United States Department of the Interior

FISH AND WILDLIFE SERVICE
ECOLOGICAL SERVICES
MONTANA FIELD OFFICE
585 SHEPARD WAY
HELENA, MONTANA 59601
PHONE (406) 449-5225, FAX (406) 449-5339

October 11, 2006

M 19 Rock Creek Mine

Paul Bradford, Forest Supervisor
Kootenai National Forest
1101 Highway 2 West
Libby, Montana 59923

Dear Mr. Bradford:

This document transmits the Fish and Wildlife Service's (Service) final biological opinions based on the Service's review of the proposed Revett Silver Company's Rock Creek Copper/Silver Mine Project (Rock Creek Mine) and associated mining operations. The proposed Rock Creek Mine is located in the Rock Creek drainage which is a tributary to Cabinet Gorge Reservoir on the lower Clark Fork River in Sanders County, Montana. The opinions describe effects of the proposed action on the threatened grizzly bear *(Ursus arctos horribilis),* bull trout *(Salvelinus confluentus),* and bull trout critical habitat. The opinions have been prepared in accordance with Section 7 of the Endangered Species Act of 1973, as amended (Act) (16 U.S.C. 1531 et seq.).

The Service prepared these documents in response to the Kootenai National Forest (Forest) request and the accompanying Biological Assessment (BA) dated July 31, 1998, (USDA 1998) amended May 13, 1999 (USDA 1999) for the bull trout.

The biological opinions are based on information provided in the BA, the environmental impact statement, telephone conversations with Forest personnel, and other sources of information. A complete administrative record of this consultation is on file in the Montana Ecological Services Field Office in Helena. If you have any questions, please contact Mark Wilson at 406-449-5225 extension 205.

Sincerely,

R. Mark Wilson

R. Mark Wilson
Field Supervisor
Montana Field Office

Endangered Species Act
Section 7 Consultation

BIOLOGICAL OPINION

on the

Effects to Grizzly Bears, Bull Trout, and Bull Trout Critical Habitat from the Implementation of Proposed Actions Associated with Plan of Operation for the

Revett RC Resources Incorporated Rock Creek Copper/Silver Mine

as proposed by the

U.S. Forest Service, Kootenai National Forest

U.S. Fish and Wildlife Service
Montana Ecological Services Field Office

October 11, 2006

SUMMARY

PART A -GRIZZLY BEARS

In 2005, as a result of a lawsuit, the court set aside and remanded the 2003 biological opinion on the Rock Creek Mine project back to the Service for reconsideration. This biological opinion is based on further consideration in accordance with the 2005 court Order and on new information related to the Cabinet-Yaak Ecosystem (CYE) grizzly bear population that became available from 2003 to the present. Potential adverse effects of the proposed Rock Creek Mine are human-caused grizzly bear mortality, displacement of grizzly bears from key habitat due to disturbances caused by the mine and associated activities, and fragmentation of habitat in the narrow CYE. The new information included additional grizzly bear mortality and scientific models that predicted a high likelihood of extinction for grizzly bears in the CYE, unless a number of recommended actions were taken.

The Service reexamined the proposed action and analyzed its effects given the new information, and engaged in further consultation with the Forest during 2005 and 2006. As a consequence, the Forest incorporated additional conservation measures to the mitigation plan to address the new information regarding the CYE grizzly bear population status, and to address the concerns raised by the court. We re-analyzed the revised mitigation plan and concluded that it includes a suite of measures that adequately address the adverse effects, and would ultimately have a net positive impact on grizzly bears and grizzly bear habitat in the CYE. The revised plan more aggressively addresses the adverse impacts of the incidental take expected as a result of development of the mine, as well as the existing conditions in the CYE that lead to human-caused grizzly bear mortality. An Oversight Committee, with technical input and advice from the Service, would work cooperatively to ensure the implementation of the numerous measures in the Forest's mitigation plan. Through implementation of the conservation measures in the mitigation plan, we expect the effects of the proposed action on the CYE grizzly bear population would include the following:

- a reduction in human-caused grizzly bear mortality rates - accomplished by improved education and outreach to mine employees and CYE communities at large, improved attractant storage and management, and effective prevention and/or resolution of conflicts between grizzly bears and people;
- conservation of grizzly bear habitat that might otherwise be developed in the future;
- continued augmentation of grizzly bears into the Cabinet Mountains; and
- continued and enhanced research related to grizzly bear ecology in the CYE and connectivity between the Yaak and Cabinet portions of the CYE.

This improved condition over baseline is anticipated to offset and fully mitigate the impacts of the incidental take anticipated as a result of mine development.

To accomplish the above, over the course of a 35-year period Revett would be required to fund conservation measures including, but not limited to:

- the purchase of or perpetual conservation easement on 2450 acres of high quality grizzly bear habitat in the CYE that is at risk of being developed;
- two Montana, Fish, Wildlife and Parks grizzly bear management specialists over the life of the mine;
- one law enforcement officer over the life of the mine;
- grizzly bear information, education and outreach programs and projects, in cooperation with Montana Fish, Wildlife and Parks and the Forest Service;
- monitoring and research efforts specifically targeting the CYE grizzly bear population, including augmented grizzly bears;
- the purchase of grizzly bear-resistant garbage containers for all mine employees living in or near grizzly bear habitat, and additional containers for the public at large;
- the conversion of the Sanders County garbage transfer station and others in the CYE over time, to be grizzly bear resistant; and
- bear resistant garbage receptacles at Forest Service campgrounds.

Collectively, the conservation measures are reasonably expected to prevent the loss of more than one grizzly bear over the 30-year life of the mine, thus more than offsetting the loss we anticipate from the project (one grizzly bear). The measures in the mitigation plan required of the Forest and Revett, if implemented, would result in a net reduction in future human-caused grizzly bear mortality rates, even with development and operation of the proposed mine. The conservation measures include actions that are known to prevent conflicts between people and grizzly bears, and/or resolve conflicts that do occur in ways that avoid the removal or mortality of grizzly bears. This reduction in human-caused grizzly bear mortality would occur concurrently with Montana Fish, Wildlife and Parks' augmentation of grizzly bears into the CYE. Research indicated that augmentation of small grizzly bear populations combined with a reduction in human-caused mortality had both short- and long-term positive effects on growth rates (Proctor et al. 2004).

Further, construction of the mine would be deferred until at least six female grizzly bears were augmented into the Cabinet Mountains (two of which have already been augmented) and monitored. The addition of six female grizzly bears to the existing population in the CYE prior to construction of the mine would further assure that the potential loss of a female grizzly bear due to the effects of the proposed mine, if such loss were to occur, would be offset (Kasworm et al. 2006b). Although Montana Fish, Wildlife and Parks' augmentation program is independent of the proposed action, Revett would fund a grizzly bear monitoring and research effort in the southern Cabinet Mountains during the operational life of the mine, which would ensure funds for monitoring all augmented bears. This funding would allow the Service to monitor augmented bears, which is essential to the Montana Fish, Wildlife and Parks' continuance of their program. Funding for CYE grizzly bear monitoring to date has been tenuous and not guaranteed, dependent on available annual government funding. Revett has also agreed to provide funding for actual augmentation, in the event that such funding is needed.

The Service anticipates that some low level of take would occur as a result of disturbance-related displacement of one or two female grizzly bears from key habitat due to noise and human activity in the Rock Creek drainage, once construction of the mine begins. Under the project's mitigation plan, grizzly bear displacement would be offset through the purchase of 2,450 acres of

land (over a five-year period) located in or near the southern portion of the Cabinet Mountains Wilderness. This land would be secured and protected from future development through purchases by Revett followed by either conveyance in fee or perpetual conservation easement to the benefit of the Forest. The effects of displacement on the grizzly bear population would be more than offset by the combination of the land acquisition, the existing and improved access management on the Forest, the net reduction in existing and anticipated future human-caused grizzly bear mortality rates, and augmentation of the CYE grizzly bear population. No other grizzly bear ecosystem has received this level of concerted and coordinated effort to reduce conflicts between grizzly bears and people, to enhance population growth, and to reduce the potential for human-caused mortality of grizzly bears. We expect that over time, the combined measures in the mitigation plan would contribute to stabilization and growth of the CYE grizzly bear population.

After reviewing the current status of the grizzly bear, the environmental baseline for the action area, the effects of the proposed Rock Creek Mine and the cumulative effects, it is the Service's biological opinion that the Rock Creek Mine as proposed, is not likely to jeopardize the continued existence of the listed entity of grizzly bears. No critical habitat has been designated for this species, therefore none would be affected.

PART B- BULL TROUT

The adverse effects of the Rock Creek Mine on bull trout, as proposed, are anticipated to be caused by sedimentation and confined to the Rock Creek watershed and Cabinet Gorge Reservoir. Sedimentation is expected to occur during the 5-year construction period and for 2 years afterward. Sediment delivered to Rock Creek could temporarily degrade spawning and rearing habitat and negatively affect water quality. However, after this period the quality of habitat conditions is expected to improve as sediment delivery subsides and sediment transport conditions return to pre-project watershed conditions. Revett would be required to monitor fine sediment and if fine sediment levels approach or exceed specified thresholds in spawning areas or in total in the watershed, corrective actions would be required to address known or potential sources of delivery.

The Service had concerns that over the 35-year operating period and beyond, mining activities may cause chemical contamination in Rock Creek and possibly Cabinet Gorge Reservoir if MPDES standards are exceeded. There is also a concern that mining activities may intercept sources of groundwater that could result in changes in surface flows and stream temperatures in Rock Creek. Although adverse effects are not anticipated at this time, the effectiveness of the proposed mitigation measures over the life of the project is uncertain. Consequently, Revett will be required to provide long-term monitoring designed to detect changes in water chemistry and changes in stream temperature and stream flows. If monitoring results indicate an elevated risk of adverse impacts to bull trout, the Service would request re-initiation of consultation.

Revett would be required to develop final monitoring and mitigation plans prior to project startup. The regulatory agencies would review and approve the plans as an interagency team. The Service would participate on issues and plan development relative to bull trout, bull trout critical habitat,

water use, water quality, groundwater, sediment, and watershed assessment. The Service would have approval authority of these plans, assessments, and evaluations.

After reviewing the current status of the bull trout and bull trout critical habitat, the environmental baseline, the effects of the proposed Rock Creek Mine and the cumulative effects, it is the Service's biological opinion that the Rock Creek Mine as proposed, is not likely to jeopardize the continued existence of the listed entity of bull trout nor adversely modify critical habitat for this species.

Introduction

This document represents the U.S. Fish and Wildlife Service's (Service) biological opinion on the proposed Revett Silver Company (formerly Sterling Mining Company) Rock Creek Copper/Silver Mine project located in the Rock Creek drainage, a tributary to the lower Clark Fork River in western Montana, near Noxon. Portions of the mine would occur on the Kootenai National Forest (Forest), which occurs in Lincoln and Sanders Counties. This biological opinion addresses the effects of the proposed action on the threatened grizzly bear (*Ursus arctos horribilis*) and threatened bull trout (*Salvelinus confluentus*). Formal consultation for the proposed action was initiated on August 3, 1998 when the Service received the biological assessment (BA)(USDA 1998b) for this project.

Section 7(b)(3)(A) of the Endangered Species Act of 1973 (Act) requires that the Secretary of Interior issue biological opinions on federal agency actions that may affect listed species or critical habitat. Biological opinions determine if the action proposed by the action agency is likely to jeopardize the continued existence of listed species or destroy or adversely modify critical habitat. Section 7(b)(3)(A) of the Act also requires the Secretary to suggest reasonable and prudent alternatives to any action found likely to result in jeopardy or adverse modification of critical habitat, if any has been designated.

This biological opinion only addresses impacts to federally listed species and does not address the overall environmental acceptability of the proposed action. This biological opinion refers only to the potential effects of the proposed action on threatened grizzly bears and bull trout. The Service has reviewed the proposed action as analyzed in the biological assessments and concurs with the Forest's determinations that the project would not likely adversely affect threatened bald eagles *(Haliaeetus leucocephalus*) or Canada lynx (*Lynx canadensis*) or endangered wolves (*Canis lupus*).

Following the "Description of the Proposed Action" section, this biological opinion is separated into two Parts, for convenience and ease of interpretation. Part A addresses the grizzly bear and Part B addresses bull trout.

Consultation history - Rock Creek Mine project A complete consultation history of this project up to the time the final BA was issued (August, 1998) is summarized in Appendix 3 of the BA. On May 20, 1999, the Service received a May 13, 1999, amendment to the BA addressing the effects of the proposed action on bull trout (USDA 1999). The Service received another BA amendment dated April 4, 2000, addressing Canada lynx. On October 3, 2000, the Service received a summary of the preferred alternative (Alternative V), which included mitigation factors. Additional information related to the proposed action was collected through correspondence, phone discussions, electronic mail and during meetings. The complete administrative record for the consultation on this project is found in the Service's Montana Field Office in Helena.

The Service completed a biological opinion for the Rock Creek Mine project on December 15, 2000 (USDI 2000c). The Service concluded that the proposed action would jeopardize grizzly bears, and therefore included a reasonable and prudent measure that would preclude jeopardy to

the species. We also concluded that the proposed action would not jeopardize the continued existence of bull trout. The Forest and the Montana Department of Environmental Quality (MDEQ) jointly completed the FEIS for this project (MDEQ and USDA 2001). As a result of the consultation process, the Forest and MDEQ incorporated additional stipulations in the preferred Alternative V description. A partial summary of changes are addressed in the Summary FEIS (MDEQ and USDA 2001, page S-20). A Record of Decision (ROD) followed the FEIS and incorporated the Rock Creek Mine biological opinion.

A Complaint for Declaratory and Injunctive Relief was filed August 27, 2001, challenging the validity of the 2000 biological opinion. The Service withdrew the biological opinion in March, 2002, and the Forest subsequently withdrew the ROD. Additional consultation on grizzly bears and bull trout occurred during 2002 to 2003.

On December 23, 2002, we received updated access management baseline information from the Forest (USDA in litt. 2002b) related to the Rock Creek Mine project, and on December 31, 2002, we received the revised and clarified grizzly bear mitigation plan for the project (USDA in litt. 2002a).

On May 9, 2003 the Service issued a biological opinion that concluded that the proposed Rock Creek Mine would not likely jeopardize grizzly bears, would not likely jeopardize bull trout, would not likely adversely modify proposed bull trout critical habitat, and would not likely jeopardize Canada lynx, based upon updated information (USDI 2003). The proposed action included a mitigation plan for grizzly bears that incorporated the substantive provisions of the reasonable and prudent alternative in our December 15, 2000 jeopardy biological opinion.

An amended Complaint for Declaratory and Injunctive Relief was filed on July 10, 2003, pertaining to the 2003 biological opinion. On March 28, 2005, the court set aside and remanded the 2003 biological opinion back to the Service for reconsideration. This biological opinion is based on further consideration in accordance with the March 28 court Order and on new information related to the CYE grizzly bears population and bull trout that became available from 2003 to the present.

In December 2004, the Forest and Service reinitiated consultation on the proposed Rock Creek Mine based on new information that revealed effects of the action that may affect grizzly bears in the Cabinet-Yaak Ecosystem to an extent not previously considered (USDI in litt. 2004b). This information included the discovery of a human-caused mortality of an adult female grizzly bear that was killed in 2002. One of her female cubs had already been discovered dead in 2003. The adult female had had two additional cubs and they were now also presumed dead. These four grizzly bear mortalities occurred in 2002 but were not known prior to 2004, and therefore were not considered in the analysis of human-caused mortality in the 2003 biological opinion. Additional new information included studies and publications related to population viability (Proctor et al. 2004) and trend (Wakkinen and Kasworm 2004) of the Cabinet-Yaak Ecosystem grizzly bears. This biological opinion completes this consultation process.

In 1993, the Service had completed a biological opinion on the Noranda Mineral Corporation's (Noranda) request to the Forest for the proposed Montanore Mine project (USDI 1993b). This

proposed mine was to be located in the Cabinet Mountains almost directly east of the currently proposed Rock Creek mine site, across the Cabinet Mountains divide. At that time, consultation on the Rock Creek mine had not occurred and so the Rock Creek mine was not considered in the environmental baseline for the Montanore project. The Montanore mine was to be constructed and operated by Noranda. Our 1993 biological opinion concluded that the proposed Montanore mine was likely to jeopardize grizzly bears and we included a reasonable and prudent alternative to preclude jeopardy. The proposed action was not implemented.

In a letter dated March 6, 2001, the Service informed the Forest that the March 1993 biological opinion on the Montanore Mine project, as proposed by the Forest and Noranda, would require re-initiation of consultation prior to that project proceeding (USDI in litt. 2001). Significant changes in the baseline information used in the biological opinion had occurred since its completion more than eight years earlier.

On October 24, 2002 the Forest sent us four letters from Noranda, dated September 2002, informing us of the applicant's (Noranda) decision to "abandon the Montanore copper-silver project" and relinquish its "authorization to construct and operate the Montanore Project as set forth in the Plan of Operations, which was never implemented." The letters also requested termination of permits related to air quality and the tailings impoundment (USDA 2002). The section 7 environmental baseline for the proposed Rock Creek Mine changed significantly with the abandonment of plans by Noranda to develop the Montanore Mine. Any new proponent of the development of a mine at the Montanore site would require a new application to the Forest for approval of a Plan of Operations pursuant to 36 CFR, part 228. The removal of the Montanore project from the environmental baseline is consistent with section 7 regulations (50 CFR 402.02)(FR 51, No. 106, 19932) and the Service's Endangered Species Consultation Handbook (March 1998). The preamble to the regulations states that "impacts [which have been reviewed under section 7] will continue to be considered as part of the environmental baseline unless the Service receives notice from the Federal agency that the proposed action will not be implemented or unless the biological opinion on the proposed action is no longer valid because re-initiation of consultation is required." Both conditions were met in this situation. Therefore, the Montanore mine project was not considered part of the environmental baseline for the proposed Rock Creek mine biological opinion in 2003.

In December 2004, Mines Management Incorporated submitted a new application to the Forest for approval of a Plan of Operations for a new mine at the Montanore site. Mines Management Inc. contacted the Service this year on reinserting the Montanore mine project into the environmental baseline. After re-examining the issue and our original rationale, we conclude that our original decision to remove the Montanore mine project from the environmental baseline is correct and therefore, impacts from Mines Management Incorporated's proposed Montanore Mine are not included in the baseline of the biological opinion. If we receive a request for consultation from the Forest on the new application for proposed mining operations at the Montanore site, we will complete consultation on that project and it will become part of the environmental baseline at that point.

According to 50 CFR 402.02, the environmental baseline "includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the

anticipated effects of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in progress." Recent correspondence between Mines Management Inc., and the Service (letters dated August 10, 2006 and September 12, 2006) indicated that Mines Management Inc. had acquired some permits, but not all permits needed to develop a mine, through their acquisition of Noranda and Noranda's Montanore project. To date, Mines Management Inc., under its State operating permit, has only been allowed to remove the temporary adit plug at the Libby adit to sample water within the adit. This specific activity is considered a private action, which is contemporaneous with the consultation in progress because it does not require federal approval. Because of the minor nature of the impacts of the activity conducted thus far, it was not likely to have had adversely affected listed species in the area. Therefore, there was no need to add these impacts to the baseline. This activity is now complete. Thus, the impacts of this activity are not included in the environmental baseline for the consultation in progress.

It is also our understanding from correspondence from Mines Management Inc. dated September 12, 2006, that the State is requiring additional review and approval prior to the implementation of further activity at this site, including exploration and drilling activities. Some of these activities may also require Forest Service authorization or approval, and would not be included in the baseline until they are reviewed as part of the anticipated Forest Service section 7 consultation. As mentioned above, once we receive a request from the Forest for consultation, and then complete the consultation, that project will then become part of the environmental baseline in accordance with 50 CFR 402.02.

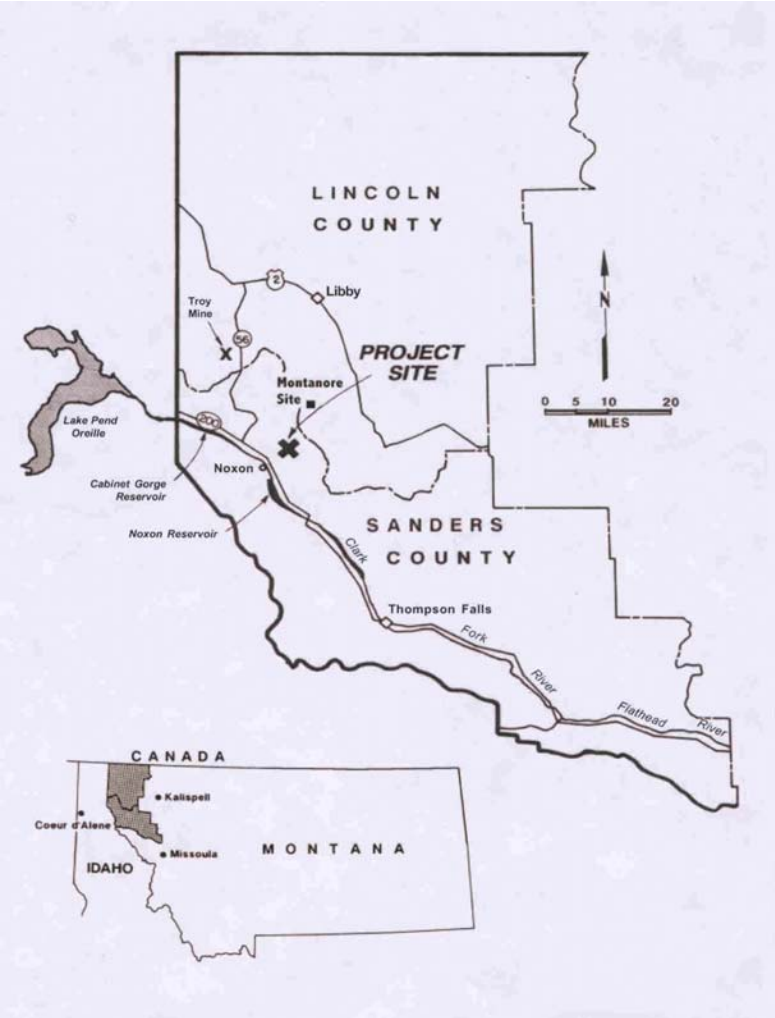


Figure A1. Proposed Rock Creek Mine project site (from MDEQ and USDA 2001).

General description of the proposed action The Forest proposes to allow Revett Silver Company to develop and operate Rock Creek Mine on portions of the Forest. Rock Creek Mine would be a 10,000-ton-per-day underground copper and silver mine in northwestern Montana. The mine, mill, and other facilities would occur in Sanders County, about 13 miles northeast of the town of Noxon (Figure A1). The mine originally was proposed by ASARCO Incorporated, but was sold to the Sterling

Mining Company in 1999. In October of 2003 the company changed its name from Sterling Mining Company to Revett Silver Company, a Montana Company, followed by the incorporation of its wholly owned subsidiary RC Resources Inc. (Revett) also a Montana Company and the new project proponent.

The proposed action is Alternative V (Appendix A), the Forest's preferred alternative to Revett's proposed mine plan. The complete description of the proposed action is provided in the FEIS (MDEQ and USDA 2001). Here we summarize only major features of the proposed action. The proposed action for the mine includes the development of an evaluation adit, a 5.5-year construction period, a 27.5-year operation/production period, and a 2-year reclamation period, for a total period of approximately 35 years (Table A1).

Table A1. The estimated annual implementation schedule for the Revett Silver Company Rock Creek Mine in Sanders County, Montana (from USDA 1998b).

Project Year	Activity
1 – 3	Evaluation adit construction
2 – 3	Mine development[1]
4 - 5.5	Mine development[1]/surface facilities construction[2]
5.5 – 6	Start-up/limited production
7 – 33	Production
34 – 35	Reclamation

[1] Waste rock will be hauled mid-August through May during mine development period.
[2] Includes construction of the mill site, wastewater treatment plant, paste plant, and utilities corridor.

The proposed action would result in construction of an evaluation adit, mine, mill, tailings paste facility, rail loadout, reverse osmosis and passive biotreatment facility, and various pipelines and access roads. A "bottom-up" construction option for the paste facility would be used and final design would incorporate measures to meet visual impact mitigation and reclamation goals. Some mine water would be stored in underground workings during mine operation, but most excess water would be treated and discharged to the Clark Fork River.

Several check points are built into the development of the mine to address specific conditions as they develop. For example, initial exploration involves developing an evaluation adit to further investigate and define the underground ore body. Results of the evaluation adit may result in various scenarios described in the proposed action, Alternative V. For example, should acid-forming rock be located, certain constraints would be required that would not be necessary if no acid-forming rock is encountered. Several similar check points and contingency plans occur throughout the life of the mine and will not be specifically addressed here (see FEIS, Alternative V (MDEQ and USDA 2001)).

The Rock Creek Mine's proposed permit boundary would encompass approximately 1,560 acres: 483 acres would be directly impacted by mining activity and 1,078 would remain undisturbed (Table A2). Land encompassed by the proposed permit boundary is 48 percent private land and

52 percent national forest lands (Table A2). As shown in Figure A2, the project area is located near the southern boundary of the Cabinet-Yaak Ecosystem (CYE), south and west of the Cabinet Mountains Wilderness area. Except for a possible ventilation adit that would disturb about 800 square feet, all ground disturbance would occur outside of the wilderness. Of the total 483 acres disturbed, 342 acres (71 percent) are privately owned by Revett and 141 acres (29 percent) are on public lands administered by the Forest. The project area contains existing roads providing public access to the wilderness area and nonwilderness Forest lands for recreation, and to areas logged in the past.

Table A2. The proposed surface disturbance and features associated with the Rock Creek Mine project (from USDA 1998b).

Project Feature	Area in Acres
Analysis area	198,394
Hard rock mine permit area	1,561**
Total area of surface disturbance	483
Tailings impoundment*	368
Mill site*	41
Exploration adit & support facilities	10
Roads	64
Road construction	3.54 miles
Road reconstruction	5.43 miles
Total road construction/reconstruction	8.97 miles

* Estimated surface disturbance includes all the features associated with the tailings impoundment and mill site.
** Corrected permit area acres from MDEQ, December 2000. From Appendix A, Alternative V description

The initial analysis for the proposed Rock Creek Mine project predicted construction of the mine would begin in 2000 (USDA 1998b). Therefore, the calendar years identified during the analysis no longer correspond with the actual implementation of the project. The life of the mine may be shorter or longer than predicted, depending on the quality, quantity and accessibility of the ore body, market values of the minerals recovered and other factors that cannot be predicted at this time.

Conservation measures and mitigation plans The Rock Creek Mine proposal includes a suite of conservation measures and mitigation plans developed during informal and formal consultation periods and through the public National Environmental Policy Act (NEPA) review process. The original 2000 mitigation plan for grizzly bears, as analyzed in the 2000 biological opinion (USDI 2000c), was revised (USDA 2002a) during the consultation process to incorporate concerns of the Service. In 2005 and 2006, during the consultation process for this current biological opinion, additional measures were added to the mitigation plan to address concerns raised by the court and issues raised by new information. The 2006 mitigation plan for grizzly bears (USDAb) is found in its entirety in Appendix B of this biological opinion and

discussed in Part A of this biological opinion. Mitigation and monitoring plans for bull trout are described fully in Appendix K of the FEIS (MDEQ and USDA 2001) and discussed in Part B of this biological opinion.

TABLE OF CONTENTS

PART A. GRIZZLY BEARS

DESCRIPTION OF THE PROPOSED ACTION SPECIFIC TO GRIZZLY BEARS A-1
Grizzly Bear Conservation Measures In The Proposed Action A-1
The Forest's Grizzly Bear Mitigation Plan A-2

STATUS OF THE SPECIES A-7
Life History A-8
Current Status and Distribution A-9
Status of the grizzly bear population in the CYE A-10
Demographic factors affecting the status of the CYE grizzly bear population A-14
Habitat factors affecting the CYE grizzly bear population A-17
Status of grizzly bear populations in the YGBE, NCDE and Selkirk Ecosystem A-22

ENVIRONMENTAL BASELINE A-23
Status Of Grizzly Bears In The Action Area A-23
Factors Affecting The Species Environmental Baseline In The Action Area A-26
Habitat management A-26
Other factors affecting the environmental baseline in the action area A-32

EFFECTS OF THE ACTION A-37
General Potential Effects Of Mining Operations On Grizzly Bears: Factors To Consider A-38
Displacement A-38
Human-caused grizzly bear mortality risk A-42
Habitat fragmentation A-45
Specific Effects Of The Rock Creek Mining Operations On Grizzly Bears A-45
Displacement A-45
Mitigation plan measures to reduce or avoid displacement A-47
Human-caused grizzly bear mortality risk A-68
Mitigation plan measures to reduce risk of human-caused grizzly bear mortality A-74
Fragmentation A-84
Mitigation plan measures to reduce and avoid fragmentation A-87
Conservation Needs of the Species A-90
Species Response to the Proposed Action A-95

CUMULATIVE EFFECTS A-99

CONCLUSION A-101

INCIDENTAL TAKE STATEMENT A-108
Amount or Extent of Take Anticipated A-109
Effect of the Take A-112

Reasonable and Prudent Measures A-113
Terms and Conditions A-113
Reporting Requirements A-115

REINITIATION NOTICE A-116

REFERENCES A-117

APPENDICES A-130

LIST OF FIGURES

Figure A1. Proposed Rock Creek Mine project site (from MDEQ and USDA 2001)..... ix

Figure A2. Cabinet-Yaak grizzly bear recovery zone..... A-10

LIST OF TABLES

Table A1. The estimated annual implementation schedule for the Revett Silver Company Rock Creek Mine in Sanders County, Montana (from USDA 1998b). x

Table A2. The proposed surface disturbance and features associated with the Rock Creek Mine project (from USDA 1998b). xi

Table A3. Mitigation acres (from MDEQ and USDA 2001)..... A-5

Table A4. Year-round road closures associated with the Rock Creek Mine Project (from USDA 1998) A-7

Table A5. Status of the Cabinet-Yaak recovery zone through 2005 in relation to the demographic recovery goals from the grizzly bear recovery plan (from Kasworm et al. in litt. 2006a)..... A-12

Table A6. Known grizzly bear mortalities associated with the Cabinet-Yaak recovery zone, 1982-2005. Shaded rows indicate human-caused mortalities (adapted from from Kasworm et al. 2005). A-15

Table A7. Habitat Effectiveness in BMUs associated with the proposed Rock Creek Mine, per year. Shaded BMUs provide 70 percent or more habitat effectiveness (from USDA 2002b and USDA 2003)..... A-27

Table A8. Percent of BMUs with open motorized route density greater than 1 mile per square mile, per year, compared to amended Forest Plan standards (FP). Shading indicates BMUs that currently meet the density of average female home range*, and bolding meets FP standards.(from USDA 2002b and USDA in litt. 2006). A-28

Table A9. Percent of BMUs with total motorized route density exceeding 2 miles per square mile, per year, compared to amended Forest Plan standards (FP). Shading indicates BMUs that currently meet the density of average female home range*, and bolding meets FP standards (from USDA 2002b and USDA in litt. 2006). A-29

Table A10. Percent core area in BMUs associated with the Rock Creek Mine project, per year, compared to amended Forest Plan standards (FP). Shading indicates BMUs that currently meet amount of core in an average female home range*, and bolding meets FP standards (from USDA 2002b and USDA in litt. 2006). A-30

Table A11. Approximate acres of surface feature disturbances, influence zones, Cumulative Effects Model compensation levels and required replacement habitat associated with the proposed Rock Creek Mine (data from BA 1998). A-52

Table A12. Percent of BMUs with open motorized route density exceeding 1 mile per square mile (OMRD) and total motorized route density exceeding 2 miles per square mile (TMRD) (data from USDA 2002b; USDA in litt. 2006). A-60

Table A13. Percent core area in BMUs (data from USDA 2002b; USDA in litt. 2006a).. A-62

Table A14. Categories, numbers and percent of grizzly bear mortalities in the CYE between 1983 and 2005 compared to approximate Rock Creek Mine project mitigation funding allocated to efforts to reduce mortality (budgets and allocations may change). A-81

Table A15. Major issues affecting grizzly bears in the CYE and mitigation plan funding. A-97

Table A16. Projected access management and habitat effectiveness conditions with implementation of the proposed Rock Creek Mine[5.] A-107

DESCRIPTION OF THE PROPOSED ACTION SPECIFIC TO GRIZZLY BEARS

The Forest developed and revised a mitigation plan for grizzly bears during the consultation processes to incorporate concerns of the Service. A revised mitigation plan was incorporated into the FEIS (MDEQ and USDA 2001). During consultation in 2002, the mitigation plan was again revised or clarified (USDA 2002a) to incorporate substantive portions of the reasonable and prudent alternative found in the original biological opinion issued by the Service (USDI 2000c). The mitigation plan was revised and clarified once again during consultation in 2005 and 2006, to address the concerns raised by the court in March, 2005 and the new information regarding the status of the CYE population. This biological opinion analyzed the effects of the proposed Rock Creek Mine based on the 2006 mitigation plan (Appendix B) as an integral part of the proposal. The 2006 mitigation plan as will be referred to as the "mitigation plan" throughout the rest of this document. Any changes to the mitigation plan, or other contingency plans that change the assumptions or conclusions in the BA may be the basis for reinitiation of consultation. The following sections *summarize* the main provisions of the revised mitigation plan. The mitigation plan is included in its entirety in Appendix B.

In March, 2006, the Service issued guidance on recovery units and jeopardy determinations under section 7 of the ESA (USDI in litt. 2006). Jeopardy analyses, conducted as part of a section 7 consultation, must always consider the impacts of a proposed action on the survival and recovery of the species. A proposed federal action may have significant adverse impacts on a recovery unit, and this would result in a jeopardy determination if these adverse impacts appreciably diminished the likelihood of both the survival and recovery of the listed entity. When an action appreciably impairs of precludes the capacity of a recovery unit from providing both the survival and recovery function assigned to it, that action may represent jeopardy to the species. Therefore, our analysis of jeopardy for this proposed action focused primarily on the effects of the action on the CYE grizzly bear population, and then on the consequences of those effects on the CYE population on the listed entity.

