Carl A. Strock, Brigadier General
Division Engineer, Northwestern Division
U.S. Army Corps of Engineers
P.O. Box 2870
Portland, Oregon 97208

Dear General Strock:

In December 1999, the U.S. Fish and Wildlife Service (Service) received a request from the Bonneville Power Administration, Army Corps of Engineers, and the Bureau of Reclamation (Bureau) (all three agencies are also referred to as the action agencies) for formal consultation under section 7 of the Endangered Species Act on the effects of the Federal Columbia River Power System (FCRPS) on threatened and endangered species and their critical habitat.

In accordance with the implementing regulations under section 7, the Federal action agencies submitted a biological assessment (BA) evaluating the effects of the FCRPS on listed species and critical habitat. In addition to the BA, the action agencies' request included a draft feasibility report/environmental impact statement, executive summary, and 18 technical appendices for the Lower Snake River Juvenile Salmon Migration Feasibility Study (draft FR/EIS). The draft FR/EIS describes four different alternatives for design and operation of the FCRPS for an unspecified duration and does not identify a preferred alternative. The alternatives focus on the design, operation and maintenance of the Lower Snake Project portion of the FCRPS, but effects from proposed changes in flow could occur throughout the Columbia Basin.

Due to on-going analyses and information gathering processes related to the FCRPS, the BA described a proposed action that has uncertainties regarding both the design and operation of facilities in the FCRPS. In lieu of a specific description of the design and operation, the BA indicated that, for the time being, the action agencies will follow the status quo operation, including requirements of existing biological opinions, and use an adaptive management approach for making design, maintenance, and operational changes in the FCRPS based on new information and analyses as they are completed. The action agencies will incorporate new information and analyses into their planning process and, in the future, select an alternative with a specific design for operating the FCRPS in the Final Environmental Impact Statement (FEIS).
In response to the request for consultation, we have prepared a biological opinion. A draft of the biological opinion was distributed to the action agencies on July 27, 2000, and was also available for review by the affected states and tribes. Comments were received by early October, 2000. This final

biological opinion addresses biological information provided in those comments, as well as the results of additional discussions between the Service and the action agencies. We note that the July 27, 2000, draft of the biological opinion suggested a no jeopardy conclusion for Kootenai River white sturgeon. However, the basis of our effects analysis at that time was predicated on ongoing discussions with the action agencies and anticipated outcomes. We have since learned that the action agencies cannot firmly commit to the time frames necessary to avoid a jeopardy conclusion, and our effects analysis has, accordingly, been altered.

Species Not Likely to be Adversely Affected by the FCRPS

We concur with the action agencies' determination contained in the BA that future operation of the FCRPS may affect but is not likely to adversely affect the following threatened or endangered species or species proposed for listing as threatened or endangered:

<u>Mammals</u>	
Endangered	Grizzly bear (*Ursus arctos horribilis*)
Endangered	Gray wolf (*Canis lupus*)
Endangered	Woodland caribou (*Rangifer tarandus caribou*)
Threatened	Canada Lynx (*Lynx canadensis*)
Threatened	Northern Idaho ground squirrel (*Spermophilus brunneus brunneus*)
<u>Plants</u>	
Threatened	*Mirabilis macfarlanei* (Macfarlane's four o'clock)
Threatened	*Howellia aquatilis* (Water howellia)
Threatened	*Spiranthes diluvialis* (Ute's ladies' tresses)
Proposed	*Silene spauldinii* (Spalding's silene)

As discussed in the BA, these species are either not aquatic, or are aquatic but do not occur in the areas directly affected by operation of the FCRPS. Indirect effects are either not likely to occur, or are very minor for the above species, and are not likely to rise to the level of adverse effects, regardless of how the FCRPS is operated.

Species Previously Addressed in Section 7 Consultation on Interrelated Actions

The effects of FCRPS operations on the bald eagle were documented in previous BAs and consultations with the Service. A biological opinion regarding effects on the bald eagle was issued on March 1, 1995. We are not aware of any changes in FCRPS operations that would warrant reinitiation of consultation. Therefore, effects of operations on the bald eagle are not addressed in the attached opinion.

The effects of continued (status quo) operation of Bureau facilities in the Snake River Basin above Hells Canyon Dam were addressed in an October 15, 1999, biological opinion issued by the Service.

Included in the consultation were the following species, which occur only above Hells Canyon Dam:

<u>Invertebrates</u>	
Endangered	Utah valvata snail (*Valvata utahensis*)
Endangered	Snake River physa snail (*Physa natricina*)
Threatened	Bliss Rapids snail (*Taylorconcha serpenticola*)
Endangered	Idaho springsnail (*Pyrgulopsis idahoensis)*
Endangered	Banbury spring lanx (*Lanx sp.)*
Endangered	Bruneau hotspring snail (*Pyrgulopsis bruneauensis*)

In the October 15, 1999, biological opinion, we also analyzed the effects of continued (status quo) operation of Bureau facilities upstream of Hells Canyon Dam on the Columbia River distinct population segment of the bull trout (*Salvelinus confluentus*).

We and the Bureau will revisit the analysis of effects of the FCRPS on the above species, including the bull trout in that area, if an alternative for operation of Bureau facilities upstream of Hells Canyon Dam is selected that would alter the results of the analysis contained in our October 15, 1999, biological opinion.

Species Addressed in This Consultation

The attached biological opinion analyzes the effects of the larger action of the FCRPS on the bull trout in areas downstream of Hells Canyon Dam and in the Upper Columbia River Basin. The opinion also analyzes the effects of FCRPS operations on listed Kootenai River white sturgeon.

We look forward to working in continued cooperation with the action agencies as you implement FCRPS operations, alternative flood control and storage strategies, and the requirements of this opinion.

Sincerely,

Regional Director

Attachments:
Biological Opinion
Distribution List

Distribution List for Biological Opinion:

William McDonald, Regional Director
Bureau of Reclamation
Pacific Northwest Regional Office

Steve Wright, Acting Administrator
Bonneville Power Administration

Donna Darm, Acting Regional Director
National Marine Fisheries Service

The Honorable Dirk Kempthorne
Governor of Idaho

The Honorable John Kitzhaber, M.D.
Governor of Oregon

The Honorable Marc Racicot
Governor of Montana

The Honorable Gary Locke
Governor of Washington

Burns Paiute Tribe
Wanda Johnson, Chair
Haas St. Martin, Fisheries

Columbia River InterTribal Fish Commission
Donald Sampson, Executive Director

Confederated Tribes of the Colville Reservation
Colleen Cawston, Chair

Coeur d'Alene Indian Tribe
Ernest Stensgar, Chair

Kootenai Indian Tribe
Velma Bahe, Chair

Kalispel Indian Tribe
Glen Nenema, Chair

Nez Perce Tribe
Samuel Penney, Chair
Confederated Salish and Kootenai Tribes
Fred Matt, Chair

Shoshone-Bannock Tribe
Lionel Boyer, Chair

Shoshone-Paiute Tribe
Marvin Cota, Chair

Spokane Tribe of Indians
Alfred Peone, Chair

Confederated Tribes of the Umatilla Indian Reservation
Antone Minthorn, Chair

Confederated Tribes of the Warm Springs Reservation
Olney Patt, Jr., Chair

Yakama Nation
Lonnie Selam, Sr., Chair

BIOLOGICAL OPINION

Effects to Listed Species from Operations of the
Federal Columbia River Power System

Action Agencies

Army Corps of Engineers
Bonneville Power Administration
Bureau of Reclamation

Consultation Conducted
by
U.S. Fish and Wildlife Service (Regions 1 and 6)

December 20, 2000

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BIOLOGICAL OPINION

1. Introduction

The U.S. Fish and Wildlife Service (Service) has reviewed the biological assessment (BA) and National Environmental Policy Act (NEPA) documents dated December, 1999 submitted by the Bonneville Power Administration (BPA), Corps of Engineers (Corps), and the Bureau of Reclamation (Bureau) (also referred to as action agencies) regarding operations of the Federal Columbia River Power System (FCRPS). The action agencies' request for formal consultation was received in December, 1999. This document represents the Service's biological opinion of the effects of the proposed action on two listed fish species: the endangered Kootenai River white sturgeon (*Acipenser transmontanus*); and the threatened bull trout (*Salvelinus confluentus*).

This biological opinion is based on information provided in the documents noted above, numerous telephone conversations, meetings and other sources of information. A complete administrative record of this consultation is on file at the following Service offices: Upper Columbia Fish and Wildlife Office, Spokane; Montana Field Office, Helena; Columbia River Fisheries Program Office, Vancouver; and the Idaho Fishery Resource Office, Orofino.

2. Consultation History

Several consultation documents (biological opinions and conference opinions) regarding the FCRPS operations have already been issued by the Service. Species addressed through formal consultation include: Kootenai River white sturgeon; Snake River snails, including, Idaho spring snail, Snake River physa, Utah valvata snail, Bliss Rapids snail; and bald eagles. In addition, to date, the Service has also concurred with the action agencies' determination that FCRPS operations were not likely to adversely affect gray wolf (*Canis lupus*), grizzly bear (*Ursus arctos*), peregrine falcon (*Falco peregrinus*), or any listed plants. Since initial consultations were completed, peregrine falcon has been de-listed by the Service.

More specifically, the following documents relate to FCRPS section 7 consultation:

November 22, 1993 - The Service issued its biological opinion on the 1993 Salmon Flow Augmentation from the Payette, Boise, and Upper Basin Reservoir Storage Snake River.

December 2, 1993 - Action agencies provided their Biological Assessment (BA) of the effects of the proposed 1994-1998 FCRPS operations.

July 27, 1994 - The Service issued its biological opinion of the effects of the 1994-1998 FCRPS operations on the Lake Roosevelt bald eagle population.

July 27, 1994 - The Service issued its biological opinion for Snake River snails, and conference opinion for Kootenai River white sturgeon on the effects of the FCRPS operations.
December 15, 1994 - the Corps, BPA, and the Bureau requested reinitiation of formal consultation on, and submitted a supplemental BA of the effects of the FCRPS operations on threatened and endangered species. At the time endangered and threatened species included: Idaho spring snail, Snake River physa, Utah valvata snail, Bliss Rapids snail, and the Kootenai River white sturgeon.

March 1, 1995 - The Service issued its biological opinion of the effects of the FCRPS on listed species. Effects to bald eagles were addressed in that opinion. Since FCRPS operations will not change in such a way to substantially alter the effects or conclusions of that opinion, bald eagles will not be considered further in this current document.

> [Note: At this point, the Bureau requested that its operations upstream of Lower Granite Dam be addressed separately from the rest of the FCRPS. This separation relates in part to the portion of augmentation flows for salmon that originate from the area upstream of Lower Granite Dam.]

April, 1998 - The Bureau submitted a consultation request and BA of the effects of Bureau Operations and Maintenance in the Snake River Basin above, but not including, Lower Granite Reservoir.

June 17, 1999 - The three action agencies submitted a draft BA of the effects of FCRPS project operations on bull trout and Kootenai River white sturgeon for Service review. The BA addressed FCRPS project operations on the Columbia River and on the Snake River, downstream of and including Lower Granite Dam.

August 20, 1999 - The Service's Upper Columbia River Basin Office in Spokane, Washington requested additional information from the action agencies relating to the June 17, 1999 BA on FCRPS project operations on the Columbia River and on the Snake River, downstream of and including Lower Granite Dam.

October 15, 1999 - The Service issued a biological opinion of the effects of the Bureau Operations and Maintenance in the Snake River Basin above, but not including, Lower Granite Reservoir on threatened and endangered species. Since there are no changes proposed to these operations at this time, this opinion, with its analysis and requirements, will remain in effect. If changes to operations of Bureau facilities in this area are proposed, the Service and the Bureau will meet to discuss the need to reinitiate consultation.

December 15, 1999 - The Corps submitted additional information in response to the Service's August 20, 1999 request.

February 2000 - The Corps and Bureau submitted additional information relating to the Service's

August 20, 1999 request.

December 19, 2000 – The action agencies submitted a letter to the Service clarifying FCRPS operations

Throughout the consultation period, numerous meetings and discussions were held between the Service and the action agencies. The discussions led to agreement between the Service and the action agencies on further modification of FCRPS operations to address adverse impacts and potential take of listed species, outlined in the December 19, 2000 letter.

During the consultation, the Service participated in a series of meetings of state and Tribal representatives that began on February 2, 2000. The Service also briefed representatives of the Northwest Power Planning Council (NWPCC) and engaged in subsequent discussions with NWPPC memebers. During those meetings, the representatives commented on technical elements of the proposed action and the Service consultation approach. In addition, the effected states and tribes had the opportunity to review and provide biological input to the draft biological opinion. The draft document was provided to them on July 27, 2000. Comments were received by early October, 2000, and were considered in developing the final biological opinion.

3. Description of the Proposed Action

The proposed action is the future operation and maintenance of the projects comprising the FCRPS. This consultation will focus on the operation and maintenance of these FCRPS project facilities: Bonneville, The Dalles, John Day, and McNary Dams (Lower Columbia River facilities); Ice Harbor, Lower Monumental, Little Goose, Lower Granite, and Dworshak Dams (Lower Snake River/Clearwater River facilities); Grand Coulee, Albeni Falls, Libby, Hungry Horse and Chief Joseph Dams, and Banks Lake Pump Storage (Upper Columbia River facilities).
The December, 1999 BA focused mainly on the facilities listed above. Other Columbia Basin Section 7 consultations have been addressed separately, including the Yakima River Basin, Willamette River Basin, Umatilla River Basin, and Snake River upstream of Lower Granite reservoir. Of these, only the Biological Opinion on the Snake River upstream of Lower Granite reservoir has been completed. These consultations are not addressed further in this opinion.

The projects and affected action areas are located in Oregon, Washington, Idaho, Montana and Canada. As noted in the June, 1999 BA, every year the regulation of the FCRPS is unique in the details, but similar in seasonal characteristics. The storage projects (Libby, Hungry Horse, Dworshak, Grand Coulee and Albeni Falls dams) draft in the winter and make space available to capture spring runoff so that flooding is minimized. The run-of-river projects (Chief Joseph, McNary, The Dalles, Bonneville, Lower Granite, Lower Monumental, Little Goose, and Ice Harbor dams) operate within a small elevation range by essentially passing inflow. John Day Dam is somewhat of a hybrid, storing water when necessary to limit flooding on the lower Columbia River, but mostly operating within a limited elevation range like a run-of-river project. Winter snow begins to melt in April, and storage reservoirs begin to refill while attempting to meet downstream flow objectives established through consultation under the ESA.

Past Biological Opinions from the Service for sturgeon, and from the NMFS for anadromous fish, outlined various flow regimes and operational guidelines necessary to avoid jeopardy to those species. Reservoir operations are guided by recommendations of the Technical Management Team (TMT) consisting of representatives from the federal operating agencies as well as other federal, state, and tribal fisheries experts. By mid-summer the storage reservoirs fill to their highest elevations. The storage reservoirs are then drafted again in July and August to meet summer fisheries objectives in the Snake and lower Columbia Rivers. In past years, operations for listed aquatic species were generally completed by September. Then the storage reservoirs again began seasonal drafts to prepare for the next flood season.

The proposed action is also described in the draft FR/EIS. In brief, the draft FR/EIS, included by reference in the December 1999 BA, includes four alternatives for the long term operation and maintenance of FCRPS facilities. The FR/EIS describes proposed structural changes for only the four lowest dams on the Snake River: Ice Harbor, Lower Monumental, Little Goose and Lower Granite. The focus is on anadromous fish passage, with only indirect reference to resident fish species. The description of alternatives, "Existing Conditions", "Maximum Transport of Juvenile Salmon", and "Major System Improvements" are similar in that these three alternatives include proposed modifications addressed in the National Marine Fisheries Service (NMFS) and Service's 1995 and 1998 biological opinions concerning Kootenai River white sturgeon and threatened and endangered anadromous fishes, respectively. Flow augmentation changes may have ramifications for operation of the other FCRPS facilities as well.

A fourth alternative described in the FCRPS, "Dam Breaching" or "Natural River Drawdown" is different from the other alternatives. The main feature of this alternative is to reconfigure the earthen embankments of the 4 lowest dams on the Snake River such that flows bypass the Ice Harbor, Lower Monumental, Little Goose, and Lower Granite dams. This opinion does not analyze the effects of this action on listed species. If a decision is made to select this alternative, consultation will be conducted at that time.

As their names suggest, the three "non-breaching" alternatives focus on different aspects of the existing configuration, but in general address different aspects of the same suite of features of structural modifications for the four lowest dams on the Snake River: Ice Harbor, Lower Monumental, Little Goose and Lower Granite; and potential flow alterations that may occur throughout the Columbia Basin. Elements of these alternatives are a combination of:

a) Structural Modifications - each of the three alternatives includes several modifications, such as, End Bay Deflectors/Pier Extensions;

b) Operational Elements - each of the three alternatives would address spill and flow augmentation, and transport of juvenile salmon; and

c) Miscellaneous Elements - each of the three alternatives includes items such as recreation and hatchery programs.

The three alternatives will be analyzed together in this biological opinion because they have similar features and would have similar effects on bull trout, and Kootenai River white sturgeon.

Through this consultation, numerous meetings and discussions have taken place between the action agencies and the Service. In those discussions, further clarification of, and modification to, FCRPS operations have taken place. As a consequence, on December 19, 2000, the action agencies sent a letter to the Service clarifying those operations (Corps, 2000c). Those clarifications are discussed under the specific facility descriptions below.

3.A. Upper Columbia River

Specific descriptions of individual projects and their proposed operations, as addressed later in this document, are briefly provided in the following sections.

3.A.1 Hungry Horse Dam

Hungry Horse Dam power peaking and other power operations as described in the Biological Assessment will be continued as they have been conducted in the past. The proposed action provides a year-round minimum flow from Hungry Horse Dam of 145 cfs, and does not incorporate ramping rates to moderate rates of flow change, except as noted below for recreation purposes. Ramping rates are applied to the action to allow discharge change to be spanned over a 6 hour period as mitigation for recreation uses. The proposed action would continue to augment mainstem Flathead River flows from Hungry Horse Dam to provide a minimum flow of 3,500 cfs in the mainstem. These power operations can occur year-round; when conducted monthly in 1999 (USGS gage records), they resulted in dam discharges varying from 145 to 14,000 cfs. The action described in the Biological Assessment would allow these flow fluctuations (no ramping rates observed) on an unrestricted basis for power production. The proposed action also provides for the occurrence, primarily during the summer season, of an estimated 20 to 40 “voltage stability events” during which dam discharges may change very quickly from 145 to 6,000 cfs or more, and then quickly return to the previous low flow. Any proposed ramping rates may be violated during these “emergency” operations. Examples of the extreme dam discharge changes and downstream river flow and gage height changes that have occurred as a result of such operations took place on August 10, 1997 and December 8, 1998. On August 10, 1997, Hungry Horse discharge rose from 145 cfs to 11,000 cfs, causing the downstream mainstem Flathead River to change from 4,500 cfs to 14,500 cfs in about 6 hours, and resulting in a gage height rise of 3 ½ feet (USGS gage records). On December 8, 1998, Hungry Horse Dam discharge rose from 2,000 cfs to 8,000 cfs, causing the downstream mainstem Flathead River to change from 3,500 cfs to 9,500 cfs in 3 hours, and resulting in a gage height rise of 2 ½ feet. A few hours later, the flows and gage height dropped to the previous level over a 3 hour span (USGS gage records).

Following the spring run-off event (May-June), the proposed action is to provide juvenile migration augmentation water from Hungry Horse Reservoir for salmon in the Lower Columbia River in late July and August. Between these two higher water events in the mainstem Flathead River, there occurs a period of several months when releases from Hungry Horse Dam can be at low flow (initial proposed action was for minimum flow of 145 cfs), depending on the water runoff forecast.

Since the proposed action was initially described in the Biological Assessment, numerous meetings and discussions have taken place between the action agencies and the Service. In those discussions, further clarification of, and modification to, operations at Hungry Horse Dam have taken place. As a consequence, on December 19, 2000, the action agencies sent a letter to the Service clarifying those operations (Corps, 2000c). The letter is included as appendix A, and those operations are described here.

In their letter the action agencies make the following commitments:

<u>VARQ Implementation:</u>

The action agencies will implement VARQ at Hungry Horse starting in the water year that begins October 1, 2000. If VARQ can not be implemented during this water year, the action agencies will re-initiate consultation with the Service to determine necessary operations in the absence of VARQ.

<u>Minimum Flows:</u>

The action agencies will adopt a sliding scale for minimum flows in the South Fork of the Flathead and in the mainstem Flathead Rivers, as measured at the Columbia Falls gage.

At Hungry Horse:

The minimum flow, measured at the USGS gauge below Hungry Horse Dam, will be determined monthly starting with the January forecast, with final flows based on the March final runoff forecast for Hungry Horse Reservoir for the period of April 1 to August 31.

- April through August forecast is > 1,790 thousand acre feet (KAF) then the minimum flow is 900 cfs.

- April through August forecast is < 1,190 KAF then the minimum flow is 400 cfs.

- April through August forecast is between 1,190 and 1,790 KAF, then the minimum flow will be linearly interpolated between 400 and 900 cfs.

- The minimum flow in the South Fork can be lowered to 145 cfs when the river reaches flood stage at Columbia Falls (13 feet).

At Columbia Falls:

The minimum flow measured at the USGS gauge at Columbia Falls will be determined monthly starting with the January forecast, with final flows based on the March final runoff forecast for Hungry Horse Reservoir for the period of April 1 to August 31.

- April through August Forecast is > 1,790 KAF then the minimum flow is 3,500 cfs.

- April through August Forecast is < 1,190 KAF then the minimum flow is 3,200 cfs.

- April through August Forecast is between 1,190 and 1,790 KAF, the minimum flow will be linearly interpolated between 3,200 and 3,500 cfs.

The action agencies will work with the Service and National Marine Fisheries Service(NMFS) to reduce and minimize the second peak for salmon operations. Reduction of the second peak can be achieved by starting discharges of salmon augmentation water when flood control operations are completed and setting releases so that flows at Columbia Falls follow a more normal recession hydrograph, and all augmentation water is released by August 31.

Ramp Rates:

The action agencies will adopt the following ramp rates at Hungry Horse Dam:

Note: The recommended ramp rates will be followed except if the recommended ramp rate causes a unit(s) to operate in the rough zone, a zone of chaotic flow in which all parts of a unit are subject to increased vibration and cavitation that could result in premature wear or failure of the units. In this case the project will utilize a ramp rate which allows all units to operate outside the rough zone. The action agencies will provide additional information to the Service describing operations outside the "rough zone."

Note: The following daily flows (not averages) are restricted by the hourly rates shown in the following tabes.

Table 1. Daily and hourly maximum ramp up rates for Hungry Horse Dam
(as measured by daily flows, not daily averages, restricted by hourly rates).

Ramp Up Rates - Hungry Horse Dam		
Flow Range (measured at Columbia Falls)	**Ramp Up Unit (Daily Max)**	**Ramp Up Unit (Hourly max)**
3,500 - 6,000 cfs	Limit ramp up 1,800 cfs per day	1,000 cfs/hour
> 6,000 - 8,000 cfs	Limit ramp up 1,800 cfs per day	1,000 cfs/hour
> 8,000 - 10,000 cfs	Limit ramp up 3,600 cfs per day	1,800 cfs/hour
> 10,000 cfs	No limit	1,800 cfs/hour

Table 2. Daily and hourly maximum ramp down rates for Hungry Horse Dam (as measured by daily flows, not daily averages, restricted by hourly rates).

Ramp Down Rates - Hungry Horse Dam		
Flow Range (measured at Columbia Falls)	**Ramp Down Unit (Daily max)**	**Ramp Down Unit (Hourly max)**
3,500 - 6,000 cfs	Limit ramp down to 600 cfs per day	600 cfs/hour
> 6,000 - 8,000 cfs	Limit ramp down to 1,000 cfs per day	600 cfs/hour
> 8,000 - 12,000 cfs	Limit ramp down to 2,000 cfs per day	1,000 cfs/hour
> 12,000 cfs	Limit ramp down to 5,000 cfs per day	1,800 cfs/hour

Daily and hourly ramping rates may be exceeded during flood emergencies to protect health and public safety and in association with power or transmission emergencies.

Variances to ramping rates during years where runoff forecasting or storage shortfalls occur, or variances are necessary to provide augmentation water for other listed species, will be negotiated through the TMT process. This is expected in only the lowest 20th percentile water years.

The feasibility of these ramp rates will be explored through the agreed upon ramping rate studies, as outlined below:

- The action agencies, in consultation with the Service, will develop and initiate a site-specific 10-year ramping rate study beginning in 2001. The first two-year phase of the study (2001-2002) will evaluate the ramping rates described in this letter and include specifically an assessment of the effectiveness of those ramping rates on improving some aspects of the physical habitat for bull trout in the Flathead River downstream from Hungry Horse Dam. The first phase of the study will also document and quantify selected biological parameters in the affected area, for example the benthic macroinvertebrate food base of bull trout prey, in the Flathead River downstream from Hungry Horse Dam, to establish a biological baseline. The action agencies will provide information to the Service annually summarizing the previous year's ramping rate operation. Within six months following completion of the first phase of the study, the action agencies will submit to the Service a report with analysis and recommendations. If the scientific analysis of the first phase of the study suggests that ramping rates other than those described in this letter should be investigated, the action agencies will submit proposed revisions in ramping rates to the Service for approval to evaluate for effectiveness in improving physical habitat for bull trout.

- The second phase of the 10-year study beginning in 2003 will focus on the biological response in the affected river zone to the ramping rates described in this letter. The second phase of the study will document and quantify selected biological parameters and compare them to the biological baseline established in the first phase of the study. If revised ramping rates are investigated, the second phase of the study will include an assessment of the effectiveness of those ramping rates on improving aspects of physical habitat for bull trout in the South Fork Flathead River downstream from Hungry Horse Dam. In either case, the biological response to ramping rates will be quantified and documented. At the end of the 10-year ramping rate study, the action agencies will submit to the Service a report with analysis and recommendations, incorporating the results of the biological response phase of the study and the effects of various ramping rates on the physical habitat of bull trout. The action agencies will operate consistent with the ramping rates described in this letter, or as they may be revised through agreement with the Service.

Emergency Situations:

To ensure the reliability of power supply and transmission service, the annual plans will be provided which will allow power system operators limited exceptions to providing the flow, spill, and project operations measures specified in this proposal. An emergency may be declared by the power system operators when a circumstance exists that threatens firm loads or voltage and transmission stability. Communication and response to emergency situations will be handled in accordance with the September 22, 2000, "Protocols for Emergency Operations in Response to Generation or Transmission Emergencies" or as revised. In the event that Federal project operators or the Regional Forum consider the power emergency to be of either exceptional magnitude or extended duration, the emergency may be elevated by one of these entities to the regional agency executives directors, for discussion and consideration of appropriate actions. Curtailing fish and wildlife operations should be viewed as a last resort action and should not be used in lieu of maintaining an adequate and reliable power system. If curtailments to fish and wildlife operations exceed this standard, the power system should be reevaluated and upgraded to the extent needed to meet the standard.

It should be understood that the emergency concept includes taking actions to prevent realization of pending emergency situations. Interruptions or adjustments in water management actions may also occur due to unforeseeable flood control of or other emergencies. The action agencies would view these actions similarly to the power emergencies as noted above and respond accordingly.

Transmission Stability at Hungry Horse:

By February 1, 2002, and February 1, 2003, the BPA will submit to Service an annual report describing the frequency and duration of flow changes at Hungry Horse Dam needed to provide voltage stability.

The action agencies, in consultation with the Service, will develop a study investigating the costs and feasibility of options that will preclude the use of Hungry Horse Dam, as currently proposed, to ensure voltage stability to the Flathead Valley. The study would consider, among other options, construction of an additional transmission line(s), as well as consideration of whether the presence of a re-regulation dam downstream from Hungry Horse would affect voltage stability in the Flathead Valley.

The action agencies will complete these studies on transmission stability, except for consideration of the re-regulation dam, within three years after the final Service BO. The action agencies will initiate a feasibility study of the re-regulation dam if the studies show that a re-regulation dam is necessary, and if Congress appropriates funds for this purpose. In the latter case, a feasibility report with recommendations will be completed within four years of study initiation.

