized by this Incidental Take Statement. The Licensees is authorized to take (harass by survey, capture, handle, and release) bull trout while conducting annual monitoring activities and surveys for the purpose of enhancing bull trout survival, as well as to take bull trout in bull trout passage operations in accordance with the conditions stated below. Permitted activities are restricted to named and unnamed waterbodies in the Baker River watershed, Whatcom, and Skagit Counties.

T&C BT 3.2. The Licensee is responsible for assuring that the individuals conducting research and monitoring or collect and haul operations at fish passage facilities are properly trained and educated, and comply with the following Terms and Conditions. The Licensee shall retain a current list of such people and the list should include the following:

1) The name of each individual.
2) The resume or qualifications statement of each, detailing their experience with each species and type of activity for which they will be conducting.
3) The names and phone numbers of a minimum of two references.

T&C BT 3.3: All capture, handling, and observation methods shall be implemented at times that will avoid temperature stress of bull trout being surveyed, collected, tagged, monitored, or relocated.

T&C BT 3.4: All live bull trout captured shall be released as soon as possible. Any bull trout captured and showing signs of stress or injury should only be released when able to maintain itself. Nurture such individuals in a holding tank until they have recovered. If bull trout are held in a tank, a healthy environment for the stressed bull trout must be provided, and the holding time must be minimized. Water-to-water transfers, the use of shaded, dark containers and supplemental oxygen shall all be considered in designing bull trout handling operations. Any bull trout fry must be held in a separate container from other bull trout (including juvenile bull trout), to avoid predation by larger bull trout during captivity.

T&C BT 3.5: The period of time that captured bull trout are anesthetized shall be minimized. The number of bull trout that are anesthetized at one time shall be no more than what can be processed (biosampled) within several minutes.

T&C BT 3.6: Prior to conducting activities that involve handling of bull trout, the permittee shall ensure that hands are free of sunscreen, lotion, or insect repellent.

T&C BT 3.7: Any electrofishing conducted during the spawning season, typically between August and December, shall only be performed in areas where adult bull trout, that is, those over 305 mm in length, or their redds, have not been observed.

T&C BT 3.8: Electrofishing during spring in bull trout habitat runs the risk of injuring or killing alevins or fry that remain in or near the gravels of redd. If salmonid alevins or fry are seen during spring electrofishing, the activity shall be stopped immediately until identification can be made. If they are determined to be bull trout, electrofishing at the site shall be terminated.

T&C BT 3.9: Artificial lures with a single barbless hook are required for all hook-and-line sampling. The use of bait is prohibited.

T&C BT 3.10: Any tagging studies (i.e., radio, acoustic, pit) shall be approved by the FWS prior to implementation.

T&C BT 3.11: Reports of incidental injury or killing must include the date, time, precise location of the injured animal or carcass, and any other pertinent information such as cause of death or injury. All incidental mortalities shall be preserved in a fashion to best

provide maximum scientific information (otoliths, scales, genetic samples, general fisheries statistics, etc.).

T&C BT 3.12: Any specimen killed shall be kept whole and put on ice or frozen, and a small sample of tissue (a fin clip approximately 1 square centimeter) shall be preserved in a vial of 95 percent ethanol for genetic analysis. Any mortalities that are frozen shall be wrapped directly in aluminum foil to preserve the specimen for future contaminant analysis. The permittee shall supply the depository with a copy of this permit to validate that the specimens were taken pursuant to a permit.

Implement RPM BT 4 – Minimize any unanticipated levels of bull trout mortality from project operation.

T&C BT 4.1(A) (Hydropower Operations): The Licensee shall consult with FWS and the ARG to develop a monitoring strategy that adequately assesses bull trout spawner returns to Baker Lake and Sulphur Creek local populations. This is necessary to confirm that bull trout take anticipated from project operations is not underestimated and will not result in population declines. The monitoring of returns will provide an early indicator of unanticipated levels of mortality potentially attributable to hydropower operations. If such monitoring should reveal an unanticipated decline of the bull trout population, then the Licensee, in coordination with the ARG and FWS, shall determine to what extent hydropower operations are the cause of the decline and whether reinitiation is warranted.