Grizzly Bear Conservation Measures In The Proposed Action

The Forest designed conservation measures to reduce adverse effects to fish, wildlife, water and air quality, reduce noise associated with the project and improve human safety. Conservation measures most relevant to reducing effects on grizzly bears include managing human access, providing seasonally important habitats, and education/law enforcement to reduce mortality risks to grizzly bears. Mortality risk would be reduced by minimizing the potential to attract bears to areas by:

- avoiding the use of salt when sanding during winter plowing operations on Forest road (FR) 150;
- avoiding the use of preferred vegetative forage like clover (*Trifolium spp*.) to reclaim sites disturbed by construction facilities and roads;
- using bear-resistant containers for human food/waste; and
- removing the remains of road-killed carcasses along roads.

The Forest's Grizzly Bear Mitigation Plan

In 2005 and 2006, the Forest added additional conservation measures to the mitigation plan (USDA 2006b), which is found in its entirety in Appendix B of this opinion. The following list summarizes the mitigation plan measures; a **(2006)** denotes measures added in 2005 and 2006.

Measures to reduce mortality risk to grizzly bears were included in the mitigation plan to reduce or minimize human/bear confrontations. The following measures would be complete or in place ***prior*** to construction of the evaluation adit:

- Revett would fund, for the life of the mine, a Montana Fish, Wildlife, and Parks grizzly bear management specialist position to educate people about bears, bear behavior and how to reduce the potential for grizzly bear conflicts, as well as to respond and resolve conflicts that may occur.
- Revett would fund, for the life of the mine, a Montana Fish, Wildlife, and Parks law enforcement position (in addition to the grizzly bear specialist position) to conduct law enforcement investigations of human-induced bear mortality and to deter illegal behavior.
- Revett would develop a transportation plan to minimize vehicular traffic associated with the mine.
- Revett would fund, for the life of the mine, monitoring and research efforts aimed at the Cabinet Mountains grizzly bear population, including the monitoring of grizzly bears augmented into the region over time.
- In coordination with the Forest and Montana Fish, Wildlife and Parks, Revett would fund and/or conduct an enhanced outreach and education program to increase public awareness and support for conservation of CYE grizzly bear population. **(2006)**
- Revett would prohibit employees from feeding wildlife.
- Revett would prohibit employees from carrying firearms on the permit area to minimize illegal or accidental mortality.
- The Forest would manage motorized access in the affected bear management units (BMUs) to offset increases in access densities associated with the Rock Creek Mine.
- The Forest would implement a mandatory food storage order in BMUs 4, 5, and 6.
- Revett would fund the purchase of grizzly bear-resistant garbage containers for all mine employees living in or near grizzly bear habitat, for their personal use at home. **(2006)**
- Revett would fund bear-resistant garbage containers for all Forest sites in the Cabinet Mountains portion of the CYE where garbage containers are provided. **(2006)**
- Revett would fund the needed measures to make the Sanders County garbage transfer station near the mine entrance grizzly bear-resistant.

Prior to the beginning of construction on the mine, the following measures would be implemented:

- Revett would ensure funds, for the life of the mine, for a second Montana Fish, Wildlife, and Parks grizzly bear management specialist position to work in the northern Cabinets and Yaak portions of the CYE. **(2006)**
- Revett would fund the needed measures to make additional county garbage transfer stations in the CYE grizzly bear-resistant. **(2006)**

- Revett would fund the purchase of grizzly bear-resistant garbage containers for all additional mine employees living in or near grizzly bear habitat, for their personal use at home. **(2006)**
- Revett would fund the purchase of an additional 100 containers and 20 containers/year for distribution to the public by the grizzly bear management specialists. **(2006)**
- Revett would fund the purchase of 10 electric fencing kits, and 2 replacements/year, for use by the bear specialists at bear attractant sites. **(2006)**
- Revett would fund bear-resistant garbage containers for all Forest sites where garbage containers are provided. **(2006)**
- Construction of the mine would begin only after at least six female grizzly bears were augmented into the Cabinet Mountains and monitored (two of the six females have been augmented to date). **(2006)**

Within 5 years of the start of evaluation adit construction:

- The Forest would implement a mandatory food storage order throughout Forest lands within the CYE. **(2006)**

Habitat protection and enhancement measures that would be implemented ***prior*** to the evaluation adit are:

- Revett would fund the acquisition of fee title or conservation easement on a total of at least 153 acres to specifically improve grizzly bear habitat security and maintain or improve habitat connectivity between the northern and southern portions of the Cabinet Mountains (Revett has recently acquired 270 acres in the north south corridor).
- The Forest would manage motorized access in the affected BMUs to offset increased effects of access densities associated with the Rock Creek Mine.
- Revett would fund a grizzly bear monitoring and research effort in the southern Cabinet Mountains during the life of the mine, including funds to monitor augmented grizzly bears.
- Revett would contribute funding to continue the existing bear research and monitoring effort to identify bear movement patterns across Highway 2 between the Cabinet Mountains and the Yaak. **(2006)**
- In coordination with the Service, the Forest would prioritize lands for conservation easement or acquisition in key linkage areas along Highway 2, as identified by research and monitoring. **(2006)**
- Revett would establish a trust fund for the mitigation plan prior to the evaluation adit.
- The Forest would organize and lead meetings that included the participating agencies (Forest, Montana Fish, Wildlife and Parks, DEQ, and the Service), Revett, and the public to regularly meet to review implementation of the mitigation plan and new information. **(2006)**

Prior to beginning construction on the mine, the following additional measures must be accomplished:

- Revett would fund the acquisition of fee title or conservation easement for preservation of an additional 1731 acres of grizzly bear habitat prior to construction, and an additional 566 acres prior to operation of the mine, for a total of 2450 acres (Table A3).
- Revett would fund habitat enhancement measures on 484 acres in the affected BMUs.

As described above, a number of mitigation measures are required to be completed or in place prior to construction of the evaluation adit. These include the Noxon-area bear specialist and law enforcement officer, bear-resistant upgrades to the county garbage transfer station near the mine entrance, acquisition or easement on 153 acres of property within the north-south corridor. Additional measures are required prior to construction of the mine, including acquisition or easement on additional mitigation property and a minimum of six female grizzly bears having been augmented into the Cabinet Mountains and other measures.

The mine would include direct surface disturbance of 483 acres, of which 342 acres are private land and 141 acres are national forest, including 115 acres of Management Situation 1 (MS 1) habitat (see IGBC 1986). Some of the disturbance would occur in Management Situation 3 habitat on the Forest, which is not considered suitable for grizzly bears due to existing permanent human development.

The BA identifies a maximum of 7,044 acres, the 483 acres and surrounding influence zone, in which grizzly bears would be directly or indirectly influenced by the mine or its activities at some time during the mine's development and operation. This larger area was developed based on the assumption that an area 0.25 to 0.50 mile surrounding physically disturbed sites and human travel routes would be under-used by grizzly bears. Upon re-examination of the net effects of displacement, we found it important to note that grizzly bears already under-use 5656 acres of this 7044 acre area because of the influence of existing human development or activity, primarily existing roads. Of the 7044 acre area, new disturbance caused by the mine would result in under-use of habitat by grizzly bears on an area of about 1400 acres that is not already influenced by existing roads or development.

The proposed mitigation plan requires a minimum of 2,350 acres of replacement habitat to replace the 483 acres directly lost through mine development, and account for displacement effects around these acres (Appendix 4 *in* BA 1998) (see also discussion in *Effects of the Action* section of this opinion). The mitigation plan requires at least 53 of the 2350 acres be located in a north south corridor along the Cabinet Divide. Furthermore, the mitigation plan also requires an additional 100 acres be protected within the north south corridor along the Cabinet Divide to avoid fragmentation of habitat. The total acreage would be acquired per the schedule in Table A3. The replacement habitat requirement would transfer currently private lands to public ownership or obtain perpetual conservation easements to mitigate for the 35-year disturbance. The Forest required these acres to compensate for the effects upon grizzly bears and their habitat from noise, disturbance and physical alteration on the 483 acres and the influence zone surrounding the developments and roads.

Acquisition of or easement on a total of at least 2450 acres would reduce or prevent displacement of bears and mortality risk on *more* than 2450 acres by (a) preventing development on properties that would cause impacts (e.g. substantive human activities, building, roading, or unsecured attractants) on adjacent lands, and (b) allowing the Forest to restrict existing or potential motorized access to acquired parcels that do or would have affected adjacent parcels. The exact amount of habitat that would be conserved or improved can be determined only after the lands are acquired.

Table A3. Mitigation acres (from MDEQ and USDA 2001)		
Activity Area	**Replacement Acres**	**Timing**
Phase 1		
Exploration Adit	153 (53 + 100)	Prior to Adit Construction
Phase 2		
Tailings & Associated Features	806	Prior to Construction
Mill & Associated Features	248	Prior to Construction
Ventilation Adit	10	Prior to Construction
New Roads	102	Prior to Construction
Existing Roads (reconstruction)	565	Prior to Reconstruction
Existing Roads (increased influence)	566	Prior to Operations
Total	**2450**	**Prior to Operations**

Specific parcels totaling over 8,000 acres of potential replacement mitigation habitat have been identified, but since acquisition is dependent upon willing sellers or successful conservation easements, the exact mitigation properties that could and eventually would be acquired are not currently known. However, these parcels have been ranked according to a priority scheme developed by the Forest and the Service based upon location, risk of development, and habitat quality. Although this priority ranking has been developed and would be used by the Forest and the Service in identifying required mitigation properties, the ranking will not be publicly disclosed prior to acquisition of those properties due to the effect such disclosure would have on property values, and consequently, the feasibility of the mitigation plan (see discussion under *Effects of the Action* section).

The habitat replacement program would require the 2,350 acres to be "in kind" acres (based on methods in the BA:Appendix 4) and provide an average of 2.11 habitat units/acre secured prior to the beginning of operations. "In kind" mitigation is based upon a required minimum amount of early season habitat units and late season habitat units to ensure that mitigation habitat compensates for the quality of habitat lost.

To ensure that adequate habitat quality and quantity would be secured to minimize the effects of the Rock Creek Mine during construction, operation, and reclamation, approximately 1,784 acres would be secured prior to the construction period and the remaining acreage would be acquired prior to the production phase of the mine operation. The revised mitigation plan requires mitigation acres be protected through acquisition, which would be transferred to the U.S. Forest Service, or through perpetual conservation easement. Table A3 shows the mitigation habitat acquisition schedule. This schedule would require all replacement habitat (except for a wilderness ventilation adit, which may not be necessary) be acquired prior to starting full operations at the end of year five, assuming no delays in construction phase.

"On-site habitat" was described as lands within "bear analysis areas" (BAAs) directly affected by the proposed action, that are to mitigate for the direct surface disturbance that would occur. "Off-site habitat" would be other lands within the southern Cabinet Mountains, including bear management units (BMUs) 4, 5, 6, 7 and 8. First choice for replacement habitat would be on-site habitat of suitable quality. If adequate replacement acres are not available in those BAAs, then acres would be acquired off-site, within BMUs 4, 5, 6, 7 or 8 in the southern Cabinet portion of the CYE recovery zone. This on- or off-site priority scheme for replacement habitat is intended to ensure the maintenance of adequate amounts of grizzly bear habitat within BMUs affected by the mine.

In addition to the 2350 acres of mitigation habitat, an additional 100 acres was required to reduce grizzly bear habitat fragmentation within the north to south movement corridor in the Cabinet Mountains (see USDA 1998, page 23) within the BMUs 4, 5 and 6. This on-site habitat was defined as that occurring within the north to south movement corridor. The Forest and Service collaborated to identify parcels of land that were important to maintaining grizzly bear habitat connectivity within the corridor. This identification of properties will not be publicly disclosed due to the effect such disclosure would have on property values and, consequently, the feasibility of the mitigation plan (see discussion under *Analysis of Displacement Effects on Grizzly Bears*: *Additional mitigation plan effects on grizzly bear displacement and habitat loss.*).

The mitigation plan was revised in 2002 (USDA 2002a) and addressed the Service's concerns that non-perpetual easements on replacement habitat parcels could result in a mortality sink for bears if habitat that had been conserved and managed for grizzly bear habitat is ultimately developed in a way that is adverse to bears. The 2002 mitigation plan changed conservation easements from 50-year to perpetual and specified that conservation easements be held by the U.S. Forest Service. The easements would contain sufficient terms to ensure that the subject property would be perpetually conserved and managed for grizzly bear habitat.

The mitigation plan includes 484 acres of habitat enhancement within BMUs 4, 5 or 6 to improve habitat conditions for grizzly bears. Revett would fund habitat enhancement, commensurate with loss of habitat effectiveness on these acres to improve habitat conditions through road closures, burns or other projects on existing or acquired lands within BMUs 4, 5 and 6. Enhancements would be preferred in the affected BMU and would include, but are not limited to, prescribed fire to restore whitebark pine, and road closures and obliterations. If opportunities for enhancement are not available in the affected BMU, then work would be done in adjacent BMUs

The 2006 mitigation plan includes a series of road closures. The following roads have been identified for year-round road closure as part of mitigation (Table A4).

The 2006 mitigation plan requires Revett to either establish a trust fund or post a bond prior to implementation of the project to insure full implementation of the mitigation plan (USDA 2002a and 2006). Revett would make deposits in five-year increments over the life of the mine to fund the mitigation plan conservation measures. More details regarding the bond can be found in the Record of Decision for the Rock Creek Mine (USDA 2003). The 2006 mitigation plan also specifies that funding from Revett would be necessary for a number of conservation measures

that are needed over the operational life of the mine, and would provide long-term and lasting benefits to the CYE grizzly bear population. The expense of some of the general conservation measures in the Rock Creek Mine mitigation plan could be shared with proponents of projects proposed in the future in the CYE, if those projects are likely to cause adverse effects on grizzly bears. Thus, the funding ratio(s) for some of the conservation measures in the mitigation plan may be adjusted over time. However, Revett would remain responsible for funding of conservation measures that are obviously linked to minimizing the direct adverse effects to grizzly bears caused by the development and operation of the Rock Creek mine. Revett would also remain responsible for funding all measures in the mitigation plan if projects appropriate for shared funding are not proposed in the CYE. The grizzly bear conservation measures suitable for potential shared funding or possible assumption by proponents of future projects are noted in the mitigation plan (Appendix B).

Table A4. Year-round road closures associated with the Rock Creek Mine Project (from USDA 1998)

Road Number	Road Name	Closure
FR 2285	Orr Creek	1.61 miles w/ barrier
FR 2741X		0.18 miles w/ barrier
FR 150	Rock Creek	2.92 miles w/ gate*
FR 2741A		0.47 miles w/ barrier

* The north 0.42 miles will be obliterated and the south 2.5 miles will be gated.

STATUS OF THE SPECIES

The grizzly bear originally inhabited a variety of habitats from the Great Plains to mountainous areas throughout western North America, from central Mexico to the Arctic Ocean. With the advent of Euro-American colonization in the early nineteenth century, grizzly bear numbers were reduced from over 50,000 to less than 1,000 in North America south of the Canadian border. Today, grizzly bears occupy less than 2 percent of their former range south of Canada (USDI 1993a). In the conterminous 48 States, only five remaining areas have either remnant or self-perpetuating populations. These remaining populations are principally located in mountainous regions in Montana, Wyoming, Idaho and Washington and are often associated with National Parks and wilderness areas. Grizzly bear populations persist in the Yellowstone Grizzly Bear Ecosystem (YGBE), Northern Continental Divide Ecosystem (NCDE), CYE, and Selkirk Ecosystem (SE). A small number of grizzly bears are believed to exist in the North Cascades of Washington.

The grizzly bear was classified as a threatened species under provisions of the Act on July 28, 1975 (40 FR 31736). The Service identified the following as factors establishing the need to list: (1) present or threatened destruction, modification, or curtailment of habitat or range; (2) overutilization for commercial, sporting, scientific, or educational purposes; and (3) other manmade factors affecting its continued existence.

Life History

The following information is abridged from the Grizzly Bear Recovery Plan (Recovery Plan) (USDI 1993a). Grizzly bears are among the largest terrestrial mammals in North America. South of the United States - Canada border, adult females range from 250 to 350 pounds and adult males range from 400 to 600 pounds. Grizzly bears are relatively long-lived, in the wild they may live 25 years or longer. Grizzly bears are omnivorous, opportunistic feeders that require foods rich in protein or carbohydrates in excess of maintenance requirements in order to survive seasonal pre-and post-denning requirements. Grizzly bears are homeo-hypothermic hibernators. Their body temperature drops no more than 5° C (approximately 10° F) during winter when deep snow, low food availability, and low ambient air temperatures appear to make winter sleep essential to grizzly bears' survival (Craighead and Craighead 1972a, 1972b). Grizzly bears excavate dens and require environments well-covered with a blanket of snow for up to 5 months, generally beginning in fall (September to November) and extending until spring (March to April)(Craighead and Craighead 1972b; Pearson 1975).

The search for energy-rich food appears to be a driving force in grizzly bear behavior, habitat selection and intra/inter-specific interactions. Grizzly bears historically used a wide variety of habitats across North America, from open to forested, temperate through alpine and arctic habitats, once occurring as far south as Mexico. They are highly dependent upon learned food locations within their home ranges. Adequate nutritional quality and quantity are important factors for successful reproduction. Diverse structural stages that support wide varieties of nourishing plants and animals are necessary for meeting the high energy demands of these large animals. Grizzly bears seek vegetation, tuber, or fruits as they develop and become available, concentrated food sources including carrion, live prey (fish, mammals, insects), and are easily attracted to human food sources including gardens, grain, compost, bird seed, livestock, hunter gut piles, bait, and garbage. Bears that lose their natural fear and avoidance of humans, usually as a result of food rewards, become habituated, and may become food-conditioned. Grizzly bears will defend food and have been known to charge when surprised. Both habituation and food conditioning increase chances of human-caused grizzly bear mortality as a result of real or perceived threats to human safety or property. Nuisance grizzly bear mortalities can be a result of legal management actions, defense of human life, or illegal killing.

Adult grizzly bears are individualistic and normally solitary, with the exceptions of females with cubs and during short breeding relationships. They will tolerate other grizzly bears at closer distances when food sources are concentrated, and siblings may associate for several years following weaning (Murie 1944, 1962; Jonkel and Cowan 1971; Egbert and Stokes 1976; Glenn et al. 1976; Herrero 1978). Across their range, home range sizes vary from about 50 square miles or more for females to several hundred square miles for males, and overlap of home ranges is common. Grizzly bears may have one of the lowest reproductive rates among terrestrial mammals, resulting primarily from the late age at first reproduction, small average litter size, and the long interval between litters. Mating occurs from late May through mid-July. Females in estrus will accept more than one adult male (Hornocker 1962), and can produce cubs from different fathers the same year (Craighead et al. 1995). Age of first reproduction and litter size may be nutritionally related (Herrero 1978; Russell et al. 1978). The average age at first reproduction in the lower 48 States for females is 5.5 years, and litter size ranges from 1 to 4

cubs who stay with the mother up to 2 to 3 years. Males may reach physiological reproductive age at 4.5, but may not be behaviorally reproductive due to other dominant males preventing mating.

Home ranges of collared grizzly bears overlapped extensively in the CYE on a yearly and lifetime basis (Kasworm et al. 2005). Bears typically utilized the same space at different times. This phenomenon was especially true of female grizzly bears and their female offspring. Male home ranges overlap those of several females to increase breeding potential, but males and females consort only during the brief courtship and breeding period. Adult male home ranges also overlap, but males seldom use the same area at the same time, to avoid conflict.

Natural mortality is known to occur from intra-specific predation, but the degree to which this occurs in populations is not known. Parasites and disease do not appear to be a significant cause of natural mortality (Jonkel and Cowan 1971; Kistchinskii 1972; Mundy and Flook 1973; Rogers and Rogers 1976). As animals highly dependent upon learned habitat, displacement into unknown territory (such as subadult dispersal) may lead to submarginal nutrition, reduced reproduction or greater exposure to adult predatory bears or human food sources (which can lead to human-caused mortality). Starvation and loss in dens during food shortages have not been documented as a major mortality factor. Natural mortality is difficult to document or quantify in rare, relatively elusive animals such as grizzly bears.

Human-caused mortality has been slightly better quantified; recent models speculate that reported mortality may be only 50 percent of actual mortality (McLellan et al. 1999). Between 1800 and 1975, grizzly populations in the lower 48 states declined drastically. Fur trapping, mining, ranching, and farming pushed westward, altering habitat and resulting in the direct killing of grizzly bears. Grizzly bears historically were targeted in predator control programs in the 1930s. Predator control was probably responsible for extirpation in many states that no longer support grizzlies. The legal grizzly bear hunting season in Montana was closed in 1991. More recent human-caused mortality includes management control actions, defense of life, defense of property, mistaken identity by black bear or other big game hunters, poaching, and malicious killing.

Grizzly bears normally avoid people, possibly as a result of many generations of bear sport hunting and human-caused mortality. Displacement from essential habitats due to avoidance of human activities may reduce fitness of grizzly bears, affecting survival in some instances.

Current Status and Distribution

In the conterminous 48 States, the CYE and five other areas in mountainous ecosystems of Montana, Wyoming, Idaho and Washington have been identified for grizzly bear recovery (USDI 1993a). The Recovery Plan established recovery zones in each grizzly bear ecosystem, the YGBE, NCDE, CYE, Selkirk Ecosystem, North Cascades Ecosystem, and the Bitterroot Ecosystem. Recovery zones are areas large enough and of sufficient habitat quality to support a recovered bear population, and represent the areas within which the population and habitat criteria for achievement of recovery will be measured. According to the Recovery Plan the

species can be delisted throughout the lower 48 states when each of the populations in recovery zones has met specific recovery criteria and has been delisted (USDI 1993a).

The estimated total population of grizzly bears in the conterminous U.S. at the time of listing was 800 to 1,000 individuals (USDI 1993a). Grizzly bear populations have increased in the YGBE and NCDE ecosystems since listing in 1975. The nature of grizzly bears and the rugged terrain they inhabit makes census difficult. The Recovery Plan relies on conservative, reasonably measurable parameters with which to assess population status in regards to recovery: number of females with cubs, the distribution of family groups, and the relationship between the minimum population estimate and known, human-caused grizzly bear mortality.

The Recovery Plan details specific recovery objectives for recovery zones within each grizzly bear ecosystem where grizzly bear populations persist: the YGBE, NCDE, CYE, and Selkirk Ecosystems. Grizzly bear recovery efforts in the North Cascades Ecosystem and Bitterroot Ecosystems are in the planning stages. In the North Cascades Ecosystem, most of the grizzly bear population occurs north of the Canada - United States border, but a few grizzly bears persist south of the border. Grizzly bears appear to have been eliminated from the Bitterroot Ecosystem decades ago; however, a vast amount of suitable habitat occurs there (USDI 2000b).

Status of the grizzly bear population in the CYE

The CYE is essential to the conservation and recovery of grizzly bears. Grizzly bears remain on less than two percent of their historic range in the lower 48 States. The CYE grizzly bear population is one of only four remaining populations of the listed entity, and is estimated to be 30 to 40 grizzly bears. The CYE represents one of six recovery areas comprising the remaining suitable habitat for grizzly bears in the coterminous United States. Grizzly bear populations require large areas of relatively wild habitat, populations inherently grow very slowly, and conflicts between grizzly bears and people are difficult to avoid and often result in grizzly bear mortality. The juxtaposition of the CYE population to the Selkirk ecosystem and NCDE grizzly bear populations to the east and west respectively, makes it essential to long-term survival and recovery of grizzly bears throughout a significant portion of its range in the United States.

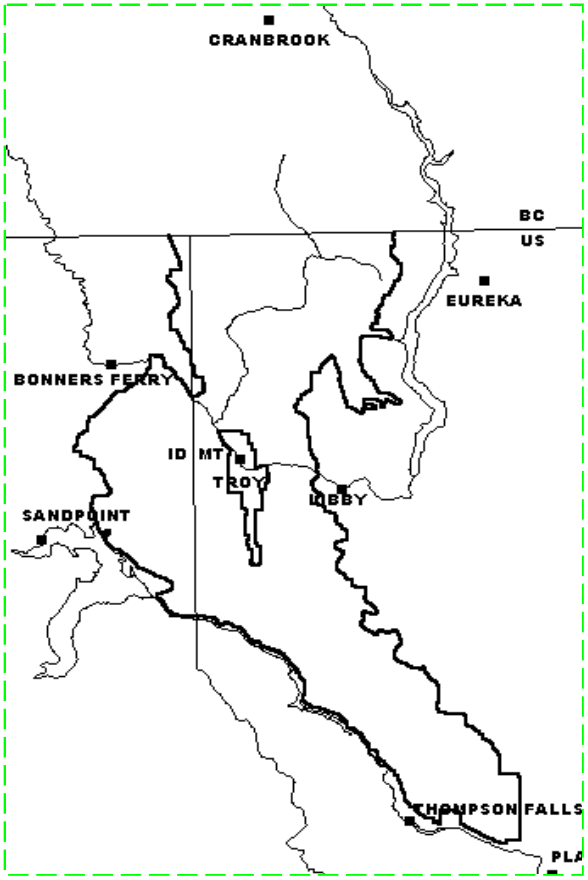


Figure A2. Cabinet-Yaak grizzly bear recovery zone.

The CYE grizzly bear recovery zone encompasses approximately 2,600 square miles (1,664,000 acres) (USDI 1993a) in northwestern Montana and northeastern Idaho (Figure A2). The CYE recovery zone is bordered to the north by the Canadian border, to

the south by the Clark Fork River and Montana Highway 200, to the west by the towns of Moyie Springs and Clark Fork, to the east by the town of Libby. The CYE is bisected by the Kootenai River.

The following CYE recovery zone description is summarized from Kasworm et al. (2005). Land ownership within the CYE recovery zone is approximately 90 percent public under federal administration (about 1,444,000 acres), 5 percent state, and 5 percent private. Land under federal administration is managed by the Kootenai, Lolo and Idaho Panhandle National Forests. The principal private land-owner in the CYE Recovery Zone is Plum Creek Timber Company, Inc. (Plum Creek). A land exchange between the Forest and Plum Creek was finalized in 1997, which transferred approximately 21,422 acres to public ownership, primarily within the CYE. Individual landowners live on various-sized acreage along the major rivers and numerous patented and unpatented mining claims exist along the Cabinet Mountains.

The CYE is often described in terms of having two portions. The Cabinet Mountains portion forms the southern half of the CYE, covering approximately 978,000 acres of national forest lands. The Cabinet Mountains portion is topographically diverse, with a steep mountain range up to 8,700 feet near the center and more definable seasonal habitats. The Cabinet Mountains Wilderness area is approximately 34 miles long, varies from .5 to 7 miles wide and consists of 94,272 acres of higher-elevation habitat. The northern Cabinet Mountains are bisected by a valley of private land including the town of Troy. The southern Cabinet Mountains are therefore connected to the Yaak to the north by 2 relatively narrow corridors of habitat. The Yaak portion of the ecosystem covers about 466,000 acres of national forest lands and has gentler topography and slightly lower elevations, up to 7,700 feet. Seasonal grizzly bear habitats are not as clearly definable. More grizzly bear research and telemetry work has occurred in the Yaak than in the Cabinet Mountains portion of the ecosystem.

CYE Recovery Plan goals The Recovery Plan estimated that a recovered population in the CYE recovery zone would consist of a minimum of about 100 individual grizzly bears. Grizzly bears also live in and use areas outside the CYE recovery zone. Therefore, Recovery Plan population parameters include bears observed up to 10 miles outside the recovery zone boundary (USDI 1993a). This biological opinion will use the term CYE grizzly bear population as referring to grizzly bears within the CYE recovery zone and the band of habitat up to 10 miles around it. Bear Management Units (BMUs) were delineated to approximate the size of an average female home range, and provide the basic analytic unit for monitoring population distribution and habitat conditions.

According to the Recovery Plan, a fully recovered population of approximately 100 bears in the CYE could theoretically sustain a total of 6 known, human-caused grizzly bear mortalities (6 percent of the population) annually, if no more than 2 were female (30 percent of the total mortality). To facilitate recovery in all grizzly bear ecosystems, the Recovery Plan goals state that in each population, known human-caused mortalities may not exceed 4 percent of the population estimate, and that no more than 30 percent of this mortality shall be females. The Recovery Plan states a that grizzly bear populations would probably not experience overall decline if annual, known human-caused mortality remains less than four percent, but cautions that demographic, genetic or other problems can be amplified in small populations. Furthermore,

the Recovery Plan includes a human-caused mortality *goal* of zero in the CYE until key parameters demonstrate a minimum population of approximately 100 grizzly bears (USDI 1993a). This goal is based on the current small size of the grizzly bear population, emphasizing that managers should strive to prevent human-caused mortality. However, although mortality levels can be reduced by recovery actions, it is unlikely that all human-caused mortality can be eliminated. Considering the current status of the CYE population, all grizzly bear mortality must be considered serious and current human-caused mortality levels should be reduced. In reality, the goal of zero human-caused mortality of grizzly bears in the CYE is not likely attainable over time, but recovery programs aim to reduce mortality to the extent possible.

Current Recovery Plan criteria/goals and data are shown in Table A5. The Recovery Plan goals are compared to the most recent information. None of the Recovery Plan goals were met in 2005. The CYE demographic parameters from 1988 through 2005 are presented in Appendix C.

Table A5. Status of the Cabinet-Yaak recovery zone through 2005 in relation to the demographic recovery goals from the grizzly bear recovery plan (from Kasworm et al. in litt. 2006a).

Demographic Parameter	Recovery Plan Target/Limit	2000 through 2005
Females w/cubs (6-year average)	6.0	1.8 (11/6 yr)
Total known, human-caused mortality limit (4 percent of minimum estimate) (6-year average)	0.9	1.8 (6 yr ave)
Known, human-caused female mortality limit (30 percent of total known, human-caused mortality)(6-year average)	0.3	1.5 (6 yr ave)
Distribution of females with young	18 of 22 BMUs	12 of 22 BMUs

CYE grizzly bear research information Research information collected in the CYE has been used to estimate the number of grizzly bears in the ecosystem. To date, the best available information suggests a population of 30 to 40 grizzly bears in the entire CYE (Kasworm and Manley 1988, Kasworm et al. 2002, Kasworm et al. 2005). Using Recovery Plan calculation methods using sightings of females with cubs (U.S. Fish and Wildlife Service 1993), the *minimum* population estimated for 2004 was 35 grizzly bears for the entire CYE (Kasworm et al. 2005).

Separate population estimates were also made for the Cabinet Mountains and the Yaak River drainage of the Cabinet-Yaak ecosystem. Kasworm and Manley (1988) estimated the Cabinet Mountains portion of the CYE alone supported a population of 15 or fewer grizzly bears. The Service's 1999 finding stated insufficient data were available to change the Kasworm and Manley (1988) estimate for the Cabinet Mountains. Beginning in 1988 the population was experimentally augmented with 4 young female grizzly bears (Kasworm et al. 1998, Servheen et al. 1995). Montana Fish, Wildlife and Parks translocated a female grizzly bear in 2005, and a subadult female in 2006, from the NCDE into the Cabinet Mountains as part of their program to augment the population,.

The Yaak River drainage adjoins grizzly bear habitat in British Columbia, and contains about 40 percent of the CYE recovery zone. A minimum population estimate for 1989 to 2004 was derived by examination of observations and captures of grizzly bears by agency personnel in the Yaak study area during that time. Forty-eight individuals were identified: 27 radio-collared grizzly bears and 21 unmarked individuals (Kasworm et al. 2005). Some sightings believed to be the same individuals may actually be separate additional animals. Of the 48 individuals, 20 were known or suspected to have died from both human (12) and natural (8) causes during 1989 through 2004. Total individuals identified during this period (48 grizzly bears) less known mortality (20 grizzly bears) suggested a population of at least 28 animals in the Yaak area. A population estimate of 20 to 30 grizzly bears for the entire Yaak portion of the CYE is reasonable.

The distribution of grizzly bears is based on sighting data collected across the CYE. From 1994 to the present, credible sightings of individual grizzly bears were recorded in all 14 BMUs making up the Cabinet Mountains portion of the ecosystem. Female grizzly bears with young were reported in seven of the 14 BMUs in the Cabinets (Kasworm et al. 2005, Kasworm et al. in litt. 2006a). From 1989 to present, credible sightings of grizzly bears were recorded in all eight BMUs in the Yaak portion of the CYE. Sightings of females with young were reported in seven of the eight BMUs. About half of the credible sightings of females with young in these BMUs did not appear to come from marked bears. The actual number of unmarked females represented is unknown. This information suggests that grizzly bears are well distributed across the CYE, although females with young are less well distributed across the Cabinet Mountains portion of the CYE.

During 2005 alone, 50 reliable sightings of grizzly bears were reported from across the entire CYE (Kasworm et al. in litt. 2006a). Also, about 15 to 20 grizzly bear observations have been recorded across the Clark Fork River to the south east of the project area (Wayne Kasworm, U.S. Fish and Wildlife Service, pers. comm. 2000). Land to the south of the Clark Fork River is not included within the recovery zone.

Researchers also collect information used to estimate the trend of the CYE grizzly bear population. Trend analysis information thus far has been statistically inconclusive. Population data from 1983 to 1998 resulted in a positive point estimate of lambda (rate of change over time, based on birth and death rates). However, wide confidence intervals suggested the population trends should be cautiously evaluated (Wakkinen and Kasworm 2004). The point rate of increase for 1983 through 2002 was much lower and indicated a declining population (Kasworm et al. 2005). The unusually high grizzly bear mortality from 1999 through 2002 influenced the change in the point estimate of the rate of increase. Mortality was both human-caused and natural. Several years of very poor huckleberry crops probably influenced the mortality levels. Lower survival rates across most sex and age classes (particularly subadult female and adult females) and somewhat lower reproductive rates most influenced the decline. The probability of decline was 89 percent (Kasworm et al. 2005). Updated analysis through 2005 indicate the probability of decline was 91 percent (Kasworm et al. in litt. 2006b).