3.A.2 Libby Dam

The proposed action as described in the Biological Assessment and supplemental information (December 1999, April 2000) is to continue power and flood control operations as they have occurred in the past. The current proposal includes operational guidelines for a 4,000 cubic feet per second (cfs) minimum flow from Libby Dam, and existing ramping rate constraints as documented in the Operating Manual. In brief, the Biological Assessment critically proposed current operations for all projects except Libby. The Biological Assessment proposed new ramping restrictions for Libby dam as summarized in Table 3.

Table 3. Proposed ramping restrictions for Libby Dam (from Biological Assessment).

Previous Day Average Outflow	**Daily Ramping Rate UP**	**Daily Ramping Rate DOWN**
15,000 cfs or more	April: 1 foot/hour No more than 6 feet/24 hour May – Aug: 1 foot/hour No more than 4 feet/24 hour	Lesser of: a 5,000 cfs reduction or 12,000 cfs outflow
10,000 - 15,000 cfs		Lesser of: a 3,000 cfs reduction or 9,000 cfs outflow
Below 10,000 cfs		1,000 cfs reduction
Hourly Changes: Either up or down, no more than a 1 foot tailwater change per hour April-August: No daily power peaking. If day average outflow is above 10,000 cfs, weekly shaping is allowed		

These operations permit rapid fluctuations in dam discharge that frequently result in daily fluctuations in river discharge between 4,000 and 20,000 cfs (Hauer and Stanford, 1997). An example of allowable dam discharges under the proposed action was provided by hourly outflow data for the Libby Project (Henriksen, 1999, pers. comm.). That data showed, during one day of winter peaking operation in 1998, river flows changed from 4,000 to 26,000 cfs in a 4 hour period, followed 12 hours later by a flow decrease from 26,000 to 10,000 cfs in a 3 hour period. The proposed action would allow such events to occur at a frequency of from 4 to 20 days per winter period at Libby Dam. The proposed action also provides for the occurrence of an estimated 20 to 40 "transmission reliability situations" during which dam discharges may change quickly from 4,000 cfs to much higher flows (26,000 cfs), and then quickly return to the previous low flow (no ramping rates would be required during these events).

The proposed action provides spawning augmentation flows for Kootenai River white sturgeon in the Kootenai River from Koocanusa Reservoir in June of most years, and provides juvenile migration augmentation water for salmon in the Lower Columbia River in late July and August. Between these two higher water augmentation events there occurs a period (of about a month) when releases from Libby Dam will be at low flow. The proposed action designates a minimum flow of 4,000 cfs.

Since the proposed action was initially described in the Biological Assessment, numerous meetings and discussions have taken place between the action agencies and the Service. In those discussions, further clarification of, and modification to, operations at Libby Dam have taken place. As a consequence, on December 19, 2000, the action agencies sent a letter to the Service clarifying those operations (Corps, 2000c). The letter is included as appendix A, and those operations are described here.

In their letter the action agencies make the following commitments:

<u>Additional Flow Capacity for Sturgeon</u>

1. The action agencies will, in consultation with the Service, conduct a spill test by July 2001, which will be designed to evaluate dissolved gas concentrations and mixing downstream from Libby Dam. The action agencies will evaluate spillway maintenance needs associated with spilling water more frequently than under operations of the past 15 years. The action agencies will determine the channel capacity downstream from Libby Dam. The action agencies will submit the results of the spill test, spillway evaluation and channel capacity study with recommendations for any changes to the Service by December 30, 2001. These recommendations may include specific ideas concerning a formal planning study, if appropriate.

2. By 2002, the action agencies will implement any recommendation of the spill test, spillway evaluation and channel capacity study. If 5,000 cfs cannot be routinely passed over the spillway without water quality impacts, and if channel capacity allows for it, BPA will fund the Corps to prepare a report on alternatives to increase the capacity of releases from Libby for sturgeon flows. Alternatives for consideration include modifications to the spillway and

installation of an additional turbine at Libby Dam to increase probability of storage for sturgeon augmentation flows and reduce the risk of spill and harm through dissolved gas supersaturation to bull trout. The report will be completed by 2003 and include appropriate NEPA documentation. If the findings of the report recommended additional action, the action agencies will seek funding utilizing the report as the justification for such action, with an implementation goal of spring 2004 or as soon as possible thereafter. By spring 2007, the action agencies will seek means and provide an additional 5,000 cfs of release capacity at Libby Dam. If either of the two 5,000 cfs increased release increments is determined to be achievable, the action agencies will reinitiate consultation with the Service.

3. Following implementation of the proposed action recommendations identified above in paragraph b., the action agencies will seek funding to conduct biological studies, in consultation with the Service, to determine the effectiveness of the additional flow capacity in improving conditions for sturgeon and in protecting resident bull trout downstream from the dam from potentially harmful effects of dissolved gas supersaturation.

<u>VARQ Implementation:</u>

The action agencies will complete appropriate NEPA compliance and coordination with Canada to implement VARQ at Libby as soon as possible but no later than October 2002. If VARQ is not implemented until October 2002, the action agencies will reinitiate consultation with the Service to determine necessary operations in absence of VARQ. By February 2001, the Corps will develop a schedule to complete all disclosures, NEPA compliance, and Canadian coordination necessary to implement VARQ flood control at Libby.

<u>Minimum Flows</u>:

The action agencies will adopt the following minimum flows from Libby Dam (measured at USGS Gauge on the Kootenai River below Libby Dam):

- Year-round instantaneous minimum flow of 4,000 cfs (already in the proposed action).

- Minimum flows between white sturgeon flows and salmon augmentation flows are shown in Table 4 using traditional flood control at Libby, and in Table 5 using VARQ flood control at Libby.

- The action agencies will work with the Service and National Marine Fisheries Service (NMFS) to reduce and minimize the second peak for salmon operations.

<u>Ramp Rates</u>:

The action agencies will adopt the following ramp rates at Libby Dam:

Note: The recommended ramp rates will be followed except if the recommended ramp rate causes a unit(s) to operate in the rough zone, a zone of chaotic flow in which all parts of a unit are subject to increased vibration and cavitation that could result in premature wear or failure of the units. In this case the project will utilize a ramp rate which allows all units to operate outside the rough zone.   The action agencies will provide additional information to the Service describing operations outside the "rough zone."

Note: The following are daily flow changes (not averages) and are restricted by the hourly rates shown in the following tables.

Table 4. Daily and hourly maximum ramp up rates for Libby Dam
(as measured by daily flows, not daily averages, restricted by hourly rates).

Ramp Up Rates - Libby Dam			
Flow Range	**Ramp Up Unit (Daily max)**	**Ramp Up (Hourly max) 1 Oct – 30 Apr**	**Ramp Up (Hourly max) 1 May – 30 Sep**
4,000 - 6,000 cfs	Limit ramp up to one unit per day (approx 5,000 cfs per day)	2,000 cfs/hr	1,000 cfs/hr
6,000 - 9,000 cfs	Limit ramp up to one unit per day (approx 5,000 cfs per day)	2,000 cfs/hr	1,000 cfs/hr
> 9,000 - 17,000 cfs	Limit ramp up to one unit per day (approx 10,000 cfs per day)	3,500 cfs/hr	2,000 cfs/hr
> 17,000 cfs	No limit	7,000 cfs/hr	3,500 cfs/hr

Table 5. Daily and hourly maximum ramp down rates for Libby Dam
(as measured by daily flows, not daily averages, restricted by hourly rates).

Ramp Down Rates - Libby Dam			
Flow Range	**Ramp Down Unit (Daily Max)**	**Ramp Down (Hourly max) 1 Oct – 30 Apr**	**Ramp Down (Hourly max) 1 May – 30 Sep**
4,000 - 6,000 cfs	Limit ramp down to 500 cfs per day	500 cfs/hr	500 cfs/hr
> 6,000 - 9,000 cfs	Limit ramp down to 1,000 cfs per day	500 cfs/hr	500 cfs/hr
> 9,000 - 17,000 cfs	Limit ramp down to 2,000 cfs per day	1,000 cfs/hr	1,000 cfs/hr
> 17,000 cfs	Limit ramp down to one unit per	5,000 cfs/hr	3,500 cfs/hr

Flow Range	Ramp Down Unit (Daily Max)	Ramp Down (Hourly max) 1 Oct – 30 Apr	Ramp Down (Hourly max) 1 May – 30 Sep
	day (approx 5,000 cfs per day)		

Daily and hourly ramping rates may be exceeded during flood emergencies to protect health and public safety and in association with power or transmission emergencies.

Variances to ramping rates during years where runoff forecasting or shortage shortfalls occur, or variances are necessary to provide augmentation water for other listed species, will be negotiated through the TMT process. This is expected in only the lowest 20th percentile water years.

The feasibility of these ramp rates will be explored through the agreed upon ramping rate studies.

- The action agencies, in consultation with the Service, will develop and initiate a site-specific 10-year ramping rate study beginning in 2001. The first two-year phase of the study (2001-2002) will evaluate the ramping rates described in this letter and include specifically an assessment of the effectiveness of those ramping rates on improving some aspects of the physical habitat for bull trout in the Kootenai River downstream from Libby Dam. The first phase of the study will also document and quantify selected biological parameters in the affected area, for example the benthic macroinvertebrate food base of bull trout prey, in the Kootenai River downstream from Libby Dam, to establish a biological baseline. The action agencies will provide information to the Service annually summarizing the previous year's ramping rate operation. Within six months following completion of the first phase of the study, the action agencies will submit to the Service a report with analysis and recommendations. If the scientific analysis of the first phase of the study suggests that ramping rates other than those described in this letter should be investigated, the action agencies will submit proposed revisions in ramping rates to the Service for approval to evaluate for effectiveness in improving physical habitat for bull trout.

- The second phase of the 10-year study beginning in 2003 will focus on the biological response in the affected river zone to the ramping rates described in this letter. The second phase of the study will document and quantify selected biological parameters and compare them to the biological baseline established in the first phase of the study. If revised ramping rates are investigated, the second phase of the study will include an assessment of the effectiveness of those ramping rates on improving aspects of physical habitat for bull trout in the Kootenai River downstream from Libby Dam. In either case, the biological response to ramping rates will be quantified and documented. At the end of the 10-year ramping rate study, the action agencies will submit to the Service a report with analysis and recommendations, incorporating the results of the biological response phase of the study and the effects of various ramping rates on the physical habitat of bull trout. The action agencies will operate consistent with the ramping rates described in this letter, or as they may be revised through agreement with the Service.

Flows to Moderate Impacts to Sturgeon

The action agencies will store and supply, at a minimum, water volumes based upon a water availability or "tiered" approach as defined in the table below. This water is available for use in May and June, and is measured as a volume out of Libby Dam above minimum flow of 4,000 cfs. Accounting of these total tiered volumes will begin when the Service determines benefits to conservation of sturgeon are most likely to occur. This will generally occur between mid-May and mid-June. Use of this water is subject to the usual constraints of flood control (at this point, flood stage is 1764 ft. mean sea level at Bonners Ferry, Idaho) and water quality, specifically dissolved gas supersaturation. These flows assume minimum flow for bull trout in July: 6000 cfs in tier 1, 7000 cfs in tier 2, 8000 cfs in tier 3 and 9000 cfs in tiers 4, 5 and 6. These tiers were developed assuming traditional flood control rule curves are used at Libby. Actual flow releases would be shaped based on seasonal requests from the Service and coordination with the Technical Management Team.

Table 6. "Tiered" volumes of water for sturgeon flow enhancement to be provided from Libby Dam according to the April - August volume runoff forecast at Libby. Actual flow releases would be shaped according to seasonal requests from the Service and in-season management of water actually available.

Forecast runoff Volume (maf*) at Libby	**Sturgeon flow volume (maf) from Libby Dam on May-June**	**Min bull trout flows between sturgeon and salmon flows**
0.00 < forecast < 4.80	Sturgeon flows not requested	6 kcfs
4.80 < forecast < 6.00	0.4	7 kcfs
6.00 < forecast < 6.70	0.5	8 kcfs
6.70 < forecast < 8.10	0.7	9 kcfs
8.10 < forecast < 8.90	1.2	9 kcfs
8.90 < forecast	1.6	9 kcfs

*maf = million acre-feet

When VARQ or similar flood control rule curves are implemented at Libby Dam, the volume of water from Libby Dam can be increased in several tiers. The following volumes are used for modeling purposes. Final volumes will be based on further studies and NEPA compliance for implementing VARQ at Libby.

Table 7. VARQ "tiered" volumes of water for sturgeon flow enhancement to be provided from Libby

Dam according to the April - August volume runoff forecast at Libby. Actual flow releases would be shaped according to seasonal requests from the Service and in-season management of water actually available.

Forecast runoff Volume (maf*) at Libby	**Sturgeon flow volume (maf) from Libby Dam**	**Min bull trout flows between sturgeon and salmon flows**
0.00 < forecast < 4.80	Sturgeon flows not requested	6 kcfs
4.80 < forecast < 6.00	0.8	7 kcfs
6.00 < forecast < 6.70	1.0	8 kcfs
6.70 < forecast < 8.10	1.2	9 kcfs
8.10 < forecast < 8.90	1.2	9 kcfs
8.90 < forecast	1.6	9 kcfs

*maf = million acre feet

Annual Operating Plan

The action agencies, coordinating with NMFS and the Service, will annually develop 1- and 5-year plans to implement the measures described in their proposed action.

The NMFS opinion on FCRPS operations and configuration calls for the action agencies to annually develop 1- and 5-year plans to implement the various measures described in that opinion. The plans will cover all operations for the FCRPS, including those affecting species of concern to the Service. Consequently, they will encompass the proposed action described in this Service opinion, and the action agencies will submit their plans to the Service as well as to NMFS.

As expressed in the NMFS opinion, the 1-year plan will describe measures that will be funded or carried out during the coming fiscal year. The first 1-year plan will be completed by September 1, 2001, and annually thereafter on a date agreed upon by the action agencies, NMFS, and the Service. The plan will include a water management plan for FCRPS operation. Id. at 9-29.

The Service will review the 1-year plan for consistency with the Service opinion, and issue a finding as to whether the plan is adequate to provide consistency.

Emergency Actions:

To ensure the reliability of power supply and transmission service, the annual plans will allow power system operators limited exceptions to providing the flow, spill, and project operations measures specified in this proposal. An emergency may be declared by the power system operators when a circumstance exists that threatens firm loads or voltage and transmission stability. Communication and response to emergency situations will be handled in accordance with the September 22, 2000, "Protocols for Emergency Operations in Response to Generation or Transmission Emergencies" or as revised. In the event that Federal project operators or the Regional Forum consider the power emergency to be of either exceptional magnitude or extended duration, the emergency may be elevated by one of these entities to the regional agency executives directors, for discussion and consideration of appropriate actions. Curtailing fish and wildlife operations should be viewed as a last resort action and should not be used in lieu of maintaining an adequate and reliable power system. If curtailments to fish and wildlife operations exceed this standard, the power system should be reevaluated and upgraded to the extent needed to meet the standard.

It should be understood that the emergency concept includes taking actions to prevent realization of pending emergency situations. Interruptions or adjustments in water management actions may also occur due to unforeseeable flood control of or other emergencies. The action agencies would view these actions similarly to the power emergencies as noted above and respond accordingly.

Transmission stability at Libby:

By February 1, 2002, and February 1, 2003, the BPA will submit to Service an annual report describing the frequency and duration of flow changes at Hungry Horse and Libby Dams needed to provide voltage stability.

The action agencies will conduct the following studies:

The action agencies, in consultation with the Service, will develop a study investigating the costs and feasibility of options that will preclude the use of Libby Dam, as currently proposed, to ensure voltage and transmission stability, including consideration of additional transmission line(s) and other technical or operational options.

The action agencies will complete these studies on transmission within three years after the final Service BO.

3.A.3. Lower Columbia and Lower Snake/Clearwater Rivers

Operations for these facilities have been a focus of the NMFS Opinion. In general, the FCRPS will be operated to meet flow objectives identified for Snake River salmon stocks, and Snake and Columbia River steelhead stocks. Operations include flow measures, fish transportation, reservoir operations, structural configurations and predator control actions to enhance juvenile anadromous fish passage survival. Additionally, existing actions for improvement of adult anadromous passage survival are described. Measures to address other listed fish species which may occur in those areas, such as bull trout, are not specifically included in the proposed action. However, in many cases, measures for anadromous fish may also address factors of concern for bull trout in these areas.

More specifically, the action agencies recommend that mainstem flow operations be based on the reasonable and prudent alternative contained in NMFS 1995 biological opinion on FCRPS operations as supplemented by the NMFS 1998 opinion. For Snake River salmon and steelhead, the seasonal average flow objectives would range from 80 to 100 thousand cubic feet per second (kcfs) during spring (April 2 to June 20) and 50 to 55 kcfs during summer (June 21 to August 31) at Lower Granite Dam. Flow objectives in the lower Columbia River, as measured at McNary Dam, would range from 220 to 260 kcfs during spring (April 20 to June 30) and 200 kcfs during summer (July to August 31). The flow objectives in any given year would be determined using a sliding scale based on forecasted runoff, as specified in the 1995 opinion. To benefit Upper Columbia River steelhead, in the mid-Columbia reach, the 1998 NMFS supplemental Opinion set a further spring flow objective of 135 kcsf (April 10 to June 30) at Priest Rapids Dam.

System operators will contine to confer with NMFS, the Service and regional fisheries managers to determine how to best manage in-season conditions relative to the seasonal average flow objectives. Flow management would continue to emphasize refill of headwater storage projects by June 30 in the Snake River basin, and by the end of the July 4 wekend in the Columbia River basin each year (or as soon as possible after July 4 at Libby), although that priority would remain subject to in-season considerations. Reservoir drafts would be limited to 80 feet at Dworshak (elevation 1,520 feet), 10 feet at Grand Coulee (elevation 1,280 feet), 20 feet at Hungry Horse (elevation 3,540 feet) and 20 feet at Libby (elevation 2,459 feet).

For fall chinook and chum salmon spawning below Bonneville Dam, the FCRPS would be operated to use storage to augment natural flows, in an attempt to provide a flow level of 125 kcfs during early November through early April while maintaining the NMFS 1995 biological opinion requirement for storage projects to be at their upper (flood control) rule curve elevation on April 10 of each year.

4. Environmental Baseline

This section is an analysis of the effects of past and ongoing human and natural factors leading to the current status of the species, their habitat, and ecosystem within the action area. The environmental baseline includes the effects of the past operation of the project, but does not include the effects of the action under review in this consultation. The effects of the proposed action itself are considered in sections 6 and 7 of this opinion.

The Columbia River Basin is 259,000 square miles in size and occurs in Washington, Oregon, Idaho, Montana, Wyoming, Utah, Nevada, and Canada. About two-thirds of the land in the Columbia River Basin is publicly owned. Public lands in the Columbia River Basin are managed by Federal agencies, state and local governments, and Indian tribes. Federal lands, including Indian reservations under Federal and tribal jurisdiction, account for approximately 55 percent of the total land area. These lands include national forests, National Park System lands, Bureau of Land Management (BLM)-managed resource lands, national wildlife refuges, and Federal reservations used for military or related purposes (Quigley and Arbelbide, 1997).

Many land and water uses occur in the Columbia River Basin, and are directly related to the FCRPS including: 7.3 million acres of irrigated areas; recreation, such as float boating, hunting, and sport fishing; commercial fishing on the Columbia River (accounting for roughly $15,200,000 gross annual value from 1986-1990); municipal water use; flood control; navigation; power generation from hydroelectric facilities; manufacturing; livestock grazing; mining; and timber extraction (Corps, 1995). At least 2,103 dams occur within the U.S. portion of the Columbia River Basin (Quigley and Arbelbide, 1997).

Water quality in the Basin has been impaired by many land and water uses. The Environmental Protection Agency (EPA) reports that of 266,257 miles of catalogued streams within the Interior Columbia Basin Ecosystem Management Project (ICBEMP; addresses all the BLM and Forest Service (FS) lands in the interior Columbia River Basin), 26,266 miles (roughly 10 percent) are classified as impaired (USDA, 1996). These figures describe only stream miles on BLM and FS lands. Effects of agriculture and urbanization are not completely included in those figures. If streams through land in agricultural and urban areas were added to the totals, the proportion of impaired miles would likely increase.

The ICBEMP classified lands in the Columbia Basin (regardless of ownership) in terms of ecological integrity -- the wholeness and resiliency of ecosystem processes and parts including species. ICBEMP found that 60% of the Basin had low, 24% had medium, and 16% of the Basin had high ecological integrity (Quigley and Arbelbide, 1997).

Due to changes in habitat and intentional or unintentional introductions, the species now living in the Columbia River Basin include many non-natives. For instance, of the 143 fish species, subspecies and races reported within the Basin, 55 were introduced (Quigley and Arbelbide, 1997). Federal and non-federal hydropower development has resulted in the conversion of riverine habitats to lake habitats. Hydropower development, water withdrawals (e.g., irrigation, industrial and municipal use), and other land use practices (e.g., urbanization and encroachment, logging, agriculture, grazing) have increased summer water temperatures, making conditions more suitable for species such as warm water centrachids not native to the Basin. Similarly, deep water inundated areas may not provide high quality habitats to native species that evolved with pre-dam riverine habitats.

The rest of this biological opinion is organized by three geographic areas corresponding to defined river reaches:

a) Upper Columbia River - the Columbia River upstream of the confluence of the Columbia and Snake Rivers;

b) Lower Columbia River - the Columbia River downstream of the confluence of the Columbia and Snake Rivers to its mouth;

c) Lower Snake River/Clearwater River - the Clearwater River, and the Snake River from the mouth upstream to the full extent of the Lower Granite Reservoir/confluence of the Snake and Clearwater Rivers.

Below, the three reaches are described with primary focus on river and riparian habitats, the areas most affected by the proposed action.

4.A. Upper Columbia River

Riparian zones along the Kootenai and Flathead Rivers are generally deciduous shrub and trees, with black cottonwood being the dominant tree species. Koocanusa and Hungry Horse Reservoirs do not have substantial riparian or backwater zones due to the power production and water management operations that alter water levels. Vegetation surrounding Lake Pend Oreille is mainly ponderosa pine communities with some areas of emergent wetlands and deciduous riparian vegetation. Lake Roosevelt riparian habitat occurs adjacent to small tributary streams and springs and along accumulations of silt. Lake Roosevelt does not harbor vast wetland areas. Wetlands that are present are mainly at the north end of the reservoir and are dominated by reed canary grass. Downstream of Grand Coulee Dam the Columbia River mainly lacks riparian vegetation, and instead shrub steppe, steppe, and ponderosa pine habitat types are generally adjacent to the River (Corps, 1995).

Lake Pend Oreille historically supported migratory bull trout which spawned in tributaries to the Clark Fork and Pend Oreille rivers, both above and below Lake Pend Oreille. Based on harvest records, this population abruptly declined by about 75 percent in the mid 1950's (Pratt and Huston, 1993), following construction of passage barriers at Albeni Falls and Cabinet Gorge Dams. Some of the tributaries below Albeni Falls Dam historically used for spawning and rearing have been degraded through various land use practices. Passage is also limited by Box Canyon Dam.

4.B. Lower Columbia River

The Lower Columbia River has several major tributaries, the Willamette, Deschutes, John Day, Lewis, Sandy, Hood, Klickitat, and Umatilla Rivers. The land is in a mix of ownership and land uses including cash-crop and row-crop agriculture, forest product production, manufacturing, urban areas, and recreation. Roughly 3,159 acres of riparian vegetation are comprised of shrub, hardwood, and herbs, and are frequently adjacent to backwater areas of the Lower Columbia River. Long stretches of shallow-water and wetland areas occur along the Lower Columbia. Backwater areas are present in many areas, and are most frequent in the John Day project area, and least frequent upstream of McNary Dam. Eighty percent of the wetlands in the Lower Columbia River occur just upstream of

John Day, and are present in lowest density near Bonneville Dam (Corps, 1995).

4.C. Lower Snake/Clearwater Rivers

Major tributaries to the free flowing section of the Snake River below Hells Canyon Dam that support bull trout subpopulations include Asotin Creek, and the Grande Ronde, Imnaha, Salmon and Clearwater rivers. Below Lower Granite Reservoir, the Tucannon River is the primary Snake River tributary that supports a bull trout subpopulation. The Lower Snake River corridor downstream of the mouth of the Clearwater River is mainly in private ownership. The only public lands in the immediate river vicinity are administered by the USCOE and isolated parcels owned by the State of Washington. The four Lower Snake River reservoirs generally fill the width of the steep-sided canyon, leaving relatively little flat land for cultivation adjacent to the reservoirs. Grassland range is the predominant land cover along the approximate 140-mile-long river corridor. Some relatively small and isolated crop land areas occur on the valley floor and river terraces, particularly toward the western end of the river corridor. Approximately 37,000 acres adjacent to Ice Harbor Reservoir are irrigated. The Lewiston-Clarkston area has a significant concentration of urban land uses at the eastern end of the corridor, including residential, industrial, and commercial uses. Isolated pockets of urban uses are located in small communities, including Almota, Riparia, and Windust. Unlike many reaches of the Columbia-Snake River System, much of the Lower Snake River is not paralleled by highways (Corps, 1999). The steep shorelines near the present-day normal water level preclude establishment of riparian vegetation. Railroad embankments occupy areas that otherwise might have been suitable for riparian vegetation. On the Clearwater River, reservoir fluctuations due to flood control and power peaking operations of Dworshak Dam have interfered with establishment of riparian vegetation. Red alder occurs near the reservoir, especially in association with tributary mouths.

5. Status of the Species and Critical Habitat

No species listed by the Service as threatened or endangered within the action area and addressed by this biological opinion have formally designated critical habitat, and therefore none are analyzed.

5.A. Bull Trout (*Salvelinus confluentus)* (threatened)

The Service initially listed the bull trout as five distinct population segments (DPS) within the conterminous United States (USFWS, 1999; USFWS, 1998). Bull trout of the Columbia River DPS occur within the action area. In the November 1999 listing decision, the Service recognized the bull trout as a single, co-terminous population. However, the DPS delineation may still be considered in section 7 analyses.

Bull trout, a char in the salmon family, were commonly known as Dolly Varden until recognized as a separate species by the American Fisheries Society in 1980. Char are distinguished from trout and salmon by the absence of teeth in the roof of the mouth, presence of light colored spots, small scales and differences in the structure of their skeleton. The bull trout (*Salvelinus confluentus*) was first described by Girard in 1856 from a specimen collected on the Lower Columbia River.

Bull trout reach sexual maturity at between three and five years of age. They spawn in gravel and cobble pockets in streams during late summer and early fall, generally after water temperatures drop below 9^{o} C (48 ^{o}F). Spawning areas are often associated with springs or areas where stream flow is influenced by cold ground water. Bull trout eggs require a long incubation period compared to trout and salmon. In general eggs hatch before the end of January with emergence occurring in late spring. Fry and juvenile fish are strongly associated with the stream bottom and are often found at or near it. Bull trout commonly live to be about 12 years old.

Bull trout are known to exhibit two life-history forms or strategies: resident and migratory. Resident bull trout complete their entire life cycle in the tributary (or nearby) streams in which they spawn and rear. Migratory bull trout spawn in tributary streams where juvenile fish rear from one to four years before migrating to either a lake (adfluvial), a river (fluvial), or in certain coastal areas to salt water (anadromous) where they grow to maturity. These diverse life histories are important to the stability and viability of bull trout populations (Rieman and McIntyre, 1993). Growth of resident fish is generally much slower than migratory fish and resident fish tend to be smaller and less fecund at maturity.

5.A.1. Bull Trout Status and Distribution within the Columbia River DPS

The Service recognizes 141 subpopulations in the Columbia River Basin within Montana, Idaho, Oregon, and Washington, with additional populations in British Columbia (USFWS, 1998). The area covered by the Columbia River population segment includes the entire Columbia River and eleven of its tributaries, excluding the isolated bull trout populations found in the Jarbidge River in Nevada. Generally, known bull trout populations in the entire Columbia River population segment are declining. Presently bull trout in the Columbia basin occupy about 45 percent of their estimated historic range (Quigley and Arbelbide, 1997). Of the 141 subpopulations identified at the time of listing, 75 are at risk of natural extirpation through physical isolation. Many of the remaining bull trout occur as isolated subpopulations in headwater tributaries, or tributaries with migratory life histories lost or restricted. Few bull trout subpopulations are considered "strong" in terms of relative abundance and subpopulation stability. Those few remaining strongholds are generally associated with large areas of contiguous habitats such as portions of the Snake River basin in Central Idaho, and the Blue Mountains in Washington and Oregon. In Montana, bull trout are considered stable in the South Fork Flathead River and Hungry Horse Reservoir, and increasing in the Swan River and Swan Lake (Deleray et al. 1999).