T&C BT 4.1(B) (Flood Control Operations): The ACOE shall consult with the Licensee, FWS and the ARG to develop a monitoring strategy that adequately assesses bull trout spawner returns to Baker Lake and Sulphur Creek local populations. This is necessary to confirm the bull trout take anticipated from project operations is not underestimated and will not result in population declines. The monitoring of returns will provide an early indicator of unanticipated levels of mortality potentially attributable to flood control operations. If such monitoring should reveal an unanticipated decline of the bull trout population, then ACOE, in coordination with the Licensee, the ARG and FWS, shall determine to what extent flood control operations are the cause of the decline and whether reinitiation is warranted.

Implement RPM BT 5 – Minimize mortality of bull trout originating outside of project area.

T&C BT 5.1: In the implementation of the Upstream Fish Passage Implementation Plan required by Article 103, if it is determined by the Licensee, the ARG, or the FWS that the movement of native char from the Skagit River into the Lower Baker adult fish passage facility is detrimental to the local bull trout population, then the Licensee shall, in consultation with FWS and the ARG develop and implement procedures to appropriately minimize the number of individuals originating from local populations outside of the Baker River Basin being passed upstream of Lower Baker Dam.

Marbled Murrelet

Implement RPM MM 1 - Minimize adverse effects on nesting marbled murrelets in occupied marbled murrelet nesting habitat.

> **T&C MM 1:** Article 303 shall be amended by FERC to ensure that the following language is included in the Baker Lake Resort Redevelopment Plan. If FWS, in consultation with USFS, determines that surveys for marbled murrelets are not necessary (T&C MM 1), this requirement may be waived:
>
> "Prior to commencing redevelopment of the Baker Lake Resort (Article 303), the 22.89 acre (9.3 hectares) development site and also within a 55 m (180 ft) border surrounding the development site, surveys for marbled murrelet occupancy will be conducted using current protocols established by the Pacific Seabird Group and adopted by the FWS."

Implement RPM MM 2 - Minimize adverse effects on nesting marbled murrelets at the peak times of marbled murrelet nest activity.

> **T&C MM 2:** Article 303 shall be amended by FERC to ensure that the following language is included in the Baker Lake Resort Redevelopment Plan:
>
> "Activities that are part of the redevelopment of the Baker Lake Resort (Article 303) including building decommissioning, construction activities, road and trail work, campsite and infrastructure development, and vegetation management including overstory thinning will be conducted to minimize effects to nesting marbled murrelets in adjacent stands. During the marbled murrelet breeding season (April 1 through September 15), these activities will only be conducted from 2 hours after sunrise until 2 hours before sunset, within 55 m (180 ft) of occupied or unsurveyed, suitable marbled murrelet habitat."

Northern Spotted Owl

Implement RPM NSO 1: Minimize the effect of disturbance on NSOs for reconstruction of the Baker Lake Resort.

> **T&C NSO 1**: Article 303 shall be amended by FERC to ensure that the following language is included in the Baker Lake Resort Redevelopment Plan:
>
> "Conduct NSO calling surveys for the presence of NSO within a quarter mile of the Baker Lake Resort prior to redevelopment of this site into a campground. If NSO are detected, conduct activities that could cause disturbance outside the nesting season (March 1-July 15)."

The RPMs, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. If, during the course of the action, this level of incidental take is exceeded, such incidental take represents new information requiring reinitiation of consultation and review of the RPM provided. The FERC

must immediately provide an explanation of the causes of the taking and review with the FWS the need for possible modification of the RPM.

The FWS is to be notified within 3 working days upon locating a dead, injured, or sick endangered or threatened species specimen. Initial notification must be made to the nearest U.S. Fish and Wildlife Service Law Enforcement Office. Notification must include the date, time, precise location of the injured animal or carcass, and any other pertinent information. Care should be taken in handling sick or injured specimens to preserve biological materials in the best possible state for later analysis of cause of death, if that occurs. In conjunction with the care of sick or injured endangered or threatened species or preservation of biological materials from a dead animal, the finder has the responsibility to ensure that evidence associated with the specimen is not unnecessarily disturbed. Contact the U.S. Fish and Wildlife Service Law Enforcement Office at (425) 883-8122, or the FWS' Western Washington Fish and Wildlife Office at (360) 753-9440.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the ESA 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, help implement recovery plans, or develop information.

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

The FWS recommends the following additional actions to promote the recovery of federally listed species and their habitats:

Bald Eagle

When planning future work at recreation sites, avoid removal of large overstory trees that could be used by bald eagles for nesting or roosting. Timing for construction should occur outside of the nesting season from January 1 through August 15 in order to avoid disturbing nesting bald eagles.