The increase in natural mortality beginning in 1999 may be linked to poor food production during 1998 through 2000 (Kasworm et al. 2005). Huckleberries are the major source of late

summer food for bears in the CYE, and berry production during these years was half the 11-year average. Four of seven cub mortalities between 1989 and 2004 came from one female bear that lost litters of two cubs each during 2000 and 2001. The effect of seven cub mortalities may be greatest in succeeding years when some of these animals might have been recruited to the reproductive segment of the population.

Finally, demographic information collected from grizzly bears in the CYE has been used in population growth and extinction simulations. Despite the relatively small size of the CYE, it is unlikely that at this time that habitat is the factor most limiting the grizzly bear population. The population of grizzly bears in the CYE remains vulnerable to extinction because of small population size (USDI 1999b; Proctor et al. 2004). The existing small population and correspondingly few reproductive-age female grizzly bears are more plausible factors limiting population growth. Grizzly bear reproductive rates are inherently low, because females grizzly bears typically do not breed until age 4 or older, average 2 cubs per litter, stay with cubs for 2 to 3 years, and have few litters during their lifetime. Cub mortality rates are relatively high. Given the small size of the CYE population, mortality of adult female grizzly bears is especially deleterious to population growth.

Proctor et al. (2004) indicated the likelihood of extinction for a grizzly bear population of 50 individuals with vital rates similar to the CYE population was 85 percent within one hundred years. Based on simulations of population growth rates and extinction probabilities, Proctor et al. (2004) recommended augmentation of the population, reduction of current rates of human-caused mortality, and ensuring female interchange between population segments, to reduce the likelihood of extinction. Efforts to augment grizzly bears have been relatively successful thus far in the CYE (Kasworm et al. In prep., Montana Fish, Wildlife and Parks, in litt. 2006, Servheen et al. 1995), and elsewhere (Quenette et al. 2001).

Demographic factors affecting the status of the CYE grizzly bear population

In 1999, the Service concluded that grizzly bears in the CYE were in danger of extinction due to: 1) habitat alteration and human intrusion into grizzly bear habitat; and 2) a small population facing potential isolation by activities across the border in Canada (Service 1999). The cumulative impacts of recreation, timber harvest, mining and other forest uses with associated road construction had reduced the amount of effective habitat for grizzly bears. Further, access management plans had the potential to reduce this threat, but had not been fully implemented. The Service's 1999 finding summarized major factors affecting the status of the CYE grizzly bear population through 1997. The following section includes recent information related to mortality factors affecting small population size and grizzly bear habitat conditions.

Mortality and small population size Table A6 reports total known grizzly bear mortality in the CYE from 1982 though 2005. Thirty grizzly bear mortalities were detected over this 24-year period in the recovery zone or within 10 miles. Of these, 21 (shaded on Table) were known human-caused within the Recovery Zone or 10 miles of the zone in the United States. In the past six years, eleven known mortalities were believed to be human-caused and are reflected in the current measures of Recovery Plan mortality parameters. Appendix C includes a table (Table 1)

that also tracks grizzly bears killed further than 10 miles outside the recovery zone in British Columbia; these mortalities are not counted in recovery parameters.

Table A6. Known grizzly bear mortalities associated with the Cabinet-Yaak recovery zone, 1982-2005. Shaded rows indicate human-caused mortalities (adapted from from Kasworm et al. 2005).

Mortality Date	Tag #	Sex	Age	Location	Mortality Category and Cause
Autumn 1982	None	M	AD	Grouse Creek, ID	Human, Poaching
1984	None	N/A	N/A	Harvey Creek, ID	Human, Mistaken Identity
Autumn 1985	14[1]	M	AD	Lyons Gulch, MT	Human, Self Defense
Summer 1986	106 cub[1]	N/A	Cub	Burnt Creek, MT	Natural
Autumn 1987	None	F	Cub	Flattail Creek, MT	Human, Mistaken Identity
Autumn 1988	None	F	AD	Seventeen Mile Creek, MT	Human, Self Defense
Summer 1989	129[1]	F	3	Burnt Creek, MT	Human, Research
1990	192	M	N/A	Poverty Creek, MT	Human, Poaching
1992	678	F	37	Trail Creek, MT	Unknown
Summer 1993	258[1]	F	7	Libby Creek, MT	Natural
Summer 1993	258-cub[1]	N/A	Cub	Libby Creek, MT	Natural
Spring 1996	302[1]	M	3	Dodge Creek, MT	Human, Unknown[2]
1997	None	M	AD	Libby Creek, MT	Human, Poaching
Spring 1999	106[1]	F	21	Seventeen Mile Creek, MT	Natural, Predation
Spring 1999	106[1]-cub	N/A	Cub	Seventeen Mile Creek, MT	Natural, Predation
Spring 1999	106[1]-cub	N/A	Cub	Seventeen Mile Creek, MT	Natural, Predation
Autumn 1999	358	M	15	Yaak River, MT	Human, Management Removal
Summer 2000	303-cub[1]	Unk	Cub	Fowler Creek, MT	Natural
Autumn 2000	592[1]	F	3	Pete Creek MT	**Human, Under Investigation** [2,3]
Spring 2001	None	F	1	Spread Creek MT	**Human- Mistaken Identity**
Autumn 2001	None	F	AD	Elk Creek, MT	**Human, Train Collision**
Summer 2002	577[1]	F	1	Marten Creek, MT	Natural
Autumn 2002	None	F	3	Porcupine Creek, MT	**Human, Under Investigation**
Autumn 2002	353[1]	F	AD	Yaak River, MT	**Human, Poaching**
Autumn 2002	None[1]	F	cub	Yaak River, MT	**Human, Poaching**
Autumn 2002	None[1]	Unk	cub	Yaak River, MT	**Human, Poaching**
Autumn 2002	None[1]	Unk	cub	Yaak River, MT	**Human, Poaching**
Autumn 2005	None	F	AD	Government Creek, MT	**Human, Train Collision**
Autumn 2005	694[1]	F	2	Pipe Creek, MT	**Human, Under Investigation**[2]
Autumn 2005	688[1]	M	3	Yaak River, MT	**Human, Mistaken Identity**

[1] Part of radio collar sample at time of mortality.
[2] Human-caused mortality determined only because of the radio collar on the animal at the time of death.
[3] Bold indicates known human-caused mortalities included in most recent Recovery Plan 6-year averages.

Known mortality was unusually high from 1999 through 2002 when compared with past history. During this three-year period, 14 known grizzly bear mortalities occurred within the recovery zone; five mortalities were natural and nine were human-caused. No human-caused mortalities were documented in 2003 or 2004. In 2005, human-caused mortality was again high compared to the past annual mortality. Three grizzly bears died, all due to human causes. During the six-year period from 1999 through 2005, 12 human-caused mortalities of grizzly bears occurred for an average annual rate of 2.0 per year (human-caused mortalities alone). During the previous 17 years, 1982 through 1998, only 13 known grizzly bear mortalities were documented, of which three were natural, nine were human-caused and one was unknown. Total known annual mortalities (natural and human-caused) averaged 0.7 per year for this 17-year period. The number of undetected, unreported grizzly bear mortalities are not known in any year.

In 2002, four human-caused grizzly bear mortalities occurred but were not detected until 2003 (Kasworm et al. 2004). A female grizzly bear known to have three cubs was illegally killed on private land; another small bear carcass was found and identified through a DNA match as one of her female cubs. The other two cubs are presumed also dead according to interagency protocol for documenting mortality, which assumes that cubs who lose their mother during their first year do not survive.

The Recovery Plan uses *minimum* population estimates and six-year averages to calculate sustainable mortality rates and limits. Therefore, the limits are conservative to account for unreported unknown mortality. However, the plan cautions that demographic problems and the impacts of stochastic events can be amplified dramatically in small populations, such as the 30 to 40 grizzly bears in the CYE. As such, our current human-caused mortality goal in the CYE is zero.

The proportion of human-caused, female grizzly bear mortality is relatively high in the CYE. Since 1982, known human-caused female mortalities comprised 48 percent (10 of 21) of the total known, human-caused mortality. If we assume one of the two cubs of unknown sex killed in 2002 was female, then female mortality is 52 percent of total known, human-caused mortality (11 of 21 known mortalities).

The Recovery Plan limit for 2005 on *total* known human-caused mortality was 0.9 grizzly bears averaged over six years, compared to the known average of 1.8 from 2000 through 2005 (see Table A5). The Recovery Plan limit on *female* known human-caused mortality is 30 percent of the total. Thus, for 2005, the Recovery Plan limit on female mortality was 0.3 averaged over six years, compared to the actual known six-year average of 1.5 females. This number exceeded the Recovery Plan limit. The population has not yet attained annual Recovery Plan criteria for females with cubs, distribution of females with young, or female mortality limits.

Female survival is the most important element for recovery of the CYE grizzly bear population (USDI 1993a). Grizzly bear population growth and recovery are closely correlated with the number and survivorship of adult female bears. Extinction may be imminent for grizzly bears in the CYE if human-caused mortality results in a significant loss of adult and subadult females. Loss can be manifested through direct mortality or indirectly due to displacement if females fail to secure the food resources needed to support reproduction. Females and cubs are also vulnerable to natural mortality, such as predation by larger males; in the CYE in 1999, an older female and her two cubs were killed by another grizzly bear.

Populations with fewer than 50 to 100 adults are at high risk of extinction (ICUN 2003). Proctor et al. (2004) modeled a grizzly bear population of 50 adults using vital and mortality rates similar to those of CYE grizzly bears, as estimated by Wakkinen and Kasworm (2004). Results suggested that such a population would have an 85 percent probably of extinction within 100 years. Proctor et al. (2004) concluded the following combination of actions was necessary to reduce the likelihood of extinction to acceptable levels over the short term and the long term:

- population augmentation;
- enhancement and re-establishment of population interchange; and
- reduction of human-caused mortality.

Recently, Montana Fish, Wildlife, and Parks began a grizzly bear population augmentation program in the Cabinet Mountains, in cooperation with the Forest and the Service. In 2005, the State stated its intention to augment one to two females grizzly bears into the Cabinet Mountains each year (Montana Fish, Wildlife, and Parks, in litt. 2005). The preferred alternative in the Montana Fish, Wildlife, and Parks Grizzly Bear Management Plan for Western Montana, DEIS, 2006-2016 (2006), is to relocate 10 to 15 sub-adult male or female, or appropriate adult females, from other areas within the next 3 to 5 years. It further stated that at present time, the emphasis for augmentation would be on females because it is believed there are still sufficient males within the CYE area to support recovery. Accordingly, in October, 2005, a seven year-old female grizzly bear was relocated into the Cabinet Mountains from the NCDE. In August, 2006, a subadult female was relocated into the Cabinet Mountains from the NCDE. According to an agreement with Montana Fish, Wildlife and Parks, the Service will monitor all bears augmented into the Cabinet Mountains, dependent upon funding, as part of an ongoing monitoring and research effort. Funding for this monitoring effort is dependent upon available agency funding.

Small isolated populations are theoretically at risk of negative effects due to inbreeding. Maintaining occasional genetic interchange between grizzly bears in Canada and bears in the United States would benefit the CYE population as would connections with the Selkirks and NCDE populations. At this time, interchange probably occurs between Canada and the United States (Proctor et al. 2004). A recent map of grizzly bear distribution indicates grizzly bear occurrences between the northwest NCDE and the CYE (USDA et al. 2002). A research and monitoring effort is underway to determine whether grizzly bears have moved between the NCDE and the Yaak area of the CYE (C. Servheen, pers. comm. 2005). This project will look at the relatedness of these two populations and the origins of any grizzly bears found between the two recovery zones.

At this time, the Cabinet Mountains grizzly bear population segment is probably isolated from that in the Yaak portion of the CYE (Mattson and Merrill 2004; Proctor et al. 2004). Augmentation of the Cabinet Mountains segment will aid in alleviating the isolation by increasing density and population pressures within that portion of the CYE. However, interchange of bears is ultimately dependent on creating and/or maintaining effective habitat linkage zones between the Yaak and the Cabinet Mountains. The State's plan to augment the Cabinet Mountains (Montana Fish, Wildlife and Parks in litt. 2005 and 2006a) would also assist in maintaining the genetic health of the population. Studies demonstrate that inbreeding depression can be reversed through augmentation (Hedrick 1995 and 2001; Keller and Waller 2002).

Habitat factors affecting the CYE grizzly bear population

A number of factors influence the quality and availability of habitat for grizzly bears in the CYE. The Forest uses several habitat measures to assess the condition of grizzly bear habitat. Here we summarize two primary factors that influence, account for, and/or moderate the majority of

human impacts on grizzly bear habitat: habitat effectiveness and access management. This section also summarizes other primary habitat factors influencing the CYE grizzly bear population.

Habitat effectiveness in the CYE Habitat effectiveness is defined as the amount of secure grizzly bear habitat remaining within BMUs after area disturbed by open roads and major activities such as timber harvest and mines, is subtracted from the total habitat in a BMU (BA). The acres actually impacted, along with a zone of influence surrounding them, are included in the calculation. The areas affected by roads and major activities are considered as having less than expected use by grizzly bears.

The CYE is divided into 22 BMUs. The Forest manages all of 15 BMUs and shares management of two more BMUs with the Pan Handle National Forest. The Pan Handle National Forest manages four BMUs. The Lolo National Forest manages BMU 22.

Prior to 2004, the Forest Plan included a standard of 70 percent or more habitat effectiveness in a BMU as adequate for bear security. The BMUs on the Forest are approximately 100 square miles. The Pan Handle and Lolo National Forests use a similar 70-square mile habitat effectiveness threshold for bear security. Since the 2004 Forest Plan amendment no longer requires habitat effectiveness on the Kootenai Forest, the last time the Forest analyzed habitat effectiveness was in 2003. Although no longer a Forest Plan standard, habitat effectiveness values are informative. In 2003 the Forest provided relatively high habitat effectiveness across the landscape. In 2003, 76 percent (13 of 17) of CYE BMUs on the Forest portion of the CYE provided 70 percent habitat effectiveness or more (USDA in litt. 2003). The remaining 4 BMUs provided 60, 65, 65, and 60 percent habitat effectiveness. In BMUs not currently meeting the 70 percent, highways, county roads, private roads and Forest roads required for private land access accounted for, at least in part, not meeting the standard. The BMU 22 is managed by the Lolo National Forest and provided 71 percent habitat effectiveness in 2003, and will likely improve as a result of a recent Forest Service project decision (Dave Wrobleski, Lolo National Forest, pers. comm. 2005).

Motorized access management in the CYE Wakkinen and Kasworm (1997) used the analysis techniques recommended by the IGBC (IGBC 1994) to analyze the average multi-year home ranges of six female bears in the CYE and Selkirk ecosystems. The IGBC (1994 and 1998) recommended ecosystem-specific data for open and total motorized route density and core area be used to limit motorized access in grizzly bear habitat. The CYE research documented:

- total motorized route densities of greater than two miles per square mile averaged 26 percent of a female home range;
- open motorized route densities of greater than one mile per square mile averaged 33 percent of a female home range; and
- a female home range averaged 55 percent core area (area further than 500 meters from motorized access routes or high-use nonmotorized trails).

The results may indicate that grizzly bears in the CYE have adapted to these road densities, or may be partially an artifact of the existing road densities in the CYE. In any case, the data used

in the analysis was collected from female grizzly bears that were successful in surviving to adulthood and producing cubs in the CYE and Selkirk's roaded environment. In 2004, the Forest amended its Forest Plan, using the parameters above to develop site specific BMU access standards (USDA 2004).

All 22 BMUs in the CYE have specific Forest Plan standards for open motorized route density limits. Forest Plan standards for each BMU, along with current open motorized route density, total motorized route density, and core area percentage within all CYE BMUs are displayed in Appendix D.

The 2004 Forest Plan amendment required 15 of 22 BMUs (68 percent) Forest-wide to have open motorized route densities of greater than 1 mile per square mile limited to no more than 33 percent of the BMU (the average female home range open motorized route density) (see Appendix D). Currently, 17 of 22 BMUs meet the Forest Plan amendment standards or provide better conditions for grizzly bears. Of the five BMUs that do not meet standards, four have open motorized route densities exceeding one mile per square mile in 34 to 39 percent of area, the remaining BMU has 59 percent.

Similarly, the amendment required 17 of 22 BMUs (77 percent) Forest-wide have total motorized route densities of greater than 2 miles per square mile limited to no more than 26 percent of the BMU (the average female home range total road density) (see Appendix D). Currently, 15 BMUs (68 percent) meet or provide better conditions than the Forest plan standard. The seven remaining BMUs (32 percent) exceed the amendment limits. Road densities in most BMUs have decreased since 1995. The amendment includes a schedule for reductions in open and total road densities.

The amendment requires that 20 of 22 BMUs (91 percent) reach at least 55 percent core area or more (the average female home range core size) (see Appendix D). The amendment will eventually result in increasing core habitat within the CYE by 11,170 acres to 943,513 acres (or about 57 percent of the CYE). Currently, 12 of 22 BMUs (55 percent) in the CYE meet Forest Plan standards for area for core area. Nine BMUs (41 percent) fall below 55 core, but 7 of these provide between 49 to 54 percent core. Since 1995, core area has increased in at least 13 of 17 of the BMUs wholly managed by the Forest. Improvements have occurred slowly. The nine BMUs managed by solely the Forest and in the Cabinet portion of the CYE (BMUs 1, 2, 3, 4, 5, 6, 7, and 8) provide from 54 to 85 percent core area.

From 1995 until the Forest Plan was amended in 2004, the Forest adhered to no net increase in open road density or total motorized route density and no net loss of core areas within BMUs. Since 1995, baseline access management conditions generally improved across the Forest. However, as described above, several BMUs have open and/or total motorized route densities exceeding the amended Forest Plan standards (Appendix D). The Forest Plan amendment provides a schedule for access changes to gradually improve and meet the Forest Plan standards.

Private forest management activities occur within the CYE. Plum Creek Timber Company is the primary private forest manager in the CYE. The Forest routinely requests consultation on activities on Plum Creek land that involve Forest roads or other permits. Activities on Plum

Creek lands that are solely on Plum Creek land, but occur within MS-1 habitat, are conducted according to Plum Creek grizzly bear habitat standards which involve a linear open road density standard of 1 mile per square mile, maintenance of cover for bears, and protection of seasonal habitats (USDI 2000c; Brian Gilbert, Plum Creek Timber Company, pers. comm. 2000). The open motorized route density, total motorized route density and core areas reported in Appendix D includes all lands in the BMUs. Thus, data presented in Appendix D includes Plum Creek roads to the extent the Forest and Plum Creek have been able to share this information.

Other factors affecting grizzly bear habitat The CYE is long and narrow (see Figure A2). An area of predominantly private land of mixed ownerships, approximately 22 miles long and up to 5 miles wide, occurs near the middle of the recovery zone. It includes the town site of Troy, the Kootenai River corridor just east and west of Troy and the private lands along the Highway 56 corridor. This area is classified as MS-3 habitat, or habitat with permanent human developments where grizzly bear use is discouraged. In the event of human-bear conflicts, the conflicts are resolved in favor of humans. This area encompasses primarily low elevation spring habitat rendered mostly unsuitable for grizzly bears as a result of the high density of people. As grizzly bear numbers slowly increase in the ecosystem, the area presents a higher risk of grizzly bear mortality due to potential human-bear conflicts. Risks to grizzly bears increase as concentrations of residences, roads, unsecured human-food attractants such as garbage cans, dumpsters, and pet foods, hunting and other recreation increase in and around this area. It also presents an area that likely displaces some bears, particularly some females and females with cubs, away from low-elevation that might contain high quality spring habitat.

Potential isolation from grizzly bears in the Canada portion of the greater CYE is identified as a potential threat to grizzly bears in the U.S. portion of the ecosystem. Conditions in Canada and along the international boundary currently allow movement of grizzly bears between Canada and the Yaak portion of the CYE, but grizzly bear habitat is being impacted by highways and associated development in Canada. Research has documented the impacts of highways on wildlife populations. Highways affect wildlife by increasing mortality and reducing movements and ultimately landscape connectivity (Chruszcz et al. 2003). Highway corridors, with commonly associated railroads and human settlement, may result in significant fragmentation of grizzly bear habitat. Recent studies on habitat connectivity and fragmentation indicate that traffic volumes on roads influence both grizzly bear use of habitat near roads and whether grizzly bears cross roads. Waller and Servheen (2005) found that 52 percent of the grizzly bears they sampled crossed U.S. Highway 2, in Montana south of Glacier Park, at least once during the study. However, crossing frequency was negatively related to highway traffic volume, with grizzly bears crossing mostly at night when traffic volumes were low (10 vehicles per hour). Grizzly bears also strongly avoided areas within 500 meters of the highway. In Banff National Park and surrounding parklands, Chruszcz et al. (2003) concluded that two patterns emerged from their study of grizzly bear movements in relation to highway traffic volumes: the avoidance of high-volume roads in a major transportation corridor (11 of 74 grizzly bear crossed the Trans-Canada Highway during 12 years of research) and the importance of high-quality habitat in determining grizzly bear movements relative to roads. In this protected area, grizzly bears were more likely to cross high-volume highways when moving from areas with low habitat values to areas of high habitat values.

Proctor (Proctor et al. 2005; 2003 *in* Proctor et al. 2004) found that the southern tip of the occupied habitat in the Purcell-Yaak area appeared to have limited female connectivity with adjacent areas across Highway 3 (in British Columbia), potentially creating a small female island population. Further to the south, the U.S. Highway 2 corridor (in Montana) runs east-west across the CYE, and includes a major state highway, railroad, the Kootenai River, and private land development and roads. The corridor bisects the CYE between the Yaak and Cabinet Mountains portions. The Service has no information documenting movement of grizzly bears between the Yaak and Cabinet Mountains; grizzly bears in the Cabinets are likely isolated from the Yaak segment and the Selkirk grizzly bear population at this time (Proctor et al. 2004). With increasing human populations, the Highway 2 corridor could be or may eventually become a significant barrier to grizzly bears attempting to move between the Yaak and Cabinet Mountains. One model influenced by habitat capability (for grizzly bears) and human population size depicted the CYE as having grizzly bear source area consisting of two patches separated by Highway 2 (Mattson and Merrill 2004). An increasing human population and higher grizzly bear mortality rates would further reduce the size of the source areas. A total barrier to movement would present a substantive impediment to grizzly bear recovery in the CYE, affecting the distribution and demographic and genetic health of CYE grizzly bears. Impacts would especially affect those grizzly bears in the Cabinet Mountains, as connectivity with grizzly bear population in the Yaak and Canada would essentially be severed. Further, the small number of grizzly bears in the Cabinet Mountains amplifies the demographic and genetic concerns related to such a barrier. An ongoing research project is documenting movement of bears across this corridor, using black bears (Kasworm et al. 2005), in order to identify existing areas with potential for linkage. Improving connectivity between the Yaak and Cabinet Mountains' portions of the CYE is a primary recovery goal (C. Servheen, pers. comm. 2005).

The Genesis Troy copper/silver mine occurs in BMU 3. The mine had been in operation from 1981 to 1993 and affects approximately 50 acres of disturbed area at the mine site on national forest system lands and an additional 400 acres of private lands. The mine is located approximately 15 miles south of Troy, Montana. This underground silver-copper mine was originally owned and operated by ASARCO (1979-1999), employing approximately 350 people. The mine was operated by Asarco from 1981 until 1993, when it shut down due to metal prices. The mine and permit were acquired by Revett Silver Company in 1999 and is operated by Genesis Inc., a wholly owned subsidiary of Revett Silver Company. It was reopened for production by Revett/Genesis in 2004 and currently employs approximately 150 employees (Revett, pers. comm. 2006). Production is approximately 4000 tons of ore per day with possible expectations of increasing production to 6500 tons per day. One to two trucks per day haul the ore concentrate from the mine to the railroad loading facility in Libby, Montana. The expected remaining mine life is 3 to 5 years. A revised reclamation plan is being updated and incorporated into the over-all Plan of Operations. In addition, the Forest re-consulted with the Service regarding the bull trout and possible changed conditions for grizzly bears. Impacts from past activities at the Troy mine are not known to have impacted bears in the southern portion of the CYE. No human-caused mortality of grizzly bears as result of past mine operations has been documented. Potential impacts during additional operation would have been primarily associated with additional workers living in the area. However, most of these employees were hired from the local area and many would also work at the Rock Creek Mine. A large ingress of people into the area associated with the Troy Mine in addition to that associated with the Rock

Creek mine was not expected and did not occur (J. McKay, pers. comm. 2005). Revett intends to finish work at the Troy Mine unit while the permitting, evaluation adits and development adits are completed at the Rock Creek Mine.

Several small patented mining properties (approximately 19, based on Figure A and B in 1998 BA, Appendix 10; J. McKay, pers. comm. 2003) occur along the borders of the Cabinet Mountains Wilderness. Large scale mineral development is unlikely on many of these small patents (J. McKay, pers. comm. 2000) due to the size of the patents and the nature of the mineral deposits. However, as patented (private) land inholdings, these scattered small parcels increase the risk of adverse grizzly bear-human interactions due to increased potential for contact with people, food and other attractants. Potential uses of these private lands include timber harvest, residences, cabins or other facilities, and hunting camps. All properties can legally be accessed by foot or horseback, and some have motorized access rights.

The Bull Lake Estates subdivision occurs in BMU 3. The Forest requested consultation on issuance of an access permit across national forest lands to access the subdivision. The Service issued a biological opinion and an incidental take statement on the project in 2000 (USDI 2000a). In 2002, the Service issued a biological opinion and an incidental take statement on the State Highway 1 project in eastern Idaho, between the Yaak portion of the CYE and the Selkirk ecosystem (USDI 2002). Incidental take statements in each of the biological opinions reduce the impacts of anticipated take on the species. Neither of these actions has of yet resulted in incidental take.

Status of grizzly bears in the YGBE, NCDE and Selkirk Ecosystem

In the YGBE, Recovery Plan parameters are generally positive and most recovery criteria have been met in recent years. In the fall of 2005, the Service published a draft rule proposing to delist the proposed distinct population segment (DPS) of grizzly bears in the YGBE (70 FR 69854). The best information suggests the YGBE grizzly bear population is stable to increasing. The long- term conservation of the proposed DPS continues to depend largely on managing conflict between grizzly bears and people.

In the NCDE, results from monitoring grizzly bears from 1987 through 1996 indicate the Recovery Plan criteria for several population recovery parameters were met, including: (1) numbers of females with cubs, (2) numbers of BMUs with family groups, (3) occupancy requirements for BMUs, and (4) total human-caused grizzly bear mortality. Female grizzly bear mortality exceeded recovery criteria limits through 1993, and again from 1997 through 2005 (C. Servheen in litt. 2006). Grizzly bear population estimates based on DNA-hair snag research in the NCDE are expected in 2007 (Katherine Kendall, U.S. Geological Survey, pers. comm.: oral presentation to the NCDE Subcommittee, spring meeting, 2006). Preliminary analysis of the results identified 486 individual grizzly bears, with about 80 percent of the sample analyzed.

The Selkirk Ecosystem grizzly bear population has not met Recovery Plan objectives (Wakkinen and Johnson 2005). The Selkirk Ecosystem Recovery Plan criteria requires observation of at least six distinct females with cubs (over a 6-year average) for recovery. The 2004 status is 1.2 distinct females with cubs over a 6-year average. The Recovery Plan human-caused annual

mortality limit (averaged over a 6-year period) for the ecosystem is no more than 0.2 bears, but the 6-year average for 2004 was 2.5 bears. The human-caused female mortality limit is 0.1 bears measured over 6 years, but in 2004 the average over the past 6 years was 0.8 females. The Recovery Plan calls for 7 of 10 BMUS be occupied by females with young over a 6-year period, but only 4 BMUs were occupied at least once in the period from 2000 through 2004 (Wakkinen and Johnson 2005.

ENVIRONMENTAL BASELINE

Under the provisions of section 7 (a)(2) of the Endangered Species Act, the Service is required to consider the environmental baseline when considering the "effects of the action" on listed species. The environmental baseline includes the past and present impacts of federal, state, or private actions and other human activities in the action area (50 CFR 404.02). The baseline analysis is a snapshot of the health of the species and habitat at a specified point in time.

The “action area” is defined as all the areas to be affected directly or indirectly by the Federal action, not merely the immediate area involved in the action (50 CFR 402.02). The action area for the analysis of effects of the Rock Creek Mine on grizzly bears includes the southern portion of the Cabinet Mountains in the CYE: BMUs 4, 5 and 6, where direct and indirect effects may occur, and surrounding BMUs 2, 7, 8 and 22 where indirect effects related to habitat fragmentation and mortality would likely affect grizzly bears (Figure 3). On the national forest, eight BMUs in the Cabinet Mountains portion of the ecosystem occur north and outside of the action area (BMUs 1, 3, 9, 10, 18, 19, 10, and 21). Private lands adjoining the recovery zone that would be directly or indirectly affected by the proposed mine are also considered part of the action area. Included are the 342 acres of private land that would be developed for the mine, as well as the area where most of the employees and others associated with the mine would settle. This area includes the Clark Fork Valley from Clark Fork, Idaho to Thompson Falls, Montana, and the Lake Creek drainage and the community of Troy.

Status Of Grizzly Bears In The Action Area

The Rock Creek Mine site would border the southwest edge of the CYE. Much of the impact would occur on private patented land on the edge or outside of the grizzly bear recovery zone. The southwest edge of the project area is approximately 1 air mile east of Noxon, Montana. Surface activities are planned along approximately 3 miles of Rock Creek and up the West Fork of Rock Creek.

Kasworm and Manley (1988) estimated the entire Cabinet Mountains section of the CYE supported a population of 15 or fewer grizzly bears. This estimate has not changed since 1988. Three grizzly bears were trapped during 1983 to 2001 in the Cabinet Mountains, requiring an average of 1768 trap nights expended per individual captured (Kasworm et al. 2002). This compares to 25 grizzly bears captured in the Yaak portion from 1986 to 2001 with an average of 210 trap nights per bear captured. These data support the premise that relatively few grizzly bears live in the Cabinet Mountains portion of the CYE.

It is not known how many grizzly bears inhabit the action area. Grizzly bear home ranges are large; average life home ranges reported in the CYE were 1294 square kilometers for males (500 square miles) and 667 square kilometers for females (258 square miles)(Kasworm et al. 2002). Kasworm and Manley (1988) documented grizzly bear use of the action area. Kasworm et al. (2005) reported 42 credible sightings of grizzly bears in the CYE in 2004, and 35 credible sightings in 2005 (Kasworm et. al. in litt. 2006) (Appendix C). In the Cabinet Mountains during 2004 alone, 16 sightings were distributed among the Cabinet Mountains BMUs 2, 5, 6, 18, 19, and 20; in 2005, 16 sightings were distributed among the Cabinet Mountains BMUs 3, 4, 5, 6 and 20. Based on these sightings and the large home range sizes, we assume the entire action area is occupied by grizzly bears.

Females with young have been documented in five of 14 BMUs in the Cabinet portion of the CYE, including action area BMUs 2, 5, 6, and to the north, in 18 and 21 (outside the action area), at least once each during the past 6 years (Kasworm et al. 2005) (see Appendix C: Figure 4). In 2004, one credible sighting of a female with cubs was reported in BMU 5; ten credible sightings of female with young (yearlings and two-year olds) occurred in BMUs 2, 5, and 6. In 2005, seven credible sightings of females with young were reported in BMUs 5 and 6 in 2005 (Kasworm et al. in litt. 2006a). These sighting of females in action area BMUs as well as in BMU 21 were indicative of recent reproduction in the Cabinet Mountains.

Based on female with young sighting data, at least one and possibly 2 reproductive-aged females appear to be using BMUs 4, 5 and 6. Sightings of females with young were reported in these BMUs in 1996, 1997, and 2000 (Kasworm et al. 2002). The proximity of the BMUs, the number of young present, and whether these young were cubs or yearlings/two-year-olds in the 1996 and 1997 suggests that there were at least two reproductive age females present. The 2000 data may be a sighting of one of the same females with a succeeding litter, and therefore cannot be identified as a third female. No sightings of females with young were received from the Cabinet Mountains during 2001 and one credible sighting of a female with 3 cubs occurred in BMU 2 during 2002 (Kasworm et al. 2005). During 2003, the Service received nine credible sightings of females with cubs or yearlings or two-year-olds in BMUs 2, 5, and 6 (Kasworm et al. 2005; W. Kasworm, pers. comm. 2005). These sightings appear to originate from at least two different adult females, one with cubs and one with yearlings or two-year-olds. Outside the action area, sightings also occurred in BMUs 18 (female with a cub) and BMU 21 (female with a yearling or two-year-old). Based on distance from other sightings and numbers or age of young, these would appear to represent two additional adult females. During 2004, the Service received seven credible sightings of females with cubs or yearlings or two-year-olds in BMUs 2, 5, and 6. These sightings appear to originate from at least three different adult females, one with cubs, one with two yearlings or two-year-olds, and one with three two-year-olds (Kasworm et al. 2005; W. Kasworm, pers. comm. 2005). Sighting data from 2005 has not been fully analyzed at this time.

Based on the population estimate of 15 or fewer grizzly bears in the Cabinet Mountains, a significant proportion of the adult females in the Cabinet Mountains may reside in the action area. For instance, if we conservatively assume 10 grizzly bears reside in the Cabinet Mountains, about three of those grizzly bears would be reproductive-aged females, based on assumption that 0.28 of a grizzly population would be adult females (based on Knight et al. 1988 and Knight et al.1993 as cited *in* USDI 1993a). If we assume that 15 grizzly bears occur in the

Cabinets, about five would be adult females. As discussed above, two or perhaps three of these females may have home ranges within the action area.

Although there are insufficient data to change the estimate of 15 or fewer bears in the Cabinet Mountains section of the CYE, the consistent sightings of individuals, females with cubs or young, and the augmentation of bears to the CYE are positive indicators, as are 2004 and 2005 sightings that document reproduction in the Cabinet Mountains. About 15 to 20 grizzly bear observations have been recorded across the Clark Fork River to the south east of the project area and recovery zone (W. Kasworm, pers. comm. 2000). These are individual observations, and do not necessarily represent 15 to 20 different bears. The observations do however indicate occupancy south of the recovery zone.