Biological constraints inherent to the species include reproductive potential, existing genetic diversity within the population, and behavioral attributes (PBTTAT, 1998). Reproductive potential can be influenced by factors which select for fish size, and factors which increase mortality on juvenile and sub-adult fish can influence reproductive potential. Genetic diversity can be influenced by introductions of nonnative fish into populations, shrinking population size, and fragmentation of populations through migration barriers. Behavioral changes can occur through selective breeding in a hatchery environment or introductions of new genetic material. Maintaining bull trout populations with genetic material which is adapted to local conditions, and with population sizes large enough that a full range of genetic material is retained (providing a greater probability of a population withstanding environmental changes or disturbances), increases the likelihood of a population persisting through time. Temporary behavioral changes may result from stress brought on through competition or other factors; the genetic integrity of a population can determine how well the population responds to stress.

Reproductive potential of a bull trout population can be significantly impacted by hybridization with brook trout (PBTTAT, 1998). Competition for spawning areas with other species can directly reduce reproductive success, if competition results in another species disturbing bull trout redds in the process of excavating their own (redd superimposition). Competition for food or habitat which is in limited supply, or predation can also impair fitness of bull trout populations by reducing survival to spawning age.

Because the bull trout populations in the Columbia River distinct population segment have been isolated and fragmented, conservation activities will be necessary to improve the connectivity between populations, and to restore habitat in population strongholds. Connectivity should be enhanced between strongholds and spawning/rearing reaches. The factors that have contributed to the loss of connectivity, such as thermal barriers or fish passage barriers, should be identified and addressed.

Migratory bull trout ensure interchange of genetic material between populations, thereby ensuring genetic variability. Migratory bull trout are more fecund and grow larger than non-native brook trout, which may reduce the likelihood of hybridization (Rieman and McIntyre, 1993). Unfortunately, migratory bull trout have been restricted and/or eliminated due to migration barriers, stream habitat alterations, including seasonal or permanent obstructions, detrimental changes in water quality, increased temperatures, and the alteration of natural stream flow patterns. Migratory corridors tie seasonal habitat together for anadromous, adfluvial, and fluvial forms, and allow for dispersal of resident forms for recolonization of rebounding habitats (USDA, 1993). Dam and reservoir construction and operation have altered major portions of bull trout habitat throughout the Columbia River Basin. Dams without fish passage create barriers to fluvial and adfluvial bull trout which isolates populations, and dams and reservoirs alter the natural hydrograph, thereby affecting forage, water temperature, and water quality (USFWS, 1998).

General Status in the Upper Columbia River Basin

Bull trout populations within the upper Columbia River have declined from historic levels (Thomas, 1992 and USDA, 1993). Overall, remaining populations are generally isolated and remnant. Fluvial bull trout populations in the upper Columbia River Basin portion of the distinct population segment appear to be nearly extirpated. Resident populations existing in headwater tributary reaches are isolated and generally low in abundance (Thomas, 1992).

Status in the Kootenai River Action Area below Libby Dam

A migratory form of bull trout utilize the Kootenai River as sub-adults and adults, and utilize its tributaries downstream of Libby Dam and upstream of Kootenai Falls for reproduction and early rearing of juvenile fish (MBTSG, 1996a). Limited information is available regarding the status of this sub-population which occupies 29 miles of the Kootenai River. Redd counts from tributary streams reveal that the Quartz, Pipe and Libby Creek drainages (core areas, MBTSG, 1996a) are most important for spawning bull trout from the Kootenai River (Marotz et al. 1998). Redd counts in these drainages indicate a sub-population numbering a few hundred adults, as compared to an adult sub-population of thousands in the reservoir (BA, 1999).

Status in the Koocanusa Reservoir

One of the strongest sub-populations of bull trout exists in Koocanusa Reservoir and its Canadian headwaters (Marotz et al. 1998). Libby Dam now isolates this bull trout sub-population from the Kootenai River sub-population downstream. The migratory form of bull trout utilize the reservoir as year-round habitat as sub-adults and adults, and migrate to some U.S. tributaries (Graves Creek drainage), but mostly to Canadian tributaries (Wigwam Creek drainage) for reproduction and early rearing of juvenile fish (for several years). These two drainages were identified as core areas by the Montana Bull Trout Restoration Team (MBTSG, 1996b). Population assessments have been based on redd counts from these streams and gill net data from the reservoir. The limited information from these sources (1993-1998) suggests a healthy population exists in Koocanusa Reservoir (Marotz et al. 1998, MFWP, 2000, and MBTSG, 1996b).

Status within the mainstem Flathead River (including the South Fork downstream of Hungry Horse Dam)

Historically, bull trout were one of three native salmonids distributed throughout the Clark Fork drainage (MBTSG, 1995a) including the Flathead Lake and river system upstream of the lake. The Flathead Lake sub-population of bull trout migrates from Flathead Lake up to 150 miles through the upstream river system, primarily in the North Fork and Middle Fork drainages, to spawn in tributary streams. The Montana Bull Trout Restoration Team identified 18 tributaries to the North and Middle Forks Flathead River as “core areas” that are key to the continued existence of bull trout in the Flathead Basin (MBTSG, 1995a). Bull trout occupying these core areas can be considered individual “stocks” that make up the Flathead Lake and River sub-population (Fredenberg, 2000b, pers comm.). The status of the overall sub-population and its component stocks is relevant to assessing the potential effects of the proposed action within the “action area”, because operation of Hungry Horse Dam directly affects 47 miles of the mainstem Flathead River occupied, at least seasonally, by these stocks.

Migratory bull trout of the Flathead Lake and River sub-population must migrate through or reside in the action area, therefore, the action area includes the entire interconnected Flathead River drainage occupied by migratory bull trout.

Bull trout abundance in the Flathead Lake ecosystem has been monitored through several methods: juvenile abundance in the rearing tributaries, redd counts in the spawning tributaries, gill net surveys in the lake, and creel surveys of Flathead Lake. All methods indicate that bull trout have declined in the lake ecosystem since the 1980's (Deleray et al. 1999; BA, 1999; Fredenberg, 2000c).

Limited winter abundance comparisons of bull trout were made between 1981 and 1997-1998 by Deleray et al. (1999). Densities in the two time periods were similar, and bull trout were found in the river year-round in both time periods. Deleray et al. (1999) concludes this evidence suggests, "that a certain proportion of the bull trout population may reside for extended periods if not entirely in the river system." Further, "...this behavior may be very important to sustaining the bull trout population into the future..." (Deleray et al. 1999).

Predator interactions were studied by Zollweg (1998) in the Flathead River during 1995 and 1996. Zollweg (1998) concluded that the decline in the number of bull trout in the1990s may be tied to predation in the Flathead River and sloughs.

Fish habitat in the South Fork Flathead River downstream of Hungry Horse Dam is generally in poor condition due to frequent and sudden dewatering, and cold water releases related to dam operations (power peaking and voltage or transmission stability operations). River water levels may vary more than seven feet in less than three hours, as flows range from 145 to 11,400 cfs (Wood, 1985). Selective withdrawal at the dam provides for more natural water temperatures. Insect and fish populations in permanently wetted portions of the South Fork are expected to benefit from that consistent temperature release (USBR, 1994). Bull trout have been observed in the South Fork Flathead River (Marotz, 2000, pers. comm.); however there have been no specific bull trout population investigations.

<u>Status in the South Fork Flathead River (Hungry Horse Reservoir)</u>

Hungry Horse Dam impounds the South Fork Flathead River, thus isolating its native species assemblage by preventing upstream migration of fishes from the downstream Flathead Lake and River system. Hungry Horse Reservoir and the upstream watershed contains one of the strongest sub-populations of bull trout in Montana, due in large part to the substantial amount of undisturbed habitat present (Marotz et al. 1998), and the isolation provided by the dam against exotic species migrations from downstream areas.

Long-term gill net data (1958-1998) collected in Hungry Horse Reservoir indicate that bull trout abundance is stable (Deleray et al. 1999). Recent (1993-1998) redd count data likewise show a stable spawning population of bull trout utilizing the tributaries to the reservoir and upstream South Fork Flathead River (Deleray et al. 1999). Weaver (1998) estimated the total reservoir (South Fork Flathead River) adult bull trout population to be in the range of 2,000 to 3,400 fish during the 1993-1998 time period.

Status of bull trout in the Pend Oreille River and Lake Pend Oreille (Albeni Falls Dam)

Historically, bull trout were abundant in the Pend Oreille River (Gilbert and Evermon, 1894 in McDonald 1895), and were still abundant in the Pend Oreille River through 1957 (Ashe and Scholz, 1992). Bull trout observed in 1957 are likely fish which were reproduced by migratory spawners prior to impoundment of Albeni Falls Dam in 1952. Ethnographic reports indicate substantial spawning runs of bull trout occurred in six tributaries of the Pend Oreille River below Albeni Falls Dam (Kalispel Tribe of Indians, 1997 in Lit., and U.S. Department of the Interior1997 in Lit.). Small numbers of bull trout have been observed in the Pend Oreille River and several tributaries in recent years. Juvenile bull trout were found at two sites in LeClerc Creek in 1993 (Toth, 1993 Plum Creek Timber Company in Lit.). In 1999, one gravid female bull trout previously captured and marked in Trestle Creek, above Albeni Falls Dam, was recaptured in Indian Creek, below Albeni Falls Dam (Joe Maroney, 1999 Kalispel Tribe, personal communication).

Historically in Lake Pend Oreille, the bull trout population was estimated to have exceeded 10,000 adfluvial spawner annually (Pratt and Huston, 1993). Based upon harvest records, the bull trout population was abruptly reduced by about 75 percent following the completion of Albeni Falls and Cabinet Gorge Dams in the early 1950s. Also, bull trout are believed extripated from eight tributaries still accessible to Lake Pend Oreille (Pratt and Huston, 1993). Although considerably reduced from historic numbers, the population of bull trout in Lake Pend Oreille is considered one of the strongest remaining. Redd counts over the last 15 years have been in the 600 to 800 range, and, at 3.2 adults per redd, this equates to an adult population between 1,920 and 2,560. However, highly variable redd counts and small numbers observed in 14 of the 16 known spawning sites indicate high levels of instability (Rieman and McIntyre, 1993, Rieman and Meyers 1997).

Currently bull trout are highly dependent (66 percent of diet by weight) upon introduced kokanee salmon as a forage base (Mallet, in lit. 2000). The adult kokanee population is greatly depressed from about 5 million in the 1950s and 1960s to100 to 200 thousand. There is risk that this bull trout subpopulation may become greatly depressed if this kokanee forage base is lost. Where this has happened in other areas, such as in Flathead Lake, lake trout have become the dominant char. Further, once lost, kokanee may not be able to reestablish because of a large population of predators such as introduced kamloops rainbow trout, introduced lake trout, and bull trout. A feasible management option to conserve bull trout is closure of kokanee and bull trout harvest seasons and liberalization of kamloops rainbow and lake trout harvest limits. These measures have been implemented by the Idaho Department of Fish and Game. The other feasible option involves annual fluctuation of winter levels of Lake Pend Oreille to improve spawning gravel conditions, and increase kokanee egg to fry survival to the extent that the adult population can expand. This experiment was initiated in 1996, and preliminary results appear promising. This experiment is long term, and it will require two life cycles, or 10 years, to complete and perhaps longer to fully evaluate its effects on bull trout.

Historically, bull trout likely ranged through much of the Columbia River Basin, with spawning and rearing occurring in the coldest creeks, often at higher elevations. Presently bull trout of the Columbia River Basin are distributed in a more fragmented pattern throughout the Basin, with fewer adult migratory fish and fewer or more compressed spawning reaches than historically. Bull trout are estimated to have once occupied 60 percent of the Basin and now are estimated to occur in about 45 percent of their former range (Quigley and Arbelbide, 1997). The largest populations of bull trout in the FCRPS system are in the reservoirs above the Hungry Horse, Libby, and Albeni Falls projects. Bull trout are also present in the Lower Snake River, Lake Roosevelt, in Dworshak Reservoir, and in Bonneville pool. Major tributaries to the free flowing section of the Snake River below Hells Canyon Dam that support bull trout subpopulations include Asotin Creek, and the Grande Ronde, Imnaha, Salmon and Clearwater rivers. Below Lower Granite Reservoir, the Tucannon River is the primary Snake River tributary that supports a bull trout subpopulation. A more complete description of the status of bull trout subpopulations is contained in the Service final rule (USFWS, 1999; USFWS, 1998).

5.A.2. Bull Trout Habitat Requirements

Bull trout have habitat requirements that are more specific than those for many other salmonids. Five elements relate to suitable bull trout habitat: 1) substrate composition that includes free interstitial spaces; 2) complex cover including, large woody debris, undercut banks, boulders, shade, pools or deep water; 3) cold water temperatures; 4) channel and hydraulic stability; and 5) connectedness through migratory corridors.

Channels for moving between safe wintering areas and summer foraging areas are necessary because extensive migrations are characteristic of some forms of the species (Fraley and Shepard, 1989). Migratory bull trout can refound local populations in areas where the species has been extirpated due to natural or human-caused events (Rieman and McIntyre, 1993, citing others). In many areas within the Columbia River Basin, migratory bull trout have been restricted or eliminated following fishery management actions (bounties/lake trout introductions), habitat alterations, including dams or seasonal or permanent obstructions; detrimental changes in water quality; increased temperatures; and the alteration of natural stream flow patterns. The disruption of migratory corridors, if persistent, would result in the loss of migratory life history types and isolate resident forms from interacting with one another (USDA, 1993).

5.A.3. Bull Trout Threats

Land and water uses that alter or disrupt any of the habitat requirements identified above can threaten bull trout. Examples of activities that have altered or disrupted habitats include: water diversions, dams, timber extraction, mining, grazing, agriculture, introduction of non-native fishes that compete or hybridize with bull trout, poaching, past fish eradication projects, and channelization of streams. These threats are prevalent throughout the Columbia River basin, except in wilderness areas.

Threats specific to action areas and projects (especially populations in the Kootenai and Flathead drainages) are described in the following paragraphs.

Kootenai River

Threats identified by the Montana Bull Trout Scientific Committee (MBTSG, 1996a) included : forestry practices (the risk is elevated by the limited number of available core areas due to the fragmentation caused by Libby Dam); dam operations and presence of the barrier; illegal harvest; introduced species and environmental instability; thermal barriers; rural residential development; mining; transportation and angling.

Specific to this proposed action, dam operations are considered a high risk to the species due to unnatural flow fluctuations and gas supersaturation problems. Dam power peaking operations have resulted in rapid and severe flow and stage changes in the river, causing adverse impacts to aquatic insect production (Hauer and Stanford, 1997). These operational impacts have chronically adversely affected bull trout and their habitat in the river. The effects of the dam as a barrier, restricting the migratory populations to 29 miles of river, increases the likelihood of localized impacts becoming a higher risk.

Koocanusa Reservoir

Threats identified by the Montana Bull Trout Scientific Committee (MBTSG, 1996a) include: illegal fish introduction; introduced fish species already present; rural residential development; and forestry. Additional risks to this population are mining; agriculture; diversions; and illegal harvest.

Specific to the proposed action, entrainment of bull trout through the turbines is the highest risk. Entrainment of large numbers of fish, primarily kokanee, through Libby Dam has been documented by Skaar et al. (1996). It is unclear how those losses are affecting bull trout populations. Losses of bull trout through entrainment are of a concern and this issue needs further evaluation. At this time loss of prey species through entrainment has not been identified as a limiting factor for reservoir populations. Productivity of the reservoir has been affected in the past by deep drawdowns. Prior to 1995, Koocanusa Reservoir was subjected to drawdowns exceeding the 90-110 foot limit set by the Northwest Power Planning Council (NPPC) (Marotz et al. 1998). Dam operational criteria, in place since the 1995 and 1998 Biological Opinions for salmon and steelhead, have reduced the frequency of deep reservoir drawdowns and resulted in maintaining higher pool levels from year to year. It is assumed that productivity will increase with more consistent reservoir water levels.

Flathead Lake and River System (including the South Fork below Hungry Horse Dam)

Threats identified by the Montana Bull Trout Scientific Committee (MBTSG, 1995) include: the Flathead Lake fish community change in species composition and abundance; incidental catch from harvest for other species; forestry issues; and residential development.

Specific to the proposed action, identified threats include: ongoing electrical power peaking and other operations at Hungry Horse Dam, especially those that result in rapid and extreme river flow fluctuations which contribute to or aggravate the negative predation/competition interactions between predators in the river system and bull trout (Hoffman et al. 2000). These operations also diminish the biological productivity of the river, decreasing food availability to bull trout (Marotz et al. 1998).

Hungry Horse Reservoir

Threats identified by the Montana Bull Trout Scientific Committee (MBTSG, 1995) include: threats of illegal fish introductions; forestry practices; reservoir level fluctuations; and illegal harvest.

Specific threats to the proposed action, dam operations and deep drawdowns of the reservoir are of primary concern. Prior to 1995, Hungry Horse Reservoir was subjected to drawdowns exceeding the 85 foot limit set by the NPPC that adversely affected the biological productivity in the reservoir (Marotz et al. 1998). Dam operational criteria, in place since the 1995 and 1998 Biological Opinions for salmon and steelhead, have reduced the frequency of deep reservoir drawdowns and resulted in maintaining higher pool levels from year to year. Mitigation programs of the BPA have funded habitat restoration and fish passage projects in tributaries to Hungry Horse Reservoir, resulting in increased quantity and quality of spawning and rearing habitat for bull trout residing in the reservoir. Because of the location of bull trout and other fish in the reservoir and in the water column in relation to dam intake structures, dam operations have not been noted to result in entrainment of significant numbers of fish from Hungry Horse Reservoir. However, specific studies have not been conducted and are necessary to verify those assumptions.

Lake Pend Oreille

Both Albeni Falls and Cabinet Gorge Dams were completed in the early 1950s without fish passage facilities. Bull trout have been denied access to and from spawning and rearing beyond these facilities since. Historically, the shore line of Lake Pend Oreille was stabilized by vegetation above the normal summer water level of 2048 feet. Summer operation of Lake Pend Oreille at 2062 feet has destabilized the shoreline. Through the 1960s, winter water levels varied 4 to 5 feet and the kokanee population was maintained. Beginning in the 1970s, winter lake levels were stabilized near elevation 2051 feet for power production, and the kokanee population declined significantly. This decline is attributed to poor lake shore spawning conditions which result from consistently low winter lake levels

(Mallet, in lit., 2000). Land management practices are believed to be contributing factors to the loss of eight historic spawning and rearing tributaries, where access to Lake Pend Oreille remains.

5.B. White Sturgeon: Kootenai River Population (*Acipenser transmontanus*)

The Kootenai River population of white sturgeon was listed as endangered on September 6, 1994 (USFWS, 1994). White sturgeon were first described by Richardson in 1863 from a single specimen collected in the Columbia River near Fort Vancouver, Washington (Scott and Crossman, 1973). White sturgeon are distinguished from other *Acipenser* by the specific arrangement and number of scutes (bony plates) along the body (Scott and Crossman, 1973). White sturgeon are generally long-lived, with females living from 34 to 70 years (PSMFC, 1992).

The size or age at first maturity for white sturgeon in the wild is quite variable (PSMFC, 1992). In the Kootenai River system, females have been documented to mature as early as age 22 and males at age 16 (Paragamian et al. 1997). Only a portion of adult white sturgeon are reproductive or spawn each year, with the spawning frequency for females estimated at 2 to 11 years (PSMFC, 1992). Spawning occurs when the physical environment permits egg development and cues ovulation. Based upon recent studies, Kootenai River white sturgeon spawn during the period of historical peak flows from May through July (Apperson and Anders, 1991; Marcuson, 1994). Spawning at peak flows with high water velocities disperses and prevents clumping of the adhesive eggs. Following fertilization, eggs adhere to the river substrate and hatch after a relatively brief incubation period of 8 to 15 days, depending on water temperature (Brannon et al. 1984).

White sturgeon in the Kootenai River system and elsewhere are considered opportunistic feeders. Partridge (1983) found white sturgeon more than 70 centimeters (cm) (28 inches [in]) in length feeding on a variety of prey items including clams, snails, aquatic insects, and fish.

5.B.1. Kootenai River White Sturgeon Distribution

The distinct population of the Kootenai River white sturgeon presently is limited to the Kootenai River between Kootenai Falls, Montana (50 kilometers (km) downstream of Libby Dam) to Corra Linn Dam (which forms Kootenay Lake in British Columbia, Canada). The Kootenai River population has been in general decline since the mid-1960's. In 1997 the population was estimated to be approximately 1,468 wild fish with few individuals less than 25 years of age. In 1997, the wild population was augmented with the release of 2,283 juvenile white sturgeon reared in the Kootenai Tribal Hatchery in Bonners Ferry, Idaho.

5.B.2. Kootenai River White Sturgeon Habitat Requirements

The Kootenai River population of white sturgeon was isolated from other white sturgeon in the Columbia River basin during the last glacial age (approximately 10,000 years ago). The population adapted to the pre-development habitat conditions in the Kootenai River drainage. Historically, spring runoff peaked during May and June. Flows were often in excess of 1,700 cubic meters/second (m^3/s) (60,000 cubic feet/second (cfs)), with record flow of 157,000 cfs in 1894. During the remainder of the year, river flows declined to basal conditions of 113 to 226 m^3/s (4,000 to 8,000 cfs). Floodplain ecosystems like the pre-development Kootenai River are characterized by seasonal floods that promote the exchange of nutrients and organisms among a mosaic of habitats and thus enhance biological productivity (Bayley, 1995; Junk et al. 1989; Sparks 1995). Annual flushing events re-sorted river sediments, providing a clean cobble substrate conducive to insect production and sturgeon egg incubation. Side channels and low-lying deltaic marsh lands were historically not diked and therefore provided productive, low velocity backwater areas. Nutrient delivery in the system was unimpeded by dams and occurred primarily during spring runoff.

Historically (pre-Libby Dam construction and operation), spawning areas for white sturgeon were not specifically known. White sturgeon monitoring programs conducted from 1990 through 1995 revealed that during that period, white sturgeon spawned within a 18 river kilometer (RKM) (11.2 river mile (RM)) stretch of the Kootenai River, from Bonners Ferry downstream to below Shorty's Island.

Most spawning is currently occurring below Bonners Ferry over sandy substrates. As flow and stage increase, sturgeon spawning tends to occur further upstream, near the gravel substrates which now occur at and above Bonners Ferry (Paragamian et al. 1997). Reproductively, active sturgeon respond to increased flows by ascending the Kootenai River, but few move to or above Bonners Ferry. Sturgeon have spawned in water ranging in temperature from 8.5 to 13° C. However, most sturgeon spawn when the water temperature is near 10° C (50° F) (Paragamian et al. 1997). Although millions of eggs are released and fertilized annually, only two larvae and a few egg cases (indication of successful hatching) have been recovered in 10 years of monitoring. Only 17 naturally recruited sturgeon 10 years of age or less have been captured during 10 years of intense monitoring. In contrast, sturgeon from the preservation stocking program, released at two years of age, survive very well. Thus, mortality appears to be most limiting to this population during the first two to three weeks of life (egg and fry stages), prior to the free swimming and feeding larval stage. Other white sturgeon populations successfully spawn and incubate over rocky substrates with velocities exceeding those observed in the Kootenai River system. Rocky substrates provide surfaces for the sinking, adhesive eggs to attach. After hatching the inter-gravel spaces provide cover until the incubating fish mostly absorb the yolk sac and “swim up” as larvae.

5.B.3. Kootenai River White Sturgeon Threats

Kootenai River white sturgeon are threatened by modification of habitat and the hydrograph, by human activities, including removal of side-channel habitats, changes in water chemistry, including elevated heavy metal concentrations, and a loss of nutrient inputs from flooding. Changes in the hydrograph, particularly from Libby and the Corra Linn Dam (in Canada), have altered white sturgeon spawning, egg incubation, and rearing habitats, and reduced overall biological productivity. These factors have contributed very low levels of recruitment in the white sturgeon population since 1974. This date coincides with commencement of Libby Dam operations.

Threats to sturgeon recruitment directly or interdependently related to the operation of Libby Dam include:

1. Direct reduction in river flow which reduces both velocity and depth, and which may result in sturgeon spawning over sandy substrates. Flood control criteria and configuration constraints at Libby Dam reduced peak flows associated with spring spawning events by more than 50 percent.

2. Indirectly, with the configuration and operational constraints at Libby Dam, Canadian operators of Kootenay Lake have been able to reduce annual peak water surface elevations by nearly eight feet. Backwater effects from Kootenay Lake also result in lower water levels in the sturgeon spawning reach of the Kootenai River near Bonners Ferry, Idaho. But for the operation of Libby Dam this change could not occur.

3. Deposition of river bottom sand below Bonners Ferry, and gravel above Bonners Ferry in the Kootenai River channel, may result from decreased river flows and bedload transport energy. Although peak flows have dropped from a preimpoundment high of 157,000 cfs (in 1894) to a high of 55,000 cfs, post-impoundment, the width of the Kootenai River has remained nearly unchanged through the spawning reach since 1928. There is data demonstrating channel aggradation in the Canadian portion of the Kootenay River, below the spawning reach. The U.S. Geological Survey is currently studying this possible change above and below Bonners Ferry.

4. Reduced flows and possibly associated turbidity reductions may be increasing the risk of predation on both sturgeon eggs and fry. This may be exacerbated because most of the fertilized eggs are released over sandy substrates. These areas do not provide suitable sites for attachment for incubation, and intergravel spaces for security during the sac-fry stage.

5. Twenty six years of frequent and large (greater than 14,000 cfs) abrupt changes in flow, and associated water levels resulting from hydroelectric load following and other operations at Libby Dam have eroded the toe of the slope of much of the levee system in the Kootenai Valley, making the levees unstable. Because of this, and other concerns, the Corps now proposes to manage the river to a target elevation of 1764 feet msl at Bonners Ferry.

   The best scientific information available to the Service indicates that the last successful, significant sturgeon spawning occurred in 1974, when the water surface elevation was at

1765.5 feet (USFWS, 1999b). Peak flows in 1974 were 55,000 cfs, and base flows were about 40,000 cfs. Thus, management of the Kootenai River to target elevation 1764 feet at Bonners Ferry is a constraint to providing this flow.

Partridge (1983) speculated that the lack of sturgeon recruitment in certain years was due in part to: (1) the elimination of rearing areas for juveniles through diking of slough and marsh side-channel habitats; and (2) the increase in chemical pollutants, e.g. copper and zinc, released in the past from mineral processing facilities which may have affected spawning or recruitment success.
However, with reference to the elimination of rearing areas noted above, sturgeon did successfully recruit between 1961, when the levees were substantially completed and most backwater habitats eliminated, and 1974, prior to Libby Dam becoming fully operational with the current storage and hydroelectric practices. In response to concerns with chemical pollutants, the Kootenai Tribes experimental hatchery was initiated largely to determine whether or not fertilized sturgeon eggs were viable because of suspected contamination with copper. These eggs have been demonstrated to be viable. Further, there are no new contaminant sources which began in 1975 that can be correlated with reproductive failure. Impoundment of the Kootenai River would have been expected to reduce sturgeon contaminant loading from Canada, beginning in 1975.

Average water temperatures in the Kootenai River are typically warmer in the winter and colder in the summer than they were before Libby Dam was built. However, when large volumes of water are released from Libby Dam in the spring, water temperatures may be colder. This may also affect the spawning behavior of sturgeon.

6. General Effects of the Action

"Effects of the action" refers to the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline. Direct effects are considered as immediate effects of the project on the species or its habitat. Indirect effects are those caused by the proposed action and are later in time, but are still reasonably certain to occur. Interrelated actions are those that are part of a larger action and depend upon the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consultation. Both interrelated and interdependent activities are assessed by applying the “but-for test” which asks whether any action and its resulting impact would occur “but-for” the proposed action.

“Insignificant effects” relate to the size of the impact and should never reach the scale where take occurs. “Discountable effects” are those extremely unlikely to occur. Based on best judgement, a person would not: (1) be able to meaningfully measure, detect, or evaluate insignificant effects; or (2) expect discountable effects to occur. Effects that result in “take” of listed species will be further addressed in the accompanying Incidental Take Statement.