Bull Trout

Puget should work with the USFS to minimize impacts of future trail construction and campground construction/reconstruction or hardening, thorough minimizing or avoiding the placement of future trails near or across streams used by bull trout; maintaining or restoring adequate vegetative buffer strips to avoid erosion and sedimentation into lakes or streams; and integrating the management of stormwater runoff into the design of campgrounds and other recreational facilities that are likely to include impervious surfaces. Management should be designed to prevent contaminated runoff from reaching lakes or streams.

Consistent with license Article 307 (Upper Baker Visitor Interpretive Services Funding), we recommend that Puget include and maintain most up-to-date information on angling regulations/restrictions for bull trout, and on appropriate handling of incidentally caught bull trout, at visitor information facilities, interpretive services, and information boards. We recommend that Puget develop additional informational materials on bull trout and associated conservation efforts for distribution or display at these facilities.

Marbled Murrelets, Northern Spotted Owls and their Critical Habitat

We recommend surveys be done for NSO or marbled murrelet nest trees or nest tree structures within a quarter mile of any construction project that could cause disturbance to nesting marbled murrelets or NSOs or removal of suitable habitat. Construction work should be done outside of the nesting season and no removal of nest trees should occur.

Wherever thinning of timber or vegetation management occurs, all feasible measures should be undertaken to retain the largest available snags, trees, and down woody debris in order to accelerate development of NSO NRF habitat.

In order for the FWS to be kep informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, the FWS requirest notification of the implementation of any conservation recommendations.

REINITIATION NOTICE

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

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Appendix 1. Baker Project Description and Effects

	Discountable Insignificant Beneficial	LAA - Likely to adversely affect PAA Potential to adversely affect (future projects)		Potential Effects to listed species and critical habitat						
Article	**Name of article**	**Activities**	**Location**	**Bald Eagle**	**Bull trout**	**Marbled murrelet**	**Marbled murrelet CH**	**N. spotted owl**	**N. spotted owl CH**	**Add'l future Sect. 7?**
Project Facilities, Operations, and Flood Control										
107	Flood control	• Continue existing flood control (throughout). • Additional flood control per Corps request (unknown).	Perimeter of reservoirs	Insignif.	LAA	LAA	No effect	LAA	No effect	No, unless Corps requests additional flood control.
Aquatics										
101	Fish Propagation	• Modify Spawning Beach 4 (2008). • Continue enhancement programs (throughout). • Decommission S. B.1, 2, and 3 (2010-2012). • Add new hatchery/adult holding facilities (2007). • Fund nutrient enhancement of Baker Lake (before 2012).	Spawning Beach 4, Baker Lake, Sulphur Creek,	Insignif. Beneficial	LAA Beneficial	Insignif. Discount. Beneficial	No effect	LAA	No effect	No
102	Aquatics Reporting	• Report for all aquatic articles (throughout).	Not applicable	No effect	No effect	No effect	No effect	No Effect	No effect	No
103	Upstream Fish Passage	• Upgrade existing fish trap to state of the art and establish protocols (2009).	Lower Baker	Insignif. Beneficial	LAA Beneficial	Insignif. Beneficial	No effect	No Effect	No effect	No
104	Fish Connectivity between Reservoirs	• Develop studies, facilities, and programs to connect migratory fish between reservoirs (Phase I 2009; Phase II 2012).	U. Baker Dam	Insignif. Beneficial	LAA Beneficial	Insignif. Beneficial	No effect	No Effect	No effect	No
105	Downstream Fish Passage	• Provide juvenile Upper Baker FSC (2008). • Provide Lower Baker FSC (2012). • Develop stress-relief ponds (2009). • Test performance standards (throughout).	Baker Lake, Lake Shannon	Insignif. Beneficial	LAA Beneficial	Insignif. Beneficial	No effect	No Effect	No effect	No