During 1990 through 1994, four female grizzly bears were released during an experimental program designed to test grizzly bear population augmentation techniques (Kasworm et al. 1998, Servheen et al.1995). All bears came from the North Fork of the Flathead River in British Columbia and had no history of conflict. Three of the four were monitored in the Cabinet Mountains for one year or more. One of these animals died after producing a cub a year after release. The cub is also presumed dead. Cause of death was unknown, but not believed to be human-caused. A fourth bear left the area, but was recaptured and released in the Cabinet Mountains. The radio signal from that animal was lost about a month later and her fate is unknown. However, hair snagging techniques and DNA analysis confirmed the presence of at least one of the transplanted bears remaining in the Cabinet Mountains during 2004 (Kasworm et al. In prep.). The grizzly bear identified was transplanted in 1993 as a two-year-old. Genetic analysis has confirmed the presence of 3 offspring from the original 1993 transplant and furthermore, that those offspring have also reproduced.

In 2005, Montana Fish, Wildlife, and Parks announced their plans to continue with an augmentation plan in the Cabinet Mountains (Montana Fish, Wildlife, and Parks in litt. 2005). They plan to augment the Cabinet Mountains with one to two female grizzly bears per year. Montana Fish, Wildlife, and Parks first recommended augmentation in *The Grizzly Bear in Northwestern Montana* (Montana Fish, Wildlife and Parks 1986). In 2006, the DEIS for the Montana Fish, Wildlife and Parks Grizzly Bear Management Plan for Western Montana, 2006-2016, detailed support for original 1986 recommendations. The DEIS preferred alternative is to relocate 10 to 15 subadult male or female, or appropriate adult females, to the CYE within the next 3 to 5 years, with initial emphasis on relocating females. Accordingly, in October of 2005, a seven year-old female was captured in the NCDE and relocated into the Cabinet Mountains. Recent telemetry data indicated that she had denned not far from her release site. She emerged from her den this spring and remained in or near the release area (W. Kasworm, pers. comm. 2006). In August of 2006, a two to three-year-old female was captured in the NCDE and relocated into the Cabinet Mountains (Montana Fish, Wildlife and Parks, in litt. 2006b).

Given the status of the CYE grizzly bears, an aggressive augmentation effort is warranted. Population simulations in Proctor et al. (2004) indicated that augmentation of female bears had the most positive effect on population growth in the short-term. Proctor et al. (2004) recommended placing 12 sub-adult female grizzly bears into the Cabinet Mountains between 2004 and 2010. Additional population simulations using data from the CYE grizzly bear

population indicate that under two different improved survival scenarios, 12 to 24 female grizzly bears augmented into the Cabinet Mountains would produce a stable population trend (Kasworm et al. 2006b). The authors indicated that the survival scenarios appear attainable based on other studies of similar bear populations, and that improvements in survival rates can occur from a variety of efforts designed to reduce human caused mortality (e.g. information, attractant storage, enforcement, habitat security, etc.). Given Montana Fish, Wildlife and Parks commitment to augmenting this population with at least one to two female grizzly bears per year, and depending whether the survival scenarios are achieved through mortality control measures, we would expect that the CYE grizzly bear population would achieve stability within 6 to 24 years. On average, if 1.5 bears were relocated per year, the population could reasonably be expected to stabilize within approximately16 years. If more females were relocated and/or human-caused mortality rates lowered, the population would stabilize sooner.

Factors Affecting The Species Environmental Baseline In The Action Area

The first discussion in this section analyzes and describes the environmental baseline in the action area as compared to numerous Forest grizzly bear habitat standards. The second section focuses on other factors affecting grizzly bears in the action area.

Habitat management

Roads providing human access into grizzly bear habitat are widely recognized as having the potential to adversely impact grizzly bears. Forest Plan standards address the impacts of roads on grizzly bears and consider standard forestry activities as well: timber harvest, road building and maintenance, recreation, and special forest products. This section uses Forest Plan standards applicable to this proposed action to assess the condition of the environmental baseline.

The first part of this section includes a discussion of various measures of grizzly habitat condition as measured by Forest Plan criteria. In the 2003 biological opinion, the environmental baseline for the proposed action was described in relation to the Forest Plan standards at that time, including habitat effectiveness and linear road densities. The 2004 amendment to the Forest Plan replaced previous access management standards and assessment criteria with BMU-specific access standards, in accordance with IGBC recommendations (IGBC 1994 and 1998). Forest Plan standards and 2005 road densities and core area for all CYE BMUs are displayed in Appendix D. We report habitat condition in these terms below. Habitat effectiveness values and some BAA (bear analysis area)-scale values originally calculated for the proposed action remain biologically informative as well, and therefore are summarized here as well.

Habitat effectiveness *Prior to the 2004 access amendment, the Forest Plan included a standard requiring 70 percent or more of secure habitat (habitat effectiveness) within a BMU as a measurement of the cumulative effects of activities.*

Habitat effectiveness is the percent of "secure" habitat remaining within a BMU after the area disturbed by major activities and the zone of influence around the activities is subtracted. The zone of influence is generally 0.25 mile or greater around features such as open roads, or major activities such as timber harvest areas, local disturbances, and developed areas such as MS-3

lands. The influence zone represents the distance within which bears are assumed to be affected or displaced by the given activity. Habitat use by grizzly bears or habitat effectiveness is reduced by human activities, according to the cumulative effects model (Christenson and Madel 1982).

Habitat effectiveness was introduced in a cumulative effects model (Christenson and Madel 1982) and was used as a standard in the Forest Plan, until the 2004 Forest Plan amendment. Habitat effectiveness provides a measure of bear security within each BMU, but does not address habitat quality or the distribution of ongoing actions. Core area is a similar concept. However, habitat effectiveness is influenced only by major activities and open roads and their buffers, but not closed or restricted road influences. Core area is free of motorized use of roads, motorized use of restricted roads or trails, high use non-motorized trails, and buffers around each. Core areas must remain in place for a minimum of 10 years.

Habitat effectiveness was last measured in 2003 (Table A7). Habitat effectiveness has remained the same, or changed only slightly since then in BMUs in the action area (W. Johnson, Kootenai National Forest, pers. comm. 2005), so we report it here. Of the three BMUs directly affected by Rock Creek, two were below habitat effectiveness standard of 70 percent in 2003, although improvements occurred since 1998 (Table A7). The low habitat effectiveness in BMU 4 is due in part to the major highways (Highways 200 and 56) that border or bisect the BMU. In BMU 6, habitat effectiveness is reduced by access to private timber lands intermingled with Forest lands in this BMU. Therefore, even lacking ongoing projects, these two BMUs would likely have never met the Forest Plan standard of 70 percent. However, BMU 6 is within one percent of meeting the standard. The BMUs 2, 5, 7, 8 and 22 met the standard. Over the entire action area, habitat effectiveness is about 73 percent.

Table A7. Habitat Effectiveness in BMUs associated with the proposed Rock Creek Mine, per year. Shaded BMUs provide 70 percent or more habitat effectiveness (from USDA 2002b and USDA 2003).

BMU	1995	1996	1997	1998	1999	2000	2001	2003
2	85	85	85	83	85	84	83	83
4	63	63	62	62	62	65	65	65
5	74	73	74	75	74	75	75	75
6	72	66	66	68	67	69	69	69
7	82	82	81	81	79	80	80	80
8	74	77	77	77	73	77	77	70
22					70	71	68	71[1]

[1]Dave Wrobleski, Lolo National Forest, pers. comm. 2003)

Open motorized route density *In 2004, the Forest Plan was amended to include BMU-specific standards for open motorized access route densities (Appendix D) in accordance with IGBC recommendations (IGBC 1994 and 1998). These standards replaced previous standards for linear road miles. Thirty-three percent of an average female home range exceeded one mile*

per square mile open motorized route density (Wakkinen and Kasworm 1997). In the following paragraphs, we compare the existing conditions to Forest Plan standards and to the average female home range characteristics reported in Wakkinen and Kasworm (1997).

Wakkinen and Kasworm (1997) used a moving windows analysis to document the relative proportions of open and total road densities and core area with female home ranges in the CYE and Selkirk Ecosystem. This research provided biological information on grizzly bears in the CYE that could be used to analyze BMU motorized access conditions, and develop standards to limit access to levels that were conducive to grizzly bear recovery. Thirty-three percent of an average female grizzly bear home range had open motorized route density greater than 1 mile per square mile, 26 percent of an average home range had total motorized route density greater than 2 miles per square mile, and 55 percent was core area. Some grizzly bears indicated a higher or lower tolerance for roads in their home range.

Five of the seven BMUs in the action area meet open motorized route density standards or provide better access conditions (lower open motorized route densities) than the Plan requires (Table 8; Appendix D). Table A8 compares the existing condition to the research information and the Forest Plan standards. The Forest Plan includes a time frame/schedule within which all BMUs will eventually reach standards.

Habitat conditions as affected by open motorized route density have improved over the past eight years (Table A8). The open motorized route densities in BMUs within the action area have all declined slightly. Only two exceed Forest Plan standards and the open road density levels in average female home range: BMU 22 contains 23 sections of private corporate timber lands (Dave Wrobleski, Lolo National Forest, pers. comm. 2003) and road densities in BMU 4 are elevated by Highways 200 and 56.

Table A8. Percent of BMUs with open motorized route density greater than 1 mile per square mile, per year, compared to amended Forest Plan standards (FP). Shading indicates BMUs that currently meet the density of average female home range*, and bolding meets FP standards.(from USDA 2002b and USDA in litt. 2006).

BMU	1997	1998	1999	2000	2001	2005 (FP)
2		29	18	17	17	**19 (20)**
4		39	36	36	36	37 (36)
5	29	29	28	27	27	**27 (30)**
6	37	37	39	34	34	**34 (34)**
7	27	27	23	23	23	**24 (26)**
8	39	32	31	32	32	**32 (32)**
22	41	41		37	38	38 (33)

* For comparison, 33 percent of an average female home range exceeded 1 mile per square mile open motorized route density (Wakkinen and Kasworm 1997).

Open motorized route densities are moderate within the action area and provide adequate to favorable conditions for use by grizzly bears. Five of the seven BMUs within the action area have open road densities comparable to or better than conditions in the average female home range as reported in research. Wakkinen and Kasworm 1997).

Total motorized route density *In 2004, the Forest Plan was amended to include BMU-specific standards for total motorized access route densities. Twenty-six percent of an average female home range exceeded 2 miles per square mile total motorized route density (Wakkinen and Kasworm 1997).*

Four of seven BMUs in the action area meet the Forest Plan standard for total motorized route density or provide better access conditions (lower total motorized route densities) than the Plan requires (Table A9). The Forest Plan includes a time frame/schedule within which all BMUs will eventually reach standards.

The total motorized route densities in BMUs within the action area have declined slightly or remained stable since 2001. The BMUs 6 and 22 contain high proportions of private corporate timber lands that increase road densities, 6 and 23 sections respectively (W. Johnson, pers. comm. 2003 and D. Wrobleski, pers. comm. 2003).

Total motorized route densities are moderate within the action area and provide adequate to favorable conditions for grizzly bears. Five of the seven BMUs within the action area have total road densities comparable to or better than the conditions in the average female home range as reported in research (Wakkinen and Kasworm 1997).

Table A9. Percent of BMUs with total motorized route density exceeding 2 miles per square mile, per year, compared to amended Forest Plan standards (FP). Shading indicates BMUs that currently meet the density of average female home range*, and bolding meets FP standards (from USDA 2002b and USDA in litt. 2006).

BMU	1997	1998	1999	2000	2001	2005 (FP)
2			15	14	14	**14 (18)**
4		28	27	26	26	**26 (26)**
5	23	23	21	21	22	24 (23)
6	35	35	34	33	32	**32 (32)**
7	22	22	19	20	20	**20 (23)**
8	23	23	21	21	23	23 (20)
22	42	42		41	41	37 (35)

* For comparison, 26 percent of average female home range exceeded 2 miles per square mile total motorized route density (Wakkinen and Kasworm 1997).

Core area *In 2004, the Forest Plan was amended to include BMU-specific standards for the amount of core area. Fifty-five percent of an average female home range was core area. (Wakkinen and Kasworm 1997).*

Four of the seven action area BMUs meet Forest Plan standards for core area or provide better conditions (larger core areas) than the Forest Plan requires (Table A10). The BMUs 5 and 6 are within one percent of meeting the standard. The seven BMUs range from 51 to 77 percent core. The Forest Plan includes a time frame/schedule within which all BMUs will eventually reach standards.

Core areas in BMUs within the action area have all increased slightly or remained relatively stable since 2001. Table A10 indicates BMUs 5 and 6 have lowered core area from 2001 and as not meeting the standard. However, this is because of road database corrections in 2006 and not to any changes on the ground (USDA in litt. 2006a). Five of the seven BMUs within the action area provide core areas equal to or larger than the average core within a female home range as reported in Wakkinen and Kasworm (1997), and BMU 6 is within one percent. The BMU 22 provides 51 percent core area, despite having approximately 23 sections of private corporate timber lands, which typically limits the amount of habitat that can be managed as grizzly bear core area (Dave Wrobleski, Lolo National Forest, pers. comm. 2003). The Forest Plan includes a time frame/schedule within which all BMUs will eventually reach standards.

A substantial amount of core area is provided within the action area, providing good conditions for grizzly bears. Six of the seven BMUs within the action area provide core areas comparable to or larger than the core area in the average female home range as reported in research (Wakkinen and Kasworm 1997).

Table A10. Percent core area in BMUs associated with the Rock Creek Mine project, per year, compared to amended Forest Plan standards (FP). Shading indicates BMUs that currently meet amount of core in an average female home range*, and bolding meets FP standards (from USDA 2002b and USDA in litt. 2006).

BMU	1997	1998	1999	2000	2001	2005 (FP)
2			77	78	77	**77 (75)**
4		62	61	63	63	**63 (63)**
5	60	60	61	62	62	59 (60)
6	51	51	51	53	55	54 (55)
7	65	65	66	66	66	**67 (63)**
8	56	54	57	57	56	**56 (55)**
22	48	48		47	47	51 (55)

* 55 percent of an average female home range provided core habitat (Wakkinen and Kasworm 1997).

Core areas are to be designed to include the full range of seasonal habitats available in the BMU. The 1998 BA analyzed seasonal habitats within the core areas affected by the Rock Creek Mine

(see *Seasonal Habitat Protection* below). Appendix 9 of the 1998 BA displays habitat components important to grizzly bears in the project area.

Opening size *The Forest Plan standard is to design harvest units to be 40 acres or less. If exceeding 40 acres under justifiable reasons, no point in the resultant opening should be more than 600 feet from cover (maximum 1,200 feet across).*

The 1998 BA does not describe the abundance or distribution of openings in the baseline condition, but historically projects have been planned to comply with this standard and openings within the action area comply (W. Johnson, pers. comm. 2000).

Movement corridors *The Forest Plan guide is to maintain unharvested corridors at least 600-feet wide between forest openings or natural openings. Functional hiding cover has a minimum of three sight distances (after harvest), where a sight distance is the mean distance at which 90 percent of an animal is hidden from view.*

The 1998 BA does not describe the abundance or distribution of movement corridors in the baseline condition, but historically projects have been planned to comply with this guidance for grizzly bears. Adequate movement corridors occur within the action area at the current time (W. Johnson, pers. comm. 2005).

Seasonal habitat protection *The Forest Plan standard includes:*

1. *Spring habitat protection--Objective is to schedule activities within spring habitat (southerly aspects less than 5,000 feet elevation) outside spring season (April 1-June 15).*
2. *Den site protection--Objective is to allow activities within .5 mile of known currently utilized den sites only outside the denning season (November 15-April 1).*

The Service considers spring seasonal habitat components to be well-distributed but often unavailable throughout the grizzly bear recovery zone due to the presence of human developments (roads and dwelling on mostly private MS-3 lands) in low lying areas.

Spring habitat is well represented in core areas in BMU 4, 5 and 6 when compared to its availability within each BMU. Spring habitat availability in core area habitat was analyzed by affected BMU. The Forest conducted an analysis of the amount of potential spring habitat (broadly defined as less than 5,000 feet elevation with south, east, or west aspect) captured by the designated core areas within each BMU (see Table 17 in BA). The BMU 4 contains the greatest abundance of spring habitat within the core area, estimated in the 1998 BA to be 27,633 acres (56 percent of the core area compared to 34 percent of the total area of BMU 4). The BMUs 5 and 6 contain an estimated 11,329 acres (30 percent of the core area compared to 16 percent of the total area of BMU 5) and an estimated 14,781 acres (42 percent of the core area compared to 24 percent of the total area of BMU 6) of spring habitat components within the core area.

Riparian habitat and wetlands support succulent vegetation important to bears. A small wetland, classified as spring habitat, occurs on the proposed tailings impoundment site. The wetland is currently MS-3 habitat and is considered unavailable to bears due to high road densities in the

area. Several small marshy lakes occur in the wilderness area on the surface several hundred feet or more above the underground rock formation that will be mined. Although these lakes provide succulent vegetation later in the season, they are likely under snow during the spring.

Denning habitat is generally defined as above 5,200 feet in elevation on north and west aspects in the Cabinet mountains, although this information is based on a very limited sample size of denning grizzly bears (Kasworm and Thier 1994). The Rock Creek drainage contains suitable denning habitat, however none exists within the immediate Rock Creek Mine permit area (BA). A transplanted grizzly bear used one den site in the Rock Creek drainage (BA).

Huckleberry fields are important in the fall for the CYE bear population. No large huckleberry fields occur in the immediate Rock Creek Mine permit area (BA). Kasworm et al. (2000) indicated that the productivity of many of the huckleberry fields that were stimulated by fires in the early 1900s had declined under closing forest canopies.

Summary of environmental baseline access conditions: We conclude that the environmental baseline in the action area is in relatively good condition for grizzly bears related to access management. The Service considers open and total motorized route densities and core area to be important habitat condition parameters for grizzly bears. Habitat effectiveness values also provide an indication of good habitat condition. Of seven BMUs, five meet the previous Forest Plan standard of 70 percent, and all provide 65 percent habitat effectiveness or more; five of seven meet or exceed the levels of core area reported for average female home ranges in the CYE; and four have open motorized route and five have total motorized route densities at or below averages reported in CYE grizzly bear research. Grizzly bear spring habitat is present in core areas in BMUs 4, 5 and 6. An examination of trends in road development and motorized access management in the CYE and Selkirk ecosystem indicated that the number of roads closed to the public and decommissioned increased during 1975 and 2001 on national forest (Summerfield et al. 2004). Even with new construction, there were fewer open roads in 2001 than in 1987 or 1975 for the three BMUs examined.

Other factors affecting the environmental baseline in the action area

The scope, complexity, length and long-term nature of changes on the landscape resulting from the Rock Creek Mine require that additional factors beyond those addressed in the Forest Plan be considered related to the mine.

Human population The human population of Sanders County is expected to grow from 10,233 people in 1999 to 13,540 people in 2020 (NPA DATA Services, Inc. 2001 *in* MDEQ and USDA 2001). This 32 percent increase would be greater than the expected 26 percent Montana population increase over the same period. From 1990 to 2000, the human population in Sanders County grew by approximately 18 percent compared to 13 percent growth statewide (Montana Department of Commerce 2003). There were 3.7 people per square mile compared to 6.2 people per square mile measured statewide (U.S. Census Bureau 2003). Larger communities in Sanders County include Plains and Hot Springs outside the CYE, and Thompson Falls which is considered inside the CYE. The human population in Lincoln County to the north is projected to grow more slowly than statewide averages, increasing from 18,819 in 1999 to 21,640 people in

2020, which is a 15 percent increase (MDEQ and USDA 2001). Larger communities in Lincoln County include Troy and Libby, which are within the CYE; Libby is outside the action area. Bonner County, Idaho is expected to grow from 36,071 people in 1999 to 53,130 in 2020, a 47 percent increase.

People living in or near grizzly bear ecosystems impact bears in several ways. Human-caused grizzly bear mortality is the most serious consequence of people in bear habitat. Thirty grizzly bear mortalities were detected over the 24-year period 1982 through 2005 in the recovery zone or within 10 miles. Of these, 21 were known human-caused. Four of these 21 human-caused mortalities occurred in the action area. In the past six years alone (1999 through 2005), 12 known mortalities were caused by people living or recreating in grizzly bear habitat (see Table A6). These mortalities resulted from malicious killing, self-defense, management removal because of food-conditioning, hunter related mistaken identity, or unknown causes. In the CYE during the past, the number of grizzly bears killed by members of the public during any one year was typically one, with the exception of 1999, when two grizzly bears were killed by the public. However, in 2002 four grizzly bears were killed by people, and in 2005, three were killed by people or died due to human causes. Recently, habitat condition models predict the potential negative impact of human population increases on grizzly bear habitat in the CYE (Mattson and Merrill 2004).

Recreational use Recreational use has been increasing in the Cabinet Mountains. According to the BA (Table 6, Appendix12) 26 percent of Forest users fish, 38 percent hunt, 49 percent visit wilderness, 53 percent hike, 98 percent drive to enjoy scenery, and about 2 percent pick berries.

Non-motorized use of the Rock Creek Trail has been steadily increasing, from an average of 0.7 people per day during the active bear season (April 1 to November 15) in 1990 to high of 1.8 people per day in 1996, a 157 percent increase. The number of parties per week also is increasing. Estimates of the number of parties per week were made during two, 3-year evaluation periods (1990 to 1992 and 1995 to 1997) using registration card data. These surveys estimated 5.7 parties per week during 1990 to 1992 and 8.2 parties per week during 1995 to 1997. High-use trails are those with more than 20 parties a week. The reported level of use from 1995 to 1997 is likely an underestimate. Actual use is typically higher due to trail use by unregistered users, ranging from 50 percent to 400 percent (BA 1998). Correcting for the actual trail use, the existing use may currently range from 10.5 to 33 parties per week (BA 1998). High-use periods are summer (generally recreational hikers) and spring/fall (hunters). The area encompassed by high-use trails and buffers must be subtracted from core area and habitat effectiveness calculations (USDA 1988).

Snowmobiles and cross country skiing With the development of more powerful snow machines and more interest in the sport, snowmobile activity has been increasing on the Forest. New technology has provided more powerful equipment that allows users to reach areas considered inaccessible in the past. The 2004 access amendment documents that snowmobile use increased thirty-six percent in the CYE over the past ten years. This activity is expected to continue to be popular and likely to increase at a faster rate. Snowmobiling is legally prohibited within wilderness areas of the affected BMUs. In BMUs 4, 5 and 6, however, only two roads

are open to snowmobile use, and they are primarily access routes to jump off points for cross country skiing into the high country on the east side of the Cabinet Mountains Wilderness.

Cross-country skiing shows the single largest increase in recreation use. The estimated increase over the past decade is 70 percent. Use is expected to almost double in the next twenty years. On the west side of the Cabinet Mountain Wilderness, the Chicago Peak road is also used by snowmobilers to reach access for cross country skiing. Two small cross country ski play areas occur in the wilderness, one on each side of Cabinet Mountain Wilderness just inside wilderness boundary. Snowmobile and cross country ski activities in BMUs 4, 5 or 6 are expected to remain relatively low due to the topography, the lack of loop roads, and lack of cirque basins that attract snowmobile users (W. Johnson, pers. com. 2002). Potential effects of snowmobiling on bears are largely limited to late spring when females emerge from dens with cubs. Cross country skiing has not been reported to cause adverse effects to grizzly bears.

Hunting The project area occurs in state hunting unit 121. Recreation analysis indicated that hunting has shown a steady increase in the general area since 1984 (BA 1998). Thirty-eight percent of the recreational users in the Forest are hunters. Hunters using horses or other pack animals have occasionally dropped animal feed, which serves as an attractant to both black and grizzly bears. Mortality due to mistaken identity is a risk to grizzly bears that can increase with the number of hunters, the number of bears and the degree of attractants. Montana has implemented a public education program to teach hunters to differentiate grizzly bears from black bears and how to handle attractants in the backcountry. Effort were expanded in 2001 (Montana Fish, Wildlife and Parks 2001). These programs are intended to reduce potential hunter-related grizzly bear mortality.

In 2001, a subadult female grizzly bear was killed by a black bear hunter who mis-identified her as a black bear in an area outside the action area, but within the CYE. Montana Fish, Wildlife and Parks recently added several components to its Grizzly Bear Management Plan to reduce the potential for hunter-related grizzly bear mortality (Montana Fish, Wildlife and Parks 2001). One measure is the requirement that black bear hunters successfully complete Montana's black bear/grizzly bear identification test prior to obtaining a license. In the fall of 2005, a young male grizzly bear was mis-identified as a black bear and killed by a hunter. This mortality triggered re-initiation of section 7 consultation on the Service's approval of Montana's Grizzly Bear Management Plan.

Attractant storage Readily available human food and garbage is one of the threats identified in the listing of grizzly bears. Human food and garbage, compost, bird feeders, livestock and livestock feed, pet food, bee hives, barbeque grills, fruit trees and garden produce, unsecured food in campgrounds, gut piles and carcasses are all strong attractants to black and grizzly bears. This attraction is often strong enough to overcome a grizzly bear's natural wariness of humans. Unless attractants are secured, a grizzly bear becomes increasingly habituated and bolder, posing a threat to human safety. Such bears are generally destroyed or removed from the wild. through agency management actions.

The IGBC SCYE Information and Education Taskforce developed recommendations to initiate food storage in the SCYE, and presented these proposals to the IGBC SCYE Subcommittee in

2001. In 2001, the Forest initiated a voluntary food storage order requesting that the public secure food from bears while working, camping, hiking or otherwise using the forest. This voluntary food storage order applies throughout the action area.

Currently the Forest does not have grizzly bear-resistant garbage containers at all campgrounds or sites where garbage receptacles are provided within the action area. Education pamphlets are available at Forest District offices as well as other public places describing good attractant storage protocols in bear country. Many residents in the area have been responsive to Montana Fish, Wildlife, and Parks information and other agency brochures to keep wildlife-friendly households, but others have been resistant or remain uninformed about sanitation issues and grizzly bears. The Forest has provided access to a video on the use of bear spray and defensive behavior (IGBC–Safety in Bear Country Video, 2001) to back country users on a limited basis.

No known grizzly bear incidents related to poor attractant storage have occurred *in the action area*, possibly due in part to the low grizzly bear population, low human population and large portions of roadless area. Few black bear incidents have been reported. Either incidents are too few or too insignificant to report, or landowners have dealt with the problems without reporting to Montana Fish, Wildlife, and Parks. Additional people living or recreating in the area raise the likelihood of increased hunting pressure and possibilities of human-bear encounters (Bruce Sterling, Montana Fish, Wildlife and Parks, pers. comm. 2002).

Outside the action area, in 1999, a male grizzly bear was killed by government biologists in the Yaak because of attractant-related problems. The bear fed on compost, bird seed, unsecured garbage, broke into an outdoor refrigerator, and preyed on domestic goats. It was eventually captured and euthanized. The last incidents occurred in a small rural subdivision that had covenants against keeping livestock, but the covenants were not enforced. In 2002, three yearling grizzly bears were preemptively moved from an area just south of the CYE recovery zone across the Clark Fork River from the Rock Creek Mine site. These grizzly bears were not accompanied by their mother and were presumed orphaned. They were frequenting areas near homes south of the CYE and the Clark Fork River, near the action area. The bears were at risk of becoming habituated to the many human residences and unsecured food and garbage attractants along the Clark Fork River. The bears were captured, fitted with radio transmitters and moved into Martin and East Fork of Elk Creek, away from any human settlement. All three were underweight for their age (55 to 65 pounds). The young grizzly bears remained away from people. However, the female was found dead several weeks later due to natural causes (W. Kasworm, pers. comm. 2003). In 2005, two subadult male grizzly bears were frequenting cabin sites, in separate incidences, and were relocated elsewhere in the Yaak The first incident involved two young bears frequenting cabins. One male was captured and relocated. The second incident involved a subadult male that obtained unsecured compost and fish. The bear was captured and relocated but was later killed by a black bear hunter in a case of mistaken identity.

These recent incidents indicate that unsecured attractants exist in the CYE, can affect the small grizzly bear population at this point, and will most likely become more a serious issue to grizzly bear recovery as grizzly bear and/or human populations increase.

Noise Baseline noise levels are measured in decibels, using the A scale (dBA). Zero dBA is the intensity when sound is audible to a young person with normal hearing. Noise is perceived as "doubling" for each 10 dBA. The lowest level at which sound begins to degrade the environment is 35 dBA (MDEQ and USDA 1998). Baseline ambient noise levels run from 25 dBA in the Cabinet Wilderness in calm conditions to 50 dBA on Highway 200 (with highway traffic).

Other access and facilities Montana Rail Link railroad runs along Highway 200 in a fairly developed utility corridor. It is mostly located on relatively flat ground and runs along the border of the CYE recovery zone. This rail system runs one train twice a week from Paradise to Trout Creek with the potential to connect to Sandpoint, Idaho, and Missoula, Montana. In 2001, a train-killed female was discovered along the tracks near Elk Creek and Heron. In 2005, another adult female was struck and killed by a train near Government Creek. No other train-related mortalities are known.

The main access road to the proposed Rock Creek Mine site, FR 150, is currently an open, high use route, receiving approximately 33 one-way trips per day, based on traffic counter use (SEIS). The road is not plowed in winter, nor is it gated. Primary use occurs during the summer.

Mines Approximately 19 patented mining properties occur in the Cabinet Mountains within the action area (BA 1998). Not all of the patented properties have legal road access. Recreational development is possible on some of these patented properties in the area. The Fourth of July and Way-up mine sites occur within the action area in BMU 6. The Forest recently authorized limited motorized access to these mine sites (USDA 2000b). Under the current authorization, motorized access on the two roads is limited to levels allowed for administrative use on restricted roads. The motorized use levels would not rise to open road levels. The Forest has assured the enforcement of attractant storage on national forest system lands, as specified in the terms and conditions of the Fourth of July and Way-up Mine biological opinion, but stated they have no jurisdiction on patented land (USDA 2000b).

Large-scale mineral development is unlikely on these or other small patents (J. McKay, pers. comm. 2000) because of the size of the patents and the nature of the mineral deposits. Potential activities on some of these private properties that could impact grizzly bears include clear-cutting, small-scale mining activity including surface disturbance and blasting, building structures, establishing hunting camps, and maintaining livestock compounds with food and attractants. These impacts were analyzed in the Service's biological opinion for the Way Up and Fourth of July Mines (USDI 1998 and 1999). We anticipated a low level of grizzly bear mortality would occur due to displacement and direct killing of grizzly bears. However, baseline habitat conditions for grizzly bears have improved in BMU 6 since issuance of the 1998 biological opinion. Open motorized route density greater than one mile per square mile is 34 percent of BMU 6 (USDA in litt. 2006a), meeting the Forest Plan standard of 34 percent (USDA 2004), and nearly meeting the research average of 33 percent (Wakkinen and Kasworm 1997). Total motorized route density greater than two miles per square mile improved, decreasing from 35 percent in 1998 (USDA 2002b) to 32 percent of BMU 6 (USDA in litt. 2006a), meeting Forest Plan standards (USDA 2004). Core area has also improved in BMU 6, increasing from 51 percent in 1998 to 54 percent (USDA in litt. 2006a), nearly meeting the Forest Plan standard and

the research average (within one percent). Therefore, the potential for incidental take as a result of displacement is reduced, and is further reduced due to the terms and condition required in the biological opinion (USDI 1998 and 1999) should the project move forward. Some low level of mortality is anticipated from habituation and food conditioning if the properties are developed; terms and conditions in the incidental take statement in the biological opinion would reduce the likelihood of anticipated take from habituation as well.

EFFECTS OF THE ACTION

The effects of the action include 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. This section will describe and analyze the effects of the Rock Creek Mine on grizzly bears.

The 1998 BA compared the direct effects of Alternative V of the proposed Rock Creek Mine project with the Forest Plan standards at that time and the associated access assessment criteria. These standards and/or criteria included habitat effectiveness, linear open road density, displacement areas by BAA, opening size, movement corridors and seasonal habitat protection. Terms and conditions of the 1995 incidental take statement in the Service's amended biological opinion on the Forest Plan (USDI 1995) also were compared to the proposed action. These terms and conditions included requirements related to open motorized route density, total motorized route density, and core area.

In 2004, the Forest Plan access amendment (USDA 2004) replaced previous standards and assessment criteria with standards and guidelines related to the management of open and total motorized route density and core (Appendix D). Thus, we are using the standards in the 2004 amendment as part of our analysis of effects. The Forest supplemented the 1998 BA with/or provided updated baseline information in 2004, 2005 and 2006.

This section analyzes the potential direct and indirect effects of the proposed action, including the measures in the 2006 mitigation plan. The effects of the proposed Rock Creek Mine will be discussed under the following, often overlapping, categories:

1. **Displacement of grizzly bears** resulting from disturbance associated with roads or activities, including: habitat effectiveness, linear open road density, open motorized route density, total motorized route density, core area, seasonal habitats, displacement habitat, opening size, seasonal habitat protection, corridor width; direct habitat loss.

2. **Mortality risk to grizzly bears** resulting from food conditioning and other human impacts, including recreation, access into grizzly bear habitat, and settlement.

3. **Fragmentation of grizzly bear habitat** resulting from impacts to a relatively narrow north-south corridor connecting the southern Cabinet Mountain BMUs (6,7, 8 and 22) to those to the north.

The analysis under each of these categories is organized into two major sections. Presented first is a synopsis of information and research regarding general, potential adverse effects on grizzly bears that could be associated with mining operations. Presented second is an analysis of the potential effects of the specific proposed action, including the accompanying mitigation plan. The first section, general potential impacts of mining operations, may include discussion of actions or impacts that ***would not* necessarily** occur or apply within the action area and/or ***would not* necessarily** be related to the proposed action, but provide background information or context for the second section, analysis of specific effects of the proposed Rock Creek Mine.

The effects analysis ends with the following sections:

4. **Conservation Needs of the Species**

5. **Species Response to the Proposed Action**

General Potential Effects Of Mining Operations On Grizzly Bears: Factors To Consider

Displacement

Grizzly bears are known to avoid, or be displaced from, preferred habitat because of human-caused disturbances. The term "displaced" does not necessarily mean that grizzly bears would totally avoid an area, or be excluded in some way from ever using an area. Displacement is used in general terms to describe "under-use" of habitat. In research, "significant under-use" of habitat means that bears use habitat "less than expected" compared to its availability. For instance, a given habitat may account for 30 percent of an analysis area, but may only receive 15 percent of bear use. Depending upon the confidence interval surrounding the 15 percent use, this may amount to statistically significant less-than-expected use of habitat, even though some use by bears is occurring. Displacement of grizzly bears from an area can range from short-term or diurnal avoidance to more significant long term under-use of habitat, depending upon the season, quality of habitat affected, and the age and sex of grizzly bears affected.