In the December, 1999 BA the action agencies outline an adaptive management framework for operations of the FCRPS through development and implementation of performance measures. The approach acknowledges that the actions outlined in the BA represent current operations for the FCRPS. The action agencies note they intend these operations to provide a base for future operations, that are subject to adjustment over time. Additional actions may be developed through consultation and implementation of recovery plans for listed aquatic species.

Rather than propose specific actions at this time, the action agencies propose a "Construct for Achieving Survival Improvements (Construct)". The premise of the Construct is establishment of measurable performance standards for the FCRPS, followed by prioritization of actions, and measurement of results.

The Construct is based on the establishment of overall recovery goals for listed aquatic species. The approach provides a methodology for defining desired levels of improvement in various activities that affect listed aquatic species, commonly referred to as "all Hs" (hatcheries, harvest, hydropower and habitat impacts). There would then be performance standards associated with those levels of improvement, and measures to determine how those standards were being met.

A performance standard is a specified goal that is a measurement or estimate of either a biological or environmental condition. The action agencies note that performance standards would likely be indicators of population or ecological responses to management actions. The standards could be used: 1) as a yardstick on which to assess progress toward survival objectives; 2) to assess the effects of experimental actions; 3) to provide information to assess model assumptions,; 4) to select and implement new actions, and 5) to compare the effectiveness of alternative actions.

The approach involves selecting an initial approach to address an activity (one of the Hs) that is expected to result in changes in life stage survival that would meet overall survival and recovery criteria. This would establish initial performance standards for each activity (each H) that would include estimated improvements in life stage survivals to be achieved over a specific period of time. Actions would then be designed to facilitate achieving the performance standard. Once the actions are implemented, they are monitored and evaluated to determine whether the intended results are being achieved. If an action is not promoting life stage survival estimates, new actions would be contemplated.

An example was provided in the BA, which focused on spring/summer Snake River chinook salmon. The Service has considered this approach, and the example provided, and believes it may also be applicable to Kootenai river white sturgeon and bull trout. It appears to provide for an adaptive management approach to consider the needs of listed species, assign a life stage survival improvement goal, with an associated performance standard designed to meet that goal. Such an approach could contribute to minimizing effects of FCRPS operations on listed species, and to minimizing take of those species, as well. This approach could be coupled with a Regional Forum, whose purpose is to develop and implement actions on an annual basis (or 5 or 10 years, as appropriate) to manage operations of the FCRPS. However, the biological information available for Kootenai River white sturgeon and bull trout is not adequate to allow development of performance standards at this time.

The predicted effects of the proposed action are presented here first as general effects resulting from the FCRPS operations, followed by a more specific discussion of effects on species reported by the geographic areas described above. Some of the major effects of the FCRPS operations include the following: 1) fish passage barriers and entrainment; 2) inundation of fish spawning and rearing habitat; 3) modification of the streamflow and water temperature regime; 4) dewatering of shallow water zones during power operations; 5) reduced productivity in reservoirs; 6) gas supersaturation of waters downstream of dams; 7) loss of native riparian habitats; 8) water level fluctuations interfering with establishment of riparian vegetation along reaches affected by power peaking operations; and 9) establishment of non-native riparian vegetation along affected reaches. These general effects of dams and impoundments may occur wherever dams and impoundments are a part of the proposed action of operation and maintenance of the FCRPS.

The proposed action also includes various potential construction projects on the Ice Harbor, Lower Monumental, Little Goose and Lower Granite dams. These are described in the BA, and include such items as surface bypass collection and extended submersible bar screens, upgrading fish handling facilities, and behavioral guidance systems. Construction of these facilities would create some degree of disturbance in the immediate vicinity of the Ice Harbor, Lower Monumental, Little Goose and Lower Granite Dams. This disturbance could affect the behavior of fish or birds using the area for the duration of the construction period.

Hungry Horse, Libby, Albeni Falls, Dworshak, and Grand Coulee dams were built without fish passage facilities and are barriers to bull trout migration. These total barriers have isolated sub-populations of migratory bull trout from the larger meta-populations. The Lower Snake and Lower Columbia River projects have fish passage facilities, but these fishways were designed for anadromous fish, not resident fish such as bull trout. Small numbers of bull trout have been observed using fish passage facilities at Lower Monumental and Little Goose dams. The dams with fish passage facilities may also be a factor isolating bull trout subpopulations if they are not readily passable by bull trout. Migratory bull trout formerly linked resident bull trout to the overall gene pool for this species. Migration barriers have isolated these populations, potentially causing a loss of genetic diversity.

Entrainment of bull trout through turbines may also occur at various projects including Libby, Hungry Horse, Albeni Falls, Dworshak, Bonneville, Ice Harbor, Lower Monumental, Little Goose, and Lower Granite dams. Fish can be killed or injured when passing the dams. Those that survive passage may be isolated in downstream reaches.

Reservoirs have inundated bull trout habitat. For example, reservoirs created by Libby and Hungry Horse dams have inundated miles of mainstem and tributary habitat used by many subpopulations of bull trout (Corps et al. 1999). However, reservoirs such as Libby, Hungry Horse, and Dworshak now provide habitat for adfluvial populations of bull trout. This habitat was not available prior to reservoir fill and the creation of these water bodies.

Flow releases from storage projects alter the natural flow regime, affect water temperature, and cause repeated and prolonged changes to the wetted perimeter. Reservoirs are drawn down substantially during drought years. Reduced volume of water in reservoirs during droughts affects the overall productivity which may ultimately reduce the food base of predators such as bull trout. Power peaking operations, which change the flow of the river on a frequent basis, cause large areas of the river margins to become alternately wet and then dry, adversely affecting aquatic insect survival and production (Hauer and Stanford, 1997). Hoffman et al. (2000) points out that flow reductions on the Kootenai River from 9,000 cfs to the minimum flow of 4,000 cfs results in loss of 37.4 percent of the total available water depth, and a loss of 46.4 percent of the channel width. Flow fluctuations at higher discharges also influenced fish habitat use by changing the varial zone (alternately wetted and dry zone along the river edge) and changing water velocities. Changes in water depth and velocity, and physical loss or gain of wetted habitat can cause juvenile trout to be displaced, thus increasing their vulnerability to predation (Hoffman et al. 2000) and causing adverse effects to their survivability. Also, as pointed out downstream of nearby Hungry Horse Dam, rapid flow reductions from Hungry Horse Dam can strand young fish if they are unable to escape over and through draining or dewatered substrate (BA, 1999). These effects, in turn, indirectly adversely effect bull trout by degrading the habitat of their prey (small fish) and the food upon which it depends (aquatic insects).

High levels of gas supersaturation can cause gas bubble trauma in fish. Uncontrolled spill at FCRPS projects which can produce extremely high levels of total dissolved gas may impact bull trout and other species.

7. Species' response to the proposed action

Below, more specific responses of threatened and endangered species are described. Information is organized geographically for each species.

7.A. Bull Trout

7.A.1 Upper Columbia River

Libby Dam

Passage/Entrainment - Libby Dam was not constructed with fishways to accommodate safe upstream or downstream passage of fish. The dam blocks any upstream migrations of bull trout and prevents the downstream Kootenai River bull trout stock from genetically mixing with the upstream Koocanusa Reservoir bull trout stock. Downstream passage of bull trout from Koocanusa Reservoir through the turbines at Libby Dam has been documented (Skarr et al. 1996) and genetic intermixing with the Kootenai River stock is possible. Disruption of migratory corridors causes habitat fragmentation and negatively affects bull trout by eliminating gene flow and lessening the chance of stock persistence (Neraas and Spruell 2000). Provision of upstream passage facilities is not being contemplated at this time; however, it may be desirable, pending further study, to incorporate devices or facilities into the dam which prevent downstream passage (see entrainment discussion, below). Potential adverse effects on the Koocanusa Reservoir bull trout stock from genetic isolation from the downstream Kootenai River stock, due to lack of upstream passage facilities, are currently unknown. Studies are necessary to identify issues and work toward resolution.

At Libby Dam, entrainment of bull trout was documented by Skaar et al. (1996) during studies conducted from1992 to1994. Expansion of the sample collections and flow conditions gave an estimate of 575 to 2,235 bull trout entrained through Libby Dam during the study period (BA, 1999). The Koocanusa Reservoir stock of bull trout appears to be stable at this time, however, entrainment of large numbers of bull trout could constitute an adverse effect on that stock. The magnitude of that effect on the sub-population would depend on the actual number, size and age of bull trout entrained. Skaar et al. (1996) documented a high rate (81 percent) of turbine related injury to other fish species entrained during the study. In addition, study of steelhead passage through turbines resulted in 22 to 41 percent mortality (Wagner and Ingram, 1993), and is likely to be similar for adult bull trout. Further investigations are warranted to verify the magnitude and potential adverse effects to bull trout from entrainment. Injury or death of bull trout is likely being caused by entrainment through dam turbines and constitutes "take" which will be addressed later in the Incidental Take Statement of this Biological Opinion.

Power Peaking - Hauer and Stanford (1997) noted that prior to construction of Libby Dam, the mean daily change in river discharge remained less than 10 percent throughout the year. However, since dam power peaking operations began, the mean daily percent change has varied greatly, but especially from October to March, with a range from 40 percent above normal to 20 percent below normal. Hauer and Stanford (1997) also demonstrated that the Kootenai River has not only been subject to a wide day-to-day change in discharge, but to changes of as much as 16,000 cfs in one day. This is significant to river biological health when it occurs, as discharge fluctuates between 20,000 and 4,000 cfs within a matter of hours, thus dramatically affecting shallow water habitats. For comparison, a natural (pre-dam) rate of river discharge decline from 20,000 to 10,000 cfs would occur over a 15 - 30 day time period.

Libby Dam operates without substantive restrictions during the winter period. This results in rapid and dramatic changes in both river flow and stage downstream of the dams. Bull trout utilize portions of the Kootenai River. These stream reaches are subjected to extreme flow fluctuations, a possible 4,000 cfs to 27,000 cfs change in 3 hours in the Kootenai River.

The BA and "supplemental information", dated 12/14/99, described the effects of power peaking and load following operations at Libby Dam on the downstream river habitat, and potential effects on bull trout occupying that habitat. As noted in the BA, Libby Dam operations can cause rapid and severe river level and flow changes, especially between the months of October and December when winter peaking "results in wide fluctuations of flow between 4,000 and 10,000 cfs which has profound effects on the wetted perimeter of the Kootenai River" (BA, 1999). Power peaking operations have had "numerous deleterious effects on river zoobenthos" with most species having reduced abundance (Hauer and Stanford 1997). The river downstream of the dam has an expansive varial zone that is essentially devoid of zoobenthos whenever the dam is operated with dramatic flow fluctuations for power peaking. Such river flow changes adversely effect juvenile and sub-adult bull trout by increasing their vulnerability to predation (Hoffman et al. 2000) and decreasing the quantity and quality of rearing habitat and prey availability.

Similar to other migratory bull trout stocks (Shepard et al. 1984), Kootenai River juvenile bull trout likely migrate from their natal streams to the Kootenai River when they are 4 to 6 inches in length (2 to 3 years old), and grow to maturity at over 18 inches in length during the next 3-4 years in the river. At maturity they are likely secure from predation. Juvenile salmonids and char prefer habitats in the river margins where shallower depths and lower velocities provide optimal habitat and foraging locations (Marotz 2000, pers. comm., Rieman and McIntyre, 1993). Flow changes affect these river margins more dramatically than other main river areas. Juvenile and subadult size bull trout have an increased risk of predation when they are forced to move from their preferred habitats by river flow changes caused by dam peaking operations (Hoffman et al. 2000). This increased risk of predation results in decreased survival, increased injury and predation avoidance stress.

Power peaking operations which change the flow of the river on a frequent basis, cause large areas of the river margins to become alternately wet and then dry, adversely affecting aquatic insect survival and production (Hauer and Stanford 1997). Hoffman et al. (2000) documents that flow reductions on the Kootenai River from 9,000 cfs to 4,000 cfs result in a loss of 37.4 percent of the total available water depth, and a loss of 46.4 percent of the channel width. Flow fluctuations at higher discharges also influence fish habitat use by affecting the varial zone and water velocities. Changes in water depth and velocity, and physical loss or gain of wetted habitat cause displacement of juvenile trout and increase their vulnerability to predation (Hoffman el al. 2000). These effects also indirectly adversely effect bull trout by degrading the habitat of the prey base.

Sturgeon and Salmon Flow Augmentation - The proposed action is to provide water from Koocanusa Reservoir for augmentation of Kootenai River white sturgeon spawning activities in June, and augmentation of juvenile migration for salmon species in the lower Columbia River in July and August. Between these two higher water augmentation events there occurs a period of approximately a month when releases from Libby Dam will be at low flow. Adverse effects to bull trout can occur if the transition between the high flow and low flow periods occurs over too short a period of time, or if the transition has extreme stage changes during the biologically productive summer growing season. The adverse effects to bull trout would be similar to those identified above for power peaking operations. Rapid changes in the river wetted substrate, and rapid changes in water velocity in bull trout micro-habitats would decrease bull trout prey availability and production, and increase juvenile and sub-adult bull trout vulnerability to predation.

Gas Supersaturation - Gas supersaturation and the potential for formation of gas bubble disease in fish is possible when spill conditions occur at Libby Dam. Fish injury from high nitrogen levels has occurred during past spill events when the saturation level in the river reached 139% (BA). At levels near 140%, gas bubble disease may occur in over 3% of fish exposed. At levels of up to 120%, the incidence of gas bubble disease decreases to a minimum of 0.7% of fish exposed (NMFS, 2000a). Adverse effects to bull trout and other fish can include death and injury depending on the length and intensity of exposure. The risk of spill, and the supersaturation conditions it causes, increases with failure of generators or transformers at the dam. The proposed action includes provisions for conducting studies to determine appropriate measures for minimizing the risk of spill and thereby reducing the potential for adverse effects.

Temperature - A selective water withdrawal system at Libby Dam provides temperature control to protect cold water fish such as bull trout in the Kootenai River, therefore, no adverse effects are anticipated. Current operations manage for 54-46° F (12-8°C).

Koocanusa Reservoir (Libby Dam):

Reservoir Operations - Annual water storage in the summer months, and subsequent water withdrawal during the fall and winter months, can affect reservoir bull trout habitat and food production. Koocanusa can be drawn down 110 feet or more for flood control during this annual cycle, which diminishes the amount of aquatic and terrestrial insect production available to bull trout prey species (BA, 1999). General aquatic production, and consequently bull trout forage fish production, can also be decreased by failure to refill the reservoir. Potential adverse effects to bull trout due to decreased prey availability are likely, but the extent of such effects is unknown.

Clarification of Proposed Action - Libby Dam Operations

The analysis of the response of bull trout detailed above was developed based on the proposed action as initially outlined in the 1999 BA. As noted in section 3 of this Opinion, on December 19, 2000, the Service received a letter from the action agencies, further clarifying their action.

A summary of those clarifications, and how they may effect bull trout, are listed here.

- The letter establishes when VARQ will be implemented at Libby Dam.

- The 1999 BA did not include minimum flows for bull trout. Minimum flows for the species are established for the July-August period. This increase in base flow should provide for additional habitat productivity in the most biologically productive time of the year.

- Ramp rates were proposed in the initial BA, however rates were not conservative for the species. The letter includes the action agencies agreement to test ramp rates, which restrict the operation of the Libby project. This test will facilitate analyses of the feasibility of the rates and the changes to biological productivity in the river sections below the dam.

- The letter establishes higher minimum flows in the Kootenai River.

- The letter identifies studies to address transmission stability issues, spill tests and supersaturation effects to the aquatic environment.

The analysis outlined above, together with the conclusions in section 7.A.5., demonstrates that the action as outlined in the 1999 BA would have avoided jeopardy to listed bull trout. Based on the modifications to the action provided in the December 19, 2000, letter, the Service feels that the modifications to operations summarized above would reduce adverse effects, and would reduce take of bull trout.

Hungry Horse Dam

Passage/Entrainment - Hungry Horse Dam was not constructed with fishways to accommodate safe upstream or downstream passage of fish. The dam blocks any upstream migrations of bull trout, and because of the location of the dam water withdrawal entrances in relation to bull trout occurrence, downstream movement or entrainment of bull trout is suspected of being minimal (Marotz 2000, pers. comm.). However, no definitive studies have been conducted to confirm this hypothesis. If entrainment is occurring, the effects would be similar to those described for Libby Dam(previous section). Hungry Horse Dam has prevented the invasion of non-native species from entering the South Fork Flathead River drainage upstream of the dam, and has had a beneficial effect in protecting the near-native fish community in Hungry Horse Reservoir (BA, 1999). Any potential adverse effects to the Hungry Horse Reservoir (South Fork Flathead River stock) of bull trout due to lack of fish passage or entrainment at Hungry Horse Dam are unknown, and should be investigated further. Any adverse effects to the downstream Flathead Lake or Flathead River stocks of bull trout due to genetic fragmentation (loss of the South Fork genetic contribution) are unknown and warrant further studies.

Power Peaking - The Hungry Horse Dam power peaking and other operations adversely affect juvenile and sub-adult bull trout in the river. Juvenile and sub-adult bull trout are normally found in shallow water shoreline margins and riffle areas which are subject to repeated flow and river stage changes from power peaking (BA). These operations can occur year-round and can result in dam discharges varying from 145 cfs up to 11,200 cfs. During the summer recreation season these flows are ramped so the discharge change is spanned over a 6 hour period, but no restrictions apply at other times of the year. The proposed action is to provide a year-round minimum flow from Hungry Horse Dam of 145 cfs. Adverse effects to bull trout residing in the South Fork Flathead River would occur with a minimum flow of 145 cfs with no other operational restrictions (ramping rates) because of the severe and frequent water level and velocity changes that would occur between 145 cfs and 11,200 cfs. The proposed action is to augment mainstem Flathead River flows from Hungry Horse Dam to provide a minimum flow of 3,500 cfs for bull trout occurring in the mainstem Flathead River, as extreme low flow river conditions would be avoided, thus stabilizing river habitats.

Shepard et al. (1984) describe Flathead Basin juvenile bull trout as migrating from their natal streams to the downstream Flathead Lake and River when they are 4 to 6 inches in length (2 to 3 years old), and mature at over 18 inches in length during the next 3-4 years in the lake. Juvenile salmonids and char prefer habitats in the river margins with shallow depths and low water velocities (Marotz 2000, pers. comm.). Flow changes affect these river margins more dramatically than other main river areas. Juvenile and subadult size bull trout have an increased risk of predation when they are forced to move from their preferred habitats by river flow changes caused by dam peaking operations (Hoffman et al. 2000). This increased risk of predation leads to increased injury, mortality, and predation avoidance stress.

Hungry Horse Dam operates without substantive restrictions during the winter period. This results in rapid and dramatic changes in both river flow and stage downstream of the dam. Bull trout may utilize the 5 miles of the South Fork Flathead River, downstream of the Dam and are present in the mainstem Flathead River. These stream reaches are subject to extreme flow fluctuations, up to 145 cfs to 11,700 cfs within hours in the South Fork Flathead River. Flow fluctuations from the South Fork also affect the mainstem Flathead River.
Power peaking and voltage or transmission stability operations change the flow of the river on a frequent basis. This adversely affects aquatic insect survival and production and can strand young fish (BA, 1999). These effects also degrade the habitat and availability of the prey base.

Salmon Flow Augmentation - Following the spring run-off event (May-June), the proposed action is to provide juvenile migration augmentation water from Hungry Horse Reservoir for salmon in the lower Columbia River during late July and August. Between these two higher water events in the mainstem Flathead River there occurs a period of several months when releases from Hungry Horse Dam can be at low flow (current minimum flow in the proposed action is 145 cfs), depending on the water runoff forecast. Adverse effects to bull trout can occur in the South Fork and mainstem Flathead Rivers if the transition between the low flow and high flow periods occurs over too short a time period, or if the transition has extreme stage changes during the biologically productive summer growing season. The adverse effects to bull trout would be similar to those identified above (power peaking operations);

rapid changes in bull trout micro-habitats. This decreases prey availability, production and increases juvenile and sub-adult bull trout vulnerability to predation.

Gas Supersaturation - Spill of water from Hungry Horse Dam is generally avoided because the dam outlet works are known to cause gas supersaturation conditions (in excess of State standards of 110%) in the South Fork Flathead River and the downstream mainstem Flathead River. Adverse effects to bull trout could occur during spill events and the severity of the effect would depend on several factors (level of gas supersaturation, depth of the fish, length of time of exposure, etc.). At the present time, potential adverse effects to bull trout would likely be minimal, as the natural unsaturated flows from the North and Middle Forks Flathead River mix with the supersaturated flows originating from Hungry Horse Dam.

Temperature - Operation of a selective withdrawal system at Hungry Horse Dam allows water temperatures in the regulated mainstem Flathead River to mimic pre-impoundment natural conditions, particularly during the optimum summer and fall fish growth period (BA, 1999). Operation of the selective withdrawal system should result in restoration of pre-impoundment aquatic insect diversity and increased fish growth in the river, resulting in improved conditions for bull trout.

Hungry Horse Reservoir

Reservoir Operations - Hungry Horse Reservoir flood control, hydropower, and salmon flow augmentation operations can affect reservoir bull trout habitat and food production. Hungry Horse Reservoir can be drawn down 85 feet during this annual cycle, which can diminish the amount of aquatic and terrestrial insect production available to bull trout prey species (BA, 1999). General aquatic production, and consequently bull trout forage fish production, can also be decreased by failure to refill the reservoir. Potential adverse effects to bull trout due to decreased prey availability are currently unknown.

Clarification of Proposed Action

The analysis of the response of bull trout detailed above was developed based on the proposed action as initially outlined in the 1999 BA. As noted in section 3 of this Opinion, on December 19, 2000, the Service received a letter from the action agencies, further clarifying their action.

A summary of those clarifications, and how they may effect bull trout, are listed here.

- The letter establishes when VARQ will be implemented at Hungry Horse Dam.

- The 1999 BA did not include minimum flows for bull trout. Minimum flows for the species are established for the July-August period. This increase in base flow should provide for additional habitat productivity in the most biologically productive time of the year.

- Ramp rates were not proposed in the initial BA. The letter includes the action agencies agreement to test ramp rates at Hungry Horse Dam over the next two years. This test will facilitate analyses of the feasibility of the rates and the changes to biological productivity in the river sections below the dam.

- The letter establishes higher minimum flows in the South Fork of the Flathead River.

- The letter establishes a year-round minimum flow at Columbia Falls with a sliding scale between 3,200 and 3,500 cfs.

The analysis outlined above, together with the conclusions in section 7.A.5., demonstrates that the action as outlined in the 1999 BA would have avoided jeopardy to listed bull trout. Based on the modifications to the action provided in the December 19, 2000, letter, the Service feels that the modifications to operations summarized above would reduce adverse effects, and would reduce take of bull trout.

Albeni Falls Dam

Passage/Entrainment - Albeni Falls Dam was constructed without fishways to accommodate safe upstream and downstream passage of fish. This dam is a barrier isolating about 50 miles of the Pend Oreille River and its tributaries from Lake Pend Oreille. These migratory bull trout subpopulations are believed dependent upon Lake Pend Oreille for sub-adult and adult rearing. Similar life history patterns (involving adfluvial bull trout utilizing spawning streams entering the system below lakes) occur with the Lake Wenatchee, Washington, and Bull Lake, Montana populations. Bull trout were abundant in the Pend Oreille River through 1957, and then abruptly their numbers decreased to the point that individual fish are now noteworthy. This abrupt decline correlates with the commencement of operation of Albeni Falls Dam in 1952. No other abrupt, or widespread threat can be identified for this portion of the Pend Oreille River basin during the 1950's. In the absence of passage, migratory bull trout remaining in the Pend Oreille River will continue to be harmed.

Forage Base in Lake Pend Oreille

Kokanee salmon and exotic species are providing the majority of the forage base for adult bull trout in Lake Pend Oreille (Mallet, 2000). Generally, where lake trout have been introduced to lakes with adfluvial bull trout, lake trout have become the dominant species. This has occurred in Priest Lake (Rieman and Lukens, 1979, Bowles et al. 1991); Flathead Lake (Weaver, 1991); and other lakes (Donald and Alger, 1992). Competition and/or predation are believed to be the principal mechanisms leading to decline of bull trout. These above mentioned lakes did not have an abundant prey base such as kokanee when bull trout were displaced

Lake trout are believed to be the principal threat to Lake Pend Oreille bull trout (PBTTAT, 1998). Thus far, Lake Pend Oreille has been an exception to the pattern of bull trout displacement. Although lake trout were introduced 75 years ago, bull trout numbers have been nearly stable in recent decades. It is suggested that bull trout have been able to coexist with lake trout in Lake Pend Oreille because of an abundant supply of kokanee as a forage base for both species (PBTTAT, 1998). However, the kokanee population is at record low levels, and at risk of collapse (Mallet, 2000). Kokanee spawning habitat is considered limiting in Lake Pend Oreille. Cabinet Gorge Dam continues to block migration to tributaries estimated to have supported 100,000 spawners annually (Pratt and Huston, 1993). Improvement in lake shore spawning success appears to be the best available option to restore kokanee numbers (Mallet, 2000). Alternation of lake levels, which allows wind-driven waters to cleanse spawning gravels, has shown promise of increasing kokanee egg to fry survival. Alternating winter water levels between Lake elevation 2051 and 2055 feet, is within operating criteria of Albeni Falls Dam. When Lake Pend Oreille is held annually at elevation 2051 feet, those gravels around the lake shore below the depth of wave driven agitation (below approximately elevation 2047 feet) become compacted with fine materials, and "sorted" into sizes not optimal for kokanee spawnings. This makes those gravels unsuitable for kokanee incubation because of poor water circulation and oxygen depletion. When the lake is managed to elevation 2051 feet, those gravels between approximately 2047 and 2051 feet are subject to wind-driven agitation. Shifting gravels are unsuitable because eggs and fry may be injured directly or exposed to predation. Studies maintaining the lake elevation at 2055 feet are intended to provide a band of gravels, between approximately 2047 and 2051 feet, around portions of Lake Pend Oreille which have recently been cleansed by wave actions. The gravels are still below elevations subject to disturbance through wave action, between elevations 2051 and 2055 feet. At some of the sites which are subject to very intensive wave action, extended stable lake levels may cause displacement of suitably sized spawning gravels, leaving cobble too large for kokanee to spawn in (Bill Harriman, 2000, IDFG pers. comm.). Thus, by supporting maintenance of the kokanee forage base, operators of Albeni Falls Dam may indirectly preclude harm to bull trout. Conversely, maintenance of static winter water levels (no alternating levels) above Albeni Falls Dam may lead to displacement of bull trout from the Lake Pend Oreille subpopulation.

7.A.2. Lower Columbia River

The present distribution of bull trout in the Lower Columbia River basin is less than their historic range (Buchanan et al. 1997). Subpopulations of bull trout have been isolated by large-scale hydroelectric facilities and large expanses of fragmented habitat. Although fish may pass Bonneville, The Dalles, John Day, and McNary dams in both upstream and downstream directions, the extent to which bull trout use the Columbia River and these fish passage facilities designed for anadromous fishes is relatively unknown. In addition, the nine major tributaries have numerous hydroelectric facilities, many of which do not provide upstream passage and may isolate the tributaries where these facilities occur, from the mainstem Columbia River.

It is not certain whether the Lower Columbia River is a seasonal migratory corridor for bull trout.

However, bull trout have been caught in the mainstem downstream from Bonneville Dam, and in both the Bonneville and The Dalles reservoirs in the northern pikeminnow reward program fishery (Wachtel, 2000). In addition, several fish tagged in the Hood River, Oregon river reach have been recaptured at Drano Lake, Washington, the Bonneville pool backwater of the Little White Salmon River (ODFW, unpublished).

Passage/Entrainment

Recent records indicate that bull trout have only been captured in the Bonneville Dam reservoir, The Dalles Dam reservoir, and the Lower Columbia River downstream from Bonneville Dam (Wachtel, 2000). Recent records of bull trout from the John Day or McNary reservoirs do not exist. Additional evidence exists of historical presence of bull trout at The Dalles and potential for use of McNary reservoir by bull trout. The earliest confirmed record for bull trout is a specimen collected in 1854 from the Columbia River at The Dalles (Cavender, 1978). Bull trout have also been collected in the adult fish trap at Threemile Dam near the mouth of the Umatilla River (Contour, Confederated Tribes of the Umatilla Indian Reservation, personal communication).