	Discountable Insignificant Beneficial	LAA - Likely to adversely affect PAA Potential to adversely affect (future projects)		**Potential Effects to listed species and critical habitat**						
Article	**Name of article**	**Activities**	**Location**	**Bald Eagle**	**Bull trout**	**Marbled murrelet**	**Marbled murrelet CH**	**N. spotted owl**	**N. spotted owl CH**	**Add'l future Sect. 7?**
106	Flow implementation	• Install new turbines (2012). • Operate per Interim Protection Plan (until 2012). • Operate per rule curve on page 3-36 of FEIS (after 2012).	All facilities and river downstream of dams	Insignif. Beneficial	LAA Beneficial	No effect	No effect	No effect	No effect	No
108	Gravel augmentation	• Track gravel aggradation and augment if necessary (after 2009).	Baker R. below dams	No effect	Discountable	No effect	No effect	No effect	No effect	No
109	Large woody debris	• Develop and implement plan to gather LWD from reservoirs and stockpile for restoration projects (after 2009).	Reservoirs	No effect	Insignif. Beneficial	No effect	No effect	No effect	No effect	No
110	Shoreline erosion	• Develop an Erosion Control Plan and fund treatment of sites (2009).	Baker Lake	PAA	Insignif. Beneficial	PAA Beneficial	Insignif. Beneficial	PAA Beneficial	Insignif. Beneficial	Yes, USFS
Cultural and historic resources										
201	Programmatic agreement	• Implement programmatic agreement (throughout).	Project lands	No effect	No effect	No effect	No effect	No effect	No effect	No
Recreational and aesthetic resources										
301	Recreation Management Report	• Develop plan and report on status of implementation (2010).	N/A	No effect	No effect	No effect	No effect	No effect	No effect	No
302	Aesthetics Management Plan.	• Develop plan and implement. Provide funds to USFS for veg management (2009).	Developed campgrounds, trails, project facilities and viewpoints	PAA	No effect	PAA	PAA	PAA	PAA	Yes, USFS
303	Baker Lake Resort Redevelopment	• Develop plan and fund USFS for implementation (2009).	Westside Baker Lake	Insignif.	PAA	LAA	LAA	LAA	LAA	Yes, USFS, for bull trout
304	Baker Reservoir Recreation Water Safety	• Develop and implement Water Safety Plan (2008).	Horseshoe Cove, Baker Lake Resort	No effect	No effect	No effect	No effect	No effect	No effect	No

	Discountable Insignificant Beneficial	LAA - Likely to adversely affect PAA Potential to adversely affect (future projects)		**Potential Effects to listed species and critical habitat**						
Article	**Name of article**	**Activities**	**Location**	**Bald Eagle**	**Bull trout**	**Marbled murrelet**	**Marbled murrelet CH**	**N. spotted owl**	**N. spotted owl CH**	**Add'l future Sect. 7?**
305	Lower Baker Developed Recreation	• Acquire and maintain boat access/Lake Shannon (2008).	Lake Shannon	PAA	Insignif.	No effect	No effect	No effect	No effect	Yes, Puget/FERC for bald eagles
306	Upper Baker Visitor Information Services	• Fund USFS for visitors info facility (2008).	Baker Lake vicinity	PAA	No effect	PAA	PAA	PAA	PAA	Yes, USFS
307	Upper Baker Visitor Interpretive Services	• Fund USFS interpretive services and preparation of an Interpretive Plan (2008).	Baker Lake vicinity	No effect	Beneficial	No effect	No effect	No effect	No effect	No
308	Managing Dispersed Campsites	• Fund USFS to develop plan and harden 3 to 6 high-priority sites (2008).	Baker Lake, unknown locations	PAA	PAA	PAA	PAA	PAA	PAA	Yes, USFS
309	Bayview Campground Redevelopment	• Fund USFS for reconstruction of Bayview campground (2008).	Westside Baker Lake	PAA	PAA	PAA	PAA	PAA	PAA	Yes, USFS
310	UB Trail and Trailhead Construction	• Fund USFS to develop up to 6 miles of new trails (2011).	Westside Baker Lake	PAA	PAA	PAA	PAA	PAA	PAA	Yes, USFS
311	Lower Baker Trail Construction	• Provide up to 2 miles of trails in the vicinity of the Town of Concrete (2019).	Near town of Concrete	No effect	No effect	No effect	No effect	No effect	No effect	No
312	Developed recreation monitoring	• Develop and implement plan to monitor rec site usage and fund site expansion if occupancy exceeds 60 percent of total available sites (2012).	Around perimeter of Baker Lake	PAA	PAA	PAA	PAA	PAA	PAA	Yes, USFS, if expansion is indicated.
313	Upper Baker Developed Recreation Maintenance	• Fund USFS for operation and maintenance of specified facilities (2008).	Baker lake Developed Sites	Insignif	No effect	PAA	PAA	PAA	PAA	Yes, USFS
314	Upper Baker Trail and Trailhead Maintenance	• Fund USFS for maintenance of trails and trailheads in Baker Lake vicinity (2008).	Existing trails around Baker Lake	Insignif	No effect	PAA	PAA	PAA	PAA	Yes, USFS
315	Lower Baker Trail Maintenance	• Fund maintenance of Lower Baker Trail (2020).	Near town of Concrete	No effect	No effect	No effect	No effect	No effect	No effect	No
316	USFS Road Maintenance and Paving	• Fund USFS for routine maintenance of up to 25 miles of roads and contribute to paving FR 1106 (2007).	Westside of Baker Lake	PAA	PAA	PAA	PAA	PAA	PAA	Maybe, USFS. USFS has consulted on these activities through 2007.
317	Access to Baker Lake	• Assure public access to east side of Baker Lake using FR 1106 across U Baker dam (throughout).	Upper Baker Dam	No effect	No effect	No effect	No effect	No effect	No effect	No