Displacement behavior in grizzly bears may be expressed through a change in diurnal habitat use or movement patterns, avoidance or under-use of otherwise preferred habitat, and/or other behaviors related to stress or fear. Displacement may be short term or long term, depending upon the nature of disturbance and consequences experienced by grizzly bears. Grizzly bears that avoid human activity may move into poorer quality habitat or habitat that is already occupied by other bears. These types of altered routine behaviors due to disturbances have been documented in grizzly bears. Clear cause-effect relationships have not often been statistically validated. However, numerous research efforts reported many grizzly bears under-use or avoid otherwise preferred habitats that are highly influenced by humans (Mace et al.1999; Wakkinen and Kasworm 1997; Mace et al. 1996; McLellan and Shackleton 1989; McLellan and Shackleton 1988).

If large amounts of preferred habitat within a female grizzly bear's home range is impacted by disturbances that cause displacement, the bear's reproductive capacity may be affected. Female

grizzly bears that are deterred from adequate use of important resources in their home range may experience significant impairment of breeding, feeding and sheltering. Stress and increased caloric expenditure searching for food or protective cover in less desirable habitat may impact normal behavior patterns, possibly to the extent that reproduction is compromised. Female grizzly bears, in particular, have a strong home range affinity (IGBC 1987). They may avoid preferred habitats in response to disturbance, but have not been documented to move from established home ranges to a significant degree. Therefore, significant impacts to their home ranges can be deleterious. The reasons for this affinity are not completely understood, but may be related to how grizzly bears find and follow the phenological development of important food plants in their habitat, returning predictably to important habitats such as huckleberry fields in the fall or avalanche chutes in the spring. Bears appear to "learn" their home range, often expanding a home range as a bear matures while maintaining a central common core zone. Grizzly bears evidently learn to use their habitat from their mother. Home ranges of young, usually female young, often border or overlap that of the mother. Exploratory movements into unfamiliar territory can be expensive in terms of energy expenditure and the low potential of finding unoccupied habitat with adequate food resources to support the high caloric requirements of bears in the feeding season. An adult grizzly bear consumes up to 20,000 calories a day in preparation for denning. Lactating females may require an even greater caloric intake. Females with cubs are generally not as able to travel, limited by the need to feed and accompany the cubs. Grizzly bear home ranges are large and overlap. Displacement from preferred habitat into areas also occupied by other grizzly bears increases the potential for adverse intraspecific interaction. Intraspecific interaction may include predation on cubs by male grizzly bears. Bears moving in less known territory or sub-optimal habitat give up known escape cover and increase their chances of encounters with dominant male bears. Intraspecific competition and/or under-use of otherwise preferred habitat in adult females may result in reduced foraging efficiency leading to adverse changes in breeding behavior, lowered reproductive success, or reduced cub and sub-adult survival.

Research demonstrates that management of human access into grizzly bear habitat can moderate the displacement of grizzly bears caused by human activity (Mace et al.1999; Wakkinen and Kasworm 1997; Mace et al. 1996; IGBC 1994). Roads into grizzly bear habitat have been widely recognized as having the potential to adversely affect grizzly bears (Nielson et al. 2004; Gibeau et al. 2001; Mace et al. 1999; Wakkinen and Kasworm 1997; Mace et al. 1996; McLellan 1989b; McLellan and Shackleton 1989; McLellan and Shackleton 1988).

Negative association with roads arises from vehicle noise and other human-related noise around roads, human scent along roads, and hunting and shooting along or from roads. Grizzly bears that experience such negative consequences learn to avoid the disturbance and annoyance generated by roads. Such animals may not change this resultant avoidance behavior for long periods after road closures and lack of negative reinforcement. Displacement of bears away from preferred habitat is related to avoidance of people who shoot at bears (legal harvest, defense, mistaken identity or malicious shooting) and of the disturbance related to people, noise, activity, roads and traffic. In their Canadian study area, McLellan and Shackleton (1989b) found that bears near roads were more vulnerable to hunting, and found support for the hypothesis that non-secretive bears were eliminated from the population by hunters. Grizzly bears may avoid

quality habitat near roads except in poor food years when they may be forced to seek those resources at higher risk to their safety.

All of the factors contributing to displacement of grizzly bears from habitat in roaded areas have not yet been quantified by research. However, grizzly bears were consistently displaced from roads and habitat surrounding roads (Mattson et al. 1987; McLellan and Shackleton 1988; Aune and Kasworm 1989; Kasworm and Manley 1990; Mace et al. 1996; Wakkinen and Kasworm 1997; Mace et al. 1999). Along the Rocky Mountain Front in Montana, Aune and Stivers (1984) found that grizzly bears avoided roads and surrounding road corridors even when the area contained preferred habitat for breeding, feeding, shelter, and reproduction. McLellan and Shackleton (1988) found that grizzly bears used areas near roads less than expected in southeastern British Columbia and estimated that 8.7 percent of the total area was rendered incompatible for grizzly use because of roads. Mace and others (1996) found under-use of areas with high open and high total road densities on national forest lands in Montana, as measured by a spatial analysis method known as "moving windows". Using a GIS computer model, this analysis identifies areas of high open or total road densities and revealed female home range selection was high for unroaded and low for roaded areas. Areas with lower open and/or total densities were used as expected. Mace and others (1996) found that as road densities and human use of roads increased, female grizzly bear use of adjacent habitat decreased significantly. In some years, avoidance of roads and areas of high disturbance may result in under-use of habitat. Waller and Servheen (2005) found that grizzly bears strongly avoided areas within 500 meters of U.S. Highway 2 in Montana, south of Glacier National Park. However, 52 percent of the bears sampled did cross the highway during the night when traffic volumes were lower (averaging 10 vehicles per hour).

Grizzly bears also avoid high-use trails and other disturbances, but existing literature provides little with which to estimate a threshold of tolerance by bears to people on trails, outside of national parks where recreationists do not carry firearms. Kasworm and Manley (1990) found that grizzly bears in the Cabinet Mountains used the 0-274 meter strip (approximately 899 feet) along trails 42 percent less than expected, based on availability. This pattern was consistent among the three grizzly bears analyzed. Distances greater than 3,322 meters (slightly over 2 miles) from the trails were used greater than their availability by one bear and the other two used it as expected. Actual use of the trails by hikers was not monitored in the study.

Grizzly bear displacement from disturbances other than roads (e.g. such as mining, seismic activity and aircraft) is usually related to distance from the activity. Individual bear behavior, the season of use, sex, habitat conditions and a wide variety of other factors influence grizzly bear response to human presence and activities. McLellan and Shackleton (1988) did not find significant displacement in terms of moving away from disturbance when radio monitored bears were exposed to seismic activities, gas exploration and timber harvest, although individual bears responded differently. They did document avoidance of roads and industrial sites (McLellan and Shackleton 1988, McLellan and Shackleton 1989b). McLellan (1989b) found that industrial activities did not appear to have a significant detrimental effect on the grizzly bear population in the Flathead Valley, British Columbia during the period of study. However, this southeastern corner of British Columbia had few permanent human residents or settlements. Cronin et. al (1999) found that some grizzly bears displayed fidelity to the Prudhoe Bay region in Alaska and

produced offspring there over several years in the presence of an active oil field, which may indicate tolerance of human activity. However, the authors indicated that bears were not hunted in the oil fields and suggested that it was possible the oil fields attracted bears due in part to anthropogenic foods in garbage. Grizzly bears conditioned to anthropogenic foods may be killed by hunters or as nuisance bears when they move to other areas (Shidler and Hechtel, in press *in* Cronin et al. 1999) (see also discussions in *Mortality Risk* section below).

Bears responded differently to people on foot, to moving vehicles and to fixed wing aircraft in open habitat as opposed to closed, often timbered habitat (McLellan and Shackleton 1989b). Grizzly bears closer to areas of high human use were less likely to immediately flee humans on foot than those in areas of low human use. The most pronounced reactions were to humans on foot in remote, open habitat.

Grizzly bears can become conditioned to human activity and show a high level of tolerance especially if the location and nature of human use are predictable and do not result in overtly negative impacts for grizzly bears (Mattson 1993, Cronin et. al 1999). In Glacier National Park, Jope (1985) suggested grizzly bears in parks habituate to high human use and showed less displacement, even in open habitats. In Banff National Park, an area where people are prohibited from carrying firearms, grizzly bears used habitat close to low-volume roads more than expected, and were more likely to cross low-volume roads than high-volume roads (Chruszcz et al. 2003). High habitat quality influenced the use of habitat near roads and the likelihood that bears would cross roads. Habituated grizzly bears were closer to roads than wary bears. Yonge (2001) found that grizzly bears near Cooke City, Montana, were willing to consistently forage in very close proximity to high levels of human use if cover was sufficient and energetically efficient feeding opportunities (high quality habitats) were present. Both Mattson (1993) and Yonge (2001) postulated that areas with higher levels of human activity might have a positive effect for bears by serving as a kind of refugia for weaker population cohorts, subadults and females with cubs, seeking to avoid intra-specific competition with adult males. However, Mattson qualified this observation by adding that the beneficial effects vary as to whether hunting is allowed, and how closely the human population is regulated. Further, food conditioned grizzly bears were much more likely to be killed by humans. Both Yonge (2001) and Mattson (1993) indicated that increases in human use levels can be deleterious if some human activities are unregulated, such as use of firearms, presence of attractants, nature and duration of human uses. Conversely, a level of coexistence between humans and grizzly bears can be achieved if such activities are controlled. Near Cooke City, Montana, the New World Mine reclamation project had minimal effects on grizzly bears, in part because reclamation activities were temporally and spatially predictable and people associated with the work were carefully regulated against carrying firearms or having attractants available to grizzly bears (Tyers, unpublished 2006). In the Swan Valley of Montana, raw location data from a small number of collared grizzly bears show nocturnal use of highly roaded, forested habitat (C. Servheen, pers. comm. 2005). The Swan Valley data have not been statistically analyzed and the study was not designed to determine the impact of roads on bears, sample size is very small, and perhaps most importantly, mortality rates for these grizzly bears are not yet known. However, these data indicate that some grizzly bears can apparently habituate or adapt to relatively high levels of human activity.

Anecdotal information regarding disturbance to bears around den sites has been reported but is inconclusive. Reynolds et al. (1984) reported elevated heart rates in one bear when a seismic shot detonated 1.4 km from its den and another responded to a shot 1.6 km from its den. Schoen et al. (1987) noted some grizzly bear movement within dens when fixed-wing aircraft flew within 150 meters above grizzly bear den sites. Reynolds et al.(1984) however, noted that heart rates of two monitored bears did not change during overflights. Harding and Nagy (1980) found that grizzly bears denned successfully 1.6 to 6.4 km from active mining camps but appeared to avoid drilling and staging camps by at least 1 km. In Sweden, Swenson et al. (1997) considered hunting early in the denning season a disturbance to brown bears. Swenson et al. (1997) suggested that denning bears may be more tolerant of industrial activity than humans or human activity such as hunting, survey work, shooting, fishing and dogs near the den site.

Human-caused grizzly bear mortality risk

Some human-grizzly bear interactions can result in negative outcomes that can lead to death or removal of the bear from the population:

1. Habituation, when a bear loses its natural caution around humans, often resulting from food conditioning, leaving the bear vulnerable to illegal shooting or management control actions in which a bear is killed or moved to avoid threats to humans or their property;

2. Encounters between grizzly bears and people in which people kill bears due to real or perceived threat to life or property damage; and

3. Increased exposure to black bear or other big game hunters who may mistakenly kill a grizzly bear due to mistaken identification.

Human-caused grizzly bear mortality most typically involves habituation of grizzly bears to people and their food, garbage and other attractants, or either intentional or unintentional mortality as people gain more access to grizzly bear habitat. Attractants include nearly all human and domestic animal and livestock foods, fruiting trees and shrubs near homes, and garbage. Management removal of habituated grizzly bears is a leading cause of known human-caused grizzly bear mortality in both the YGBE and the NCDE (from Montana Fish, Wildlife and Parks 2005, Gunther et al. 2005, Schwartz and Haroldson 2002, Servheen in litt. 2005a). Conflict situations caused by non-secured human attractants continue to be the major cause of bear-human conflict (Gunther et al. 2005, Schwartz and Haroldson 2001, Montana Fish, Wildlife and Parks 2001, Montana Fish, Wildlife and Parks 2005). In the past decade, the number of grizzly bear-human conflicts has increased in the YGBE (Schwartz and Haroldson 2001) and NCDE (Servheen in litt. 2005a). In the CYE, very few conflicts have been reported thus far. However, the potential for conflict is high, considering the number of unsecured attractants in grizzly bear habitat. In the CYE during the past decade, 1995 through 2005, a total of 14 known human-caused mortalities were attributed to the following causes: five to poaching; two illegal mistaken ID; one unknown; one management removal due to livestock conflict; three under investigation; and two were killed by trains (see Table A6). Further, in the past few years, three separate incidences involved moving and relocating young grizzly bears in the CYE because

they were frequenting areas near residences or garbage, and were at high risk of becoming habituated.

Continued exposure to non-secured attractants or human presence and activity without negative consequences can result in habituation. Grizzly bears are highly individualistic. As mentioned earlier, some bears can become conditioned to human presence and disturbance with little to no significant adverse effect. However others are eventually lured to human foods and attractants and become a threat to human safety. Habituation increases the potential for conflicts between people and bears. Human attractants such as food, garbage, livestock feed, and pet food pose powerful incentives for grizzly bears to use areas near people and residences. Habituated bears that obtain human food rewards often become involved in incidents where they threaten human life or property. Food conditioned bears generally experience high mortality rates; they are killed illegally or are eventually destroyed or removed from the population through management actions. Some bears, particularly subadults, more readily become habituated to humans and consequently suffer increased mortality risk. Habituated bears are more vulnerable to illegal killing because of their increased exposure to people. In the Yellowstone region, people killed habituated bears over three times as often than non-habituated bears (Mattson et al.1992).

Montana Fish, Wildlife and Parks' grizzly bear specialist program is recognized as being successful in fostering public awareness and support of grizzly bear conservation. The program is aimed at resolving conflicts between bears and people, but also reducing the potential for conflicts to arise though education and information regarding attractant storage. Since many of the efforts are preventative, quantifying effects is difficult. In any case, ample evidence demonstrates that securing human food and garbage from grizzly bears can dramatically reduce the number of grizzly bears removed through management actions (see Gunther 1994). The results of bear specialist programs are summarized biannually at IGBC Subcommittee meetings and in annual reports, such as the annual "Yellowstone Grizzly Bear Investigations", and annual reports from the Montana Fish, Wildlife and Parks grizzly bear specialists in the NCDE (Madel 1996; Wenum 2002; Wenum 2004; Montana Fish, Wildlife and Parks 2005). Montana's bear specialists report annually on progress that can be measured. For example, conflict reports detail the number of grizzly bear conflicts before and after construction of electric fencing around attractant sites (see Agency Summaries *in* Schwartz and Haroldson 2001). The grizzly bear management program on the NCDE Rocky Mountain Front began in 1988. Since that time, records indicate that the presence of grizzly bears in the region, including females with cubs, has remained stable to slightly increasing, but the level of known human-caused grizzly bear mortality has declined (Mike Madel, Montana Fish, Wildlife and Parks, pers. comm. 2002).

Roads in grizzly bear habitat also create a serious risk of mortality to grizzly bears. Grizzly bear mortality can result directly from collisions with vehicles, but more commonly, indirectly through increased exposure to and interaction with humans. The specific relationship between roads and the mortality risk to bears is difficult to quantify. The level of human use of roads is one of several factors influencing the mortality risk associated with any road. Forest roads facilitate human access into grizzly bear habitat, which directly or indirectly increases the mortality risk to grizzly bears. Grizzly bears are increasingly vulnerable to illegal and legal harvest as a consequence of increased road access by humans in Montana (Mace et al. 1996) and in the Yellowstone region (Mattson et al. 1992). In southeastern British Columbia, roads

increased access for settlers, legal hunters and poachers, the major source of adult grizzly mortality in that area (McLellan and Shackleton 1988; McLellan 1989c.) McLellan (1989a) reported that 7 of 13 successful legal hunters interviewed had been on a road when they harvested a grizzly bear.

McLellan (1989a) reported 11 human-caused grizzly bear mortalities during a 9-year period of research in southeastern British Columbia, whereas the study in the South Fork of the Flathead River, Montana, reported 13 mortalities during 6 years of research in the South Fork Study area, excluding legal mortalities. Although the British Columbia study area was roaded for gas exploration, timber harvest, and other uses, the area had very few permanent human residents and generally received lower use by humans than did the South Fork Study area, and had a very high density of grizzly bears for an interior population (McLellan 1989b). In 1994, grizzly bear population trajectories for the two study areas were computed (Servheen et al. in litt.1994). In the British Columbia study area, high survivorship rates of adult and subadult females resulted in an upward trend in the grizzly population. In the South Fork Study area, a peninsular area largely bordered by settlement, dispersed rural residences, highways and a reservoir, relatively low adult and subadult female survivorship rates resulted in an annual decline in the grizzly bear population. Adult female grizzly bear mortality was the most important factor in determining trend. Most of the known grizzly bear mortalities were attributable to humans and occurred on private lands near or adjacent to national forest lands.

This comparison illustrates that the proximity of grizzly bear populations to human population centers and resulting availability of attractants on private lands, high numbers of people using forest roads, dispersed recreation or other activity in roaded habitat, and other factors leading to increased interaction between bears and humans pose considerable risks to grizzly bears.

In the North Fork of the Flathead River Valley in British Columbia, McLellan and Mace (1985) found that a disproportionate number of mortalities occurred near roads. In the Yellowstone ecosystem, Mattson and Knight (1991) reported that areas influenced by secondary roads and major developments were most lethal to bears. Aune and Kasworm (1989) reported 63 percent of known, human-caused grizzly bear deaths on the east front of the Rocky Mountains occurred within 1 kilometer (0.6 miles) of roads, including 10 of 11 known female grizzly bear deaths. In Montana, Dood et al. (1986) reported that 48 percent of all known, nonhunting mortalities during the period of 1967 through 1986 occurred within 1 mile of roads. Recent models indicate that the relative risk of grizzly bear mortality was positively associated with human access, roads and trails or the area's human population size (Nielsen et al. 2005; Mattson and Merrill 2004). Bears were also killed by vehicle collision (Greer 1985, Knight et al.1981, Palmisciano 1986, Servheen in litt. 2005a). The Grizzly Bear Compendium (IGBC 1987) and Mattson (1993) summarized impacts reported in current literature including direct mortality from legal and illegal harvest and other factors resulting from increased human-bear encounters.

We conclude that excessive road densities in grizzly bear habitat are among the serious adverse impacts to grizzly bears, especially when located near towns or cities. Where people are abundant and Forest access is provided nearby, roads receive more routine use and higher use levels. Negative impacts associated with roads and excessive road densities influence grizzly bear population dynamics and habitat use patterns in numerous ways.

Social values and attitudes also contribute to the level of mortality risk to grizzly bears. Incidental or accidental human caused grizzly bear mortality, combined with a few people intent on illegally shooting bears, can collectively result in serious, detrimental effects to grizzly bear populations. Access management that provides adequate amounts of habitat secure from the influence of roads and high use trails, when combined with public information programs, efforts to foster local public support for grizzly bear recovery such as those of bear specialists, and law enforcement, can be instrumental in reducing mortality risks to grizzly bears by managing the present and anticipated future national forest road use levels that result from the increasing human population in western Montana.

Habitat fragmentation

Habitat connectivity is essential in maintaining the ecological functions of grizzly habitat. Connectivity allows normal use of home range, security from human-caused mortality risks, security cover and escape cover to avoid other grizzly bears, optimal opportunities for subadult grizzly bears to establish home ranges and the resulting distribution of bears across the landscape, and allows males unimpaired access to breeding partners, which promotes optimal conditions for successful reproduction. Habitat fragmentation can significantly reduce or preclude successful dispersal, movements associated with breeding behavior, or occasional migration, as well as increase the risks to bears moving through insecure habitat patches.

Within home ranges and during dispersal and home range selection movements, grizzly bears that are deterred from traveling to preferred feeding areas may experience reduced weight gain and increased risk of starvation or reduced reproductive success. High road densities, human development and activity with grizzly bear habitat can impact connectivity and bear movement. Altering preferred travel patterns results in bears using less optimal habitat, or using more resources and traveling farther to find suitable habitat. Subadult males were disproportionately killed by humans in many study areas, partly attributable to wider-ranging movements (Mattson 1993). If young bears, typically subadult males, are deterred from dispersing through secure habitat, they are more likely to range closer to people. In doing so they suffer increased risks of food habituation, mortality from hunters through mistaken identity, death due to real or perceived defense of life or property, collisions with vehicles, or control actions. Displacement into habitat already occupied by grizzly bears or unfamiliar habitat that fails to offer good bear security increases the chance of encounters with adult bears, which can lead to direct intraspecific mortality or indirect effects such as reduced fitness or survival due to stress or injuries.

Specific Effects Of The Rock Creek Mining Operations On Grizzly Bears

Displacement

The proposed Rock Creek mine would result in direct loss of 483 acres of grizzly bear habitat from the CYE recovery zone; 342 acres are privately owned lands and 141 acres are national forest, of which 115 acres are MS 1 habitat. The displacement analysis for the project included a cumulative analysis process developed by the IGBC to establish displacement distances from a

constant high noise and high activity environment (IGBC 1990 *in* USDA et al. 1998b) (see discussion 3 below for complete analysis). Based on this analysis, the 1998 BA predicted that bears would be displaced from this 483 acres and also from zones of influence around mine sites and roads (new and existing), which would result in under-use of about 7,044 acres. Upon re-examination of the net effects of this displacement, we found it important to note that grizzly bears are already displaced from about 5656 of this 7044 acres, due to existing roads not associated with the proposed mine. Additional disturbance attributable to only the mine and resulting in displacement of grizzly bears from currently undisturbed habitat would occur on less than 1400 acres.

In earlier biological opinions on this project, the Service indicated that actual displacement and under-use of habitat may occur from ridge to ridge in some places based on the steep topography surrounding the mine and facilities. To clarify this point, according to the Cumulative Effects Model displacement analysis (USDA et al.1988) (CEM) used in the BA, displacement from mine activities would result in an influence zone of between .25 and .50 miles from actual mine features and roads (BA). In some areas within the Rock Creek drainage, a zone of .25 to .50 miles from roads would reach the ridgeline. It is not likely that the displacement effects from the mine would be realized on the other side of a ridge. Therefore, the area subject to displacement effects would be no more than 7044 acres. Further, the model indicated that of the 7044 acres, 5656 acres are already affected by disturbance from existing roads not associated with the mine.

The Service expects that displacement of areas by bears would occur initially within the drainage due to heavy road use and the continual noise and activity generated by the construction and operation of the mine (see item 3 below for more discussion of displacement). Displacement effects would be most pronounced near the roads and facilities at lower elevations in the drainage, which encompass areas of spring habitat. Habitat near the mine site, facilities and roads may be under-used by grizzly bears for the life of the mine. As mentioned, grizzly bears are already displaced from 5656 acres of this area impacted by existing human activity along the Clark Fork River and along Forest roads in the 7044 acre displacement area. The area includes road FR 150, which is an existing high-use road (see discussion 3 below for complete analysis). Long-term displacement from, or under-use of MS 1 habitat within portions of the Rock Creek drainage by some grizzly bears could occur as an indirect effect from increased high-intensity human activity. Females may teach avoidance of disturbed area to cubs, extending the displacement for an unknown period of time after the mine is reclaimed.

The CEM model adjusts the level of displacement effects from habitat near existing and new roads according to the level or intensity of the disturbance (see discussion 3 below for complete analysis). The construction and operation of the mine would result in increased traffic levels on the existing access and service roads, as well as main highways in and around the CYE. The primary impact of increased traffic would be an increase in existing levels of displacement of bears from 5656 acres of habitat near the main road. Forest route 150 is already considered a high-use road and is open to the public. Although bussing of mine employees would be required and would lessen mine-related traffic on FR 150, traffic levels on FR 150 are anticipated to increase 1,120 percent over pre-Rock Creek Mine levels during the lengthy construction phase (USDA 1998b). Traffic would remain from 30 to 300 percent above existing traffic levels during the 35-year operation phase of the Rock Creek Mine. Traffic along Montana Highway

200 also would increase. Existing roads and activities associated with the Rock Creek mine would serve to inhibit bear activity within this area. Further, displacement of bears is likely on an additional 1350 to 1400 acres (approximately) due to new mine-related roads, increased road use levels, and structures and the influence zones around them. Therefore a total of about 7044 acres would be affected by the proposed action.

Noise levels would be a primary factor contributing to the displacement of grizzly bears. Construction, operation and reclamation of the Rock Creek Mine would raise background noise levels substantially during the life of the operation. Blasting during adit construction would generate sounds up to 125 dBA within 900 feet of the blast and 60-80 dBA within the Clark Fork Valley and the Cabinet Mountains Wilderness. Blasting could be heard up to a mile or more away from the construction site (MDEQ and USDA 1998). Construction equipment would generate sounds up to 100 dBA within 50 feet. Mine operations noise of 52 to 62 dBA would exceed baseline conditions. The conveyor, crushing plant and ball mill are the loudest continual disturbances, and would be heard up to a mile or more away (MDEQ and USDA 1998, page 4-154). Traffic noise on FR 150 would increase from 30 to 70 dBA.

We do not anticipate that the construction and operation of the evaluation adit would result in similar levels of displacement. Disturbance effects of the evaluation adit would not approach levels associated with the construction and operation of the mine, considering the habitat condition (moderate motorized route densities and abundant core), number of employees, level of road use along an existing open road, and disturbances generated by construction and operation of the adit. Given the existing road management in the action area, effects would be moderate. The number of employees working on the evaluation adit would increase quarterly, beginning with 20 people in the first quarter and 55 during the fourth and last quarter (see *Asarco Rock Creek Exploration Project: exploration adit cumulative effects and baseline data*, in litt. 1992), as compared to over 300 during construction and operation phases. Crews would assemble at the office area just off Highway 200 and from there would be bussed to the adit site. Bussing of employees would minimize traffic on FR150, which is already an existing, high-use open road. Employees would be sourced from the Troy mine and would likely live in the Troy or Libby area (C. Rife, Revett Silver Co. pers. comm. 2006). Noise generated by construction and blasting for the adit would occur sporadically for about two weeks (John McKay, Kootenai National Forest, pers. comm. 2005). Blasting would then mostly occur underground. The noise generated would be short and sporadic and likely not audible to degrees that would significantly impact grizzly bear behavior. Based on experience at the Troy Mine, blasting noise would be eliminated at the surface after the adit has advanced approximately 500 feet underground (C. Rife, pers. comm. 2006). Electrical power at the adit would be sourced via a buried power line in the existing road thereby greatly reducing noise by eliminating the need for generators (C. Rife, pers. comm. 2006).

Mitigation plan measures to reduce or avoid displacement

The Service has concluded the conservation measures in the mitigation plan would adequately offset impacts to grizzly bears from both direct habitat loss and displacement from habitat due to disturbances generated by the mine. Several factors, including those outlined in the following paragraphs, lessen displacement and/or moderate the impact of displacement on grizzly bears in

the action area.

1. **We anticipate that displacement of grizzly bears would occur within the Rock Creek drainage, but these bears would likely have sufficient alternative habitat available elsewhere within their home ranges:**

- **Substantial core areas and moderate road densities would provide secure alternative habitat for grizzly bears displaced from near the mine site (see discussion 4 below for details).** The proposed action would not result in less core habitat in any BMUs within the action area (USDA 2003). The BMUs 4 (127 square miles), 5 (109 square miles), and 6 (100 square miles) encompass approximately 81000, 70000, and 64000 acres respectively. These BMUs provide substantive core areas of approximately 50000, 40000, and 35000 acres respectively. The existing and resulting levels of secure core, and the seasonal habitats within them, would provide essential and available habitat for grizzly bears in BMUs 4, 5, and 6. Large core areas are also provided in the surrounding BMUs 2, 7, and 8 (see Table A10). Core areas in BMUs 2, 5, 6, and 7 are well connected through the action area and encompass portions of the Cabinet Mountains Wilderness.

  As mentioned earlier, the Service considers core areas extremely important in partially mitigating the displacement impacts of the proposed action. Core areas in each of the three BMUs 4, 5, and 6 (63, 59 and 54 percent) are comparable to or larger than the core area within the average female home range reported in research (55 percent) (Wakkinen and Kasworm 1997) (see Table A13). Each of the home ranges used to develop the average were ranges of female who were successful in surviving to adulthood and producing cubs. Similarly, BMUs 2, 7 and 8 provide more core area than the average amount reported in research. Core areas in BMUs 2 and 7 are substantial at 77 and 67 percent. The BMU 8 provides 56 percent core and BMU 22 provides 51 percent.

  Outside core areas, the proposed action would slightly decrease both open and total motorized route densities (USDA 2002b). Four miles of new road would be required and five miles of existing road would be reconstructed, but these road miles would not substantially expand the existing spatial distribution of roads in the BMUs (e.g. the existing areas impacted by human activity) and so would not increase total or open road densities, and would not decrease core area. Open motorized route densities within BMUs 4, 5, and 6 are near or lower than levels reported in average female home range (Wakkinen and Kasworm 1997). Of the remaining four BMUs in the action area (2, 7, 8 and 22), three of four have lower open road densities than that reported in research. Open motorized route density in BMU 4 (37 percent) is higher than the average reported in the research (33 percent), in part due to the presence of Highway 200 along the unit's boundary and Highway 56 which bisects the unit. Total motorized route densities in the action area are likewise near or lower than the average reported in the research. Only BMUs 6 (32 percent) and 22 (37 percent) have higher total road densities than that reported in the research (26 percent). Total motorized route density in BMU 6 is higher than the average due in part to Highway 200 which runs along its boundary and 6 sections of private corporate timber lands. Open and total motorized route densities in nearby BMUs 2, 7 and 8 are below the research average. Habitat effectiveness would be

reduced by two percent in BMU 4, one of seven BMUs in the action area. The proposed action would not decrease habitat effectiveness for grizzly bears in the remaining six of seven BMUs. The habitat effectiveness values in BMUs in the action area range 65, 69, 70, 71, 75, 80, and 83 percent, compared to the previous Forest standard of 70 percent (see Table A7).

- **A total of 2,450 acres of mitigation properties would be acquired; a portion *prior* to construction of the evaluation adit, a portion *prior* to construction of the mine and the remaining portion *prior* to the production phase (see Tables 1 and 3, and discussions under 3 below).** As properties are acquired, access management within BMUs 4, 5, and 6 would improve (as required by the mitigation plan). Disturbance impacts within spring habitat within the Rock Creek drainage and in other portions of BMUs 4, 5, and 6 would be alleviated to varying degrees, depending upon existing access, development on the properties acquired and proximity to spring habitat. Spring habitat may be conserved if acquired parcels contained spring habitat, or had existing access via roads through spring habitat, or could require roads through spring habitat for access in the future. See discussion under **3** below.

- **Based on the best available information, grizzly bear density in the Cabinet Mountains is currently relatively low.** Grizzly bear home ranges are large and overlap. With the low number of grizzly bears in the Cabinet Mountains at this time, about 15, it is unlikely that density-induced stresses currently affect adult female grizzly bears within their home ranges there. More likely, they have adequate amounts of space and habitat. As described earlier, we estimate that of the 15 grizzly bears, currently three to five adult females occupy the Cabinet Mountains. Based on habitat and area in each BMU, the Cabinet Mountains could likely support at least 14 female grizzly bears (W. Kasworm, pers. comm. 2006). In the action area, one or possibly two reproductive-aged females appear to be using BMUs 4, 5, and 6. During the six-year period from 1996 to 2001, at least one female grizzly bear with young was reported in each of BMUs 2, 4, 5 and 6 and in nearby BMU 7 as well (Kasworm et al. 2002). The proximity of the BMUs, the number of young present, and whether these young were cubs or yearlings/two-year-olds in the 1996 and 1997 data suggests that at least two reproductive age females were present. The 2000 data may be a sighting of one of the same females with a succeeding litter and so likely cannot be classed a third female. No females with young were reported in BMUs 8 or 22 to the south of the action area during that same period. During the period from 2000 through 2005, females with young (including cubs/yearlings/two-year-olds) were reported in five of 14 Cabinet Mountain BMUs: 2, 5, 6, 18 and 21 (Kasworm et al. in litt. 2006a).

- **The area affected by disturbance generated by the mine and roads is relatively small compared to the size of an average grizzly bear home range, and represents about five percent of the size of the life range of a female grizzly bear native to the Cabinet Mountains, so alternative habitat would be available to bears if displaced from areas near the mine site.** Grizzly bear home ranges are variable and range from approximately 17,000 acres (68 square kilometers) to 640,000 acres (2,600 square km) in the CYE (Kasworm et al. 2002). Male grizzly bears typically have larger home ranges

than females. However, female grizzly bear home ranges are also large; native adult female life ranges in CYE averaged approximately 165,000 acres (668 square kilometers; 258 square miles)(Kasworm et al. 2002). One of these native females lived in the Cabinet Mountains and had a life range of 143,000 acres (579 square kilometers; 224 square miles). The 7044 acres area from which grizzly bears would be displaced is relatively small compared to the size of an average grizzly bear home range. Further, of the 7044 acres, 5656 acres are already impacted by disturbance from existing roads.