The Lower Columbia River dams are equipped with fish passage facilities and are operated to pass anadromous salmonids. Bonneville, John Day, and McNary dams are equipped with fish screen and bypass systems for downstream migrating juvenile salmon and steelhead. The Dalles Dam’s turbines are not screened. Juvenile fish passage facilities at The Dalles Dam include an ice-trash sluiceway and one six-inch diameter orifice in each turbine bay gatewell. Fishways are provided at each Lower Columbia River dam for upstream passage by adult salmon and steelhead. All fish passage facilities are operated and maintained according to criteria specified in the annual Fish Passage Plan (Corps, 2000a).

Bull trout move into the Bonneville Dam reservoir from tributaries such as the Hood River and migrate back into the tributaries on spawning migrations. It is not known how long they spend in the mainstem. Some of these fish may move upstream or downstream within the reservoir and attempt to pass Bonneville or The Dalles dams. The possible passage routes for downstream migrants at Bonneville Dam include the spillway, juvenile fish bypass system, sluiceways, turbines, fish ladders for adult fish, and navigation lock. With the exception of the juvenile fish bypass system, similar routes of passage also exist at The Dalles Dam. Upstream migrants may use the fishways designed for adult salmon and steelhead or the navigation lock.

Downstream Passage

Presently, it is not known if downstream passage conditions at the Lower Columbia River dams are suitable for bull trout. Little is known about the migratory behavior of bull trout in the Lower Columbia River (e.g., time of downstream migration or the size of fish when they would be passing the dams). The Lower Columbia River dams are presently configured and operated to pass juvenile salmon and steelhead according to the NMFS' 1995 biological opinion and the 1998 and 2000 supplemental opinions for operation of the FCRPS. The main passage routes for juvenile fish are the spillways, fish screen and bypass systems, and turbines.

The Lower Columbia River dams are operated to pass juvenile anadromous salmonids during the migration season (March 1 through November at Bonneville Dam; April 1 through November at The Dalles and John Day dams; April 1 through December 15 at McNary Dam). Specific operational measures that are implemented for juvenile anadromous salmonid migration include voluntary spill, transportation of fish, flow augmentation, mechanical bypass, and operating turbines at peak efficiency. Controlled, voluntary spill is provided at the Lower Columbia River dams from April 20 through August 31 to improve the survival of juvenile salmonids when they pass these projects. All juvenile fish that are collected at McNary Dam after about June 20 are transported by barge or truck and released downstream from Bonneville Dam. The NMFS has established spring and summer flow objectives at McNary Dam to reduce the time required by juvenile salmonids to migrate through the Lower Columbia River. The spring flow objective may be from 220 to 260 thousand cubic feet per second (kcfs), depending on water runoff forecasts, and the summer flow objective is 200 kcfs. Water is provided from upstream storage reservoirs such as Libby, Hungry Horse, Grand Coulee, and Dworshak to help meet these flow objectives.

The goal of these facilities and operations has been to ensure that as few juvenile fish as possible pass through dam turbines. The percentage of fish that pass the dams by routes other than turbines is expressed as "fish passage efficiency"(FPE). The FPE goal set by the NMFS for the Lower Columbia River dams has been 80 percent. Under existing conditions, McNary, John Day and The Dalles dams exceed this goal for spring chinook salmon, while Bonneville Dam's FPE is about 69 percent. For fall chinook salmon, only The Dalles Dam exceeds this goal, while the remaining projects range between 49 and 71 percent.

The juvenile anadromous fish passage strategy of the NMFS will be to maximize the survival of juvenile outmigrants through the FCRPS. This is to be accomplished by a combination of actions. These include: maximizing spillway passage, investigating surface bypass passage, investigating surface collection passage, maximizing fish survival through powerhouse intake screen and bypass systems, investigating ways to reduce turbine mortality, and reducing predation.

The effect of operation of the Lower Columbia River hydroelectric projects on downstream bull trout passage is unknown at this time. Recent Smolt Monitoring Program records indicate that no bull trout have been collected in the juvenile fish collection facilities at McNary, John Day, or Bonneville dams (Basham, 2000). However, it is possible that bull trout may pass all of the Lower Columbia River dams over the spillways or through the turbines. Measures intended to improve downstream passage survival of juvenile anadromous salmonids at the Lower Columbia River dams would be expected to pass smaller bull trout, provided they are at the same depths as juvenile salmon and steelhead, and provided those measures are implemented when bull trout are present. There is little, if any, information regarding the depths at which bull trout would be present in Bonneville pool or other Lower Columbia River reservoirs. Data from Powerdale Dam on the Hood River indicate that bull trout migrating upstream, presumably out of Bonneville reservoir, were primarily collected between early May and late July (cite). A few bull trout have been collected in August and October. Passage measures for anadromous salmonids are being implemented during this time at Bonneville and The Dalles dams.

A high percentage of juvenile bull trout that would pass dams over the spillway and via the juvenile fish bypass systems would be expected to survive. Lower survival would be expected for those bull trout that pass through turbines. Survival of juvenile anadromous salmonids passing Columbia River dams via the spillways has been found to range between 97% and 100% at each dam. Fish that pass through the juvenile fish bypass system survive at rates of 97% to 99% per dam. Direct turbine survival through Columbia River dam turbines has been estimated to average about 90% per dam (NMFS, 2000).

Larger adult bull trout passing over the spillways are expected to survive at rates comparable to those for smaller salmonids. Those adults passing through the juvenile bypass system would be expected to have low mortality rates, but higher injury rates. Wagner and Hillson (1973) found that 1% of adult steelhead that fell back through the juvenile bypass system at McNary Dam died, but that 40% to 50% suffered injuries. Mortality rates for adult bull trout passing through turbines is expected to be higher than for juvenile fish. Mortality estimates ranging between 22 and 57 percent for adult steelhead that passed through turbines were reported in a summary of adult fish fallback rates and mortality (NMFS, 1998).

Any bull trout that would be collected at McNary Dam during the summer juvenile fish migration season would be transported by barge or truck and released into the Columbia River downstream from Bonneville Dam. This would displace these fish at least 150 miles downstream. Presently, it is not known if this would occur because no bull trout have been recorded to date (1981 to the present) in the smolt monitoring facilities at McNary Dam.

Upstream Passage

The Lower Columbia River dams are all equipped with fishways for upstream passage by anadromous fish. To date, there are no records of bull trout passage at any of the Lower Columbia River dam fish ladder counting stations (John Loch, WDFW, personal communication). However, in the past there has not been a requirement to count and record bull trout at these projects. Therefore, records of fish passage may not represent actual upstream migration by bull trout. However, a lack of records of bull trout passage seems to indicate that passage does not occur.

Depending on the results of studies to determine the extent that bull trout use the mainstem Columbia River, there may be a need to determine the upstream passage requirements of bull trout at fishways on major dams. Presently, fishways are designed and operated for passage by adult salmon and steelhead. It is not known if criteria that have been developed for salmon and steelhead will suffice for bull trout. Information needs include the flow velocities required to attract bull trout into fishway entrances, types of fishway configurations that bull trout prefer (vertical slot, submerged orifice, pool and weir, etc.), temperature requirements, and entrance and fishway depths.

Power Peaking

Presently, the four Lower Columbia River dams are operated for power peaking within the limits for change in tailwater elevation and flow volume shown in Table 8. John Day Reservoir elevations also fluctuate for flood control. When they are present in the Lower Columbia River, bull trout can be adversely impacted by rapid elevation fluctuations in both reservoirs and unimpounded river reaches below projects. Sudden increases or decreases in flows can dewater stream banks, strand or displace juvenile fish, disrupt adult fish populations, and reduce availability of aquatic insects and small fish for food (BA, 1999).

Table 8. Existing flow fluctuation limits for Lower Columbia River dams.

Dam	Rate of tailwater elevation change	Rate of flow volume change (cfs/hr)
Bonneville	Summer 1.5 ft/hr, 4 ft/24 hr Winter 3 ft/hr, 7 ft/24 hr	Not specified
The Dalles	3 ft/hr	150,000 cfs/hr
John Day	3 ft/hr	200,000 cfs/hr
McNary	1.5 ft/hr	150,000 cfs/hr

Entrapment and stranding of salmon fry caused by fluctuating flows from hydroelectric facilities in the Columbia River has been documented and is currently being studied. The Oregon Department of Fish and Wildlife (ODFW), Washington Department of Fish and Wildlife (WDFW), and the Service are presently involved in a joint study to determine the effects of flow fluctuations on juvenile anadromous salmonids downstream from Bonneville Dam. Field observations from this study indicate that fluctuating flows entrap salmon fry by isolating them in pools, or strand them on gravel bars (Joe Hymer, WDFW, personal communication).

The effects of flow fluctuations appear to be greatest on smaller fish. Chinook salmon fry inhabit shallow waters near shorelines and move to deeper water as they become larger. In the Hanford

Reach, protective measures to reduce fish entrapment and stranding are in effect until the juvenile chinook salmon reach 60 millimeters (mm) in length.

The effects of flow fluctuation on bull trout in the Lower Columbia River are undetermined at this time because little information regarding the numbers of bull trout present, the size of bull trout when they enter the Lower Columbia River, their habitat preferences, and responses to flow changes is available. Limited data are available for larger fish that have been collected in sport fisheries, gill nets, or adult fish traps. Downstream migrant traps in the Hood River system have collected limited numbers of bull trout (n = 18) ranging between 115 to 211 mm in length (Newton, 1998). However, the type of sampling gear used does not effectively collect bull trout, which are bottom dwellers.

Smaller bull trout may be susceptible to entrapment or stranding due to flow fluctuations. Goetz (1989) reported that bull trout less than 100 mm in length were primarily bottom dwellers and that juveniles were found in highest abundance in larger rivers among rocks along the stream margin or in side channels. Flow fluctuations could potentially strand or entrap juvenile bull trout if they are present in the Lower Columbia River. Additional information is needed to determine the size of bull trout when they are present in the Lower Columbia River.

Larger bull trout could be affected by flow fluctuations. Bjornn (in Goetz, 1989) reported that bull trout moved to near surface waters when temperatures were below 12.8 degrees C. Goetz (1989) also noted that Hanzel (1985) reported bull trout consistently traveled along the shoreline of Flathead Lake. The feeding behavior of bull trout could also make them susceptible to stranding or entrapment if they feed upon juvenile salmon or resident fish in shallow waters. There is little information regarding the movement of bull trout in the Lower Columbia River. Bull trout that are captured at the Powerdale Dam trap are tagged. A few bull trout have been tagged with radio transmitters, but additional tagging is necessary to determine their patterns of movement, preferred depths, and the relationship of their movements to water temperature.

Inudated Habitat

The construction of the hydroelectric projects on the mainstem Columbia River has resulted in significant changes to the aquatic habitat and the biological community. Hydroelectric projects have created reservoir systems upstream of the dams, changing what was once a free-flowing riverine (lotic) system into a slow-moving lacustrine (lentic) system. Dam construction has inundated, impeded, or blocked access to spawning areas (Fulton 1968; Gordon 1964; Raymond 1988). As a result, these changes, in part, have resulted in sharp decreases of returning Pacific salmon and little is known about the extent at which these changes are affecting bull trout. Other effects of inundated habitat have included changes in the biological community within the system due to modifications of the aquatic habitat. Changes in resident fish assemblages have been documented (Barfoot, U.S. Geological Survey (USGS), pers. comm., 2000). Historically, fish communities in the Columbia River Basin were dominated by stenothermic coldwater salmonids and cottids (Li et al. 1987). However, hydroelectric development has resulted in aquatic habitat changes, thus changing the native biotic communities in rivers of the basin (Barfoot, pers. comm., 2000). These changes restructured fish assemblages which were then further modified by a proliferation of introduced warmwater and coolwater fishes, such as centrachids and percids, in littoral and sublittoral habitats of reservoirs (Li et al. 1987; Poe et al. 1994). The extent of the effect that these "community" changes may be having on bull trout within the Columbia River is unknown. Historically, bull trout have been captured in the Columbia River (Gray and Dauble, 1977), and recent captures of bull trout in the mainstem suggest that bull trout use of the Columbia River is a feasible hypothesis. Therefore, habitat loss and increased competition and predation from introduced species may be adversely affecting remnant populations.

Gas Supersaturation

Bull trout have been reported from the reservoirs of Bonneville and The Dalles dams and in the free-flowing reach downstream from Bonneville Dam. Uncontrolled spill during spring runoff may adversely affect bull trout within the main stem due to high dissolved gas levels resulting in gas bubble trauma (GBT). The time of year for major uncontrolled spill appears to coincide with bull trout upstream spawning migrations to cooler, headwater streams, based on radiotelemetry work on Deschutes/Warm Springs rivers and Powerdale Dam trap information. Therefore, a mainstem population would most likely be moving into the tributaries during spring and early summer to holdover for fall spawning.

Uncontrolled or forced spill could detrimentally affect bull trout in dam tailraces and reservoirs if they are exposed to excessively high levels of total dissolved gas for extended periods of time. Both voluntary and involuntary spill occur at the Lower Columbia River dams. The voluntary spill program is conducted to improve the survival of juvenile anadromous salmonids during their seaward migration. Voluntary spill usually begins on April 20 and continues through August 31 at the Lower Columbia River dams. Spill is limited by water quality standard waivers that are issued by the Washington Department of Ecology and the Oregon Department of Environmental Quality to the NMFS. The waivers limit total dissolved gas (TDG) to 115 percent in the dam forebays and 120 percent in the dam tailraces.

Voluntary spill that limits TDG to the 115/120 percent level does not appear to adversely affect aquatic life. Research and monitoring of spill and TDG have found that the waiver limits of 115/120 percent TDG do not detrimentally affect migrating juvenile salmonids, resident fish, or invertebrates (Shrank et. al. 1997). Monitoring conducted from 1995 through 1999 indicates that the average incidence of GBT increases above 1% when TDG exceeds 115%. The incidence and severity of GBT increase at TDG levels above 120% (NMFS, 2000a). Severe signs of GBT have not been observed in resident fish and invertebrates when TDG levels were below the 115/120% level (Shrank et al. 1997).

Adult anadromous salmonids have shown varying frequencies of GBT depending on species. In 1997, sockeye salmon and steelhead examined at Bonneville Dam had higher incidences of GBT (15.6% and

7.1%, respectively) than chinook salmon (less than 1%). The highest incidences of GBT occurred when flow and involuntary spill were the highest during the year and TDG was greater than 125% (NMFS, 1998). In 1999,when TDG was generally within the 120/115% range, no signs of GBT were detected in adult salmonids sampled at Bonneville Dam (NMFS, 2000b).

Involuntary or forced spill occurs when riverflow exceeds turbine capacity or when there is a lack of electrical power demand. Involuntary spill can cause TDG levels to exceed the state standard of 110 percent, as well as the waiver limit of 120 percent. For example, in 1997, a high flow year, spill during the spring was primarily uncontrolled and TDG levels generally exceeded the waiver levels (NMFS, 1998). The NMFS has concluded that there are limited management actions available to decrease gas supersaturation in above average water years.

The impacts of spill and gas supersaturation on bull trout are expected to be similar to the effects on anadromous salmonids. Controlled spill up to the TDG waiver limits should not adversely impact bull trout. Uncontrolled spill typically occurs during the spring freshet, a period when bull trout are present in Bonneville pool and when they are migrating upstream into tributaries. Involuntary spill that produces TDG levels greater than the waiver limits may adversely affect bull trout if they are in shallower waters. Depth compensation reduces the effect of gas supersaturation so that fish are less affected at greater depths than they are in shallower waters. It is not known whether bull trout inhabit deeper waters or whether they frequent shallow waters in the Lower Columbia River reservoirs, so the effect of high TDG levels is unknown.

A secondary impact of gas supersaturation would be its effect upon the prey base of bull trout. Sampling of resident fish and juvenile salmonids during voluntary spill has not shown an adverse impact on those fish. Spill that produces TDG levels greater than 120% would produce signs of GBT in resident fish. Shrank et al. (1997) noted a high prevalence of GBT in resident fish downstream from Ice Harbor Dam when TDG levels ranged from 120 to 145 percent.

Research is needed to determine when bull trout reside in the Lower Columbia River, the size of bull trout when they are present in the Lower Columbia River, and the depth of water inhabited.

Temperature

The harmful effects of large reservoirs created by hydroelectric projects consist of reduced velocities and higher water temperatures (Gordon, 1964). Pools behind dams tend to have relatively warm water in comparison to their respective tributaries. Dam construction on the mainstem of the Columbia began in the 1930s. Over the past six decades, there have been increases in the maximum temperature with progressively earlier peak temperatures in the mainstem Lower Columbia River and its tributaries (Quinn and Adams, 1996). Water temperatures recorded at Bonneville Dam on the Lower Columbia River during recent years indicate that a substantial overall increase in temperature has occurred since 1949 (Petersen, U.S. Geological Survey (USGS), pers. comm., 2000). Bull trout are considered a cold-water salmonid. Goetz (1989) suggested optimum water temperatures for rearing of about 7 to 8° C; temperature above 15° C (59° F) is believed to limit bull trout distribution (Fraley and Shepard, 1989). Mainstem Columbia river water temperatures vary seasonally, with the warmest temperatures being recorded in the late summer to early fall and the coldest temperatures during the winter months. High temperatures in the mainstem are close to or can exceed bull trout temperature limits. In fact, the general consensus concerning bull trout presence in other areas where they have not been previously documented (i.e., Drano Lake) is that these captured fish are "dip-ins," i.e., fish seeking temperature refugia from the mainstem in the smaller, colder tributaries similar to upstream migrating steelhead. It appears that some bull trout are utilizing reservoirs created by hydroelectric projects. However, certain factors such as temperature may be integral in causing seasonal movements of mainstem fish into the major tributaries of the Columbia when mainstem temperatures rise above preferred temperatures for bull trout.

7.A.3. Lower Snake/Clearwater River

The only subpopulation of bull trout associated with the four Lower Snake River reservoirs spawns and rears in the Tucannon River basin. Both resident and migratory forms occur here. Only resident fish are suspected to be present in the headwater of Pataha Creek, but both forms exist in the main stem Tucannon River and its upper tributaries (WDFW, 1997). Evidence suggests that migratory bull trout from the Tucannon River also utilize the main stem Snake River on a seasonal basis (Buchanan et. al. 1997 citing Ward; WDFW, 1997). Kleist in litt. (1993) reported several observations of adult bull trout passing Lower Monumental and Little Goose dams. From 1994 to 1996, there were 27 bull trout passing the adult fish counting station (mainly in April and May) at Little Goose Dam (Richards, WDFW, personal communication, 2000). At least six bull trout passed counters at Lower Monumental and Little Goose dams in 1991 and 1992 (Kleist, 1993). Kleist also observed one bull trout in 1993 just downstream of the count window at Lower Monumental Dam. Furthermore, one bull trout was captured in the Palouse River below Palouse Falls in 1998 (Mendel, WDFW, personal communication, 2000). These were likely migratory fish from the Tucannon River. However, one bull trout was observed at Lower Granite dam in 1998 (Hurson, USCOE, personal communication, 2000) that may indicate fluvial fish are migrating to other upstream subpopulations. The status of bull trout associated with the Tucannon River was rated as "healthy" by WDFW, although some habitat is degraded due to timber harvest and recreational use. The Tucannon subpopulation is not currently at risk of extinction, and is not likely to become so in the foreseeable future because of sufficient habitat protection (wilderness designation) in the upper watershed and the lack of brook trout encroachment from Pataha Creek. The Pataha Creek subpopulation is at risk of extinction as a result of habitat degradation, and competition and hybridization from brook trout.

Bull trout may pass dams downstream via the juvenile fish bypass systems at the Lower Snake River projects. Bull trout may also pass these projects during periods of spill. Controlled spill for juvenile salmon passage or uncontrolled spill at Lower Snake River dams is likely to increase the entrainment rate of individual bull trout that migrate into the reservoirs to feed seasonally. Once entrained, bull trout can become stranded or isolated in the downstream reservoirs or significantly delayed in their return migrations. Alternatives that increase uncontrolled or controlled spill are likely to increase adverse affects from entrainment. The Dam/Impoundment alternatives also include major system improvements that are focused on more effective diversion of juvenile fish away from the turbines. If effective for juvenile anadromous salmonids, they may also effectively divert bull trout away from the turbines and thereby potentially decrease take below existing levels. However, short term disturbances from improvement construction may also adversely affect bull trout by preventing or discouraging use in the construction area, further impeding migration. Since the extent and timing of bull trout use of the four dam facilities is unknown, the Service cannot quantify the impacts to bull trout at this time.

In the Clearwater Basin there are known subpopulations of bull trout in Selway, Lochsa, and North Fork and South Fork Clearwater rivers. While little is known of the status or trends of these subpopulations, we do know that migratory forms do exist. Their use of the main stem Clearwater River is seasonal, as summer water temperatures exceed those preferred by bull trout. As with many subpopulations elsewhere, the suppressing factors impacting these include habitat degradation, loss of prey species, passage barriers, hybridization and competition with exotics, and harvest (Clearwater Basin Bull Trout Technical Advisory Team, 1998). Dworshak Dam is a factor isolating the North Fork Clearwater River subpopulation from the others in the basin. Bull trout that are entrained from Dworshak Dam or migrate from other Clearwater Basin subpopulations cannot contribute to the North Fork subpopulation.

<u>Passage/Entrainment</u>

The Tucannon River subpopulation appears to use the main stem Snake River for adult rearing on a seasonal basis. Their occurrence in the hydro power system has been verified by a few incidental observations during sampling in Lower Monumental Pool (Buchanan et al. 1997 citing Ward), and in the adult passage facilities at Lower Monumental and Little Goose dams in the early 1990s (Kleist, in litt. 1993). Basham, in litt. (2000) reported additional observations at Lower Monumental (n = 1) and Little Goose (n = 4) dams in 1998 and 1999. Based on fish counting schedules outlined in Corps reports (Corps, 1997), adult fish enumerations are not conducted at the Lower Monumental, Little Goose, or Ice Harbor fish counting windows from November 1 through March 31. Unfortunately, this period coincides with typical adult bull trout movements into larger main stem systems for adult rearing and foraging as indicated in the Tucannon (Underwood et al. 1995) and other Columbia Basin local populations (Elle, 1995; Faler and Bair, 1992; Martin et al. 1992; Theisfeld et al. 1996). Also, during fish counting activities, counters are not specifically asked to note bull trout. As a result, it is unknown if the FCRPS and existing fishways at the Lower Snake River dams are impeding bull trout passage, or if migratory fish originating from the Tucannon River attempt to pass these facilities on a regular basis.

Bull trout are known to occur in the tailrace below Dworshak Dam. They have been observed occasionally in the Dworshak National Fish Hatchery adult trap (Clearwater Basin Bull Trout Technical Advisory Team, 1998), and are incidentally caught in fish sampling efforts and sport fisheries below the dam (Bigelow, USFWS, personal communication, 2000; Cochnauer and Putnam, 1997; Connor, USFWS, personal communication, 2000).

The Service believes most, if not all bull trout residing below Dworshak Dam are the result of entrainment through the dam from Dworshak Reservoir. This is based on: 1) the proximity of the tailrace to known spawning subpopulations (the closest being those in the Selway River, at least 92 rkm upstream from the mouth of the North Fork), 2) documented entrainment of kokanee and other reservoir fishes, and 3) the ocurrance of adult migrant sized bull trout in the area during periods when these fish would be expected to be on their spawning grounds. The Service does not believe that the North Fork Clearwater River below Dworshak Dam provides suitable spawning habitat for natural production of bull trout. We also assume that the frequency of bull trout entrainment likely mirrors that of other salmonids such as kokanee. The highest entrainment rates of kokanee at Dworshak Dam occurred in 1996 and 1997, and were associated with the flood releases of those years. These same years are associated with the highest incidental catches of bull trout in the hatchery adult trap (n = 5) and fish sampling in the tailrace (n = 12) (Cochnauer and Putnam, 1997; Roseberg, USFWS, unpublished data).

The effects of entrainment can include physical injury, direct mortality, migration delays, and isolation from spawning areas. All these effects are likely to occur at all the FCRPS facilities at some unknown rate, but entrainment at Dworshak Dam results in the direct loss of those entrained individuals to the population above the dam.

Inundated Habitat

Available historical data does not suggest bull trout spawning/early rearing habitat was inundated when Dworshak or the Lower Snake River dams were completed; all evidence suggests that the impounded areas were historically used as adult/subadult foraging and overwintering areas. This use continues today for these age groups. The transition from a riverine environment to a reservoir would likely eventually force the historic fluvial local populations to adapt to an adfluvial type life history. Provided the local populations adapt to the altered environment and sufficient forage is available throughout time in the reservoir, the change to a reservoir system could have some positive effects on the bull trout as well. For example, adfluvial fish typically grow to larger sizes than fluvial migrants, and as a result can be more fecund (Goetz, 1989). If sufficient spawning and early rearing habitat is available, a potential increase in individual fecundity may result in a larger, more robust local population. However, the available data does not indicate whether the reservoirs on the Lower Snake and Clearwater rivers have resulted in larger, more fecund bull trout. The data indicates some individuals use the reservoirs for adult and subadult rearing, so we assume that at least a portion of the local populations have adapted to the adfluvial migratory behavior. As a result, the Service believes adverse effects associated with inundated habitat are minimal, and may be offset by associated increased growth and fecundity.

Gas Supersaturation

Elevated levels of total dissolved gases (TDG) are a common problem below dams during periods of high runoff and spill. High TDG can result in gas bubble disease (GBD) in fish. Bull trout that may be present in the tailraces below Dworshak or the Lower Snake River dams are subjected to high TDG levels, and as a result, could be adversely affected by GBD. Shrank et al. (1997) found that resident fish experienced a higher mortality rate from GBD than migratory fish moving through areas with high TDG concentrations.

GBD was observed in 90 out of 8,842 individual fish sampled downstream of Dworshak Dam in the spring and summer of 1997 (Cochnauer and Putnam, 1997). GBD occurrence in sampled fish ranged from 0.9 to 16.5%, and was most prominent following periods when TDG levels approached 120% saturation. TDG levels of this magnitude were associated with flood release discharges > 20,300 cfs. The highest rate of incidence occurred in resident salmonid species sampled in the 1.5 mile long section immediately below the dam, but none of the 12 bull trout sampled in this section showed signs of GBD. Because discharges in excess of 20,000 cfs are relatively uncommon and short-lived at Dworshak Dam, and no sampled bull trout showed signs of GBD, the Service assumes TDG effects on bull trout resulting from Dworshak operations are minimal.

TDG levels in the tailraces below the Lower Snake River dams are typically higher than those observed at Dworshak (Fish Passage Center, 1997). During high spring runoff in 1997, TDG levels below these facilities were commonly at or above 130% saturation, and occasionally approached 140%. During late summer and early fall, when discharge was low, TDG levels were typically around 100%. Results from fish sampling to monitor GBD near the Lower Snake facilities indicate that the occurrence of GBD in fishes in the Lower Snake River was actually lower than that observed by Cochnauer and Putnam (1997) in the Dworshak Dam Tailrace. The data presented, however, appeared to focus on emigrating anadromous species. The Service is unaware of any documented GBD effects to bull trout in association with the Lower Snake River dams, but the potential for adverse effects is higher than that below Dworshak Dam as a result of higher TDG levels.

Clearwater River Water Temperatures

Water temperature in the North Fork Clearwater River and the main stem Clearwater River below the confluence has been altered by releases from Dworshak Dam and Reservoir. Changes from the historic water temperature regime began in 1972 when Dworshak Dam was closed and the reservoir was impounded. Dworshak Dam is equipped with multilevel selector gates that are adjustable for selective withdrawal between full pool (1600 ft. mean seal level (msl)) to minimum pool (1445 ft. msl) (Corps, 1986). This system is used to provide cool water suitable for fish production at the Dworshak steelhead mitigation hatchery located below the dam. These cool water releases moderate seasonal water temperature fluctuations in the river below. When compared to pre-dam conditions, facility operations result in: 1) warmer water in the winter, 2) slower warming in the spring, 3) colder water in the summer, and 4) slower cooling in the fall (Ball and Cannon, 1974; Ball and Pettit, 1974). The effects of these water temperature changes on bull trout distribution and usage in the Lower Clearwater River is unclear, but the Service speculates that both benefits and negative affects may occur.