	Discountable Insignificant Beneficial	LAA - Likely to adversely affect PAA Potential to adversely affect (future projects)		**Potential Effects to listed species and critical habitat**						
Article	**Name of article**	**Activities**	**Location**	**Bald Eagle**	**Bull trout**	**Marbled murrelet**	**Marbled murrelet CH**	**N. spotted owl**	**N. spotted owl CH**	**Add'l future Sect. 7?**
318	Law Enforcement	• Fund development and implementation of Law Enforcement Plan (2008).	Baker watershed	No effect	Beneficial	No effect	No effect	No effect	No effect	No
Water quality										
401	Water quality	• Comply with water quality certification (throughout).	Project lands	No effect	Beneficial	No effect	No effect	No effect	No effect	No
Terrestrial Resources										
501	Terrestrial Resource Management Plan	• Develop Terrestrial Resources Management Plan and report annually (2007).	N/A	No effect	No effect	No effect	No effect	No Effect	No effect	No
502	Deciduous Forest Habitat	• Acquire and manage deciduous forest habitat (2007).	Baker watershed or vicinity	Insignif	No effect	PAA Beneficial	PAA Beneficial	PAA Beneficial	PAA Beneficial	Yes, Puget/FERC
503	Elk habitat	• Acquire and manage elk habitat (throughout).	Baker watershed or vicinity	Insignif.	No effect	Insignif. Discount.	Insignif. Discount.	Insignif. Discount.	Insignif. Discount.	No
504	Wetland Habitat	• Acquire and manage wetland habitat (2010 and throughout).	Baker watershed of vicinity	Insignif	No effect	No effect	No effect	No effect	No effect	No
505	Aquatic Riparian Habitat	• Develop Aquatic Riparian Habitat Protection Plan and implement (2009 until complete).	Baker watershed of vicinity	Insignif. Beneficial	PAA Beneficial	PAA Beneficial	PAA Beneficial	PAA Beneficial	PAA Beneficial	Yes, Puget/FERC
506	Osprey Nest Structures	• Provide/maintain 10 artificial nest structures and expand as necessary to support 7 breeding pairs (2007 and throughout).	Lake Shannon	No effect	No effect	No effect	No effect	No effect	No effect	No
507	Loon Floating Nest Platforms	• Install and maintain three to six floating platforms for common loon nesting (2008).	Baker Lake and Lake Shannon	No effect	No effect	No effect	No effect	No effect	No effect	No
508	Noxious Weeds	• Manage project lands for the control of noxious weeds, complying with state and federal regulations (throughout).	Project lands	No effect	No effect	No effect	No effect	No effect	No effect	No
509	Special Status Plants	• Manage plants of special status on existing project lands and specified non-project lands (throughout).	Project lands	No effect	No effect	No effect	No effect	No effect	No effect	No