- **Spring habitat remains available in the action area.** The area from which grizzly bears would be displaced is primarily spring habitat; a net loss of freely available spring habitat for grizzly bears would result during the construction phase and operation phase of the Rock Creek Mine. The proposed project is likely to displace grizzly bears from the active mine, mill and tailings sites, the access road and utility corridors, highly-used trails and other recreational areas, and possibly the surface conveyor that carries waste products from the exploratory adit to the mill site. Most of the 7000 acres impacted by the disturbances of construction and operation of the mine occur in low-elevation spring habitat, which is thought to be less abundant than other seasonal habitats in this ecosystem. Up to 6400 to 6500 acres of spring habitat would be less available and likely under-used by grizzly bears. Much of this spring habitat is already influenced by existing disturbance within the 5656 acre zone along existing roads in the area, but displacement effects would likely increase due to the substantial increase in level of human activity and traffic volumes on the roads due to the mine and at the mine sites (W. Johnson, pers. comm. 2002).

  As mentioned, core areas in the action area are large. In many ecosystems, core area occurs at higher elevations and lacks quality spring habitat. Higher elevation habitat in the Cabinet Mountains tends to provide abundant summer habitat (BA 1998). However, the best information indicates that core areas in the affected BMUs do contain spring habitat, defined by aspect and elevation. Spring habitat occurs in proportionately greater amounts in core than in the BMU as a whole (from BA 1998), although some of this area would contain expanses of open rock and scree slope. Potential future improvements or additions to core area are possible due to acquisition or easement of mitigation land parcels. As required in the mitigation plan, once the Forest acquired or obtained easements on parcels, elimination or reduction of access routes or elimination of the potential for future routes leading to or crossing through the parcels would create or preserve core habitat for grizzly bears.

  To compensate for the displacement from habitat by bears, the Forest conducted a spring habitat analysis using BAA scales. The BAA scale analysis was required by the Forest Plan prior to 2004. In 2004, the Forest Plan amendment replaced BAA scale analysis with road density and core area management at larger BMU scales. However, the BAA scale mitigation for compensating for the reduction in available spring habitat remains useful and will be retained for this project (W. Johnson, pers. comm. 2005). For the three BAAs directly impacted by the mine, five BAAs were identified to provide "displacement habitat". "Displacement habitat" would be kept free from major activities throughout the 30-year life of the mine. These five BAAs would serve to secure a greater

amount of spring habitat for grizzly bears from major activities than the amount of spring habitat impacted by the project in the affected BAAs. The five displacement BAAs would secure 177 more acres of spring habitat (between 6577 and 6677 acres)(defined east, west, and south aspects) below 5000 feet and 7,452 more acres above 5,000 feet than that found in the three BAAs directly affected during the proposed Rock Creek Mine project. As mentioned previously, the displacement mitigation habitat would not increase the net amount of spring habitat available to grizzly bears, but overall would ensure a larger area of spring habitat remain free of major disturbance during operation of the mine, than the amount of spring habitat affected by the mine.

2. **The mitigation plan measures include 2350 acres of replacement habitat to reduce or mitigate for grizzly bear displacement and habitat loss, and an additional 100 acres to offset potential fragmentation.** The mitigation plan stipulates that 2350 acres of private lands in the CYE be acquired by Revett Silver Company through fee-title transfer or perpetual conservation easements (Appendix B) to compensate for both direct habitat loss and additional loss of habitat use by grizzly bears due to disturbance. An additional 100 acres is required to contribute to offsetting potential fragmentation of grizzly bear habitat in a north to south corridor along the Cabinet Mountains divide, east of the mine. Conservation easements would be held by the Forest. The revised mitigation plan requires perpetual conservation easements to ensure long-term conservation of the habitat parcels for grizzly bears whose home ranges include these areas.

The proposed Rock Creek Mine would physically alter 483 acres (see Table A2), of which 141 acres are national forest (115 are MS 1 habitat), and 342 acres are privately owned. The 1998 BA determined that displacement would impact another 6,561 acres, assuming bears would avoid an area 0.25 to 0.50 mile around physically disturbed sites and human travel routes. Therefore, the mine would contribute to under-use of (displacement from) approximately 7044 acres (of which 73 acres were already impacted by existing roads and 5656 acres were already affected by disturbance from existing roads) by grizzly bears for a period of time of about 35 years. Actual displacement of grizzly bears might occur as far as from ridge line to ridge line in some areas of the Rock Creek drainage; due to steep topography, the 0.25 to 0.05 mile influence zone would span from the road or site to the ridgeline in some areas.

As explained previously, the term “displaced” does not necessarily mean that grizzly bears would totally avoid an area, or be excluded in some way from ever using an area. Displacement is used in general terms to describe “under-use” of habitat. In research, “significant under-use” of habitat means that bears use habitat “less than expected” compared to its availability. For instance, a given habitat may account for 30 percent of an analysis area, but may only receive 15 percent of bear use. Depending upon the confidence interval surrounding the 15 percent use, this may amount to statistically significant less-than-expected use of habitat, even though some use by bears is occurring. Displacement of grizzly bears from an area can range from short-term or diurnal avoidance to more significant long term under-use of habitat, depending upon the season,

quality of habitat affected, and the age and sex of grizzly bears affected. The following paragraphs describe how mitigation acres were derived.

The mitigation plan requires a total of 2450 acres of private land within the action area be purchased or secured through perpetual conservation easements, and managed to conserve grizzly bears. The 2350 acres of replacement habitat acreage required to offset displacement on 7044 acres was determined by using the Cumulative Effects Model (CEM) (USDA et al. 1998) (BA 1998). Areas impacted by disturbance were assigned "compensation levels." Compensation levels assigned the amount of replacement or mitigation habitat required for each acre of disturbed habitat and influence zones. Physically disturbed areas (Table A11) were assigned a compensation level of 100 percent. A compensation level of 100 percent means that the ability of the area to support bears has been reduced to 0 percent of its potential to support bears without the mine or existing disturbance feature. A compensation level of 100 percent requires a 1:1 disturbed to replacement acre mitigation. All physically disturbed sites (483 acres) were assigned compensation of 100 percent for each acre lost to development (Table A11).

Table A11. Approximate acres of surface feature disturbances, influence zones, Cumulative Effects Model compensation levels and required replacement habitat associated with the proposed Rock Creek Mine (data from BA 1998).

New Project Features	**Acres disturbed by site development or influence zone**	**Compensation factor (level)**	**Total Replacement Habitat Required (rounded acres)**
Tailings impoundment	368acres	x 1 (100%)	368 acres
Influence zone	486 acres	x .9 (90%)	437 acres
Mill site	41 acres	x 1 (100%)	41 acres
Influence zone	230 acres	x .9 (90%)	207 acre
Evaluation adit and support facilities	10 acres	x 1 (100%)	10 acres
Influence zone	62 acres	x .7 (70%)	43 acres
New total roads	64 acres	x 1 (100%)	64 acres
Influence zone	54 acres	x .7 (70%)	38 acres
Ventilation adit	0 acres		
Influence zone			10 acres
SubTotal (new features)	**1315 acres**		**1218 acres**
Existing Project Features			
Existing roads	73 acres		0 acres
Influence zone	5656 acres	x .2 (20%)	1131 acres
Total New and Existing Features	**7044 acres**		**2349 (2350) acres**

Each of these developed sites or features was then buffered by either a 0.25 or 0.05 mile influence zone, depending upon the level of the expected disturbance. The areas within each influence zone were then assigned compensation levels of between 70 to 90 percent, depending upon the intensity of the disturbance. For instance, a compensation level of 90 percent means that the effects of the mine would reduce the ability of the influence zone to support grizzly bears to 10 percent of its potential, and therefore the replacement acres required were 90 percent of the acres in the influence zone itself.

Note that the difference between the required 2350 acres of replacement habitat and the 7044 acres where displacement is expected to occur results primarily from the replacement acres required for the 5656 acre displacement area around 73 acres of *existing roads*. These roads already exist and already have a displacement effect on grizzly bears within the influence zones surrounding them. According to the CEM, the influence zone extends 0.25 miles from roads characterized as having "low linear motorized use." Existing roads in the action area were characterized this way, and the zone of influence around them totaled 5656 acres. The CEM model predicts that "low linear motorized use" of roads would reduce the ability of the surrounding influence zone to support grizzly bears by 70 percent, or in other words, to 30 percent of its potential.

In the CEM analysis, the mining company was not held accountable for existing effects of the 73 acres of roads or the 5656 acre influence zone because this disturbance was already in the baseline and not caused by the mine. Further, the Forest had already accounted for this displacement and moderated its effect on grizzly bears by adhering to its road density limits (standards) within the affected BMUs (see discussion 4 below). Therefore, of the approximately 7044 acre disturbance zone that would be affected by the proposed action, 5656 acres are already impacted by 73 acres of existing roads and use on roads. The ability of the 5656 acre influence zone near existing roads to support grizzly bears has already been reduced by about 70 percent.

The mine would cause a significant increase in traffic on these existing roads. Thus, in accordance with the CEM, the categorization of existing roads was changed from "low motorized linear use" to "high motorized linear use." According to the CEM, the increase in road use from "low" to "high" linear motorized use was expected to decrease the ability of the influence zone to support grizzly bears from the existing 70 percent by another 20 percent, or by a total of 90 percent. In other words, with the effects of the proposed action, the ability of the influence zone to support grizzly bears would be reduced to about 10 percent of its potential. Although the mining company was not required to offset the *existing* impacts within the 5656 acre influence zone, the mitigation plan requires offsetting the impacts of *increased* levels of disturbance associated with higher road use. The plan requires acquisition or easement on 1131 acres (20 percent of 5656 acres) of replacement habitat to compensate for the increased use of existing roads (see Table 11).

This replacement habitat strategy accounted for following:

- Although bears may still use influence zones, the effects of the project would substantially diminish the frequency or probability of their using the zones.

- Displacement effects attributable to the mine itself were identified and then added to existing displacement effects from roads already in the environmental baseline.

- The amount of replacement habitat required to adequately mitigate for displacement of grizzly bears was determined through an objective process based on the best information regarding levels of grizzly bear displacement caused by disturbance.

Additional features and effects of the mitigation plan related to replacement habitat:

- The revised mitigation plan would further require acquisition of fee title or perpetual easement on *an additional 100* acres of mitigation habitat (for a total of 2450 acres) to specifically address habitat fragmentation with a north to south habitat corridor east of the mine site, near and along the divide. Any acres acquired through fee title would be eventually transferred to Forest ownership, as would conservation easements. The mitigation plan specifies: "Secure or protect (through conservation easement including road closures, or acquisition in fee) from development (including but not limited to housing, motorized access) and use (timber harvest, adverse grazing, mining) 100 acres of replacement habitat that will enhance the north to south habitat corridor in the Cabinet Mountains." These parcels are to be acquired *prior* to the beginning of the evaluation adit.

- The mitigation plan specifies: "Secure or protect (through conservation easement including road closures or acquisition in fee) from development (including but not limited to housing, motorized access) and use (timber harvest, adverse grazing, mining) replacement habitat to compensate for acres lost by physical alterations, or acres with reduced habitat availability due to disturbance." Of the 2450 acres of mitigation properties required, 153 acres are required to be acquired *prior* to the development of the adit phase, 1783 acres are to be acquired during the evaluation adit phase *prior* to mine construction; the remaining acres are to be acquired *prior* to production phase (see Table A1 and Table A3). All 2450 acres are to be acquired within four or five years of the initial activities associated with mine construction.

- Revett has already secured 273 acres within the north-south corridor (Carson Rife, Revett Silver Company, in litt. 2005) by purchasing fee title. This property was ranked as number 2 in the priority ranking in "*Replacement Habitat Assessment for acceptable lands to consider*" (explained below). This property is valuable to conserving grizzly bear habitat in the north-south corridor because development of the property or access to or from it would be precluded by either transfer of ownership to the Forest, or by permanent conservation easement. If previous

landowners had requested access for homebuilding or logging, for instance, about one to four miles of new or reconstructed road could have been required and core area would have decreased within the corridor (W. Johnson, pers. comm. 2006).

- Each acquisition (or protection through easement) of privately-owned grizzly bear habitat would not necessarily increase the amount of habitat available to grizzly bears, because some private lands are undeveloped and currently available to bears. However, the mitigation lands were prioritized according to habitat quality *and risk of being developed in the future*, unless acquired by the Forest through fee title or easement. Thus, the long-term management of these lands is important to the conservation of grizzly bears and their habitat. On some private parcels with no existing roaded access, there was risk that the Forest may be required to provide reasonable private access in the future. Therefore, Forest acquisition of or easement on mitigation habitat that is *at risk* of development would benefit grizzly bears in the southern Cabinets over the long-term, by precluding access, development, or other management adverse to bears.

- Some of the potential mitigation properties have existing developments, and several potential parcels already have roaded access. Removing the developments and roaded access to these parcels would increase habitat available to bears, decrease future grizzly bear mortality risk due to sanitation issues and illegal mortality, as well as reduce existing displacement risks due to access and human activity. Depending upon the specific property, eliminating existing access (or preventing access to them in the future) would reduce or eliminate the potential for displacement on many acres in addition to the 2450 acres required. The mitigation plan calls for a total of 2450 acres to compensate for acres lost through physical alterations or acres with reduced habitat availability due to disturbance. Each of the properties is valuable to grizzly bear habitat conservation and would benefit grizzly bears if acquired. The specific location of mitigation properties and the roads on them and/or leading to them are as important as the total acres required. Acquisition or easement of parcels precludes development on any parcels acquired, and also allows elimination of the motorized access across Forest lands that have roads or motorized trails leading to the parcels. Elimination of such access routes could improve conditions on more acres than the mitigation properties alone. Acquisition of certain lands would allow the Forest to reduce or eliminate displacement of bears (or potential future displacement effects) on lands adjacent to them or on lands where access roads lead to them. Each acquisition would be reviewed by the Oversight Committee, and approved by the Forest in coordination with the Service, to ensure its value as grizzly bear habitat over time and to lessen the effects of displacement.

- The mitigation plan requires habitat enhancement on 484 acres. Habitat enhancement has potential of improving bear habitat if fruiting shrubs and/or spring vegetation can be enhanced, possibly through fire, and security habitat around these key habitats can be assured through road closures or other access restrictions.

- The mitigation plan would require that as properties are acquired, management of access in BMUs 4, 5 and 6 would be more conservative than that required in the Forest Plan. This would further reduce displacement of grizzly bears from habitat.

- Most mitigation properties required by the mitigation plan have not yet been acquired, and habitat enhancement actions are not yet specified. Therefore, the specific mitigation impact or reduction in potential displacement of grizzly bears that would result after acquiring these properties, implementing access management and implementing habitat enhancement activities cannot be accurately predicted at this time. However, in coordination with the Service, the Forest would assess and approve each of the potential parcels, ensuring that they each contribute to offsetting the impacts of the proposed Rock Creek Mine. A number of potential lands have been identified. The revised mitigation plan relies on the "*Replacement Habitat Assessment for acceptable lands to consider*" (not available to the public until replacement habitat mitigation is completed). The Service was involved in the development of the Replacement Habitat Assessment, which identifies many potential mitigation habitat parcels and prioritizes them according to location, development potential, and potential contribution to grizzly bear habitat security and improvement. The plan also states that **the Forest Service would have final approval of mitigation acres** and associated covenants prior to recording. The Forest would approve in writing and describe how the properties to be acquired would meet the habitat assessment requirements.

3. **Some grizzly bears may adapt to the consistent, repetitive noise provided that natural food availability and quantity are not reduced and they suffer no adverse consequences associated with the mine activity.** In the South Fork of the Flathead River in Montana, which encompassed multiple use national forest lands, adult female bears were likely to avoid highly roaded habitat and roads with high levels of use (Mace et al. 1996, Mace et. al 1999). Other research indicates that resident grizzly bears are more likely to habituate to human activity if the use is spatially and temporarily predictable, and the bear population is not hunted (Cronin et al. 1999, Mattson 1993, McLellan and Shackleton 1989a). Such conditions can exist along major roads and highways. Waller and Servheen (1999) reported five of nine grizzly bears radio-collared in the U.S. Highway 2 corridor in Montana, south of Glacier National Park, maintained home ranges that were centered over the highway corridor, and remained in the highway corridor during their active season. However, they found that grizzly bears strongly avoided areas within 500 meters of the highway (Waller and Servheen 2005). In Yellowstone National Park, Mattson et al. (1987) found displacement effects surrounding developments and reported that habituated adult females that used areas near developments suffered higher mortality rates than more wary bears. They suggested that sanitation of developments (securing attractants from bears) would allow adult females to occupy habitat near development and yet not incur the increased mortality risks typically associated with habituation. These results are consistent with those reported in Yonge (2001) and Tyers (unpublished 2006) in the Cooke City basin, in Montana, outside of

Yellowstone National Park. There, grizzly bears near Cooke City consistently foraged in very close proximity to high levels of human use if cover was sufficient and energetically efficient feeding opportunities were present (Yonge 2001). Also near Cook City, the New World Mine reclamation project had minimal effects on grizzly bears, in part because reclamation activities were temporally and spatially predictable and people associated with the work were carefully regulated against carrying firearms or having attractants available to grizzly bears (Tyers, unpublished 2006).

Grizzly bears would initially be displaced from about 7000 acres in the drainage due to high levels of human activity. Grizzly bears are already displaced from about 5656 acres of this area, as described earlier. However, the activities associated with Rock Creek Mine would become predictable, routine and concentrated along FR 150, especially as the operation phase is implemented. Habituation of grizzly bears to these activities would allow bears more use of surrounding habitat, but would be detrimental if human food or attractants were available. Food-conditioned bears typically become threats to people and so are often euthanized through management actions. Attractant storage measures would be implemented at the mine site, and routinely inspected by the State grizzly bear specialist, funded by Revett. Employees would be highly informed of the importance of attractant-storage issues through programs developed by the State grizzly bear specialist. Mine employees would be prohibited from carrying firearms when on duty. Public use of roads would occur, but illegal shooting would be discouraged by the presence of mine employees and associated traffic on the road. With full implementation of these measures, grizzly bears could potentially habituate to the activity and disturbance along FR 150 and use habitat nearer the mine site without negative consequences from mine activities.

We anticipate that the displacement impacts related to mine-generated disturbance within the Rock Creek drainage on resident female grizzly bears would decline as time goes on, although not entirely. Over time, we expect the potential for adverse consequences to grizzly bears frequenting areas near the mine site would be lowered because of effective sanitation, information and education mitigation efforts (see lists under 1, 2, and 3 of section: *Mitigation plan measures to reduce risk of grizzly bear mortality*, found later in this document). However, use of this habitat by grizzly bears may result in habituation to human presence. This habituation in turn may make less wary bears more vulnerable to human-caused mortality if they attempt to use other developed areas within their home ranges or, especially in the case of subadults, other areas to which they may wander or be displaced, such as residential sites. The two State grizzly bear specialists and the law enforcement officer would improve the level of information on co-existing with grizzly bears that is provided to area residents. The bear specialists would work within the communities to reduce the risk of attractant-related conflicts. Reducing the potential for such conflicts in communities within and outside the immediate action area is intended to contribute to offsetting the risks associated with grizzly bears habituated to people and human activity at the mine.

The specific effects of such habituation on specific grizzly bears in the area is difficult to predict, as is whether bears that become accustomed to mining activity and use the

habitat in the Rock Creek drainage would retain some wariness of people. Although grizzly bears are not hunted in the contiguous United States, people in the area would use trails and areas of the drainage further from the mine and mine activity for dispersed recreation, carry firearms and use the area for hunting. The sporadic disturbance generated by dispersed recreation and hunting would likely serve to keep some grizzly bears wary of people; grizzly bears more often flee from encounters with people when on foot or where human access and use is not spatially or temporally predictable (Jope 1985, Gunther 1990, and Albert and Bowyer 1991 *in* Mattson 1993; McLellan and Shackleton 1989b). Such activities present a greater direct mortality risk (for instance, malicious or accidental shooting) for habituated bears that do not retain some wariness of people. The programs conducted by bear specialists would increase public awareness of the presence of grizzly bears and bear behavior.

In summary, we expect female grizzly bears, especially females with cubs, would under-use or avoid habitat near the mine sites and roads. Such displacement is probably already occurring to some extent, as Forest road 150 is an open road, but displacement potential would increase with mine activity. As time goes on, however, these females or others are likely to regain the use of some areas in the Rock Creek drainage at higher elevations further from the roads and disturbance, especially to take advantage of quality summer or fall habitat. Grizzly bears may habituate to the noise and activity of the mine without suffering the negative consequences of habituation by retaining wariness of less predictable or routine human activity, such as dispersed recreation. We expect that displacement would be most significant during the construction phase, as adult female bears using the Rock Creek drainage would have to adjust to the newly increased human activity. As time goes by, we expect that the potential for impaired reproduction would decline as bears adjust by habituating to the disturbance or by using alternative habitats within their home ranges. Over the short- and long-term, the severity of the effects of displacement of grizzly bears from the project area would be alleviated by substantial amounts of core habitat and moderate motorized access levels in the action area (see discussion 4 below) and acquisition of replacement habitat (see discussion 3 below). Also, the following sections and discussions describe how the effects of displacement on the CYE grizzly bear population would also be moderated by continued augmentation, and improved connectivity between the Cabinets and the Yaak portion of the CYE.

4. **Displacement within the BMUs would be moderated by Forest Plan standards that address habitat condition and displacement.** The 2004 Forest Plan amendment replaced previous access management standards and assessment criteria with subunit-specific access standards, in accordance with IGBC recommendations (IGBC 1994 and 1998). Project compliance with the 2004 amendment requirements is discussed below. However, habitat effectiveness and some BAA measures originally calculated for the proposed action and parts of the analysis remain biologically informative, and therefore are summarized here.

Habitat effectiveness is one measure of the impacts of human activities on grizzly bears. Habitat effectiveness is measured by identifying a zone of influence around open roads, logging activities, and other high-impact human activities in order to quantify the

remaining secure habitat outside the zone of influence. Road density, core area, and BAA displacement analyses are other measures of these impacts. These analyses provide a measure of the degree to which a bear must alter routine behavior in response to human activities, or the degree to which it is displaced.

Habitat effectiveness *Prior to the 2004 amendment, the Forest Plan standard was 70 percent or more of secure habitat (habitat effectiveness) within a BMU.*

Summary BMUs 5 and 6 would provide 70 percent or more habitat effectiveness during the project or after reclamation. Currently, habitat effectiveness in BMU 5 is 75 percent, which more than meets the prior 70 percent standard, and the project would not change habitat effectiveness (USDA 2002b and 2003). Current habitat effectiveness in BMU 6 provides 69 percent, and the proposed action would increase habitat effectiveness to 70 percent or higher. BMU 4 provides 65 percent. The proposed action would decrease habitat effectiveness an additional 2 percent in BMU 4, the BMU most directly impacted by the mine. Habitat effectiveness in this BMU will likely never reach the standard of 70 percent due to the influences of Highways 200 and 56. The proposed action does not affect habitat effectiveness in BMUs 2, 7, 8, or 22, which overall provide high habitat effectiveness values: 83, 80, 70 and 71 percent habitat effectiveness respectively (see Table A7).

Displacement habitat BAAs *Prior to the 2004 amendment, the Forest Plan standard was to provide displacement habitat in an undisturbed BAA adjacent to each BAA impacted by a major activity.*

Summary The project meets the previous standards or assessment criteria. The results of this analysis indicated 5 displacement BAAs were required to offset the loss of spring habitat within the 3 BAAs directly impacted by the major activity (mine). Five displacement BAAs would be provided.

Open and total motorized route density *The 2004 Forest Plan amendment limited open motorized route densities exceeding 1 mile per square mile to no more than 36 percent, 30 percent and 34 percent of BMUs 4, 5, and 6 respectively. The amendment limited total motorized route densities exceeding 2 miles per square mile to no more than 26 percent, 23 percent and 32 percent of BMUs 4, 5, and 6 respectively.*

Summary The proposed action would meet the access requirements of the amended Forest Plan. The proposed action would not substantially change motorized route densities. Open and total motorized route densities would not change, or would slightly decrease with implementation of the proposed action (Table A12).

The proposed action would not change motorized route densities in BMUs 2, 7, 8, or 22. Current route densities in the action area are moderate and provide conditions suited for use by grizzly bears. All but BMU 22 meet or are within three percent of meeting Forest Plan standards for open or total motorized route density. Further, in BMUs 4, 5, and 6, open and total route densities would remain the same or decrease (improve), and meet or

provide slightly better access management conditions than required by Forest Plan standards (Table A12). The exception is BMU 4, which is within one percent of open motorized route density standards, and would not change. The Forest Plan includes a time frame/schedule within which all BMUs will eventually reach standards.

Discussion The IGBC (1994,1998) recommended managing both open and total motorized route densities and providing adequate core areas for grizzly bears, based on research conducted within specific ecosystems. The Service endorsed this strategy to limit the effects of road densities on grizzly bears. Because of scale and the effects of motorized administrative use of closed roads on grizzly bears, management of core area and open and total route densities outside of core at the BMU scale is a better indicator of habitat security for grizzly bears than are displacement BAAs. As mentioned earlier the 2004 Forest Plan amendment incorporated management of route densities and core and discarded management on smaller BAAs scales.

The proposed action would not increase open or total motorized route densities, or decrease core area, in any BMU (Table A12). Open and/or total motorized route densities would decrease (i.e. improve) slightly in BMUs 4, 5, and 6.

Table A12. Percent of BMUs with open motorized route density exceeding 1 mile per square mile (OMRD) and total motorized route density exceeding 2 miles per square mile (TMRD) (data from USDA 2002b; USDA in litt. 2006).

	Percent of BMU**					
	BMU 4		BMU 5		BMU 6	
	OMRD	**TMRD**	**OMRD**	**TMRD**	**OMRD**	**TMRD**
Forest Plan Standard	36	26	30	23	34	32
Baseline 2005 (USDA in litt. 2006)	37	26	27	24***	34	32
Net percent change due to Rock Creek Mine (USDA 2002b)*	0	-1	-1	-1	-1	0

*Net change in road densities as a result of the Rock Creek Mine construction and operation, including full implementation of the proposed road closures in the BA, but **not** including mitigation lands.
**For comparison, 33 percent of an average female home range exceeded 1 mile per square mile OMRD and 26 percent exceeded 2 miles per square mile TMRD (Wakkinen and Kasworm 1997).
***TMRD increased by 1% in 2005 due to road construction on private land (U.S. Forest Service, in litt. 2006).

Open and total motorized route densities in BMU 6 are elevated by roads on private corporate timber lands (6 sections) in the BMU and by Highway 200. The project would slightly decrease open motorized route density in BMU 6, and would not change total motorized route densities in BMU 6 (see Table A12). If route densities on private lands remain similar to existing conditions, access conditions would meet or be slightly better than Forest Plan standards for BMU 6, during and after the proposed action.

In BMU 4, open motorized route density is elevated by Highways 200 and 56. The project would not increase open motorized route densities further. The Rock Creek Mine

road closures identified in the BA and revised mitigation plan (MDEQ and USDA 2001) would result in limiting high total motorized route densities to less than 26 percent of BMUs 4 and 5. If route densities on private lands remain similar to existing conditions, access conditions would meet or be slightly better than Forest Plan standards for BMU 4, during and after the proposed action.

Four of the seven BMUs within the larger action area have open motorized route densities (exceeding one mile per square mile) that are equal to or less than that within the average female home range as reported in Wakkinen and Kasworm (1997) and required by the Forest Plan amendment (see Table A8; and Appendix D). The proposed action would result in slight improvements (decreases) in open motorized route densities in BMUs 5 and 6. With implementation of the proposed action, five of seven BMUs would then have open motorized route densities similar to or slightly less than that in the average female home range as reported in research, meeting or providing better conditions than Forest Plan standards.

Four of the seven BMUs within the action area have total motorized route densities (exceeding two miles per square mile) that are comparable to or less than the average within a female home range as reported in research (Wakkinen and Kasworm 1997) and required by the Forest Plan amendment (see Table A9). The proposed action would result in slight improvements (decreases) in BMUs 4 and 5 (see Table A12). The acquisition or easement of mitigation lands would also either further reduce existing motorized route densities or prevent future increases in motorized route densities by obviating the need for access to privately-owned in-holdings.

Core area *The 2004 Forest Plan amendment required core areas of 63 percent, 60 percent, and 55 percent in BMUs 4, 5, and 6 respectively, and the incidental take statement in the 2004 biological opinion on the Forest Plan amendment requires no permanent loss of core area.*

Summary The proposed action would meet the requirements of the 2004 Forest Plan amendment and the 2004 incidental take statement in the biological opinion on the amendment (USDI 2004). The proposed action would not result in a reduction of baseline core area (USDA 1998b) in any BMUs. The biological opinion on the 2004 Forest Plan amendment concluded the proposed access management was not likely to jeopardize grizzly bears. Across the action area, core area exists in substantial amounts for use by grizzly bears and the proposed action would not decrease core area.

Discussion Core area currently comprises 63, 59 and 54 percent of BMUs 4, 5 and 6 respectively (USDA in litt. 2006a) (Table A13). The amount of core habitat would not decrease in any BMU and could improve further as a result of the acquisition or easement of mitigation properties associated with the proposed Rock Creek Mine project. The Service considers core areas extremely important in partially offsetting the impacts of the proposed action. The existing and resulting levels of secure core, and the seasonal habitats within them, would provide essential habitat for grizzly bears in BMUs 4, 5, and

6. Further, core areas in adjacent BMUs 2 and 7 are substantial at 77 and 67 percent. The BMU 8 provides 56 percent core and BMU 22 provides 51 percent.

Table A13. Percent core area in BMUs (data from USDA 2002b; USDA in litt. 2006a).

	Percent BMU 4	Percent BMU 5	Percent BMU 6
Forest Plan Standard	63	60	55
Baseline 2005 (USDA in litt. 2006a)	63	59***	54***
Net percent change due to Rock Creek Mine (USDA 2002b)*	0	0	0

*Net change in motorized route densities as a result of the Rock Creek Mine construction and operation, including full implementation of the proposed motorized route closures in the BA, but **not** including mitigation lands.
**For comparison, 55 percent of an average female home range was core area (Wakkinen and Kasworm 1997).
***1% change due to 2005 INFRA motorized route database corrections (U.S. Forest Service, in litt. 2006).

The proposed action may result in heavier use of popular hiking trails in the action area, due to increased people living in the immediate area. A reduction in effective core area habitat would occur if human use of the Rock Creek or St. Paul Trails in BMU 5 reach levels that would result in the displacement of grizzly bears. This trail is located in a narrow north-south movement corridor between BMUs 6,7,8 and 22 and the rest of the Cabinet Mountains to the north and northwest.

The mitigation plan includes funding for the Forest to monitor the trails and a contingency strategy to manage recreational use of the Rock Creek and/or St Paul Trails in the event use levels increase to “high use” levels. As proposed, “high use” levels during one year would result in limits on trail use imposed during the following year. This may result in short-term adverse impacts to grizzly bears in the area during the first year of high use. The Service agrees that trail management restrictions would be best implemented on a recreational season basis to foster public understanding and acceptance. The short-term impacts during the high use year that triggers restrictions would likely be tolerated by grizzly bears in the area provided remedies be immediately implemented prior to the following recreational season, and food and attractant storage is adequately monitored and enforced.

Core area in BMU 5 could potentially be impacted by a ventilation adit in the wilderness area (USDA 1998b). The proposed ventilation adit would be located in a cliff that the 1998 BA (USDA 1998b) states is not currently usable by grizzly bears. Currently the adit is predicted to affect a surface area of 800 square feet (SEIS). The adit portal size would be approximately 15 feet by 15 feet (Dave Young, Sterling Mining Company, in litt. 2000). It would be accessed from underground, and some rock might be expelled to the surface. The fans would be installed well below the surface and noise would be estimated to be less than 45dBA more than 50 feet from the adit. The 1998 BA (USDA 1998) states that the noise level from the adit would be low since fans would be deep in the adit and therefore concludes that there would be no loss of core. However, the noise generated by the ventilation adit may constitute an impact on grizzly bears and if it is

determined as such, the area would be buffered and discounted as core area as would area impacted by any other disturbances to grizzly bears.

The wilderness ventilation audit may not be needed, pending information gained during the evaluation adit and construction phases of the mine. The ventilation adit would be evaluated at the time it is needed (and if it is needed) to determine alternatives and to ensure latest technology is incorporated. If the ventilation adit is needed, the Forest and the Service would assess the situation prior to construction to further reduce potential impacts as appropriate.

Movement corridors *The Forest Plan standard is to maintain forested corridors at least 600 feet wide between management induced or natural forest openings. Functional hiding cover has a minimum of three sight distances following timber harvest, where a sight distance is the mean distance at which 90 percent of an animal is hidden from view.*

Summary The proposed Rock Creek Mine would meet the Forest Plan standard or assessment criteria of maintaining a minimum of 600 feet between openings (BA 1998). The BA noted that this standard was primarily intended for vegetation management-created openings (e.g. openings between harvest units).

Discussion The displacement of grizzly bears is affected by the availability and functionality of cover within which to move about home ranges. Although the standards would be met, the effectiveness of movement corridors and cover adjacent to the Rock Creek Mine area would be significantly impacted. The presence of new facilities (on-site), increases in motorized traffic levels on FR 150, and anticipated increases in motorized and non-motorized recreation due to improved access would increase disturbance to grizzly bears attempting to use these corridors near the mine site.

Conservation measures proposed for the Rock Creek Mine project include a transportation plan to reduce traffic levels, including busing employees to the mine facilities. Even with the transportation plan in effect the Forest anticipates a 1,120 percent increase in road use during construction phase of the proposed Rock Creek Mine and a 300 percent increase in road use during the operation phase (USDA 1998b). The increase in traffic volume on FR 150 would not approach levels that are likely to constitute a complete barrier to movement of grizzly bears, based on existing research (Waller and Servheen 2005, Chruszcz et al. 2003, Ruediger et al. 1999).

However, effective cover along FR 150, the principal access road, would be compromised by the increased traffic. The ability of the influence zone around the road to support grizzly bears would be reduced from existing levels, as discussed earlier under 3) above. Existing cover areas also may be impacted by the increased recreational use anticipated with the influx of people into the area.