While the annual range of water temperatures below Dworshak Dam is not as variable as historic temperatures, it does typically follow ambient conditions with one exception - summer flow augmentation. Since 1992, summer flow augmentation from Dworshak Dam under the National Marine Fisheries Service's Biological Opinion's has been provided to cool the Snake River for juvenile fall chinook salmon which emigrate during the summer. The summer augmentation releases have had variable temperatures ranging from 6.2 to 13.9°C since the program's inception in 1992 (Connor et al. 1998). These releases are implemented from early July to late August, and have a major cooling effect on the lower main stem Clearwater River because of the low flows typical in the river at that time of year (Connor et al. 1998).

The cool water provided during summer could be both beneficial and detrimental to bull trout found in that section of river. The benefits may be that the cool water could provide relief for, and may reduce temperature related mortalities of bull trout that have been entrained from the dam. It is likely that any bull trout that are in the Clearwater River near the mouth of the North Fork would move into the North Fork to escape the warm water temperatures in the main stem Clearwater during the summer. Daily average water temperatures have been commonly measured at 23 - 25°C during July and August in the main stem above the confluence with the North Fork (Nez Perce Tribe, unpublished data). Because bull trout distribution is believed to be limited by temperatures exceeding 15°C (Fraley and Shepard 1989; Ratliff, 1992) the Service believes Dworshak summer flow augmentation artificially creates a section of river with temperatures that bull trout may seek out. This would entice bull trout to remain in the river longer than they would under natural water temperature regimes, and these fish may never move out to found unoccupied habitat, or become incorporated into other existing subpopulations.

It is unlikely that migratory bull trout from other subpopulations in the Clearwater Basin would be residing in the main stem Clearwater River from late June into July due to increasing water temperatures. The mean daily water temperature recorded at Peck, Idaho from the last week in June to the first week in July increases from 11.3 to 14.2°C. Because researchers have found peak upstream movement to coincide with maximum water temperatures of 10 to 12°C (McPhail and Murray, 1979; Elle et al. 1994), the Service believes any overwintering bull trout that use the area from the Lochsa, Selway, or South Fork Clearwater rivers would have already left the main stem on their spawning migrations before the onset of summer flow augmentation. However, those fish entrained from Dworshak would likely be imprinted on the North Fork Clearwater River, and the reduced summer temperatures that are in the North Fork during these cool water releases could cause isolation of these fish from other subpopulations. As a result, they would not contribute to natural production for the population.

<u>Other Snake River Basin Subpopulations</u>

Several subpopulations of bull trout occur upstream of the reservoir influence of Lower Granite Dam, and migrants from these groups have the capability of freely moving to and from Lower Granite Reservoir. These groups include fish from Asotin Creek, and the Grande Ronde, Imnaha and Salmon rivers. The Service has found little evidence to suggest these populations use habitat associated with the FCRPS in the Lower Snake River. Radio tracking data from Elle et al. (1994) and Elle (1995) showed that adult migrants from the Rapid River subpopulation typically overwinter in the main stem Salmon River as far downstream as Whitebird, but a few may move as far as Mahoney Creek. None of these fish have been observed in the Snake River. Buchanan et al. (1997) suggested that some migrants from the Grande Ronde still utilize the Snake River. Recent observations of radio-tagged bull trout from the Grande Ronde River verified the use of the Snake River by those fish as far down as RM 146, just upstream from Asotin, WA (Shappart, ODFW, personal communication, 2000). In the lower reaches of the Imnaha River, large migrant sized bull trout are incidentally caught by steelhead anglers each year, and ODFW believes these fish are migrants that use the Snake River seasonally (Knox, ODFW, personal communication, 2000). The most compelling evidence is data from the Idaho Fish and Game smolt trap at Lewiston. It indicates the capture of an occasional bull trout (Basham, in litt. 2000), but the catch rates have been no more than 1 bull trout annually. Because there is little evidence to support the use of the hydro power system by these subpopulations, the Service believes effects from the FCRPS on these groups are extremely small.

7.A.4. Cumulative effects

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 the section because they require separate consultation pursuant to section 7 of the Act.

State, Tribal and local government actions are likely to be in the form of legislation, administrative rules, or policy initiatives. Government and private actions may include changes in land and water use patterns, including ownership and intensity, any of which could affect listed species or their habitat. Even actions that are already authorized are subject to political, legislative, and fiscal uncertainties. These realities, added to the geographic scope of the action area, which encompasses numerous government entities exercising various authorities and many private land holdings, make any analysis of cumulative effects difficult and even speculative.
Therefore, these issues are addressed in a summary way below.

State Actions

As noted previously, the FCRPS dams are located in the states of Oregon, Washington, Idaho and Montana. In the past, each state's economy depended on natural resources, with intense resource extraction. Changes in the states' economies have occurred in the last decade and are likely to continue, with less large-scale resource extraction, more targeted extraction, and significant growth in other economic sectors. Growth in new businesses, primarily in the technology sector, is creating urbanization pressures and increased demands for buildable land, electricity, water supplies, wastedisposal sites, and other infrastructure.

Economic diversification has contributed to population growth and movement in all three states, a trend likely to continue for the next few decades. Such population trends will place greater overall and localized demands in the action area for electricity, water, and buildable land; will affect water quality directly and indirectly; and will increase the need for transportation, communication, and other infrastructure. The impacts associated with these economic and population demands are likely to affect habitat features such as water quality and quantity, which are important to the survival and recovery of the listed species. The overall effect will be negative unless carefully planned for and mitigated.

Each state in the Columbia River basin administers the allocation of water resources within its borders. Water resource development has slowed in recent years: most arable lands have already been developed, the increasingly diversified regional economy has decreased demand, and there are increased environmental protections. In this current atmosphere, it is impossible to predict the outcomes with any reasonable certainty. However, in the event that substantial new water developments occur, cumulative adverse effects to listed fish are likely. The Service will continue to work with NMFS and the state water resource management agencies with regard to impacts of developing new water resources in the Columbia River basin on listed species. It is hoped that through this effort, vigorous water markets may develop to allow existing developed supplies to be applied to the highest and best use.

Local Actions

Local governments will be faced with similar and more direct pressures from population growth and movement. There will be demands for intensified development in rural areas, as well as increased demands for water, municipal infrastructure, and other resources. The reaction of local governments to growth and population pressure is difficult to assess without certainty in policy and funding. In the past, local governments in the states generally accommodated growth in ways that adversely affected listed fish habitat. Because there is little consistency among local governments in current ways of dealing with land use and environmental issues, both positive and negative effects on listed species and their habitat are probably scattered throughout the action area.

Tribal Actions

Tribal governments will participate in cooperative efforts involving watershed and basin planning, designed to improve aquatic and fish habitat. The results of changes in Tribal forest and agricultural practices, in water resource allocation, and in land use are difficult to assess, for the reasons discussed above. The earlier discussion of the effects of population applies also to Tribal government actions. Unless the Tribal governments can apply and sustain comprehensive and beneficial natural resource programs to areas under their jurisdiction, Tribal actions are not likely to have measureable positive effects on listed species and their habitat.

Private Actions

The effects of private actions are the most uncertain. Private landowners may convert their lands from current uses, or they may intensify or diminish those uses. Individual landowners may voluntarily initiate actions to improve environmental conditions, or they may abandon or resist any improvement efforts. Their actions may be compelled by new laws, or they may result from growth and economic pressures. Changes in ownership patterns will have unknown impacts. Whether any of these private actions will occur is highly unpredictable, and the effects even more so.

Summary

Non-Federal actions are likely to continue affecting listed species. The cumulative effects in the action area are difficult to analyze, considering the broad geographic landscape covered by this opinion, geographic and political variation in the action area, the uncertainties associated with government and private actions, and ongoing changes in the region's economy. Whether those effects will increase or decrease in the future is a matter of speculation; however, based on the population and growth trends identified in this section, cumulative effects are likely to increase. Although state, Tribal and local governments have developed plans and initiatives which may benefit listed species, these must be applied in a comprehensive manner before the Service can consider them "reasonably foreseeable" in an analysis of cumulative effects.

7.A.5. Conclusion

Effects of the Action Summary

The preceding analysis depicted local effects of each project to the listed species considered. This analysis relates the combined impact of all projects to the DPS as a whole, in order to determine if the action jeopardizes the continued existence of the species.

According to 50 CFR 402.02 "*Jeopardize the continued existence of means to engage in an action that reasonably would be expected, directly or indirectly to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species*."

Table 9 below provides a summary of FCRPS projects and their major impacts to bull trout in the Columbia River distinct population segment. Appendix B relates projects and a limited number of impacts to bull trout subpopulations identified in USDI 1998. Overall, the Service's analysis indicates that FCRPS projects affect or potentially affect 116 of the 141 bull trout subpopulations in the Columbia River DPS (appendix B).

Table 9. Summary of project impacts to bull trout in the Columbia River distinct population segment.

Dam Name	Excludes Migratory Use (no ladder)	Downstream Passage (screens/juvenile bypass system)	Entrainment	Gas Supersaturation	Power Peaking	Temperature Impacts	Operation Isolates Spawning Habitat
Hungry Horse	Yes	No	Yes	Yes	Yes	No	Yes
Libby	Yes	No	Yes	Yes	Yes	No	Yes
Albeni Falls	Yes	No	Yes	Yes	Yes	Yes	Yes
Grande Coulee	Yes	No	No	Yes	Yes	Yes	No
Banks Lake	Yes	No	No	Yes	Yes	Yes	No
Chief Joseph	Yes	No	No	Yes	Yes	Yes	No
McNary	No	Yes	Yes	Yes	Yes	Yes	No
John Day	No	Yes	No	Yes	Yes	Yes	No
The Dalles	No	No	Yes	Yes	Yes	Yes	No
Bonneville	No	Yes	Yes	Yes	Yes	Yes	No
Ice Harbor	No	Yes	No	Yes	Yes	Yes	No
Lower Monumental	No	Yes	Yes	Yes	Yes	Yes	No
Little Goose	No	Yes	Yes	Yes	Yes	Yes	No
Lower Granite	No	Yes	Yes	Yes	Yes	Yes	No
Dworshak	Yes	No	Yes	Yes	Yes	No	Yes

Direct effects include reservoir operations isolating fish from spawning tributaries, or stranding redds either above or below the project. Indirectly, precluding reservoir use by anadromous or other prey fish may limit reproduction by reducing the food supply necessary to maintain reproduction rates. Altered water temperatures downstream of impoundments may also indirectly affect reproduction by altering natural thermal conditions in a manner that reduces egg to fry survival.

As shown in Table 9, all existing projects express one or more of these characteristics. However, regarding temperature impacts that may affect reproduction, our analysis indicates none of the projects resulted in temperature effects to known spawning habitat. Hungry Horse, Libby, Albeni Falls, and Dworshak dams may all isolate or impede access to spawning tributaries affecting six known bull trout subpopulations. Lost productive capacity based on partial or complete restriction of access to streams from anadromous fish also extends to 60 bull trout subpopulations. Based on the Service's analysis, these project impacts extend to 65 of the 141 total bull trout subpopulations in the Columbia River DPS. This represents an impact to 46% of the subpopulations in the Columbia Basin.

Direct effects include loss of individual fish through turbines, potential mortality due to gas bubble disease, operations that dewater existing redds, or spawning reaches. Indirect effects include loss of productivity by complete or partial exclusion or elimination of prey species such as anadromous fish, and loss of productivity due to reduced or eliminated anadromous fish returns. As shown in Table 9, all existing projects express one or more of these characteristics. Although entrainment is possible at nearly all dams, due to limited population size the Service does not expect entrainment to occur at the indicated projects. Further, although presence is verified at the indicated Snake and Columbia River facilities, low numbers of bull trout inhabiting the mainstem Snake and Columbia rivers make entrainment unlikely to be a major factor affecting the viability of the DPS as a whole. The primary potential for entrainment exists at Hungry Horse, Libby, Albeni Falls, and Dworshak Dams, affecting eight bull trout subpopulations. The Service expects similar conditions regarding the potential for gas bubble disease. Based on the Service's analysis, these project impacts extend to 67 of the 141 total bull trout subpopulations. This represents an impact to 48% of the subpopulations in the Columbia Basin.

<u>Project impacts that reduce distribution</u>

Direct effects include either completely or partially blocking migratory corridors to the degree that historic or suitable habitat is not occupied, and lack of passage at occupied habitat to the degree that emigration depletes or will eventually deplete the existing population. As shown in Table 9, seven existing projects completely exclude upstream migration. The remaining eight, while not excluding migration, are expected to inhibit migration. The Service is not currently aware of a FCRPS project that is leading to extirpation of an existing subpopulation due to one-way emigration past a project. The Service's analysis identifed 116 subpopulations with migration inhibited or potentially inhibited by FCRPS projects. Based on the Service's analysis, these project impacts extend to 116 of the 141 total bull trout subpopulations, representing an impact to 82% of the subpopulations in the Columbia Basin.

Conclusion

After reviewing the current status of the bull trout, the environmental baseline for the action area, the effects of the proposed action, and cumulative effects, it is the Service's biological opinion that continued operation of the FCRPS is not likely to jeopardize the continued existence of the bull trout, for the following reasons:

- Bull trout numbers within the action area do not appear to be reduced, relative to baseline conditions at the time of listing, due to operation of the FCRPS. Dams with the most direct affect on bull trout subpopulations (Libby, Hungry Horse, and Dworshak) appear to harbor stable or secure subpopulations;

- As implied above, direct impacts to spawning habitat do not appear to have any significant affect on bull trout reproduction. Improved passage and survival conditions for anadromous fishes at mainstem projects should work to improve overall stream productivity relative to baseline conditions, and may eventually express a positive effect on bull trout reproduction;

- At present, there is no verifiable reduction in bull trout range that can be attributed to operation of the FCRPS, although volitional passage is suspected to be inhibited at all projects. As noted above, projects with the most direct affects appear to harbor stable or secure subpopulations.

Clarification of Proposed Action

The analysis of the response of bull trout detailed above was developed based on the proposed action as initially outlined in the 1999 BA. As noted in section 3 of this Opinion, on December 19, 2000, the Service received a letter from the action agencies, further clarifying their action.

A summary of those clarifications, and how they may effect bull trout, are listed here.

- The letter establishes when VARQ will be implemented at Libby and Hungry Horse Dams.

- The 1999 BA did not include minimum flows for bull trout. Minimum flows for the species are established for the July-August period below both Libby and Hungry Horse Dams. This increase in base flow should provide for additional habitat productivity in the most biologically productive time of the year.

- Ramp rates were not proposed in the initial BA. The letter includes the action agencies agreement to test ramp rates, which restrict the operation of the Libby project. In addition, ramp rates will also be tested at Hungry Horse Dam. This test will facilitate analyses of the feasibility of the rates and the changes to biological productivity in the river sections below the dam.

- The letter establishes higher minimum flows in the Kootenai and South Fork of the Flathead Rivers.

- The letter establishes a year-round minimum flow at Columbia Falls with a sliding scale between 3,200 and 3,500 cfs.

The analysis outlined above, together with the conclusions in section 7A.5., demonstrates that the action as outlined in the 1999 BA would have avoided jeopardy to listed bull trout. Based on the modifications to the action provided in the December 19, 2000, letter, the Service feels that the modifications to operations summarized above would reduce adverse effects, and would reduce take of bull trout.

7.B. Kootenai River White Sturgeon

The current strategy related to operation of the FCRPS to improve the recruitment of juvenile sturgeon into the population involves flow augmentation from Libby Dam for sturgeon spawning and incubation. The present sturgeon operation is a combination of 2 approaches: 1) that described in the 1995 sturgeon biological opinion (USFWS, 1995), which specifies flow targets of 35,000 cfs at Bonners Ferry for 42 days followed by 21 days of incubation flows of 11,000 cfs; and 2) a tiered flow approach contained in the Final Recovery Plan (USFWS, 1999). The tiered approach varies the volume of flow required each year depending on the forecast volume to the reservoir expected in April through August. There would be no flow augmentation during low water years.

Since 1991, the Corps, in cooperation with the BPA, the Service, state and Canadian provincial entities, BC Hydro Company, and tribal entities, has provided higher experimental flows in the spring to improve sturgeon spawning. Some spawning has been documented by collection of eggs. No larval sturgeon have been collected by sampling during 1991 through 1995. However, 17 unmarked juvenile sturgeon aged to the 1991 through 1997 year classes were found in later sampling (FWS, in preparation).

Presently it is estimated that there may be 1,468 adult Kootenai River white sturgeon, with a male to female ratio of 1.7:1, or about 539 females (Paragamian et al, 1997). With 7% of these females reproductively active in a given year (Apperson.1992), and an assumed average fecundity of 100,000 eggs per female, there may be as many as 3.8 million eggs released annually. Large numbers of fertilized and developing eggs have been recovered during the last nine years of monitoring. However, during that time, only two larvae and a few empty egg cases (indicating successful hatching) have been found, and no young-of-the-year sturgeon have been captured. To date, only 17 naturally recruited juvenile sturgeon that can be associated with the experimental augmentation flows between 1991 and 1997 have been identified.

Because of sampling gear limitations, the success of sturgeon recruitment during 1998 and 1999 augmentation flows can not be assessed at this time. The Service believes other naturally recruited sturgeon from these same years are present in the system which are yet to be captured. However, because of the high incidence of recapture of marked juvenile sturgeon in this system, the numbers of yet to be captured juvenile sturgeon are believed small. In summary, there is evidence that high levels of take (mortality) are occurring annually to eggs, larvae and possibly young-of-the-year sturgeon.

Under current plans, flow augmentation from Libby Dam is targeted for release when low elevation runoff from Kootenai River tributaries occurs, and when water temperatures in the main river are between 10 and 12 degrees C. At Libby Dam, operators can selectively withdraw water from various depths of the reservoir to provide water that is in the 10 to 12 degree C. range. Water is provided to meet this temperature range at Bonners Ferry when possible.

Fluctuations in stream flow may disrupt sturgeon spawning. In recent years, operating guidelines developed by the Service have specified that discharges from Libby Dam not be fluctuated for electrical load following purposes. Generally, the Service requests have been implemented.

Flood Control Rule Curves

In section 3.5.2 of the Biological Assessment, the action agencies propose adoption of VARQ flood control operating procedures for Libby Dam. VARQ complies with all existing flood control constraints, laws, project authorization, treaties and agreements. Coordination and analysis needs prior to implementation are identified including; coordination with Canada, additional economic analysis, effects upon Grand Coulee, and another iteration of review under NEPA. The timing for implementation is not specified in the 1999 Biological Assessment. No alternative flood control procedures are presented to reduce take of sturgeon during this unspecified interim period, or in the event that VARQ is not implemented. Implementation of VARQ is necessary to reliably implement the proposed spillway alternative(s) (section 3.8) for increased Libby Dam release capacity. Under the existing flood control procedures, the surface of Lake Koocanusa would not reliably reach the spillway elevation by the time water is needed for sturgeon. VARQ is also necessary to provide storage for tiered sturgeon augmentation flows, bull trout flow and reservoir refill.

The existing flood control rule curves do not provide reliable storage of sufficient water for sturgeon recruitment, and for other listed aquatic species in the Columbia Basin (bull trout and listed anadromous fish). Although the reasonable and prudent alternatives of the1995 sturgeon jeopardy opinion recommended storage, the flood control rule curves have not yet been amended to meet this need. The proposed action would continue with the existing flood control rule curves for two more years without modification for storage. Thus, in all but exceptional high runoff years, (greater than 8.1 maf inflow April through August) near total mortality of an estimated 3.8 million eggs released annually is anticipated to continue under the proposed action.

Kootenay Lake/Kootenai River Stage

In the lower Columbia River, white sturgeon spawn in areas with greater water velocity than is typically observed in the Kootenai River spawning areas. This altered depth velocity relationship over suitable spawning substrate is believed to be adversely affecting spawning site selection and survival of fertilized sturgeon eggs in the Kootenai River. Sturgeon eggs are adhesive and normally attach to rocky substrates before hatching, and then the fry continue to absorb yolk sac while hiding in inter-gravel spaces prior to swim up. Most spawning now occurs over sandy substrates in deeper water several miles below Bonners Ferry, and eggs are now commonly found drifting along the river bottom, covered with sand.

Without deliberate adjustment of the elevation of Kootenay Lake at Corra Linn Dam, large quantities of water would be necessary to restore the historic water depths at Bonners Ferry. To increase the water depth as measured at Bonners Ferry by approximately 1 foot requires an additional 10,000 cfs. With agreement and cooperation of Canadian interests, modest increases in water surface elevations are still possible. Flood plain encroachment has occurred, but current areas of development may still allow 4 to 6 feet of surface elevation increase during non-flood years. This is an operational change which could promote sturgeon conservation, provide hydroelectric benefits in both countries, and be carried out within the International Joint Commission’s (IJC) 1938 Order on the operations of Kootenay Lake.

The IJC Order was originally developed primarily to protect agricultural lands in the U.S. from backwater effects of Canadian hydroelectric operations. However, these lands have since largely been protected from, and their owners compensated for, the effects of elevated river water levels in several ways. First, the Corps of Engineers completed the levee system under PL 84-99 in 1961 to protect against flows ranging from 48,000 to 84,000 cfs, depending on the stage of Kootenay Lake. Second, Libby Dam, which is authorized to provide 100-year event protection, became fully operational in 1975. Operations of this project were then administratively redefined to provide 200-year event protection (elevation 1770 feet at Bonners Ferry), the approximate point where unleveed areas begin to flood. As an interim measure while levee maintenance needs are being assessed at some sites, the Corps now proposes to maintain river water levels below elevation 1764 feet at Bonners Ferry. Third, because of the operations of Libby Dam, West Kootenai Power has been able to maintain lower water levels on Kootenay Lake, with the average annual peak events now almost 8 feet lower than possible under pre-Libby Dam operations. Finally, under PL 93-251, many of the land owners and diking districts in the Kootenai Valley were compensated for possible damages from Federal operations of the Kootenai River through flowage/seepage easements and payment for pumps and pumping costs. Thus, the conditions and expectations existing at the time of the 1938 IJC order have been altered, and the threats to farm lands reduced, mitigated, and compensated. Cumulatively, these additional flood protection measures encourage agricultural and urban floodplain encroachment which may obstruct Federal agency obligations to conserve the sturgeon under section 7(a)(1) of the Endangered Species Act.

Through the indirect effects of the operation of Libby Dam, the average spring peak water stages, or depths (including the sturgeon spawning period), of both Kootenay Lake, and through back water effect, the sturgeon spawning reach in the Kootenai River, have been lowered by nearly 8 feet. Sturgeon spawn further upstream in response to increasing water depths (Paragamian et al. 1997, Paragamian et al. 2000 in litt.,and Paragamian and Kruse, in press). White sturgeon are broadcast spawners that release adhesive eggs which sink to the river bottom (Stockley1981 and Brannon 1984). White sturgeon successfully recruit in the lower Columbia River where most sturgeon eggs are sheltered by attaching themselves and incubating on rocky substrate near the spawning site (Parsley et al. 1993). However, in the Kootenai River, most current spawning sites are over sandy substrate, and most eggs are found drifting along the river bottom, covered with fine sand particles (Paragamian et al. in press). In 1997, with the highest river stage observed since Libby Dam (1764 feet at Bonners Ferry), the median sturgeon spawning location was river kilometer 237(Paragamian et al in litt). Suitable gravel spawning substrate is now exposed at approximately river kilometer 245. The exact water depth necessary to cause or allow sturgeon to spawn successfully over this existing gravel substrate has yet to be determined . However, there is information indicating that sturgeon have successfully recruited when river stages, or depths, at Bonners Ferry were between 1765.5 and 1770 feet. In 1974, during the last season of significant sturgeon recruitment, the peak water stage at Bonners Ferry was 1765.5 feet. Between 1961 and 1973, sturgeon were able to recruit while Bonners Ferry peak water stages were contained within the levees. During this period, peak water stages at Bonners Ferry reached 1770 feet in approximately 50 percent of the years (Ziminske in litt 1999).

As noted in Section 3 of this Opinion, the Corps states that 1) elevation 1770 feet at Bonners Ferry is still the stage associated with the authorization of Libby Dam; and 2) water can safely be passed somewhere between elevations 1764 and 1770 feet (Corps 1996). It appears this information was then used by the National Weather Service to redefine flood stage as 1764 feet, the point where “potential hazards began to occur due to high water”(Corps 1999; Corps in litt. 2000). This potential hazard, identified by the Corps at request of the Service in 1996, was based on “potential erosion damage to levees and damage to structures which have been built since Libby Dam went into operation”(Ziminske in litt., 1999). It is unclear whether or not these hazards would occur on leveed or unleveed properties previously released to the Federal government through purchased flowage and seepage easements for the operations of Libby Dam under PL 93-251. Further, such a change to a target flood stage of 1764 feet means that flows at Bonners Ferry are to be controlled down to 50,000 cfs from the Libby Project authorized 75,000 cfs when Kootenay Lake is at 1750 feet, a loss of 25,000 cfs in flow and about 3 feet in stage or water depth at Bonners Ferry (Corps 1999).

The proposed action as described by the Corps is “we try to maintain the regulated stage [at Bonners Ferry] below 1764 feet, but we recognize that damages caused above this elevation are subject to controversy”(Corps, in litt, 2000b). However, exceptions will be made to this 1764 feet flood control target for Libby Project authorized flood control “If forecasts indicate that attempting to hold Bonners Ferry stage to elevation 1764 will overfill Libby reservoir to the extent that the dam may be required to spill or if the potential to limit Bonners Ferry stage to elevation 1770 is jeopardized, the attempt to limit stage to 1764 will be abandoned"(Ziminske in litt., 1999). Although a reconnaissance investigation of seepage and levee status in the Kootenai Valley was initiated this year, this study is limited by local request to options at or below stage 1764 feet. There is no proposed action or schedule to remedy the hazard defined above and again control the Kootenai River to stage 1770 feet at Bonners Ferry.

The effect of managing the Kootenai River to this target stage of 1764 feet at Bonners Ferry is to preclude significant natural recruitment of the sturgeon.

Flood Elevation Flow Constraints

The proposed action is to continue hydroelectric load following at Libby Dam. These operations are associated with frequent and large changes in flow and stage in the Kootenai Valley. This in turn causes erosion of the toe of the earthen levees. This unanticipated effect has contributed to a levee maintenance problem, resulting in degraded conditions of some portions of the levee system.

One of the objectives of the Libby Dam project was to provide flood control for the Kootenai River valley. The issue of flood control and water elevations is significant to Kootenai River white sturgeon, as high spring flows are a "trigger" for the species to spawn, and to maintain incubation and rearing conditions. The original design memoranda on the construction of Libby Dam state that the objective of local flood regulation is the prevention of flows in excess of 57,000 cfs at Bonners Ferry, Idaho, and an 85 to 100 year flow event for agricultural protection (Corps 1963a, 1963b). The 1972 Columbia River Treaty Flood Control Operating Plan states the "Libby project will be regulated in a manner not to exceed a discharge of 57,000 cfs for the Kootenai River at Bonners Ferry, Idaho, insofar as possible..." (Corps, 1972).

In supplementary information to the Biological Assessment provided by the Corps (Corps, 1999), McGrane (Corps, 1996) notes that this flow itself does not represent a flood threat to the Kootenai River Valley. He states that "the level of the Kootenai River at Bonners Ferry is influenced by a backwater effect from Kootenay Lake in Canada resulting from the generally flat topography. Because of the backwater effect, accurate measurement of discharge at Bonners Ferry is extremely difficult. Various combinations of Kootenai River streamflow and Kootenay lake stage can produce damaging stages at Bonners Ferry." In 1974, Merkle noted that a river stage of elevation 1770 feet (ft) mean sea level (msl) was the physical limit at which damage began in unleveed areas near Bonners Ferry. He further noted that the 57,000 cfs flow constraint described in the Columbia River Treat Flood Control Operating Plan was "somewhat arbitrary and more restrictive with respect to Libby operation than would be the 27 foot (i.e., elevation 1770 ft.) maximum stage." The 1770 ft. msl stage limit was officially presented in the 1984 Water Control Manual for Libby Dam which states that "Libby Dam will be regulated to limit the stage at the Bonners Ferry gage to 27 feet (i.e., elevation 1770 ft.) insofar as possible..." (Corps, 1984). Because of the difficulty in accurately measuring 57,000 cfs, that control objective has been eliminated, and the stage limit elevation of 1770 ft. was retained (McGrane, 1996).