	Discountable Insignificant Beneficial	LAA - Likely to adversely affect PAA Potential to adversely affect (future projects)		**Potential Effects to listed species and critical habitat**						
Article	**Name of article**	**Activities**	**Location**	**Bald Eagle**	**Bull trout**	**Marbled murrelet**	**Marbled murrelet CH**	**N. spotted owl**	**N. spotted owl CH**	**Add'l future Sect. 7?**
510	*Carax Flava* (yellow sedge)	• Manage for protection of *Carax flava* (yellow sedge) (throughout).	Project lands	No effect	No effect	No effect	No effect	No effect	No effect	No
511	Decaying and Legacy Wood	• Manage snags, logs, and residual live trees on project lands as habitat for decaying and legacy wood-dependent species (throughout).	Project lands	No effect	No effect	Beneficial	Beneficial	Beneficial	Beneficial	No
512	Bald Eagle Night Roost Surveys	• Conduct two surveys for communal night roost for bald eagle near the project (2007-2010 and 2022-2024).	Project lands	Beneficial	No effect	No effect	No effect	No effect	No effect	No
513	Bald Eagle Management Plans	• Develop mgmt plan for each nest and night roost site known on project lands (throughout). • Develop mgmt plan for each nest and night roost site known on acquired lands (throughout).	Project lands	Beneficial	No effect	Beneficial	Beneficial	Beneficial	No effect	No
514	Use of Habitat Evaluation Procedures	• Develop plan to monitor effectiveness of implementation of articles 502–504, 506, 507, and 513 (throughout).	N/A	No effect	No effect	No effect	No effect	No effect	No effect	No
515	Late Seral Forest	• Fund USFS for thinning on 321 acres to improve habitat (2008).	Baker watershed and vicinity	Insignif.	No effect	Beneficial	Beneficial	Insignif. Beneficial	Insignif. Beneficial	No
516	Mountain Goats	• Fund USFS for habitat improvements in mountain hemlock zone for mountain goats (2010).	Baker watershed	No effect	No effect	PAA	PAA	Discount.	Discount.	Yes, USFS
517	Road Closures for Grizzly Bears	• Fund USFS for planning, reviewing, and implementing road closures to benefit grizzly bear recovery (2007).	Baker watershed	Beneficial	No effect	PAA Beneficial	Beneficial	PAA Beneficial	Beneficial	USFS has already consulted on this action
General										
601	Baker River Coordinating Committee	• Create topical subgroups (ARG, TRIG, RRG, and CRAG), conduct decision making, track settlement implementation, and resolve disputes (throughout).	N/A	No effect	No effect	No effect	No effect	No effect	No effect	No
602	Contingency funds	• Create HERC, TERF, RAM and CREF funds for adaptive management needs (2008).	Project lands	No effect	Beneficial	No effect	No effect	No effect	No effect	No
603	Adaptive management	• Consider alternative strategies (throughout).	Project lands	No effect	Beneficial	No effect	No effect	No effect	No effect	No

Appendix 2. Bull trout take. (Location and estimated number of bull trout individuals harassed and harmed by the proposed action's activities during the 50 year license period).

		Operation and Maintenance		Fish Passage and Transport				Construction			Fish Propogation	Research and Monitoring
Location of Take	**Type of Take**	Instream Flows/ Ramping	Reservior Fluctuations	Upstream Passage Improvements	Downstream Passage Improvements	Effects of Spill	Effects of Turbine Passage	Turbidity/ Sediment and Contaminants	Cofferdams and Construction Activity	Channel/Bank/ Shoreline Modification and Riparian Removal	Competition for Spawning Habitat	Disturbance, Capture and Handling, Marking and Tagging
Upper Baker River & Tributaries	mortality		50 redds (1 per year)								37 redds (1 per year)	
	capture and handling											950 juv/subad
	mortality											10 juv
	capture and handling											100 adults
	mortality											1 adults
Channel Creek	injury (sublethal)							2 subadults				
Baker Lake	capture and handling											450 adults
	mortality											2 adult
Baker Lake Tributaries	capture and handling											500 juv/subad
	mortality											5 juv/subad
Upper Baker Dam	capture and handling				1,078 juv/subad							
	mortality				23 juv/subad	19 juv/subad	9 juv/subad					
	capture and handling				1,292 adults							
	mortality				27adults	31 adults	15 adults					
	capture and handling											
Sulphur Creek	capture and handling								1 juvenile			400 juv/subad
	mortality											4 juv/subad
	capture and handling			5,487 adults								100 adults
	mortality			57 adults								1 adult
	disturbance								2 adults			
	injury (sublethal)							2 adults	2 juveniles	juvenile use associated with 1200 ft 2 of stream channel		
Lake Shannon	capture and handling											350 adults
	mortality											2 adults
Lower Baker Dam	mortality				58 juv/subad	77 juv/subad	41 juv/subad					juv/subad
	mortality			14 adults	26 adults	45 adults	22 adults					
	capture and handling				2,911 juv/subad							
	capture and handling			3,014 adults	1,254 adults							
Lower Baker River/ Skagit River	mortality	750 juv/subad										