Seasonal habitat protection *The Forest Plan standard is:*

1. *Spring habitat protection objective: schedule activities within spring habitat (southerly aspects less than 5,000 feet elevation) outside spring season from April 1 to June 15.*
2. *Den site protection objective: allow activities within one-half mile of known den sites only outside the denning season, from November 15 to April 1.*

Summary The project would not meet the Forest Plan standard for spring habitat. No seasonal avoidance of important spring habitats can be incorporated into the mine activities since the mine is planned to run year round, 7 days a week, and several shifts a day. A total of 26,822 acres of spring habitat components are present in the three BAAs directly affected by the Rock Creek Mine (USDA 1998b). Up to 6500 acres of this spring habitat will be impacted by the proposed mine sites and associated roads. However, as described previously, many of these acres are already affected by high use on existing roads, especially FR 150 and the Highway 200 (W. Johnson, pers. comm. 2002). Due to the increased traffic volumes and significant human activity along the FR 150 and at the mine site, this spring habitat would be under-used by grizzly bears.

Denning habitat is not expected to be impacted by this action (USDA 1998b, page 23)**.** BMUs 5 and 6 provide denning habitat in designated roadless areas in high elevation grizzly bear habitats within the Cabinet Mountain Wilderness Area.

Discussion As mentioned earlier, this analysis indicated that five displacement BAAs be required, and have no major activity for the life of the Rock Creek Mine. Spring habitat would be lost to bears through facility or road development, and bears would likely be displaced from adjacent areas of spring habitat. Between 6400 and 6500 acres of spring habitat would be directly impacted by the proposed action and major activities, through site development, roads, or increased disturbance in adjacent influence zones. To compensate, five displacement BAAs would protect 177 more acres of spring habitat from major activities than that affected by the proposed mine. Displacement BAAs would not result in a net increase in acres of spring habitat, but would ensure that more acres of spring habitat were protected from major disturbances, throughout the life of the mine, than the amount of spring habitat lost to the mine. This measure provides for over 6500 acres of spring habitat to be available for use by grizzly bears throughout the life of the mine. Displacement BAAs also secure more potential denning habitat than that occurring in the active BAAs (USDA 1998b).

Further, based on the best information available, information in the BA indicates that core areas in BMUs 4, 5 and 6 contain substantive amounts of spring habitat (defined as <5000 feet elevation on south, east or west aspects) (see Table 17 in BA). The core areas within the BMUs provide proportionately more spring habitat than that available in the BMUs.

5. **The mitigation plan requires that the Forest form and lead an Oversight Committee that would develop an MOU to define the roles and responsibilities of each member and the committee itself. Participation by DEQ and Montana Fish, Wildlife and Parks on the oversight committee would be strongly encouraged. The Service would participate in an advisory capacity.** The mitigation plan includes several measures and requirements such as acquisition of fee title or conservation easements on property, and extends over a 35-year time period. The plan is complex and would require detailed oversight to achieve objectives. Accurately predicting or anticipating conditions related to the CYE grizzly bear population over such a long time frame is difficult. The mitigation plan states that the Oversight Committee has the responsibility to oversee the implementation of all mitigation requirements, and to collect and review new information on grizzly bears and other information relevant to CYE grizzly bears over the life of the mine. If such information or relevant data indicate the need, the provisions of adaptive management would allow modifications of the mitigation plan. The Service would be an ex-officio, nonvoting member of the Committee, with advisory responsibilities. We would review proposed revisions to the management plan or mitigation plan under the appropriate section 7 provisions, if required.

   The Forest would also organize and lead regularly scheduled meetings, attended by agency, county commissioner, mining company, local citizen and other non-governmental group representatives, and the interested public in general. This group would meet regularly to review management objectives, implementation of mitigation measures and review monitoring and research results.

6. **The mitigation plan requires funding to conduct a long-term monitoring study of grizzly bears throughout the life of the mine within the action area, in coordination with the current grizzly bear research conducted in the CYE.** The Service's current monitoring effort in the CYE was expanded to include monitoring all grizzly bears augmented into the Cabinet Mountains as a result of the Montana Fish, Wildlife and Park's effort. However, annual federal funding for such monitoring is not assured and dependent upon annual federal budgets. Revett has agreed to provide funding to ensure that the Service is able to adequately monitor the augmented bears, as well as native bears (see mitigation plan). Monitoring information would provide essential survival and reproductive information females and cubs, both native and augmented bears. Augmentation of the grizzly bear population in the Cabinets Mountains, along with reduced grizzly bear mortality through mitigation plan measures, will over time provide an improved and improving baseline for the CYE grizzly bear population (see discussions under *Grizzly Bear Mortality Risks* section below). Over time, this improved population status is expected to more than offset any loss of reproductive potential in the female grizzly bears displaced from areas surrounding the mine.

   Monitoring results would be used to assess whether mitigation measures, including road closures, habitat acquisition and easements, were in fact working to maintain grizzly bear use of habitat within the action area. If information suggested otherwise, the Oversight Committee would develop and recommend measures the Forest could implement to

remedy the situation, and allow agencies to employ adaptive management if needed to accommodate the conservation needs of grizzly bears in the area. The Service, in its advisory capacity on the Committee, would advise the Forest as to whether additional consultation may be required to assess new information or changes in the mitigation plan resulting from adaptive management.

Displacement summary In its March 28 2005 Order, regarding whether mitigation would sufficiently remedy the habitat problem, the court raised the concerns that it appeared the Service was "not even sure what the effects of displacement will be."

The Service has determined that it is not possible to precisely quantify the effects of displacement especially when related to whether such displacement actually kills or injures wildlife by significantly impairing breeding, feeding or sheltering. Displacement is likely the result of the level of disturbance, relative habitat quality and population density. Displacement may not occur where the level of disturbance is low, or in very high value habitats even where disturbance levels are high, or may not occur if there is a lack of adequate quality habitat elsewhere. Displacement may not occur if bears have no options to move elsewhere due to the presence of other bears.

Precisely quantifying or predicting such effects on grizzly bears is difficult for several reasons. While displacement of grizzly bears, or under-use of habitat by bears, has been well-documented, research has yet to quantify the effects of disturbance or displacement on fitness or reproduction in grizzly bears. At this time we *estimate* that two adult females could potentially be using the Rock Creek drainage and other portions of the action area. As time goes on and grizzly bear numbers increase, more adult females, perhaps offspring of existing bears or augmented bears, may use the area. It is difficult to predict how many females would attempt to use the Rock Creek drainage over the course of 30 years. However, we know that road densities and core areas in the action area are mostly similar to or better than levels in the average female home range (Wakkinen and Kasworm 1997), so we do not expect that road density would substantially negatively impact use of the action area by females. Based on existing research, we expect that some individual female grizzly bears may be displaced by the high, constant levels of disturbance generated by the mine (Mace et al. 1996, Waller and Servheen 2005) and others may become accustomed to the continuous, routine disturbance (Mattson 1993, Yonge 2001, Tyers 2006). Of those bears displaced, some may find adequate habitat away from the mine and suffer no significant impacts. Some may be stressed to levels that impair their reproductive potential. Finally, factors such as availability of seasonal foods are dependent upon annual climate and precipitation, and have a strong influence on reproductive success (see Kasworm et al. 2005). All of these factors play a role in the reproductive success of females using the Rock Creek drainage. Most are not easily predicted or well understood given current information. Therefore, how the disturbance caused by the mine would affect female grizzly bears over a 30-year period is difficult to predict with certainty due to the influence of factors (e.g. individualist nature of bears, habitat quality, climate) that are inherently variable.

Despite the uncertainty, the best information suggests that there would *initially* be displacement effects on female grizzly bears now using the Rock Creek drainage. At the current time, we estimate that about two adult female bears may be using the action area (as discussed earlier). These female bears would be impacted initially because they are unaccustomed to the level of disturbance created by the mine. We expect this initial displacement would begin when construction of the mine begins and human activity levels substantively increase along FR 150, the route leading to the mine. Displacement of bears would be most pronounced at lower elevations in the drainage near the road, particularly spring habitat, but would extend throughout larger portions of the drainage for some time, affecting a total of about 7000 acres, including 5650 acres of habitat already disturbed by existing roads. It is not likely that the displacement effects of the mine would drive grizzly bears from established home ranges within the action area, especially female bears, even though displacement effects in the Rock Creek drainage during the construction phase initially may be significant. We anticipate that at some time during the 30-year life of the mine, most likely during the 5-year construction phase, one to two adult female grizzly bears may be displaced to the point where their reproduction is impaired. In other words, females may not breed or complete a pregnancy during a breeding cycle due to lack of adequate nutrition or stresses associated with displacement. We do not anticipate that this impairment would be permanent. We do not anticipate that this level of disturbance would result in the death of cubs, subadult or adult bears.

Over time, we expect that the severity of this effect would diminish to lower levels. Female grizzly bears initially displaced from Rock Creek drainage when construction begins would eventually regain their reproductive potential through adaptation, by using other portions of their home range or by habituating to the disturbance over time to regain use of preferred habitat. The area from which bears would be displaced, about 80 percent of which is already impacted by disturbance from roads, represents only a small proportion of an average female grizzly bear home range. Based on the size of grizzly bear home range, the direct displacement impacts of construction and operation of the mine and the existing habitat condition (including roads and core area) now and during the life of the mine, it is reasonable to expect that those grizzly bears that use the Rock Creek drainage would have alternative areas to use if displaced from areas near the mine. Existing and future levels of motorized route densities and core area, with implementation of the mine, meet or are within one percent of Forest Plan standards and are similar to or provide better conditions than those in an average female home range.

Further, 2450 acres of habitat would be acquired by the Forest or conserved under conservation easement to compensate for the displacement. Some of the identified habitat parcels have existing development or have roaded or trail access to them, and some as of yet undeveloped parcels would likely be developed within the next 30 years. As explained earlier in this biological opinion, the benefits of conserving this acreage would add to security on additional acres as well. Conservation of this habitat for grizzly bears over the long term would contribute to suitable habitat for female grizzly bears during the life of the mine. The replacement habitat acquisition would contribute further

to offsetting the long-term disturbance effects of the mine. Finally, some grizzly bears, either those living there now, their offspring, or bears immigrating to or augmented into the area, are likely to adapt to the consistent, repetitive noise provided that natural food availability and quantity are not reduced and they suffer no adverse consequences associated with the mine activity. The effects of attractant storage, lack of firearms at work sites, and intensive education program for mine employees would improve the likelihood that bears could successfully regain some use of habitat from which they were initially displaced. Thus, habitat conditions in BMUs 4, 5, and 6 should continue to allow female grizzly bears to successfully produce offspring over the long-term.

Therefore, the direct loss of habitat (483 acres, of which 115 are MS 1 habitat) plus under-use of influence zones around the sites and roads may initially have adverse effects on grizzly bears. We expect that during the construction phase of the mine, displacement effects on one or two adult female grizzly bears using the area would result in some level of impairment of reproduction, but would not impair females' reproduction over the long term. The lasting effect of the mine would be long-term under-use of habitat in, but likely not total avoidance of, the 7000-acre influence zone within the Rock Creek drainage. While this under-use of habitat by grizzly bears is of concern in an ecosystem the size of the CYE, these adverse effects would be offset by the conservation measures. Considering the large home range sizes of grizzly bears and the area of displacement, the information on grizzly bear home range use in the Cabinets (Kasworm et al. 2002, and 2005), Noranda's abandonment of the Montanore mine project in the east side of the action area, the year-long and seasonal road closures on the east side, the existing habitat condition, existing and future management of roaded access in action area BMUs, and habitat acquisition, it is reasonable to expect that grizzly bears with home ranges encompassing the Rock Creek drainage would have relatively secure alternatives to habitats from which they are displaced due to mine-related disturbances over the life of the mine. Finally, the grizzly bear monitoring required as part of the proposed action would enable the Service to evaluate the impacts of displacement on bears over time.

Human-caused grizzly bear mortality risk

The action area occurs within a narrow portion of the Cabinet. Since 1988, credible sightings of individual grizzly bears in all 14 BMUs in the Cabinet Mountains were reported, including BMUs in the action area (Kasworm et al. 2005). Based on large grizzly bear home ranges, grizzly bears that live in the southern Cabinet Mountains have a high probability of being somehow affected by the mine itself or by increased numbers of people working and living in the area.

The most prominent direct and indirect effects on grizzly bears from the implementation of the proposed Rock Creek Mine project would stem from the influx of mine employees into this relatively remote area. This local workforce would live within commuting distance of the proposed Rock Creek Mine. The FEIS (MDEQ and USDA 2001) suggested the number of immigrants (mine employees and families, and people associated with related employment) to the area could range from 450 to a high of about 770 during peak construction periods; numbers

would vary over a period of about 5 years during the construction period. Of total mine employees during construction periods, 206 to 230 would be local hires and 163 to 319 would be immigrants.

The initial influx of workers into grizzly bear habitat would be associated with the evaluation adit phase of the project. The first influx of people would range from 23 to 73 employees and their families (MDEQ and USDA 2001). Unmitigated, this number of people could pose some risk to bears in this ecosystem. This phase would bring people into an area that is relatively undeveloped at the current time, which could be associated with higher mortality risk to grizzly bears. However, these potential risks would be immediately addressed, reduced, and more than offset by the magnitude of the mitigation plan measures to address mortality risk, specifically those to be in place *prior to construction of the evaluation adit.* The bear management specialist and law enforcement officer would be on duty to advance bear awareness and education in the community and among the employees. Each employee would meet and receive information from the grizzly bear management specialist and law enforcement officer, receive a personal-use grizzly bear resistant garbage container for use at home, and be encouraged by Revett to respect the importance of grizzly bear conservation efforts needed to live compatibly with bears, in or near grizzly bear habitat. Other measures are listed in discussions below. Further, because the term of employment is limited (12 to 18 months), most of these employees would seek rentals, motel units, or mobile home recreational vehicle sites, rather than build new homes (in or near grizzly bear habitat) and remain in the area.

Most of the human impact would be associated with the subsequent five-year mine construction phase. Peak levels of immigrant workers, families and people associated with related employment would be about 770 people during the construction phase. Following the five-year construction period, the full production stage could last about 28 years during which time the mine would employ about 340 full time workers. During operation of the mine (post construction to full production), full time employees (including immigrants and original residents) and their families would live in the area for up to 30 years (MDEQ and USDA 2001). Of these 340 employees, about 240 would be local hires and 100 would be new immigrants to the area. Approximately 200 additional immigrants and their families would live in the Cabinet Mountains area to work at associated businesses that would develop. Fewer total immigrant numbers (workers, families and people associated through related employment) are associated with the production phase, about 660 compared to peak levels of about 770 during construction. Most immigrating employees and their families would settle in the local area. Of these total immigrants, 332 would live in the Noxon/Heron/Trout Creek area, with stable employment during full production. About 200 immigrants would settle in Thompson Falls. This immigration would result in an 11 percent increase in the current local population (Noxon/Heron/Trout Creek area) over a period of years (MDEQ and USDA 2001). The remaining immigrants would live further from the mine in Troy, Libby, and in eastern Idaho (see MDEQ and USDA 2001, Table 4-57) resulting in less of a proportional increase in population of these areas. Additionally, it is expected that people already living in the area would fill a number of the positions at and in support of the mine (see MDEQ and USDA 2001, Table 4-56).

The construction and full operations period would require between 304-320 new housing units (MDEQ and USDA 2001). The local area of Noxon/Heron /Trout Creek would see the largest number of new households, 116 to 125, and the rest would be distributed in the Thompson Falls, Troy, Libby and Eastern Bonner County, Idaho areas. Some new residents would build on undeveloped private land in or near the CYE, perhaps resulting in a permanent loss of habitat otherwise available to grizzly bears. Others would occupy existing housing within commuting distance. An estimated 150 acres of private land could be developed (USDA 1998b). Probably more important than actual acres of habitat developed, the associated increased number of people living on private lands in or near bear habitat would increase the potential for conflicts with grizzly bears related to sanitation, habituation or displacement, thus increasing grizzly bear mortality risks due to management actions or illegal actions. Large numbers of dispersed home sites in rural areas or new subdivisions in previously rural areas would impose adverse impacts on grizzly bears. If new home sites were developed in or adjacent to existing communities, less impacts on grizzly bears would occur than if homes were built further from existing towns or settlements. Grizzly bears tend to avoid areas of high human activity such as towns and communities. This tendency would generally keep many grizzly bears from wandering near new home sites that were located within or near existing communities, thus reducing the potential for habituation and food conditioning. We have no information predicting how many of the 304 to 320 new homes would be built in or near existing communities.

Potential sources of human-caused grizzly bear mortality as a result of direct or indirect impacts of the proposed mine can be attributed to two primary and somewhat overlapping categories, attractant-related and recreation-related mortality. Traffic-related mortality may also increase somewhat due to increased traffic along major roads such as Highway 200. Traffic levels along Highway 200 in and near the action area already exceed those levels that usually result in some mortality risk to wildlife (Ruediger et al. 1999). The effects of the action, including mitigation measures to reduce adverse effects, are discussed next under these categories, followed by an analysis of the effects of the mitigation measures aimed at reducing human-caused mortality risk.

Attractants The area proposed for Rock Creek Mine is currently relatively remote, and most people live along the main roads and in small towns. The proposed Rock Creek Mine would substantially increase the number of people working, recreating or maintaining homes in the area. The influx would occur over a very short time frame once hiring for the mine begins. Local residents already living in the area generally have had repeated exposure to grizzly bear issues through the media, workshops, school presentations and personal experience. Newly-arrived people coming from areas where grizzly bears do not occur, or immigrating from areas where living with wildlife is not emphasized, would increase the risks of conflicts between people and grizzly bears. Some people may be prone to poor compliance with sanitation recommendations. Voluntary education and information programs typically result in success over a period of time. Without pro-active attractant storage measures, grizzly bears in the area could be exposed to a rapid increase in available garbage, pet foods and other household attractants with little opportunity to adapt. Thus, the risk of the indirect effects of food conditioning or other types of habituation resulting from additional human residences on private lands would increase.

Unmitigated, an ingress of people could result in increased *potential* for attractant-related conflicts with grizzly bears on public lands as well. Attractant-related incidents would likely be infrequent at first; such incidents have not yet been reported in the Cabinet portion of the CYE, probably due to the existing small number of grizzly bears and sparse human population in the region. As the grizzly bear and human populations expand, the potential for conflict would increase.

We anticipate that food storage and attractant issues would be less problematic on Forest lands than on private lands. The Forest does not currently have a mandatory forest-wide food storage order that requires forest users to keep their food unavailable to grizzly bears. The mitigation plan requires that the Forest implement a food storage order specifically for BMUs 4, 5 and 6 prior to the construction of the evaluation adit. In addition, the Forest would implement a food storage order Forest-wide within 5 years of construction of the evaluation adit. These orders would be mandatory, and success would depend on enforcement by the Forest and upon long-term education and information efforts. The order would mandate that all human foods and attractants be made unavailable to grizzly bears. Additionally, grizzly bear resistant garbage receptacles would be required at the mine site as well as in campgrounds or other Forest facilities within all BMUs in the CYE where garbage containers are normally provided. These efforts to curb attractant-related conflicts on public land would become increasingly effective over time, with the increased levels of information programs in the CYE. These measures would substantively reduce the risk of grizzly bear mortality as a result of habituation and food conditioning on national forest lands. Such risks to grizzly bears resulting from the mine-related increase in number of people using the Forest would be lowered. Further, such risks outside the action area and not associated with the mine would be lowered from the existing condition.

Many of the human impacts associated with the Rock Creek Mine that may affect grizzly bears would occur on private lands, which are beyond the direct jurisdiction of the Forest or Revett Silver Company. Attractant storage conflicts between bears and people would likely arise on private lands over the 35-year life of the mine. Private land attractant storage issues are typically more difficult to resolve than those occurring on national forest.

Unmitigated, the mortality risk to grizzly bears associated with attractant storage would grow with increased numbers of residents in the vicinity of the mine. In both the YGBE and the NCDE, attractant storage issues became one of the primary causes of conflict between bears and people, and of human-caused grizzly bear mortality as the number of bears and people in and around the ecosystem increased. As discussed earlier, while attractant storage has not yet been a primary cause of human-caused grizzly bear mortality in the CYE, we expect its significance to increase as the bear population grows. In the past few years, one grizzly bear was killed through management action and five others relocated because of habituation or the risk of habituation to human foods and garbage. However, the proposed action addresses the problems and would significantly reduce the risks both from the proposed mine and the current condition. Benefits would accrue over time, especially as the grizzly bear population increases over time. Without funding for the conservation measures outlined in the mitigation plan, the current condition for grizzly bears is not expected to improve. Adequate funding through government sources is not likely within the near future. Details are described in the following section *Summary of all*

mitigation plan measures to reduce risk of grizzly bear mortality.

Over a 35-year period, the Rock Creek Mine would likely result in the risk of grizzly bear mortality because of attractant storage conflicts. The expected increase in numbers of people in the area and the 35-year life of the mine would increase the potential for bear-human confrontation. The agencies recognized this risk, and therefore the mitigation plan includes a number of measures to significantly reduce this potential for mortality associated with the mine. Further, the measures in the mitigation plan would substantially improve conditions for grizzly bears over current conditions not attributable to the mine. A full listing of measures to address sanitation-related risks occurs below in the *Summary of all mitigation plan measures to reduce risk of grizzly bear mortality.*

Recreation Roads and trails facilitate encounters between grizzly bears and humans, and roads markedly increase the risks of grizzly bear mortality, especially at higher open road densities. Seventy-five percent of the human-caused grizzly bear mortalities from 1982 through 1999 in the CYE were within 500 meters of an open road (W. Kasworm, pers. comm. 2002). Hunting-related incidences and poaching contribute to human-caused grizzly bear mortalities. Increased trail use leads to increased chances of bear-human interactions with bears that are not displaced from trails and the habitat around it.

As discussed earlier, open road and trail densities would not increase over existing levels due to the proposed action, and currently are moderate within the action area. The proposed levels of access management would be significant in moderating human access in the action area (see Tables 10, 12, 13). However, an influx of workers, supporting businesses, and families would likely increase recreational use of the existing roads and trails in the action area. Improved access and a substantial increase in local population is expected to increase recreational and hunting use within grizzly bear habitat. In particular, use of the Rock Creek Trail along the East Fork of Rock Creek is expected to increase substantially with the improvement of access, greater publicity and increased people moving to the area. This trail would be accessed by the improved road to the mine and would be expected to attract greater use following improvement of the road. The Rock Creek Trail is currently considered a low use trail, and is not considered a significant detrimental impact to core area or habitat effectiveness.

A reduction in security for grizzly bears could occur within the north south corridor if human use on the Rock Creek or St. Paul Trails increased to levels that displace grizzly bears and contribute to fragmentation of the north to south corridor, or result in a corresponding increase in human food and attractants made available to bears. The potential for confrontations between bears and people would be expected to increase if high use of the Rock Creek Trail should occur. Increased hiking and camping in the area could lead to increased food and attractant storage problems, resulting in conflicts between grizzly and recreationists.

From 1982 through 2005, only four grizzly bears were known to be mis-identified and killed during big game or black bear hunting seasons in the CYE. Increased hunting pressure in the area would elevate the potential for grizzly bears to be misidentified as game species and inadvertently killed. Montana Fish, Wildlife and Parks manages and regulates all hunting in the

action area and currently implements a proactive hunter education program aimed at reducing the potential for mistaken identification of game animals (Montana Fish, Wildlife and Parks 2001). As a result of the fall, 2005 mistaken identity-related death of a grizzly bear by a black bear hunter, the Service has reinitiated consultation on the Montana Fish, Wildlife and Parks grizzly bear management plan (Montana Fish, Wildlife and Parks 2001).

The potential for poaching could increase with the influx of workers with diverse social, cultural and economic backgrounds, many of whom may be unfamiliar with or lack interest in wildlife conservation. For example, following the initial phase at the Montanore Mine project, some workers associated with the mine were convicted of poaching deer (USDI 1993b). From past experience, Montana Fish, Wildlife and Parks has found that poaching incidents tended to increase during construction activities. The spike in illegal activities seems to correlate with transient work forces that work "around-the-clock" schedules, but tends to decline once construction is complete and the stable work force is in place (Mark Soderlind, Montana Fish, Wildlife, and Parks, pers. comm. 2000).

Unmitigated, over a 35-year period, the Rock Creek Mine would likely result in the risk of legal and illegal mortality of grizzly bears. The expected increase in numbers of people using the Forest to recreate over the 35-year life of the mine would increase the potential for conflicts between grizzly bears and people. The agencies recognized this risk, and therefore the mitigation plan includes a number of measures to reduce the potential for mortality. See below for a summary and analysis of the measures in *Summary of all mitigation plan measures to reduce risk of grizzly bear mortality.*.

Vehicle collision The Rock Creek Mine would result in increased traffic levels on the access and service roads in the action area, as well as main highways in and around the CYE. Traffic levels on FR 150 are anticipated to increase 1,120 percent over pre-Rock Creek Mine levels during the construction phase (USDA 1998b). Traffic would increase from 30 to 300 percent above existing traffic levels during the 35-year operation period of the Rock Creek Mine. Traffic along Montana Highway 200 also would increase. Grizzly bear mortality resulting from motorized vehicles collision has been documented (Servheen in litt. 2005a; IGBC 1987). Typically, these collisions have occurred on major highways or roads that receive higher traffic volume and have higher speed limits, such as U.S. Highway 2 south of Glacier National Park, and Montana Highways 83 and 93.

The Rock Creek Mine would result in an increase in the average vehicle speed on FR 150 due to the proposed paving of the main access road and several spur roads within the Rock Creek Mine area. As vehicle numbers and/or speed increase on FR 150 and Highway 200, the mortality risk to bears attempting to cross these principal access routes would also increase. The small number of grizzly bears living in the action area and surrounding areas has and would probably continue to contribute to the lack of grizzly bear mortalities along roads in the area. At least one grizzly bear is known to have crossed Highway 200 along the boundary of the action area (Kasworm and Manley 1988). The Service lacks data and information with which to accurately estimate the level of risk associated with higher traffic volumes. If vehicle collision is a risk, it is more likely to occur along Highway 200 than along FR 150, due to higher traffic volumes and speeds along

that route. Traffic on Highway 200 already poses a risk to grizzly bears, although no vehicle-related mortality has been recorded. Traffic levels from 2000 to 3000 vehicles per day usually have adverse impacts on wildlife due to habitat fragmentation and mortality (Dr. Tony Clevenger and Dr. Paul Paquet, pers. comm. *in* Ruediger et al. 1999). Traffic levels on Highway 200 are already in this range. The lack of bear mortality reported is probably a result of few grizzly bears within the CYE, and/or their ability at this point to navigate the highway successfully. Traffic levels are expected to increase, with or without the mine. The level of mortality risk to grizzly bears on Highway 200 that could be attributable to the mine would not likely be determinable, given the already high levels of traffic and anticipated increases not associated with the mine.

Mitigation plan measures to reduce risk of human-caused grizzly bear mortality

The following measures are included in the mitigation plan and would reduce or minimize the mortality risks associated with the proposed action. The 2006 mitigation plan was fashioned in recognition that current levels of human-caused grizzly bear mortality in the CYE were too high, and that measures to reduce mortality were needed with or without the proposed action. Collectively, the measures represent a substantial effort to reduce and minimize human-caused grizzly bear mortality risk, not only that associated with the mine, but also risks that arise from current conditions in the CYE:

1. Management of road and trail access into grizzly bear habitat.

- The Forest would ensure no increases in open or total motorized route densities or decreases in core area within BMUs 4, 5, and 6 for the life of the mine; open and total road densities are near or lower than research averages and core areas are substantial, equal to or greater than 55 percent of the area in each of BMUs 2, 4, 5, 6 (54 percent), 7, and 8 (see *Analysis of Displacement Effects on Grizzly Bears* section for greater detail on access management);
- The Forest would close portions of roads on the east front of the Cabinet Mountains, contributing to a more secure habitat corridor from north to south along the face (see Table A4 and discussion);
- As the total 2450 acres of mitigation habitat is acquired through purchase or easement, management actions would decrease motorized route densities and/or increase core areas, acquisition of fee title or conservation easement would eliminate existing access and/or preclude the development of improved access and/or attractant sources, thus reducing future mortality risks to bears; and
- The revised mitigation plan requires Revett to fund monitoring and requires the development of a recreational management plan to ensure high trail use does not occur. The recreation management plan would be completed prior to construction of the mine would be reviewed by the Service, and signed by the U.S. Forest Service. The Forest would monitor trail use, and in the event that high use occurred, the plan to limit visitor use and reduce levels of trail use on Rock Creek Trail would be implemented. This action would reduce potential risks to grizzly bears along this particular trail. Recreational use of other trails and open roads in the action area is expected to generally

increase. High use on other trails in the area would be accounted for in route density calculations and/or core area requirements and mitigated as needed to maintain or improve habitat conditions for grizzly bears.

The impacts of increased numbers of people accessing the Forest would be adequately moderated by full implementation of the measures above. Although use of roads and trails would increase, the existing access baseline meets or is very near meeting Forest Plan standards for grizzly bears, and would remain so and gradually improve due to the measures above. As a result, we do not expect that access management related to the mine would result in increased mortality risk to grizzly bears.

2. **Management of attractants**. A **(2006)** denotes measures added to the mitigation plan in 2005 and 2006):

- Prior to construction of the evaluation adit, Revett Silver Company would fund Sanders County and Montana Fish, Wildlife, and Parks to upgrade the county garbage transfer station near the mine entrance to make it grizzly bear-resistant prior to construction of the evaluation adit. Mine employees living in the local area would use this facility to dispose of their trash.
- Revett would fund the eventual upgrade of 16 county garbage transfer stations in the CYE to bear-resistant during construction and operation of the mine. Preventing food conditioning of both black bears and grizzly bears at the garbage transfer stations, as well as at residences, has proven very important in both the YGBE and NCDE (Tim Manley, Montana Fish, Wildlife and Parks, pers. comm. 2002). **(2006)**
- Revett would require employees to attend annual educational workshops on living with grizzly bears, attractant storage at home and in the back-country, and would prohibit employees from feeding bears.
- Revett would fund purchase of grizzly bear-resistant garbage containers for all employees living in or near grizzly bear habitat, for their personal use at home.**(2006)**
- Revett would provide 20 additional personal use containers/year for distribution to the public by the grizzly bear specialists. **(2006)**
- Revett Silver Company would fund grizzly bear resistant garbage containers for Forest campgrounds that provide garbage receptacles in BMUs throughout the CYE. **(2006)**
- Grizzly bear-resistant containers would be used at mine facilities, in place in advance of any work being initiated on any phase of the mine, and would be emptied at least weekly unless problems arise, whereupon, removal would be daily.
- Revett would have a company-sponsored education program to advance knowledge of how people can coexist with grizzly bears in and near grizzly bear habitat. **(2006)**
- Prior to construction of the evaluation adit, the Forest would implement a mandatory food storage order for BMUs 4, 5 and 6.
- The Forest would implement a Forest-wide food storage order within five years of construction of the evaluation adit. **(2006)**
- Revett would fund two **(2006)** grizzly bear specialist positions dedicated to work in the CYE (see discussion 3 below), one of which would be funded prior to construction of the evaluation adit. Combined with the grizzly bear information and education program, two

bear specialists and wildlife law enforcement officer, the measures listed above would significantly improve existing and future sanitation conditions within the action area and the CYE.

Unmitigated, a mine development such as the one proposed would increase conflicts between people and grizzly bears due to attractants. If the project moves forward with the mitigation plan, the current conditions for grizzly bears related to attractant storage would be substantially improved over its current condition. None of the measures listed immediately above exist within the ecosystem today, and most would be contingent upon securing government funding, which has not been available in the past. The mine would result in an increased number of people living in the area, but the measures listed above would reduce the potential for conflicts, not only those associated with the mine but also those not attributable to the mine. Further, the mitigation plan now includes measures that address attractant issues across the ecosystem, outside the immediate action area. Mine-related attractant risks to grizzly bears would be reduced and while not entirely eliminated, their adverse impact would be more than offset by the above measures in combination with item 3 immediately below. These measures would benefit the action area as well as the entire CYE.

The mitigation measures outlined above and in 3 below represent the full complement of the types of actions that are recognized by grizzly bear experts as being effective in reducing conflict between bears and people and they would affect the entire CYE. With reasonable certainty, we expect that implementation of such measures would result in a net decrease in the potential for conflict and in the actual number of conflicts between grizzly bears and people that would arise in the CYE, with or without the Rock Creek mine project. We expect that the mitigation measures would prevent conflict and /or resolve conflicts in ways that prevent the removal or death of more than one grizzly bear over the 35-year life of the project, thus more than offsetting the loss we anticipate from the project (one grizzly bear). In other words, we believe that the measures to be implemented by Revett and the Forest would result in a net reduction in future human-caused grizzly bear mortality rates that would have occurred without the project.

3. Enhancement of law enforcement and comprehensive, proactive information and education programs that build public support of grizzly bear recovery. A **(2006)** denotes measures added to the mitigation plan in 2005 and 2006.

- Prior to the construction of the evaluation adit, Revett would provide funding for a wildlife law enforcement position to reduce the potential for illegal activities (e.g. poaching) and readily handle any illegal activity that may arise due to the increased number of people living in the area.
- Prior to the construction of the evaluation adit, Revett would fund a bear specialist position to help educate mine personnel, their families and other residents in the area about how to live and recreate safely in grizzly bear habitat, to implement proactive sanitation efforts in the communities, and to respond to black or grizzly bear conflict situations;

- Prior to the beginning of construction of the mine, Revett would fund a second grizzly bear specialist to live in the Libby area and work in the northern reaches of the CYE. **(2006)**

    - All three of these positions would receive funding from Revett throughout the life of the project.
    - Funding for two bear specialist and a law enforcement positions would be adequate for highly skilled, full-time, professional staff (including benefits);
    - Funding for these positions would ensure that Montana Fish Wildlife and Parks creates new positions in addition to the Montana Fish Wildlife and Parks staff already in the area; duties of the positions would be clearly defined to deal with the grizzly bear issues related to the Rock Creek Mine.
    - The duties of these personnel would include monitoring and documenting black and grizzly bear-human encounters and how these situation were handled as well as conflict resolution.
    - These personnel would remain in place during temporary shutdowns and for a reasonable amount of time following mine reclamation to maintain continuity in community relationships, grizzly bear incident response and monitoring.