In concluding his analysis, McGrane notes “the local flood control objective for Libby Dam has been refined since the original project authorization as more data has been collected, and detailed studies have been performed....The current objective of local flood protection for Libby Dam is to protect the Bonners Ferry area from river stages above elevation 1770 ft. msl with a frequency of once every 200 years” (Corps, 1992). However, in 1996, the National Weather Service reduced the flood stage at Bonners Ferry from 1770 feet to 1764 feet. This reduction was based on Corps field survey information, which indicated this was the level when potential hazards began to occur due to high water.

In a recent letter to the Service, the Corps noted that “although the levees downstream of Libby Dam have not been maintained to their appropriate level of maintenance, their design level of protection has not been adjusted below the elevation of 1770 feet. Therefore, when asked about what the levees are designed to by the public, the response is technically 1770 feet. However, since local entities have not maintained the levels, the levees cannot safely pass all the high water that reaches the design elevation of 1770 feet. Water can only safely be passed somewhere between 1764 and 1770. From an operational perspective, therefore we try to maintain the regulated stage below elevation 1764 feet, but we recognize that damages caused above this elevation are subject to controversy” (Corps, 2000b). Although this issue is not entirely clarified in the Biological Assessment, nor in supplementary information, the Service assumes, for purposes of this opinion, that the Corps proposes to manage Libby Dam flows to maintain the regulated stage below elevation 1764 feet at Bonners Ferry. This is well below the 200 year event stage of 1770 feet, and the slightly higher stage originally authorized for a 100 year event under the Libby Project. The Corps is currently conducting a study to evaluate levee stability and localized flooding. Tributary runoff below the dam can sometimes cause a stage higher than 1764 feet at Bonners Ferry. This Corps interim goal of managing the Kootenai River to about 1764 feet at Bonners Ferry may constrain sturgeon flows by as much as 25,000 cfs when Kootenai Lake is at elevation 1750 feet NGVD, which is 5 feet below the point where damage commences at Nelson BC, (Corps, 1999).

Responsibility for maintenance of the levees lies with the local diking districts throughout the Kootenai Valley in Idaho. In 1975, the Corps made a one time payment for flowage easements and pumping on some diking districts and properties. There have been some difficulties in maintaining these levees, and, as a consequence, they do not always function at the levels of protection they did in 1975. In response to this, and other factors, the Corps issued a report to the diking districts and local officials redefining the flood stage as elevation 1764 feet at Bonners Ferry (Corps 1996). As noted in the description of the proposed action, the flood stage was originally 1770 feet.

The significance of this lower flood stage operating constraint is that it may limit the ability of the action agencies to restore minimum historic water depths and flows in the reach of the Kootenai River with gravel substrate, at and above Bonners Ferry. The last significant year class of sturgeon was spawned in 1974, with the peak water surface elevation at Bonners Ferry of approximately 1765.5 feet. Peak water surface elevations and flows associated with other significant year classes of sturgeon are typically higher than 1765.5 feet. Thus, this lower flood stage of 1764 feet may adversely affect sturgeon. This criterion precludes recreation of river conditions in 1974, which are the best available information on the minimum requirement needed for sturgeon to reproduce. As a consequence, take of fertilized eggs is anticipated to continue.

Libby Dam Flow Capacity
In section 3.8 of the December 1999 Biological Assessment, the action agencies propose to increase release capacity of Libby Dam by either installation of turbines in the unused bays, or installation of flow deflectors on the spillway to allow significant releases, while remaining in compliance with the Montana State water quality standard of 110 percent total dissolved gas. The possibility of limited use of the unmodified spillway is also acknowledged. It is noted that these changes will provide greater flexibility to increase flows for the sturgeon (and other listed species), and also increase the probability of refilling Lake Koocanusa annually. However, this initial proposed action lacks specificity with regard to the sequence of actions to be taken, their timing, and anticipated volumes of increased release capacity each may be expected to provide.

The sturgeon last recruited successfully in 1974, with base flows during the spawning and incubation period of approximately 40,000 cfs measured at Bonners Ferry. Runoff into the Kootenai River below Libby Dam and above Bonners Ferry is typically less than 5,000 cfs by the end of the incubation period. To sustain incubation flows of 40,000 cfs requires the ability to release near 35,000 cfs from Libby Dam, an increase of approximately 10,000 cfs above the current capacity. The proposed action to increase Libby Dam release capacity does not specify a goal beyond 5,000 cfs, and it is uncertain when that goal will be achieved. There is no clear commitment or schedule to increase total release capacity at Libby Dam by 10,000 cfs as needed to sustain incubation flows.

Dissolved Gas Standard in the Kootenai River below Libby Dam
Presently the Montana State water quality standard for total dissolved gas in the Kootenai River below Libby Dam is 110%, with no mixing zone. Site specific testing is being planned to determine the extent to which the existing spillway can be used for flood control releases or sturgeon flow augmentation while precluding harm to bull trout and other resident fish. This 110% dissolved gas standard may be a constraint which cumulatively effects the sturgeon through limitation of available water release capacity at Libby Dam.

7.B.1. Cumulative effects

As noted in Section 7.A.4 for bull trout, non-Federal actions are likely to continue affecting listed species. The cumulative effects in the action area are difficult to analyze, considering the broad geographic landscape covered by this opinion, geographic and political variation in the action area, the uncertainties associated with government and private actions, and ongoing changes in the region's economy. Whether those effects will increase or decrease in the future is a matter fo speculation; however, based on the population and growth trends identified in this section, cumulative effects are likely to increase. Although state, Tribal and local governments have developed plans and initiatives which may benefit listed species, these must be applied in a comprehensive manner before the Service can consider them "reasonably foreseeable" in an analysis of cumulative effects.

7.B.2. Conclusion

After reviewing the current status of sturgeon, the environmental baseline for the action area, the effects of the proposed actions and the cumulative effects, it is the Service biological opinion that the actions, as proposed, are likely to jeopardize the continued existence of the Kootenai River white sturgeon. No critical habitat has been designated for this species, therefore, none will be affected.

This conclusion is based upon the probability that, under the proposed action, continuing high levels of mortality of fertilized eggs, and the resulting lack of significant recruitment to the only extant population of Kootenai River white sturgeon, will continue. Hence, the proposed action will continue to appreciably reduce the likelihood of both the survival and recovery of the Kootenai River white sturgeon in the wild by essentially eliminating its reproductive capacity and directly contributing to, over time, declining population levels.

8. Reasonable and Prudent Measures – Kootenai River White Sturgeon

Regulations (50 CFR 402.02) implementing section 7 of the Act define reasonable and prudent alternatives as alternative actions, identified during formal consultation, that: (1) can be implemented consistent with the intended purpose of the action: (2) can be implemented consistent with the scope of the action agency's legal authority and jurisdiction: (3) are economically and technologically feasible; and (4) would, the Service believes, avoid the liklihood of jeopardizing the continued existence of listed species or result in the destruction or adverse modification of critical habitat.

The final recovery plan for the sturgeon specifies the following factors as necessary to reclasssify the sturgeon from an endangered status to a threatened status:

1. Significant natural reproduction occurring in at least three out of 10 years. A naturally reproduced year class is defined as detection through standard recapture methods of at least 20 juvenile fish from a year class reaching at least one year of age;

2. A stable or increasing wild sturgeon population and the availability of juveniles reared through a conservation aquaculture program are available to be added to this wild population each year for 10 consecutive years;

3. Development of a long term interagency strategy which can repeatedly allow the sturgeon to reproduce naturally to meet conditions 1 and 2 above.

With the exception of some progress in the conservation aquaculture program, these reclassification factors have not yet been realized.

The Service acknowledges that substantial annual variation in water availability (due to total precipitation and actual water yield, substantial runoff forecasting uncertainty, timing, intensity and duration of runoff) can affect the action agencies' ability to provide flows necessary for successful sturgeon spawning and recruitment. With annual weather variations and the ability of the action agencies to accommodate both sturgeon conservation measures and the primary purposes of operating the FCRPS in mind, the Service believes the following RPAs for operations during the 2000 through 2009 time period are necessary and appropriate to avoid jeopardy.

1. Water Storage for Sturgeon Recruitment. Sturgeon reproduced successfully in the unregulated Kootenai River prior to the construction of Libby Dam. The existing operations of Libby Dam have greatly reduced the quantities of water available to spawning and early life stages of sturgeon during the spring, and significant recruitment has not occurred for 26 years. The RPAs listed below are intended to modify operations of Libby Dam to assure storage of water specifically allocated for augmentation of Kootenai River flows during sturgeon spawning and development during early life stages. This stored water is necessary to allow the sturgeon to again reliably reproduce. Inadequate water supplies adversely affect sturgeon survival through altered habitat conditions including water depth; water velocity/energy, which maintains rocky substrate needed for cover and successful incubation; and water velocity/volume as a protective measure relative to predation. With adequate supplies of water for flow augmentation, jeopardy may be avoided.

a. The action agencies shall regulate flows from Libby Dam, consistent with existing treaties, Libby Project authorization for public safety, other laws, and the 1938 IJC order, to achieve water volumes, water velocities, water depths, and water temperature at a time to maximize the probability of allowing significant sturgeon recruitment.

b. By January 2001, the action agencies shall develop a schedule of all disclosures, NEPA compliance and additional Canadian coordination necessary to implement VarQ flood control/storage at Libby Dam. The action agencies shall complete coordination with Canada and NEPA compliance, and implement VarQ by October 2001.

c. During water year 2001, (October 1, 2000 - September 30, 2001) the action agencies shall store water and supply, at a minimum, water volumes during May, June and July based upon a water availability or "tiered" approach as defined and summarized in Table 10 (below), as shown in the final Sturgeon Recovery Plan. This shall be in addition to storage needs for listed bull trout, salmon, and the 4,000 cfs minimum releases from Libby Dam. Accounting on these total tiered volumes shall begin when the Service determines benefits to conservation of sturgeon are most likely to occur. This may include releases timed to enhance survival of eggs, yolk sac larvae, or larvae reared under the preservation stocking program and released into the Kootenai River. Releases may be timed to serve both wild fish and hatchery eggs/fish. Sturgeon flows will generally be initiated between mid-May and the end of June to augment lower basin runoff entering the Kootenai River below Libby Dam.

Table 10. Minimum "tiered" volumes of water for sturgeon flow enhancement to be provided at Bonners Ferry according to April-August volume runoff forecasts at Libby. [*Actual flow releases would be shaped according to seasonal requests from the Service and in-season management of water actually available. Volumes are in addition to the minimum release of 4,000 cfs. Some of these volumes may be allocated to maintenance of at least 15,000 cfs in the vicinity of Bonners Ferry during May or June, if recommended by the Service. (maf=million acre-feet)*]

Forecast runoff Volume (maf) at Libby	Tier	Sturgeon Flow (maf) at Bonners Ferry
0.00 < forecast < 4.80	1	Sturgeon flows not requested
4.80 < forecast < 6.00	2	1.42
6.00 < forecast < 6.70	3	1.77
6.70 < forecast < 8.10	4	2.56
8.10 < forecast < 8.90	5	3.89
8.90 < forecast	6	4.77

By February, 2001, the Service, NMFS, and the action agencies shall discuss and reach agreement on how to meet these flow targets at Bonners Ferry, through accounting for these releases from Libby Dam.

d. Begining October 2001 the action agencies shall store water under VarQ and supply, at a minimum, water volumes during May, June and July based upon a water availability or "tiered" approach as modified from the final Sturgeon Recovery Plan and summarized in Table 10 (below). This shall be in addition to storage needs for listed bull trout, salmon, and the 4,000 cfs minimum releases from Libby Dam. Accounting on these total tiered volumes shall begin when the Service determines benefits to conservation of sturgeon are most likely to occur. This may include releases timed to enhance survival of eggs, yolk sac larvae, or larvae reared under the preservation stocking program and released into the Kootenai River. Releases may be timed to serve both wild fish and hatchery eggs/fish. Sturgeon flows will generally be initiated between mid-May and the end of June to augment lower basin runoff entering the

Kootenai River below Libby Dam.

The following volumes are for planning purposes only. Final minimum tiered sturgeon volumes shall be based on further studies involving May, June, and July volumes and daily modeling. Final tiered sturgeon volumes shall be defined and modeled in coordination with the Service by October 2001.

Table 11. Possible minimum “tiered” volumes of water to be stored for sturgeon flow enhancement based upon the April - August volume runoff forecast above Libby Dam.

Forecast runoff Volume (maf) at Libby	Tier	Sturgeon Flow (maf) from Libby Dam
0.00 < forecast < 4.80	1	Sturgeon flows not requested
4.80 < forecast < 6.00	2	0.80
6.00 < forecast < 6.70	3	1.12
6.70 < forecast < 8.10	4	1.20
8.10 < forecast < 8.90	5	1.20
8.90 < forecast	6	1.60

e. The action agencies have proposed to seek opportunities to reduce the second peak flow created by July/August salmon flow through Kootenay Lake. One such opportunity for consideration to reduce the second peak is retention of July/August water in Lake Koocanusa under a Libby-Arrow water exchange. The action agencies shall seek to consummate such an agreement by October 2001.

f. The action agencies shall seek a means to support an equitable portion of the ongoing Kootenay Lake fertilization program by October 2001. This program increases the Lake’s productivity and forage base, presumably providing a benefit to sturgeon.

g. The action agencies shall routinely, and at all appropriate decision points, seek timely input and concurrence from the Service on all matters affecting listed fish through the Columbia River Treaty, International Joint Commission Orders, and all other decision-making processes involving transboundary waters in the Columbia River basin. This shall include notification of all meetings and decision points and provision of opportunity to advise the action agencies during meetings and in writing as appropriate

h. By June 2003, the action agencies shall evaluate the feasibility of a variable December 31 flood control target of 2,411 feet at Libby Dam, based on various alternative long range forecasting procedures (such as the procedures developed by USGS, Tacoma, for western Washington), and any opportunities arising from operational or configuration changes (additional turbines or spillway flow deflectors) addressed elsewhere in this biological opinion. These factors would be used at Libby Dam to increase the probability of storage during less than average water years. This variable target shall be adopted by October 2003 if deemed feasible.

i. By October 2004, the action agencies shall revisit the volume forecast procedure in the Kootenai River above and below Libby Dam. If additional equipment, in-season data, or modeling is feasible, the action agencies shall seek a means to accomplish this by December 2004. (Note: There may be a plus or minus 24 percent error in the April through August forecasts for the Kootenai River basin above Libby Dam.)

2. Increased Release Capacity at Libby Dam. The existing five turbine configuration limits Libby Dam releases to about 25,000 cfs, depending upon reservoir levels. This is a constraint upon reestablishment of sturgeon spawning/early life stage flows, because the high elevation Canadian Rockies runoff, which historically would have provided these flows, typically peaks two weeks later than the low elevation runoff peak that occurs below Libby Dam. Although sturgeon may spawn over several weeks in temperatures ranging from 9 to over 12 degrees Celsius, most sturgeon spawning now occurs with water temperatures near 10 degrees Celsius on the descending limb of low elevation runoff peak. Approximately 21 days are required for a sturgeon egg to hatch and absorb its yolk sac to become a free swimming larvae. Some sturgeon eggs may complete incubation while others are being fertilized, and the entire spawning through incubation period may extend beyond 42 days. Eggs from a single spawning event at 10 degrees Celsius require about 21 days to fully incubate, and by that time the runoff entering the Kootenai River below Libby Dam may be less than 5,000 cfs. Base flows at Bonners Ferry were near 40,000 cfs when the sturgeon last produced a significant year class, in 1974. Thus, an additional 10,000 cfs of release capacity is needed at Libby Dam to approach the 40,000 cfs that historically provided conditions necessary for sturgeon eggs to complete incubation. The inability to deliver adequate incubation flows may cause harm through greatly reduced survival of fertilized eggs. Increased release capacity is also necessary to maintain substrate for cover, and to reduce risk of predation through velocity/volume relationships which respectively exclude predators from spawning substrate and reduce their foraging efficiency. Additionally, increased release capacity will also contribute to restoring water depths and allowing spawners upstream access to gravel substrate, as well as providing additional energy to scour sand from gravel substrates now buried below Bonners Ferry.

In section 3.8 of the biological assessment, the action agencies propose two general approaches to provide increased sturgeon flows from Libby Dam while complying with the state water quality standards for total dissolved gas. These proposals include the use of an additional turbine or turbines, and/or the use of the spillway with addition of flow deflectors for dissolved gas abatement. The possibility of limited use of the unmodified spillway is also mentioned. It is stated that either of these measures will provide greater flexibility to increase flows for sturgeon and to refill Kookanusa reservoir. Through a letter of December 19, 2000, the action agencies provided clarification of this proposed action to include: 1) conducting incremental flow tests of dissolved gas concentrations with the existing spillways by 2001; 2) conducting studies to verify channel capacity of the river below Libby Dam; 3) evaluating spillway maintenance needs; and 4) reporting to the Service on all of these investigations by December 30, 2001. The action agencies propose to implement the use of the existing spillway in 2002 up to some flow threshold to be determined by the above listed investigations. (Note: It has been estimated the existing, unmodified, spillway may allow increased flows in the range of 5,000 cfs.) Further, if the existing spillway can not be used to release at least 5,000 cfs, the action agencies propose to provide a report and NEPA analysis on the alternatives, including spillway flow deflectors and/or installation of an existing turbine. Then, if the action agencies report recommends these additional actions, the action agencies propose to the utilize the report to seek funding for the selected alternative(s).

Neither the schedule, nor the total extent of increased flows associated with turbine installation and/or spillway flow deflector additions are defined by the action agencies in the December 19, 2000 letter of clarification.

a. To address this issue, the action agencies shall provide at least 10,000 cfs of increased release capacity at Libby Dam in two increments of at least 5,000 cfs each under the following conditions, sequence, and schedule:

   1. The proposed spillway test in 2001 shall be conducted under sufficiently high turbine discharge levels during the sturgeon conservation operation to reliably estimate the maximum spillway flow dilution capability and compliance with the state water quality standard of 110 percent gas saturation, with up to six(6) turbines operating at full capacity, and/or a total release capacity of 35,000 cfs through a combination of spillways and a turbine. Possible changes in dissolved gas concentrations throughout the Kootenai River shall be evaluated. This test shall also include monitoring of effects of the spill on bull trout and other fish in the Kootenai River.

   2. The report of the proposed Kootenai River channel capacity investigation shall include or append all site specific elevation data gathered on structures which could be impacted and data on the defined 100 year floodplain. Should the evaluations of channel capacity study determine that structural floodplain encroachment may constrain the increased release capacities at Libby Dam (specified herein, up to 35,000 cfs at Libby Dam), the December 30, 2001 report shall also include any remedies necessary to restore this channel capacity, the means available to effect those remedies, and a schedule to do so.

3. By spring 2002, the action agencies will begin routine use of the existing spillway for sturgeon flow augmentation within the constraints determined above.

4. This spillway option shall only be considered a viable long term conservation measure if VarQ, or a comparable flood control/storage procedure, is in effect which assures the reservoir surface routinely (in all but the greatest 20th percentile of water years, for April-August runoff) exceeds the spillway elevation by the time sturgeon flows are needed. The timing of spillway use shall be determined in part by the ability to maintain 10 degrees Celsius at Bonners Ferry with the selective withdrawal facilities at Libby Dam.

5. If, by December 30, 2001, it is determined that at least 5,000 cfs can not be routinely passed over the spillway within the total dissolved gas criteria of 110 %, or VarQ or some other flood control/storage procedure has not been adopted, the action agencies shall immediately begin preparation of NEPA documentation and seek funding for installation of one turbine or spillway flow deflectors, which are to be operational by spring 2004. (Note: This will also increase the probability of storage for reservoir refill to the benefit of other listed fish including bull trout, resident fish, and recreation, it will hasten the date in which the reservoir reaches the spillway and fills, and it will reduce the risk of harm to fish in the Kootenai River through dissolved gas supersaturation in the event of forced spill.)

6. By spring 2007, the action agencies will seek means and be prepared to release an additional 5,000 cfs (total of at least 10,000 cfs) at Libby Dam for sturgeon conservation.

7. The action agencies shall immediately reinitiate consultation with the Service if at any point it is determined either of the above two 5,000 cfs (10,000 cfs total) increased release increments scheduled for spring of 2002, or 2004 and 2007, is not achievable.

8. The action agencies have proposed to seek funding to conduct biological studies, in consultation with the Service, to both determine the effectiveness of increased flows in improving sturgeon recruitment and to determine any adverse effects to bull trout in the Kootenai River below Libby Dam.

   These studies shall be in addition to the ongoing monitoring specified below under 2.b, below.

9. If, as a result of these increased releases, in any year during the 10-year life of this biological opinion, a new year class of at least 20 naturally recruited yearling or older sturgeon is documented, the action agencies shall reinitiate consultation with the Service before proceeding with any additional facilities or improvements at Libby Dam for sturgeon flow augmentation.

b. Interim monitoring reports of biological results, storage volumes, flows, augmentation flows released, water temperatures, and total dissolved gas concentrations shall be provided to the Service by October 1 each year, and final reports by December 1 of each year, to allow timely adaptive management for subsequent annual operational guidelines.

c. The action agencies shall fulfill the operational guidelines provided by the Service annually prior to and during the sturgeon spawning/incubation period. Specific release recommendations will be developed in consultation with action agencies and submitted annually through the TMT or similar regional process.

d. The action agencies shall seek redundancy in transformers at Libby Dam to assure that sturgeon flows can be released. Loss of one transformer can result in the loss of use of two turbines, or 10,000 cfs of release capacity.

3. Flood Stage Constraints to Sturgeon Recruitment. To prevent "potential levee erosion damage to levees and damage to structures which have been built since Libby Dam went into operation", the Corps has proposed to now operate Libby Dam, to the extent possible, to maintain the Kootenai River stage at Bonners Ferry of 1,764 feet or less. Since the 1980s, the Corps has managed the Libby Project to control a 200 year event (i.e. a stage of 1770 feet measured at Bonners Ferry). Sturgeon have spawned successfully with peak river stages between 1765.5 and 1770 feet. Although sturgeon spawn progressively nearer to Bonners Ferry (and the gravel substrate which now begins there) with increasing river stage, few sturgeon now reach Bonners Ferry during the spawning period, and only 15 eggs have been collected there in 10 years of monitoring. The highest stage observed at Bonners Ferry since the operation of Libby Dam is1764.5 feet. The lowered stages are excluding spawning adults from gravel substrates suitable for egg attachment and incubation, contributing to the lack of spawning success and recruitment for the past 26 years.

a. By spring 2001, the Corps shall evaluate flood levels and public safety concerns along the banks of the Kootenai River below Libby Dam, and the feasibility of increasing releases above any identified channel capacity constraints through structural or non-structural means. A report shall be provided to the Service by December 1, 2001.

b. By May 2004 the action agencies shall seek means to restore, maintain, or enhance levees throughout the Kootenai Valley to the greater of: 1) the PL 84-99 Corps' 1961 levee specifications, or 2) the levee elevations needed to contain the flows/river stages of the 100 year event as authorized for the Libby Project, which is now defined as 1,770 feet at Bonners Ferry. The action agencies shall also seek means to incorporate conservation measures for sturgeon, including self maintaining rocky spawning substrates, as a component and Federal purpose of any new levee project above.

In the interim, the Service and Corps will coordinate efforts to attempt to limit sturgeon spawning flows so they do not exceed a levee elevation of 1,764 feet at Bonners Ferry. (Note: This may not always be possible during periods of unusual local runoff which may be beyond control of Libby Dam.)

c. By December 1, 2001, the action agencies shall quantify the effects of groundwater seepage associated with the magnitude and duration of sturgeon flows on crops in the Kootenai Valley relative to all other types high flow/stage events which occur in the Kootenai River. The effects of direct precipitation and runoff from small tributaries within the Kootenai Valley on both surface and ground water levels shall also be accounted for in this study. This shall include delineation of specific sites affected and identification of all feasible remedies specific to those sites such as, drainage, willing seller land purchases, and enrollment in the Department of Agriculture's Wetland Reserve Program.

d. By December 1, 2001, the action agencies shall design and conduct those studies necessary to determine the indirect effects of Libby Dam operations on sturgeon recruitment and mortality, including both the lowered average Kootenay Lake/Kootenai River stages, and altered spawning substrate-stream energy relationships, depths and velocities.

e. By December 1, 2001, the action agencies shall report specifically on the effects of load following on levee integrity throughout the Kootenai Valley over the last 26 years. This may be incorporated into the ongoing flood damage reduction study.

f. The action agencies shall limit daily load following in the outflow from Libby Dam to the extent that levees in Kootenai Valley are no longer damaged, and provide public outreach materials addressing this issue. Misunderstanding regarding the principal cause of levee erosion (26 years of load following and fluctuating water stages on the toes of the levees under freeze-thaw conditions, versus impacts from sturgeon augmentation flows), has created an institutional barrier to providing flows needed for conservation of the sturgeon.

g. During sturgeon recruitment flow periods, the action agencies shall allow local inflow to supplement Libby Dam releases to the maximum extent feasible, while assuring public safety by monitoring water levels throughout relevant areas of the Kootenai River basin.

h. The action agencies shall continue to monitor water temperature profiles in the south end of Lake Koocanusa during May and June to provide information necessary for timing of sturgeon spawning/rearing flow augmentation.

i. By December 1, 2002, the action agencies shall complete an evaluation and report on any changes in depth, water velocity and substrate in the vicinity of Bonners Ferry which have occurred since Libby Dam became operational. These studies of the known sturgeon spawning/rearing habitat, were initiated by the USGS under BPA sub-contract with the Kootenai Tribe of Idaho during 2000 to evaluate alternative recovery strategies identified in the Final Sturgeon Recovery Plan, 1999.

j. Should spawning/incubation habitat changes be documented, the December 1, 2002 report, identified above shall be expanded to include all feasible remedies such as channel constrictions or other physical habitat modification(s) to restore and maintain suitable spawning/incubation substrate, water velocities, and depths between RKM 228 and 246, or greater water depths above RKM 246. This shall be done in coordination with USGS and the Service, and a feasibility report shall be submitted to the Service by December 1, 2003. (Note: While this may conserve water for other beneficial uses, it may also require levee reconstruction to assure public safety is maintained.)

4. Conservation Aquaculture to Prevent Extinction. Because of the uncertainties and delays in reestablishing natural sturgeon recruitment, the conservation aquaculture program was initiated to prevent extinction.

a. The action agencies shall continue to maintain the preservation stocking program operated by the Kootenai Tribe of Idaho, and associated rearing facilities operated by B.C. Ministry of Environment, Lands and Parks. This program is described in the Sturgeon Recovery Plan, and shall be operated until deemed unnecessary by the Service.

b. The action agencies shall maintain the current level(s) of monitoring associated with all stages of natural recruitment, and the preservation stocking program. This program involves monitoring by the Kootenai Tribe of Idaho, Idaho Department of Fish and Game, and British Columbia Ministry of Environment Lands and Parks.

Because this biological opinion has found jeopardy, the action agencies are required to notify the

Service of their final decision on the implementation of the reasonable and prudent alternatives.

9. Incidental Take Statement

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

The measures described below are non-discretionary, and must be undertaken by the action agency so that they become binding conditions of any grant or permit issued, as appropriate, for the exemption of section 7(o)(2) to apply. The action agencies have a continuing duty to regulate the activity covered by this incidental take statement. If the action agencies (1) fail to assume and implement the terms and conditions, or (2) fail 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 grant 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 Service as specified in the incidental take statement.

9.A. Amount or Extent of Take/Effect of Take

The Service anticipates incidental take of bull trout will be difficult to detect for the following reasons: Incidental take of actual species numbers may be difficult to detect when the species is wide-ranging; has small body size; finding a dead or impaired specimen is unlikely; losses may be masked by seasonal fluctuations in numbers or other causes; or the species occurs in aquatic habitats that makes detection difficult.

9.A.1. Bull Trout

The Service anticipates that the proposed action is likely to result in variable levels of incidental take of bull trout in some reaches of the Columbia River basin. However, the Service is at this time unable to quantify the numbers of bull trout to be taken. We anticipate that an unquantifiable number of bull trout will be taken annually as a result of the proposed action. We anticipate incidental take of bull trout will be difficult to quantify or detect for the following reasons: 1) the limited scope, timing, and sampling locations of existing monitoring programs which may detect predation of bull trout, 2) finding dead or impaired specimens is unlikely because of water depth and scavengers, and 3) injuries or trauma caused by attempted predation or competition, which cause reduced survival of bull trout would be virtually undetectable. The extent of each take is estimated below.

Project Specific

The Service anticipates indeterminate levels of harassment, harm or killing of bull trout to occur in the following reaches/water bodies of the Columbia River basin.

<u>Libby Dam and Hungry Horse Dam:</u>

- Harm or loss of bull trout through increased potential of uncontrolled spill and dissolved gas supersaturation at Libby Dam.

Libby Dam "Gas Supersaturation". The incidental take is expected to be in the form of both harm (death and injury) and harassment (disruption of normal feeding and sheltering behavior) to bull trout resulting from gas supersaturation in the Kootenai River during periods of spill. These effects will in turn cause take of bull trout by decreasing river survival due to the effects of gas bubble disease on individual fish. Exact quantification of the extent of this take is not possible at this time because insufficient scientific information is available to predict the extent of gas supersaturation in the Kootenai River during spill events, and to estimate the amount of take attributable to these effects on juvenile and sub-adult bull trout survival. Gas supersaturation has occurred in the past when spill conditions occur at Libby Dam (BA, 1999), creating the potential for formation of gas bubble disease in fish. Fish injury (or death) from high nitrogen levels can occur, depending on length of time and intensity of fish exposure.

- Harassment and harm to bull trout from rapid and severe water level changes to river sections below Libby and Hungry Horse Dams, and harm to bull trout due to inadequate minimum instream flow in the river sections below Libby and Hungry Horse Dams.

Libby Dam and Hungry Horse Dam "Power Peaking" and "Salmon Flow Augmentation". The incidental take is expected to be in the form of both harm (death and injury) and harassment (disruption of normal feeding and sheltering behavior) to bull trout resulting from reduction of aquatic insect production (forage fish food) in river near- shore areas, degradation and alteration of river juvenile fish rearing habitat, and enhancement of predator opportunities to capture bull trout. These effects will in turn cause take of bull trout by decreasing river survival because of decreased food and habitat availability and quality, by increasing predation and competition in the river due to modification of prey abundance and availability, and by increased exposure to predation (due to rapid and extreme modification of habitats). Exact quantification of the extent of this take is not possible at this time because insufficient scientific information is available to estimate the size of the bull trout sub-populations, or to predict the amount of take attributable to these effects on juvenile and sub-adult bull trout survival. Juveniles are exposed to predation and competition interactions for 3-4 years, as they grow to maturity, therefore it is likely that several year classes of juvenile and sub-adult bull trout are exposed to potential take in a given year. It is likely that some portion of current predator interaction is above the "normal" level of predator interactions as a result of project operations and their effect on bull trout habitat, and this situation is anticipated to continue into the future under the proposed action . In addition, take in the form of disrupted normal feeding and sheltering behavior is likely to occur on a continuous and repetitive basis, affecting many individual bull trout.

Lake Pend Oreille

- Harm to bull trout in Lake Pend Oreille through changes in the water level elevations, which in turn may reduce kokanee egg to fry survival and, subsequently, the kokanee forage base. This may exacerbate predator-competitor interactions among top-end predators, including bull trout.

Lower Columbia, Clearwater, and Snake River Projects

- Harm and harassment to bull trout resulting from impediments to both upstream and downstream passage, potential entrainment of both adult and juvenile bull trout into turbine intakes, potential entrainment of adult bull trout into juvenile bypass systems, changes in pool water level elevations affecting food and habitat availability, elevated water temperatures resulting from impoundment, and gas supersaturation resulting from both voluntary and involuntary spill events are likely to continue to occur under the proposed action.

In the accompanying biological opinion, the Service determined that this level of anticipated take is not likely to result in jeopardy to the species. Critical habitat has not been designated for bull trout, therefore, none will be affected.

10. Reasonable and Prudent Measures

Section 7 of ESA requires minimization of the level of take. It is not appropriate to require mitigation for the impacts of incidental take. Reasonable and prudent measures (RPM) 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 project.

Since the FCRPS operates on a regional scale, many of the reasonable and prudent measures, and associated terms and conditions, are most appropriately implemented at that same scale. As a consequence, the Service feels the following RPMs are necessary and appropriate to minimize impacts of incidental take of bull trout in the Columbia River Basin.

1. The action agencies shall annually develop one and five-year implementation and funding plans to implement the measures contained in this Opinion.

2. The action agencies shall coordinate with the Service and NMFS on the proposed annual plan in sufficient time to allow review and discussion prior to implementation (normally before the start of the fiscal year).

3. The action agencies shall participate with the Service and NMFS in developing an interdepartmental memorandum of agreement which establishes and formalizes the purpose, structure, and scope of activities of a regional Federal coordinating body.

4. The action agencies shall coordinate annual implementation, review, and modification of the measures through an interagency group, such as the Implementation Team, or Technical Management Team (TMT).

5. The action agencies shall coordinate with the Service and NMFS, and the affected states and Tribes, in preseason planning and in-season management of water management operations. The coordination of in-season water management operations shall occur in the TMT process.

6. The action agencies, in coordination with the Service, shall implement an adaptive management approach for designing and implementing actions, including performance standards, needed for survival improvements for Kootenai River white sturgeon and bull trout in the Columbia River Basin.

7. By June 30, 2001, the action agencies shall develop and coordinate with the Service, NMFS and EPA on a plan to model the water temperature effects of alternative Snake River operations, including Libby and Hungry Horse Dams. The modeling plan shall include a temperature data collection strategy developed in consultation with EPA, NMFS, and State and Tribal water quality agencies. The data collection strategy shall be sufficient to develop and operate the model and to document the effects of the project operations.

8. The action agencies shall initiate research to determine the upstream and downstream passage requirements of bull trout at FCRPS dams in the Columbia Basin. These investigations should address entrainment, both upstream and downstream adult passage, and juvenile passage. Consideration of spill, flow attraction, temperature and other issues affecting passage should be included.

10.A. Measures Specific to Bull Trout

The Service believes that a phased approach, involving application of the principals of adaptive management, is the most appropriate course of action in providing measures to minimize the take of bull trout.

The Service acknowledges that the action agencies have provided clarity of the proposed action in a letter dated December 19, 2000. The addition of the dates for implementation of VARQ, modified minimum flows below Libby and Hungry Horse Dams, modified ramp rates and agreed upon studies further reduce the risk and level of take of bull trout as a result of the operations of those projects. These factors were considered in our analysis of effects, as additional considerations to the features of the proposed action. As a consequence, additional measures to minimize incidental take are not needed for some of these factors. However, for other factors, the additional information provided by the action agencies lacks specificity. In those instances, additional measures necessary to minimize incidental take are included, with accompanying terms and conditions.

10.A.1. Upper Columbia River

The Service believes that the following Reasonable and Prudent measures are necessary and appropriate to minimize impacts of incidental take of bull trout in the Upper Columbia River area. The "Discussion" provided below in italics is to provide the objectives and rationale behind the measure and its complementing terms and conditions.

Project Specific - Libby and Hungry Horse:

1. Implement operational constraints at Libby Dam intended to minimize adverse effects of rapid and severe river flow fluctuations on bull trout, including year-round minimum flows and ramping rates, seasonal water management, conducting studies to monitor the adequacy of the constraints, and providing for modification of the operational constraints depending on study results.

Discussion: The objective of this measure is to minimize take of bull trout resulting from rapid and severe river level changes caused by dam operations. The "effects" section of this Biological Opinion described the effects of power peaking operations and other operations at Libby Dam on the downstream river habitat and potential effects on bull trout occupying that habitat. These adverse effects constitute take of individual bull trout. The justification of these measures and the following terms and conditions is provided by general scientific knowledge regarding dam operational effects on regulated rivers and by site specific research conducted on the Kootenai River. Hauer and Stanford (1997) and Hoffman et al. (2000) demonstrated that radical and rapid flow fluctuations in the Kootenai River caused by power peaking operations at the dam have a major effect on shallow water habitats and aquatic insects upon which bull trout depend for food. Stanford and Hauer (1992) stated,"after analysis of natural flow regimes and daily flow fluctuations, concluded that a smoothing out of the annual hydropower discharge pattern would be necessary to restore benthic production and achieve a more natural fishery."

Fundamental changes in operations for Libby Dam were suggested for Kootenai River restoration by Hauer and Stanford (1997), including, "restrict daily rate of change in discharge to no more than 10 percent per day". Marotz et al. (1998) concluded that flow fluctuations, especially during the productive summer months, are harmful to aquatic life and that the zone of stream bed subject to water fluctuations becomes biologically unproductive habitat. Marotz et al. (1998) suggested that deleterious effects on biological production could be reduced if dam discharges were gradually ramped down. In addition to physical displacement of fish due to lack of watered habitat, Hoffman et al. (2000) concluded that changes in water velocity in the Kootenai River also have adverse effects on juvenile trout. Hoffman et al. (2000) stated, "if juvenile trout are displaced, they are forced to seek velocity breaks, thus increasing their vulnerability to predation." These adverse effects (decreased availability of forage and increased vulnerability to predation) constitute take of individual bull trout.

2. Implement operational measures at Hungry Horse Dam intended to minimize adverse effects of rapid and severe river flow fluctuations on bull trout, including year-round minimum flows and ramping rates, and seasonal water management; conduct studies to monitor the adequacy of the constraints; and provide for modification of the operational constraints depending on study results.

Discussion - As noted in more detail in the "effects" section of this BO, the Hungry Horse Dam power peaking operation adversely affects juvenile and sub-adult bull trout residing in the South Fork Flathead River and the mainstem Flathead River. Small-sized bull trout (juvenile and sub-adult ages) are normally found in shallow water shoreline margins and riffle areas which are subject to repeated flow and river stage changes from power peaking (BA, 1999) and other dam operations. Additionally, adverse effects, including take, to bull trout residing in the South Fork Flathead River would occur with a minimum flow of 145 cfs with no other operational restrictions (no ramping rates) because of the severe and frequent water level and velocity changes that would occur between 145 and 11,800 cfs. The justification of these reasonable and prudent measures and the following terms and conditions is provided by general scientific knowledge regarding dam operational effects on regulated rivers and by site specific research conducted on the Flathead River system. Hauer and Stanford (1982), Perry (1984), Perry et al. (1986), Hauer et al. (1994) and Hoffman et al. (2000) demonstrated that radical and rapid flow fluctuations caused by power peaking operations at Hungry Horse Dam have a major effect on shallow water habitats and aquatic insects upon which bull trout prey species depend for food. In the Flathead basin, Stanford and Hauer (1992),"after analysis of natural flow regimes and daily flow fluctuations, concluded that a smoothing out of the annual hydropower discharge pattern would be necessary to restore benthic production and achieve a more natural fishery." Marotz et al. (1998) concluded that flow fluctuations, especially during the productive summer months, are harmful to aquatic life and that the zone of stream bed subject to water fluctuations becomes biologically unproductive habitat. Marotz et al. (1998) suggested that deleterious effects on biological production could be reduced if dam discharges were gradually ramped *down. In addition to physical displacement of fish due to lack of watered habitat, Hoffman et al. (2000) concluded that changes in water velocity also have adverse effects on juvenile trout. Hoffman et al. (2000) stated, "if juvenile trout are displaced, they are forced to seek velocity breaks, thus increasing their vulnerability to predation." These adverse effects (decreased availability of forage and increased vulnerability to predation) constitute take of individual bull trout.*

3. The action agencies shall evaluate the feasibility of reestablishing bull trout passage at Albeni Falls Dam. If the information from these studies warrants consideration of modifications to the Albeni Falls facility, then the Service will work with the action agencies to implement these measures, as appropriate, or to reinitiate consultation, if necessary.

4. The action agencies shall continue the lake winter elevation study to promote kokanee spawning/ recruitment along the shore of Lake Pend Oreille.

10.A.2. Lower Columbia River

The Service believes that the following reasonable and prudent measures are necessary and appropriate to minimize the take of bull trout in the Lower Columbia River:

1. Determine the extent of bull trout use of the Lower Columbia River affected by the FCRPS. This would include the river reach from the Pacific Ocean to the upstream extent of the McNary Dam reservoir.

Discussion - Presently, information regarding bull trout use of the Lower Columbia River is limited. However, existing information indicates that bull trout are present in Bonneville Pool and in several tributaries of the Lower Columbia River. Tributaries known to support bull trout populations include the Willamette, Lewis, Hood, White Salmon, Klickitat, Deschutes, John Day, Umatilla, and Walla Walla rivers. Numerous actions are underway or proposed to improve habitat and passage conditions in these tributary systems. These actions include reestablishment of riparian vegetation, improvement of passage at barriers such as culverts, screening of water diversions, providing for bull trout passage at Round Butte Dam, and removal of Condit Dam. These actions are anticipated to increase bull trout populations in these tributary systems and migrations within and between these streams. The increase in bull trout populations in tributaries is likely to result in their increasing use of the Lower Columbia River reservoirs.

There are no records of bull trout using fish ladders or juvenile fish bypass systems at any of the Lower Columbia River FCRPS projects. Information from studies conducted to determine the extent of bull trout use in the Lower Columbia River would be used to determine the need for implementing specific fish passage measures for bull trout at FCRPS projects.

2. If it is determined, in consultation with the Service, that there is a significant bull trout population in the Lower Columbia River that is affected by the FCRPS based upon results of the study outlined in #1, then performance standards and appropriate measures shall be developed to ensure that upstream and downstream passage for bull trout is not impeded at FCRPS dams. If the information from these studies warrants consideration of additional modifications to facilities or operations, then the Service will work with the action agencies to implement these measures, as appropriate, or to reinitiate consultation, if necessary.

Discussion - Increased use of the Lower Columbia River reservoirs by bull trout will likely result in movement between tributary streams. The results of studies conducted under Item #1 of this section would be used to determine the need to implement this measure. Information regarding passage needs for bull trout that is developed from studies would then be applied to bull trout passage measures throughout the FCRPS area.

3. If it is determined, in consultation with the Service, that there is a significant bull trout population in the Lower Columbia River based upon results of the study outlined in Item #1, then a study shall be conducted to determine the effect of flow fluctuations on stranding or entrapment of bull trout or their prey in FCRPS reservoirs and free flowing reaches of river downstream from FCRPS projects.

4. If it is determined, in consultation with the Service, that there is a significant bull trout population in the Lower Columbia River based upon results of the study outlined in Item #1, then, in coordination with the Service, operational and structural changes shall be made to reduce uncontrolled spill and the effects of high levels of total dissolved gas at Lower Columbia River dams. If the information from these studies warrants consideration of additional modifications to facilities or operations, then the Service will work with the action agencies to implement these measures, as appropriate, or to reinitiate consultation, if necessary.

Discussion - High levels of total dissolved gas can result from uncontrolled or involuntary spill at FCRPS projects. Total dissolved gas levels that are higher than state waiver limits (currently 120%) could adversely impact bull trout or their prey by causing gas bubble trauma. Measures to reduce total dissolved gas production at FCRPS projects would benefit anadromous fish and other resident fish as well as bull trout. Such measures are currently being investigated by the Corps and the Water Quality Team of the Columbia River Regional Forum to implement Reasonable and Prudent Alternatives of the National Marine Fisheries Service's existing biological opinion for operation of the FCRPS.

10.A.3. Lower Snake and Clearwater River

The Service believes that the following reasonable and prudent measures (RPM) are necessary and appropriate to minimize the take of bull trout in the Lower Snake and Clearwater Rivers:

1. The action agencies shall determine the presence of, and use by, bull trout in the mainstem Snake River, and shall implement monitoring and studies to provide critical information on bull trout distribution, timing, and usage of the Lower Snake River dams and reservoir system. If the information from these studies warrants consideration of additional modifications to facilities or operations, as determined by the Service in consultation with the action agencies, then the Service will work with the action agencies to implement these measures, as appropriate, or to reinitiate consultation, if necessary.

2. The action agencies shall implement monitoring and studies to provide critical information on bull trout entrainment and distribution, timing, and usage of Dworshak Reservoir for modifying facilities and/or operations.

11. Terms and Conditions

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

The Service believes the following terms and conditions are necessary and appropriate to minimize the take of listed bull trout in the Columbia River Basin:

1. In coordination with the Service and NMFS, the action agencies shall participate in development of performance standards appropriate for bull trout. The standards shall consider direction contained in the recovery plans for these species. Wherever feasible, the performance standards shall be developed and ready for implementation by November, 2003.

2. By September 1, 2001, in coordination with the Service, the action agencies shall develop a priority list of the FCRPS dams for research to determine up- and downstream passage needs of bull trout.

3. Based on the priority list in #2 above, the action agencies shall initiate research to determine the upstream and downstream passage requirements of bull trout at FCRPS dams. Include the Service, Oregon Department of Fish and Wildlife, Washington Department of Fish and Wildlife, Idaho Department of Fish and Game, and Montana Department of Fish, Wildlife and Parks, and relevant tribes, whenever appropriate, in development of research/study plans.

4. Based on research conducted above, and in coordination with the Service, implement any interim and long term measures found to be needed to provide suitable up- and downstream passage conditions for bull trout at FCRPS dams. If necessary to implement these measures, the action agencies may reinitiate consultation with the Service.

5. By September 1, 2001, in coordination with the Service, the action agencies shall develop a priority list of the FCRPS dams for evaluation to determine the extent of bull trout entrainment.

6. Based on the priority list in item #5, the action agencies shall assess the extent of bull trout entrainment at FCRPS Dams. If entrainment is determined, in consultation with the Service, to be significant, the action agencies will explore techniques to deter bull trout entrainment (e.g., the expansion of strobe light research).

11.A. Bull Trout

11.A.1. Upper Columbia River

The action agencies have agreed to a modified proposed action that is incorporated in Section 3 of this document. As a result of that modified proposed action many of the issues related to take of bull trout have been addressed and minimized by the action agencies letter dated December 19, 2000. However, for some of the measures, addition clarification is needed. These factors are addressed in the terms and conditions below.

The Service believes the following terms and conditions are necessary and appropriate to reduce impacts and minimize take of listed bull trout in the Upper Columbia River area:

1. The action agencies have agreed to a modified proposed action as described in Section 3 of this document and documented in a letter dated December 19, 2000. The following terms and conditions are established to clarify the proposed action or describe additional measures to implement reasonable and prudent measure #1 for the Upper Columbia River, Libby Dam Operations:

    a. During water year 2001, (prior to implementation of VARQ), the action agencies shall seek a means to store and release sufficient water to provide for bull trout base flow prior to salmon flows and associated ramping volumes. The action agencies will adhere to the described ramping rates and minimum flows, as described in the revised proposed action. Should VARQ not be adopted by water year 2001, the action agencies shall continue with these alternative storage procedures, ramping rates and minimum flows for the duration of this biological opinion or with modifications agreed to during re-initiation of consultation.

    b. If Koocanusa Reservoir elevations are below salmon guidelines (2439 ft) on July 1, and salmon augmentation will not occur for that year, the action agencies shall provide 6,000 cfs for the bull trout minimum flow during July and August (lowest water years). If additional water is available, increases in minimum flows may be determined through the TMT process.

c. The action agencies shall provide to the Service annually, on or about May 1 but not later that May 10, an annual operational schedule to be supplemented on a monthly basis. The annual schedule shall include month-end estimates of water surface elevation at Koocanusa Reservoir and estimates of monthly discharge from Libby Dam. The monthly supplement shall include a report of actual operations over the previous month and shall include daily water surface elevation at Koocanusa Reservoir and hourly spill and releases at Libby Dam.

2. The action agencies have agreed to a modified proposed action as described in Section 3 of this document. The following terms and conditions are established to clarify the proposed action or describe additional measures to implement reasonable and prudent measure #2 for the Upper Columbia River, Hungry Horse operations:

   a. The action agencies shall provide to the Service annually, on or about May 1 but not later that May 10, an annual operational schedule to be supplemented on a monthly basis. The annual schedule shall include month-end estimates of water surface elevation at Hungry Horse Reservoir and estimates of monthly discharge from Hungry Horse Dam. The monthly supplement shall include a report of actual operations over the previous month and shall include daily water surface elevation at Hungry Horse Reservoir and hourly spill and releases at Hungry Horse Dam.

3. The following terms and conditions are established to implement reasonable and prudent measure #3 for the Upper Columbia River (Albeni Falls Operations):

   a. By October 1, 2004, the action agencies shall conduct a feasibility study for reestablishment of two- way passage of adult and sub-adult bull trout at Albeni Falls Dam. This study must include observations of movement and survival of radio tagged bull trout from Lake Pend Oreille, and survival of adult and subadult bull trout passing through or over Albeni Falls Dam. The study must also analyze the feasibility of structural improvements such as fish ladders and measures to guide fish away from turbines.

   b. Based on the results of the study, by October 1, 2005, the action agencies shall consult with the Service, as necessary, on the decision to reestablish fish passage at Albeni Falls Dam. If fish passage is determined to be necessary the action agencies will seek appropriations for the construction of the facility by October 1, 2008.

   c. By October 1, 2004, the action agencies shall evaluate and report to the Service on total dissolved gas concentrations downstream of Albeni Falls Dam in the Pend Oreille River which may occur within the full range of operations of the facility, including forced spills.

4. The following terms and conditions are established to implement reasonable and prudent measure #4 for the Upper Columbia River (Lake Pend Oreille):

   a. The action agencies shall continue the lake winter elevation/kokanee egg-to-fry survival study on Lake Pend Oreille for the next six years. The study shall begin in 2001 by drafting the lake to fall/winter water levels of elevation 2051 feet. This is intended to allow winter storms to improve the condition of spawning gravel along the shore of Lake Pend Oreille. During the fall/winter of 2002, maintain the Lake Pend Oreille at elevation 2055 until fry emerge from shoreline gravels.

   b. By September 2003 the Service will secure independent scientific review relative to the appropriate duration (one to three years) of maintaining winter lake elevations at 2055 feet, and, with input from Idaho Department of Fish and Game (IDFG), provide written recommendations to the action agencies for fall/winter operations for 2003 through 2006. During this six year period, the action agencies, in coordination with the Service and IDFG, shall evaluate the effects of varying winter lake level elevations on all life stages of kokanee in Lake Pend Oreille, and predator/prey dynamics.

   c. If, in September 2007, it is determined that this action is effective in significantly improving kokanee production as bull trout forage, the Service will provide written recommendations on the frequency of varying Lake Pend Oreille winter lake elevations for the remainder of this biological opinion.

   d. The action agencies, the Service, and IDFG shall meet annually to evaluate Lake Pend Oreille kokanee monitoring results and make necessary adjustments through subsequent in-season management.

11.A.2. Lower Columbia River

The Service believes that the following terms and conditions are necessary and appropriate to minimize the take of bull trout in the Lower Columbia River area:

1. The following terms and conditions are established to implement reasonable and prudent measure #1 for the Lower Columbia River:

   a. The Corps shall include bull trout in the species to be counted and recorded at Bonneville, The Dalles, John Day, and McNary dams.

   b. The Corps shall record the occurrence of bull trout in the smolt monitoring facilities at the Lower Columbia River dams.

c. The action agencies shall include observations of bull trout captured in field activities under their funding (e.g., research studies and northern pikeminnow reward program fisheries) and report that information annually to the Service.

d. The action agencies shall estimate the annual population size of bull trout migrating to and from the Lower Columbia River reservoirs, and develop abundance trends over time.

e. The action agencies shall cooperate in studies to determine the movements of bull trout from the Hood River and other tributaries into Bonneville Dam reservoir. Include the Service, Oregon Department of Fish and Wildlife, Washington Department of Fish and Wildlife, Forest Service, Confederated Tribes of the Warm Springs Reservation, Confederated Tribes of the Umatilla Indian Reservation, Yakama Indian Nation, and PacifiCorp, whenever appropriate, in development of research/study plans.

f. The action agencies shall cooperate in studies to evaluate potential habitat use of the White Salmon River subsequent to removal of Condit Dam. Include the Service, Oregon Department of Fish and Wildlife, Washington Department of Fish and Wildlife, Forest Service, and PacifiCorp, whenever appropriate, in development of research/study plans.

g. The action agencies shall cooperate in studies to evaluate re-establishment of fluvial bull trout in the Klickitat River. Include the Service, Oregon Department of Fish and Wildlife, Washington Department of Fish and Wildlife, and Forest Service, whenever appropriate, in development of research/study plans.

The terms and conditions for reasonable and prudent measure #1 are intended to determine the existing and future extent of bull trout populations using the lower Columbia River reservoirs and tributary streams. Improvement of habitat and passage conditions in tributaries resulting from implementation of the bull trout recovery plan and removal of Condit Dam are expected to increase bull trout populations. Increased populations in tributaries may result in greater bull trout use of the Lower Columbia River reservoirs. Implementation of terms and conditions for reasonable and prudent measures # 2 and 3 would not be required unless studies conducted under reasonable and prudent measure #1 find substantial numbers of bull trout to be using the reservoirs or attempting to pass the dams.

2. The following terms and conditions are established to implement reasonable and prudent measure #2 for the Lower Columbia River:

a. Initiate studies to determine the effect of flow fluctuations on river or reservoir water surface elevations and on stranding or entrapment of bull trout and other aquatic life related to the prey base of bull trout.

b. Initiate studies to determine use and suitability of bull trout habitat for all life history stages in the Lower Columbia River.

c. Include the Service, Oregon Department of Fish and Wildlife, Washington Department of Fish and Wildlife, Idaho Department of Fish and Game, and Montana Department of Fish, Wildlife and Parks whenever appropriate, in development of research/study plans.

3. The following terms and conditions are established to implement reasonable and prudent measure #3 for the Lower Columbia River:

a. Investigate, and in coordination with the Service, implement as appropriate, structural and operational measures to reduce TDG production. The Corps has recently installed flow deflectors at John Day Dam and, through its Gas Abatement Study, is investigating other potential measures at other FCRPS projects to reduce gas supersaturation. Measures recommended in this study to reduce gas supersaturation should be implemented as soon as possible.

12. Conservation Recommendations

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

1. It is recommended that the action agencies seek cooperation of West Kootenai Power and other involved agencies and parties in Canada to negotiate higher Kootenay Lake/Kootenai River stages within the 1938 IJC order during sturgeon spawning flows. This may promote sturgeon recruitment with less stored water and fewer configuration improvements at Libby Dam during intermediate and low water years.

2. As U.S. representatives on the Kootenay lake board of control, and operators of Libby Dam, it is recommended that the action agencies seek opportunity to provide low flows in the Kootenai River during January or February for burbot migration and spawning.

3. The Service recommends that the action agencies initiate section 7 consultation on the

proposed Columbia River Treaty Flood Control Operating Plan, October 1999. Proposed changes contained in this Plan may affect sturgeon spawning/rearing habitat conditions necessary for the survival and recovery of those species.

4. The Service recommends that the Corps continue monitoring TDG levels, and invest in facility improvements to keep TDG levels at or below 110% (or other applicable state water quality standards).

5. The Service recommends that the Corps cooperate with research of bull trout movements and distribution for Dworshak Reservoir and tributaries.

6. The Service recommends that the action agencies participate in development and implementation (when completed) of the bull trout recovery plan.

7. The Service will participate in the Regional Forum consisting of the TMT, the Implementation Team (IT), and the Executive Committee. The primary purpose of this Regional Forum is conservation of species listed under the Endangered Species Act with consideration given to other affected aquatic resources. Recommendations by the Regional Forum to the action agencies will be made by consensus, except when no consensus is reached, the Service shall make the final recommendations on listed resident species. Operations for sturgeon, bull trout and salmon will be coordinated annually between the Service and NMFS through the TMT process. They may include the multi-year planning process when warranted.

8. The action agencies will work with the Service and Montana Department of Fish, Wildlife, and Parks to re-establish appropriate vegetation in the 20 foot drawdown zone of Hungry Horse Reservoir. A schedule should be developed for plans and funding to be secured by 2003, with implementation by 2005.

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

13. Reinitiation

This concludes formal consultation on the action outlined in the BA, and as clarified by the action agencies in the December 19, 2000 letter. As provided in 50 CFR§402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control of 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. In addition, the Service is currently developing a bull trout recovery plan. Information contained in the recovery plan and/or direction provided by the plan may necessitate the need to reinitiate consultation on this action to further clarify the effects to recovery units of bull trout, if such units are ultimately designated.

LITERATURE CITED

Appendix A. Letter from Action Agencies Clarifying Proposed Actions.

Letter will be inserted once “hard copy” is received.

Appendix B. Summary of Bull Trout Subpopulations and Effects from FCRPS facilities.