- Revett would develop a public outreach program that conveys its support of grizzly bear conservation in the CYE. **(2006)**
- Mine employees would be prohibited from carrying firearms while on duty.
- Defer the construction phase of the mine until at least six female grizzly bears have been augmented into the Cabinet Mountains. **(2006)**

Prior to construction of the evaluation adit, the revised mitigation plan requires funding for one grizzly bear specialist and one law enforcement position to be located in the vicinity of the mine, to primarily deal with the Rock Creek Mine mitigation issues, and initiate preventative management and education programs to avoid impacts to threatened and endangered species. The presence of the grizzly bear specialist and wildlife law enforcement officer in the community would be consistent and long term (retained for the life of the mine), including periods of shutdown. These personnel would be on the job prior to the time construction began on the evaluation adit. The positions would be based in the Noxon/Heron/Trout Creek area where the majority of immigrating people would settle.

The local State wildlife law enforcement agent and bear specialist would make personal contacts with mine employees and with other area residents as well. This effort would begin to address the current mortality risks in the action area. The bear specialist's duties would be similar to those described in Montana Fish, Wildlife and Parks Bear Management reports (Montana Fish, Wildlife and Parks 2005). The bear specialist would work with and provide information to all mine employees and other area residents on managing garbage, foodstuffs and livestock at their homes or camping and hunting sites to avoid attracting bears. Information on game carcass management and other issues related to hunting in grizzly bear habitat would be provided, enhancing Montana Fish, Wildlife and Parks' hunter education programs already in place. The law enforcement officer would provide additional wildlife and conservation information, and

work as a deterrent to reduce the risk of illegal human-caused grizzly bear mortality. These personnel would precede the influx of mine construction workers so that pre-emptive planning could occur and education programs would be in place when people arrive. The bear specialist would respond to conflicts between people and both black and grizzly bears, and result in timely resolution if they arise. Every mine employee would be exposed to the information and support provided by the bear specialist and law officer. Mine employees would attend mandatory annual grizzly bear update workshops/presentations presented by the grizzly bear specialist. This level of personal contact with mine employees and area residents would improve awareness of grizzly bear conservation issues, and improve local support for grizzly bear recovery.

Prior to construction of the evaluation adit, Revett would provide funding for the grizzly bear monitoring study. Further, grizzly bear resistant garbage facilities would be in place at the mine site and on Forest locations in BMUs 4, 5, and 6, a mandatory food storage order would be issued for BMUs 4, 5, and 6, and the county garbage transfer station at the mine entrance would be made grizzly bear-resistant, all prior to activities beginning on the evaluation adit and prior to any grizzly bear conflicts arising. Should sanitation related incidents occur, the bear specialist would be available to respond to the situation quickly to avoid escalation of the problem. As mine employees are hired, each employee would be provided with a personal use grizzly bear-resistant garbage container, as well as workshops and other forms of information related to grizzly bear conservation from programs developed by the bear specialist and law enforcement officer. This is a significant level of effort aimed at the 55 or so employees hired to construct and work at the evaluation adit. Thus, we do not expect construction and operation of the evaluation adit to result in grizzly bear mortality.

Prior to construction of the mine itself, a second State bear specialist would be funded to work in the Libby area, and implement a similar program for residents of the northern part of the CYE, including the Yaak. This effort would further address human-caused mortality risk associated with the existing conditions throughout rest of the CYE outside the action area. The bear specialist positions would include duties comparable to the existing grizzly bear management specialist positions within the Montana Fish, Wildlife, and Parks, and would be provided adequate funding for public education programs and workshops, aversive conditioning equipment, dogs, electric fencing and other prevention work.

Combined, the local presence of these personnel in addition to the grizzly bear monitoring/research effort, food storage orders, measures to secure attractants, other mitigation efforts and other recovery efforts, is expected to contribute significantly to increased public awareness, cooperation and support of grizzly bear conservation needs, not only in the action area but across the CYE. No other grizzly bear ecosystem has received this level of concerted effort to reduce conflicts between grizzly bears and people, and to human-caused mortality of bears.

The importance of these new positions cannot be overstated. Bear specialists are influential in numerous ways that promote recovery of grizzly bears. Montana Fish, Wildlife and Parks stated that perhaps the greatest advancement in the management of problem bears has been the development of bear management specialist positions (Montana Fish, Wildlife and Parks 2001).

The combination of shortened response time to grizzly bear conflict reports, preventative actions to remove attractants, the deterrent effects of local law enforcement, and perhaps most important, building community involvement in the management and conservation of grizzly bears, has been invaluable in dealing with nuisance bears, preventing habituation of bears, and fostering local public support of grizzly bear conservation (see Montana Fish, Wildlife and Parks 2005a; Wenum 2002; Wenum 2004). Grizzly bear management specialists have been able to keep grizzly bears alive through an array of preventative measures. For example, in 1998 grizzly bear specialists trapped and radio-collared six nuisance grizzly bears in the North Fork of the Flathead River Valley (Tim Manley, Montana Fish, Wildlife and Parks, pers. comm. 2006). The bear specialists initiated an intense, proactive information and education effort with people living in the area. In the past three years, there have been no reports of nuisance grizzly bear activity in the North Fork, despite a substantial number of people living in grizzly bear habitat. In other areas, a Montana Fish, Wildlife and Parks bear specialist was instrumental in developing the trust and confidence of local residents participating in a study that ultimately resulted in reducing conflicts between ranchers, bee-keepers and grizzly bears along the Rocky Mountain Front region in Montana (Primm and Wilson 2004). State bear specialists also participated in the highly successful Blackfoot Challenge project (Primm and Wilson 2004). The groups involved created a wildlife committee to improve human-wildlife management in the Blackfoot River Valley, Montana. This committee worked on human-grizzly bear conflict abatement through many means: workshops, outreach, and sanitation projects. These efforts now enhance existing state grizzly bear management programs.

If the proposed project moves forward, conditions for grizzly bears related to law enforcement, conservation education, proactive prevention of conflicts between bears and people as well as responsive conflict resolution, would be significantly improved over its current condition. None of the measures listed immediately above exist within the ecosystem today. All are needed within the CYE in the short and long term to reduce levels of human-caused grizzly bear mortality. Currently, the nearest grizzly bear specialist is based in Kalispell, and covers about one-third of the NCDE as well as the CYE. The local grizzly bear specialists and law enforcement officer would provide enhanced levels of security and protection for grizzly bears that currently does not exist, thus improving current conditions for grizzly bears in the CYE. The positive effects of related programs would not only impact those people living in the action area and/or working at the mine, but would reach people living throughout the CYE ecosystem. The current conditions for grizzly bears in the CYE would also improve with the measures addressing access management, attractant storage, and research and monitoring (see discussion below). As new or existing residents to the area, mine employees would be among the most informed members of the public in the CYE about grizzly bear conservation, assisted by the support for conservation of grizzly bears from the company.

Overall, if the project proceeds and the mitigation plan is implemented, we expect a reduction in future rates of human-caused mortality of grizzly bears, even when we take into account the mortality risk posed by the mine. The human-caused grizzly mortality expected to result from the mine would be more than offset by reductions in the present level of human-caused mortality risks within the CYE, due to the benefits of the mortality risk management measures in the

mitigation plan. The net human-caused grizzly bear mortality rate is expected to decline within the CYE with full implementation of the mitigation plan associated with the proposed action.

The Service has determined that the full-time law enforcement and bear specialist positions to be funded by the Revett Silver Company are essential to offsetting the potential mortality risks associated with the Rock Creek Mine and those in the existing baseline. We expect that the law enforcement and bear specialist positions would significantly reduce and minimize the potential for human-caused grizzly bear mortality associated with the mine, although the risk cannot be entirely eliminated. However, the lowered mortality risk of the mine itself would be more than offset by the decrease in mortality risk conditions for grizzly bears in the action area and other areas of the CYE. As a result of the agency bear specialist and law enforcement positions, we expect:

- a significant reduction in the potential for increased conflicts between grizzly bears and people due to the increased number of people in the area as a result of the mine, and
- a net reduction in the overall existing mortality risks to grizzly bears on both national forest and private lands within the action area and across the CYE.

4. Support monitoring and research.

The mitigation plan requires funding for the ongoing grizzly bear monitoring and research effort in the action area for the life of the mine in conjunction with the ongoing grizzly bear research in the CYE, conducted by the Service. The study would monitor grizzly bears in the action area and gain information to ensure the effectiveness of the conservation measures. The Service would also monitor grizzly bears augmented into the CYE through Montana Fish, Wildlife and Parks' efforts, providing information with which to gauge the success of the effort and make improvements if needed. The ongoing monitoring and research would also act to increase public awareness and interest in grizzly bears. Because of the increased potential for detecting bear mortality, monitoring would likely act as a deterrent to illegal killing of grizzly bears. Data collected from radio-collared grizzly bears would enhance our understanding of survival and mortality, which is crucial to determining population trend. Furthermore, the monitoring would provide information as to whether or not the mitigation plan is working to allow grizzly bears to safely use habitat and move through the action area and north-south corridor. Because this information is important to judging the effectiveness of the mitigation, Revett has agreed to ensure adequate funds as part of the mitigation plan for this ongoing work during the life of the mine.

5. Reduction of risks posed by increased traffic on FR 150.

- Revett Silver Company would implement a transportation plan requiring employees be bused from parking lots near the highway up through the drainage to work. Bussing employees would substantially reduce the expected elevated levels of traffic but overall traffic levels would remain high. Controlling employees on their way to work sites would significantly reduce the potential for illegal harassment or shooting of grizzly bears and reduce litter and other attractants along the route;

- the use of salt would be avoided when sanding during winter plowing operations on road FR 150 to reduce attracting bears to roadways,
- palatable vegetative forage like clover (*Trifolium spp*.) would not be used to reclaim disturbed sites from construction facilities and roads; and
- the remains of road-killed carcasses along roads would be removed daily.

Summary of human-caused mortality risks The Service concludes that the mitigation plan measures aimed at decreasing the risk of human-caused mortality of grizzly bears would significantly reduce human-caused mortality risks associated with the proposed action. We expect that these measures would reduce not only the risk of mortality attributable to the mine, but also risks that currently exist and future risks not attributable to the mine. Further, habitat conditions such as habitat effectiveness and access management can affect mortality risk. Both have generally remained stable or improved over the past decades, and are expected to improve in the action area as a result of the mitigation plan

Table A14 displays the past causes of mortality in the CYE and the proportion of the mitigation funding directed at each cause. Fifty three percent of the total mitigation plan funding would be directed at reducing human-caused mortalities of grizzly bears. The main causes of human-caused mortality between 1983 and 2006 were illegal/malicious killings and mistaken ID by big game hunters. Thirty-six percent of funding would be directed at these two categories and self defense. Combined these categories account for about 42 percent of all mortalities. Another 17 percent of the funding is directed at reducing human site conflicts, which currently accounts for about 3 percent of mortalities. As has occurred in the NCDE and YGBE, attractant related human-site conflicts are expected to become more of a problem in the CYE as the grizzly bear population increases. Table A14 indicates that mitigation funding is appropriately directed at main sources of human-caused mortality that may be associated with the mining project.

Table A14. Categories, numbers and percent of grizzly bear mortalities in the CYE between 1983 and 2005 compared to approximate Rock Creek Mine project mitigation funding allocated to efforts to reduce mortality (budgets and allocations may change).

Category	Number of Mortalities	Percent of Total		Percent of Mitigation Plan Funding
Human site conflicts	1	3%		17%
Illegal/malicious	6	21%	42%	36%
Mistaken ID	4	14%		
Self-defense	2	7%		
Train	2	7%		0
Car	0	0		0
Capture Mortality	1	3%		not applicable
Under investigation	3	10%		*not applicable
Natural	8	28%		not applicable

Livestock depredation	0	0	not applicable
Unknown	2	7%	*not applicable
Total	**29**		**53%**
Deaths/Year	**1.26**		

* not directly applicable, but the additional wildlife law enforcement officer would help alleviate problems associated with these categories

The proposed action would result in risk of human-caused mortality simply due to the increased number of people that would live in the area, but it also includes essential short- and long-term recovery actions that would benefit grizzly bears throughout the CYE. These beneficial actions would not likely occur otherwise in the near or long-term. The mitigation plan includes a full complement of the types of measures, actions and strategies known to reduce conflicts between grizzly bears and people. Within the first five years of work beginning with the evaluation adit, we expect that the mitigation measures aimed at reducing mortality would be effective at reducing the *existing* risks of human-caused mortality because of implementation of many grizzly bear conservation measures, described earlier, that currently do not exist. The measures in the mitigation plan would also significantly reduce the potential for human-caused mortality of grizzly bears that *is attributable* to the mine. This comprehensive approach to reducing potential mortality (e.g. bear specialists in the action area and in Libby, increased law enforcement presence, sanitation efforts throughout the ecosystem, etc.) is also expected to significantly reduce the potential for grizzly bear mortality *not attributable* to the mine, within and outside the action area.

No empirical data is available with which to accurately predict the number of grizzly bears likely to be killed as a result of the proposed mine over 30 to 35 years. The proposed mine would result in additional people living and working in and near the Cabinet Mountains. The expected increase in human population in the Noxon/Heron/Trout Creek area and Thompson Falls is about 11 percent (MDEQ and USDA 2001), and less in the communities of Troy, Libby and eastern Idaho.

The best information upon which to base estimates of future human-caused grizzly bear mortality includes the existing rates and causes of human-caused mortality information in the CYE and in the action area, baseline habitat and access conditions leading to existing mortality levels, and the adequacy of the conservation measures in the proposed action and requirements in the mitigation plan.

Although the conservation measures in the mitigation plan would significantly lower risks, we expect that the mitigation plan measures cannot entirely eliminate the risk of human-caused grizzly bear mortality associated with the project over 35 years, primarily due to the increased number of people living in the area. Legal grizzly bear mortality is possible through management action or defense of life, or illegally through malicious or accidental events. We expect that attractant-related conflicts between grizzly bears and people would most likely be the cause of grizzly bear mortality that would be attributable to the mine during the 35-year period. The potential for such conflict is substantially reduced by conservation measures in the

mitigation plan. While malicious killing remains a possibility, its likelihood is also significantly reduced by the presence of bear specialists and law enforcement, and the information provided through their programs. The company's support of grizzly bear conservation would act as a deterrent for any mine employee to illegally kill a grizzly bear or be negligent regarding attractant storage. Conflicts between grizzly bears and people recreating on the Forest are possible, but are less likely to be related to the mine. Based on the number of grizzly bears in the action area, existing mortality records and expected displacement effects near the mine, we consider this risk discountable.

During the 23- year period from 1982 through 2005, five known human-caused grizzly bear mortalities occurred within the Cabinet Mountains portion of the CYE, four of which occurred in the action area. In 1982, one grizzly bear was poached in BMU 19, outside the action area. In 1985, a grizzly bear was killed in self-defense in BMU 8. In 1997 a grizzly bear was poached in BMU 2, and in 2001 and 2005, grizzly bears were struck by trains. This information indicates approximately two known human-caused mortalities of grizzly bears occurred per decade in the Cabinet Mountains, since 1982. The mortalities in the 1980s predate the period when concerted interagency grizzly bear information and education efforts were initiated.

Three of the five known, human-caused mortalities in the Cabinet Mountains were a result of people using national forest lands and were due to poaching and self defense. None were caused by attractant-related problems on private lands. Self -defense and poaching caused three mortalities. These mortalities, especially those occurring in the 1980s, took place during a time when grizzly bear conservation programs and recovery efforts were not as developed and obvious as they are today. Further, there were no grizzly bear specialists or law enforcement officers working in the Cabinet Mountains focusing primarily on grizzly bear issues. The mitigation plan addresses this mortality through the bear specialists and law enforcement personnel, education and information provided to the mine personnel and community, access management on the Forest that provides substantial core areas and moderate road access, and a grizzly bear research and monitoring effort. Montana Fish, Wildlife and Parks has increased its efforts to inform and educate hunters about hunting in grizzly bear habitat (Montana Fish, Wildlife and Parks 2001). The mitigation plan also includes a substantial level of attractant management efforts at the mine, on the Forest and on county and private lands in the Cabinet Mountains, including an immediate mandatory food storage order in BMUs 4, 5, and 6, and an ecosystem-wide order within five years.

Based on existing levels and causes of grizzly bear mortality in the Cabinet Mountains and CYE, the proposed action, expected improvements in the environmental baseline due to implementation of the full compliment of conservation measures in the mitigation plan, we estimate that impacts of the proposed action would result in no more than one grizzly bear mortality over the 35-year life of the mine.

The number of CYE grizzly bears killed by people since 1982 is skewed toward females; 11 of 18 (61 percent) known sex, human-caused mortalities were female. In the Cabinet Mountains, of five known human-caused mortalities, three were known to be males and two were female. In general males and subadult male grizzly bears have larger home ranges and conduct wider

exploratory and home range movements, making them more vulnerable to confrontations with people (McLellan et al. 1999). However, due to existing information on this ecosystem, we analyzed the worse case scenario where the one human-caused mortality associated with the mine would be a female bear. We do not expect mortality associated with the evaluation adit phase, but it is more likely during the construction phase of the mine itself, when the number of employees is highest, or at sometime during the operation phase.

As described above, analysis of all factors leads us to conclude that the proposed action would fully offset the expected grizzly bear mortality due to the mine and result in a net reduction in human-caused mortality of grizzly bears within the CYE, through the implementation of measures that improve conditions for grizzly bears by reducing the current and future risk of human-caused mortality not attributable to the mine. We expect that the mitigation plan conservation measures would prevent the human-caused mortality of more than one female grizzly bear over a 35-year period. Without the proposed action, we reasonably expect that few if any of the proposed conservation measures outlined above would occur in the near future.

Fragmentation

The CYE is a long, narrow ecosystem, approximately 100 miles long north to south and ranging from 15 to 35 miles east to west. The Cabinet Mountains Wilderness is a small, unroaded area in the higher elevations of the ecosystem, approximately 34 miles long and varying in width from 0.5 to 7 miles. The Cabinet Mountains Wilderness consists of approximately 94,272 of the 1,664,000 acres of the CYE (5.7 percent) (MDEQ and USDA 1995) and contains all or part of BMUs 1, 2, 4, 5 and 6. The BMU 8 contains the Cataract Roadless Area. These unroaded or wilderness areas provide a relatively high quantity of summer habitat, abundant throughout the CYE, but relatively limited important spring habitat. The Cabinet Mountains Wilderness forms the central section of the north to south movement corridor, linking the Cabinet Mountains to the Yaak River basin to the north. The wilderness area is unroaded, however it is impacted in places by open roads leading near or adjacent to its borders. The influence of nearby roads is especially detrimental where the wilderness narrows or where habitat in the wilderness is not conducive to grizzly bear movement, such as open areas devoid of cover.

The proposed action would not increase, and would decrease slightly, open and total motorized route densities (USDA 2002b). Core area would not decrease and potentially could increase with acquisition of mitigation habitat parcels. Open and total motorized route density and core areas in BMUs 4, 5, and 6 are near those reported for the average of female home ranges documented by Wakkinen and Kasworm (1997) (see discussion in previous section *Analysis of Displacement Effects on Grizzly Bears*). The moving windows calculations for BMUs 4, 5 and 6 do not necessarily depict the significance of the location of some key forest roads and private land parcels, particularly roads occurring in the north to south movement corridor.

Roads in the action area tend to be concentrated in the lower elevations where the spring habitat is concentrated and where human development and activities are situated. Several roads on the east side especially impact grizzly bears, including the Bear Creek Road (FR 4784), Midas Creek Road and associated spurs (FR 4778), and the South Fork Miller Creek Road (FR 4724). Bear

Creek road would be gated upon project implementation (W. Johnson, pers. comm. 2006), which would significantly improve grizzly bear habitat in BMU 5. The very end of Midas Creek Road (FR 4778) is restricted yearlong, and the South Fork Miller Creek Road (FR 4724) is open yearlong (W. Johnson, pers. comm 2006).

Other roads, particularly on the eastern slope of the Cabinet Mountains in BMUs 5 and 6, access patented and other mineral claims in the Snowshoe fault zone. These roads originate at lower elevations and lead up slope to higher elevations. A few approach the wilderness boundary, contributing to the constriction of the north-south movement corridor and risks of adverse encounters between grizzly bears and people. Two such routes are the proposed access roads to the Way-up and Fourth of July patented mine parcels. The biological opinion on these access routes was completed in 1998 (USDI 1998b) and amended in 1999 (USDI 1999a). In the biological opinion, the Service concluded that these roads would have significant adverse effects on grizzly bears. Terms and conditions specified in the incidental take statement limit the amount of motorized access to these parcels to that allowed for administrative use on restricted roads. Road use levels should not reach those of open roads. Other patented mining properties occur in the same general area, including those held by Mines Management, Inc., some of which were formerly leased by Noranda Minerals Corporation. Should private patented lands be developed or used in ways that displace or pose mortality risks to grizzly bears, the impacts to habitat connectivity could become more severe. However, where access or other federal permits are required, consultation under section 7 of the Endangered Species Act would be required and could provide a means to offset any adverse impacts to grizzly bears.

Approximately nine roads, including the roads accessing Way-Up and Fourth of July parcels, partially bisect the southern Cabinet Mountains from east to west in BMUs 5 and 6. Portions of some of the roads enter the north south corridor (W. Johnson, pers. comm. 2003). Of these, seven are open to the public and two allow access to only landowners with inholdings. On the west side, two roads are open to the public and are within the north south corridor. Open roads occurring within this corridor pose displacement and mortality risks to bears attempting to move north or south through the ecosystem. The displacement resulting from these roads is particularly disruptive to grizzly bears because they cross important spring habitat, which is limited in the ecosystem, and early-season huckleberries, also not abundant within the southern portion of the ecosystem. A few of these roads run from the highways bordering the CYE up to the edges of the wilderness area bringing people near secure bear habitat. Additionally, roads just outside the corridor boundaries on the east side occur in or traverse through important spring habitat. The Vermilion River road (FR 154) bisects BMU 8.

Near the proposed Rock Creek Mine project action area, the ecosystem narrows to approximately 15 miles, its narrowest portion. The topography of this narrow mountain range and human development on the east and west slopes constrict the width of the ecosystem, impacting the north to south movement corridor for grizzly bears in BMUs 4, 5, and 6. The BA delineates this north south movement corridor and existing and potential sites that may constrict the corridor and impair movement of bears through the area (see BA: Appendix 10, figures A, B, and C) (Appendix E). Distances between existing or potential sites of high human use could be less than 2 miles in some cases. This corridor is critical as it links grizzly bear habitat in the southern

Cabinet Mountains, specifically BMUs 6, 7, 8, and 22 with habitat in the Cabinet Mountains BMUs to the north.

The proposed Rock Creek Mine has the *potential* to further constrict the north south corridor in the southern Cabinet Mountains, contributing to fragmentation of the block of habitat in BMUs 6, 7, 8, and 22 from areas to the north. Improvements and increased use of FR 150 along Rock Creek, and the predicted increased access to and use of Rock Creek Trail could displace grizzly bears using the north to south corridor, or those attempting to navigate the action area west of the divide. The major roads and activities associated with the Rock Creek mine could serve to inhibit grizzly bear movement west of the divide in the Rock Creek drainage itself along FR 150 and use of habitat near the mine site. When added to the existing patented private lands, other private in holdings, and roads occurring on the east side of the Cabinet Mountains, the proposed Rock Creek Mine would contribute to disturbance across BMUs 5 and 6.

Unmitigated, the disturbance and displacement of grizzly bears from the proposed mine and activities, and existing roads on the east side could reduce the safe movement and dispersal of bears moving north and south along the Cabinet Mountains. The 1998 BA suggested that a band of disturbance could potentially reduce the connectivity between the lower third of the Cabinet Mountains section of the CYE from the rest of the CYE (USDA 1998b, Appendix 10). It is important to note however, that the BA's analysis considered the Montanore Mine, with all of its associated activities on the east side, to be part of the environmental baseline. Noranda abandoned the Montanore Mine project (see Introduction), and its omission creates a significant improvement in the baseline conditions in the action area. Still, the effects of the Rock Creek Mine, when added to existing roads occurring on the east side of the divide, would contribute to human disturbance within the action area. Although it would not constitute a complete barrier to movement, the disturbance could evoke avoidance behavior by some bears and reduce use of the north south movement corridor, by inhibiting movement west of the divide. The disturbances on both sides of the divide may result in some grizzly bears moving into areas of human activity and increased mortality risk. Grizzly bears using BMUs 4, 5, and 6 may be compelled to change traditional movement patterns and behaviors.

Human use of the Rock Creek Trail along the East Fork of Rock Creek is expected to increase substantially with the improvement of access, greater publicity and increased people moving to the area. This trail would be accessed by the improved road to the mine and would be expected to attract greater use following improvement of the road. The Rock Creek Trail is currently considered a low use trail, and is not considered a significant detrimental impact to core area or habitat effectiveness.

If not addressed, a reduction in effective core habitat may occur if human use on the Rock Creek or St. Paul Trails increased to levels that displace grizzly bears and contribute to fragmentation of the north to south corridor. The potential for confrontations between bears and people would be expected to increase if high use of the Rock Creek Trail should occur. According to the BA, the Forest predicted the Rock Creek Mine would result in a 31 percent increase over the current (actual) use levels on this trail, ranging from 14 to 35 parties per week. This predicted increase was based solely upon a portion of the anticipated influx of Rock Creek Mine employees and their family members recreating during the life of the mine, and did not include a general

increased public interest in the area. The Service has determined that the average 18 percent annual increase in reported general recreation use of the trail from 1990 to 1996 would likely continue for at least part of the next 35 years. If the existing use exceeded 20 parties per week, trail use would be considered high and significant displacement of bears away from the area would be expected, but also expected is an increased chance of adverse human-grizzly bear interactions within the north south corridor.

The Rock Creek Mine directly affects BMUs 4, 5 and 6 just south of the Troy valley. Further human development in the valley and along the Clark Fork River would displace bears sensitive to human activities and could lead to further constriction of the ecosystem to the north of the action area. People coming to the area because of opportunities associated with the proposed Rock Creek Mine could contribute to the fragmentation as they build homes in grizzly bear habitat. However, of the predicted 300 to 320 new housing units that would result due to the mine, the Noxon/Heron/Trout Creek area would see the largest number of new housing units, between 116 to 125 (MDEQ and USDA 2001). The remaining units would be distributed in or near Troy, Thompson Falls, Libby, and eastern Bonner County, Idaho.

Mitigation plan measures to reduce and avoid fragmentation

1. **The Forest would restrict Bear Creek Road (FR 4784).** The Forest closed this east-side route to the public for safety reasons and to mitigate the impacts of the proposed action (USDA 2002c). It is now reopened, but would be closed if the proposed action proceeds. This restriction was an important benefit to grizzly bears using the action area east of the Cabinet Divide. Bear Creek Road accesses some of the best spring, summer and fall grizzly bear habitat in the Cabinet Mountains (Kasworm and Manley 1988). Securing spring habitat in the drainage would be of particular importance. West of the divide, all or portions of routes FR 2285, 2741X, 150, and 2741A would be closed year long with barriers (Table A4). The proposed action would restrict access on a portion of FR 150 in BMU 4. This closure would effectively close a loop route which would significantly reduce traffic on this route and improve security conditions for grizzly bears in BMU 4.

   The restrictions on public use of Bear Creek Road would significantly improve secure habitat for grizzly bears on the east side, creating a block of habitat to the south with no roads open to the public covering Bear, Cable, Poorman and Ramsey Creek drainages. The closure does not entirely eliminate impacts to important habitat on the east side, but results in a significant improvement for bears in the action area. Similarly, the restrictions on FR 150 (closure of the loop route) in BMU 4 and other routes would not compensate entirely for the increased activity and disturbance in adjacent BMU 6, along FR 150 and along the Rock Creek trail, but would significantly improve habitat conditions for bears west of the divide in the action area.

2. **The revised mitigation plan provides funding for the development of a recreational management plan that would require monitoring to ensure high trail use on the Rock Creek trail does not occur.** The recreational management plan would be completed prior to construction of the mine. The U.S. Forest Service and the Service

would sign the plan. The Forest would monitor trail use, and in the event that high use occurred, would implement the plan to limit visitor use. This action would reduce potential risks to grizzly bears along this particular trail and would reduce the impact of the trail within the north south corridor. Recreational use of other trails and open roads in the action area is expected to generally increase. If use of any trails in core area would reach high use, the Forest would implement actions to either reduce human use to levels that maintain core area effectiveness, or create adequate core elsewhere within the BMU.

3. **The mitigation plan requires acquisition of or easement on 2450 acres of mitigation habitat, 153 of which must be in the north south corridor.** As mentioned previously, a minimum of 153 acres of this mitigation habitat is required in BMUs 4, 5 and 6 to *specifically* reduce or mitigate for the potential fragmentation of the north to south movement corridor that results from impacts of the proposed mine. The mitigation plan requires that these 153 acres be acquired *before* the evaluation adit phase of the mine could begin. The 153 acres of mitigation habitat within the north to south corridor would improve connectivity, increase core area, and maintain benefits for grizzly bears throughout a larger area depending upon the current and potential access to the lands that could be eliminated and the parcels' development potential.

In 2005, Revett purchased 273 acres within the north-south corridor (C. Rife, Revett Silver Company, in litt. 2005). This property has high value for grizzly bears and was ranked number two in priority in the *Corridor Replacement Habitat Assessment for acceptable lands to consider*. Upon approval of the Service and Forest, this parcel could be used as part of the mitigation acres and transferred to the Forest. This parcel could be conserved into perpetuity as core habitat, which would eliminate an existing potential for fragmentation or loss of core because of private access development (W. Johnson, pers. comm. 2006). Additionally, the remainder of the required 2177 acres would gradually be acquired in phases prior to construction and operation of the mine to compensate for acres lost to physical alteration of habitat and disturbance (see schedule in Table A3). A portion of these acres could also improve security in the north south corridor.

The most critical objective of the required mitigation habitat is to maintain and improve grizzly bear habitat connectivity within the north to south movement corridor, to ensure grizzly bears in the southern Cabinet Mountains portion of the CYE can adequately maintain and use home ranges, and can move between BMUs 6, 7, 8 and 22 and BMUs to the north and north west, including BMUs 5, 4, 2 and beyond. The key element in assuring connectivity in the north-south movement corridor is the juxtaposition of properties acquired through fee title or easement to the proposed mine site, the mine's zone of influence, and the east-side roads. With the number of private land parcels available in Bum's 4, 5 and 6, there are a number of combinations of mitigation properties that would meet this objective. However, some combinations of mitigation properties may not adequately offset the significant potential for fragmentation of the north to south movement corridor. Therefore, the Service would review the combination of properties to ensure an adequate movement corridor and home range use for grizzly bears within BMUs 4, 5, and 6.

The revised mitigation plan relies on the *Corridor Replacement Habitat Assessment for acceptable lands to consider* (not available to the public until replacement habitat mitigation is completed). This assessment would ensure that the 153 acres acquired adequately reduces the potential for fragmentation of the north to south corridor. The Service was involved in the development of the Replacement Habitat Assessment, which identifies potential mitigation habitat parcels and prioritizes them according to location, development potential, and potential contribution to maintaining and improving connectivity in the north-south corridor. The plan also states that the Forest Service would have final approval of mitigation acres and associated covenants prior to recording. **The Forest would approve and describe in writing how the properties to be acquired effectively reduce the potential for fragmentation of the north to south corridor.** At the request of the Forest, the Service would review the identified properties to further ensure they contribute to an adequate movement corridor. Portions of the additional 2350 acres of mitigation habitat could also serve to further improve connectivity north to south, if those acquisitions were determined to be most beneficial to grizzly bears. The 273 acres already purchased by Revett lies in the north-south corridor, and was ranked as the number 2 priority mitigation parcel. As such, it is valuable in reducing the likelihood of fragmentation in the north south corridor. If the proposed action is approved, and Revett offers these parcels as mitigation habitat, we would work with the Forest to describe in writing how the parcels, acquisition or the easements on the parcels, accomplish our goals to avoid fragmentation.

The revised mitigation plan stipulates that private lands be acquired by Revett through acquisition of fee-title or *perpetual* conservation easements and transferred to the Forest Service through donation or land exchange. The revised mitigation plan requires perpetual conservation easements, which would ensure long-term protection of security habitat for bears who have incorporated these secure areas into their home ranges. Mitigation habitat would preclude development of existing private habitat that might occur without such protection. Acquiring mitigation habitat that is currently developed or at risk of development would benefit bears by eliminating or precluding development or other management adverse to bears over the long-term, provided these mitigation properties are managed in a way supportive of bear survival and recovery, especially in the north to south movement corridor. The mitigation plan requires these acres be managed for grizzly bear security pursuant to protective conservation easement terms or pursuant to Forest management strategies supportive of grizzly bear recovery and survival. Acquisition of fee title or permanent easement would ensure that these private lands remain secure for bear habitat in the future.

The 2350 acres of mitigation habitat would also contribute to improving connectivity of habitat in the general action area (see discussion above under *Mitigation plan effects on grizzly bear displacement and habitat loss*).

4. **The mitigation plan requires funding to conduct a long-term monitoring study of grizzly bears throughout the life of the mine within the action area, in coordination with the current grizzly bear research conducted in the Cabinet Yaak ecosystem.** The information would be used to ensure the mitigation measures, including road

closures, habitat acquisition, and easements, were in fact working to alleviate fragmentation of habitat within the action area. If monitoring information suggested otherwise, the Service would consider that as new information requiring initiation of additional consultation. Information gained through monitoring could be used to inform the adaptive management process.

5. **The proposed action and mitigation plan ensure no degradation of access management conditions for grizzly bears in BMUs 4, 5 and 6 for the life of the mine.** As discussed in detail in the previous section *Analysis of Displacement Effects on Grizzly Bears*, levels of open and total motorized route densities are near or below the average reported in CYE grizzly bear research. Core areas in BMUs 4, 5, 6, 7, and 8 are equal to, or in most cases substantially above the average reported in research. The mitigation plan requires the Forest to manage above these baseline conditions once mitigation properties are acquired and access management opportunities arise. This level of access management would contribute to reducing or mitigating for displacement and fragmentation effects of the mine.

6. **As mentioned earlier, the revised mitigation plan would require an Oversight Committee to establish an MOU that would define roles and responsibilities of members and the committee, whose primary function would be to oversee the 35-year grizzly bear management plan.** The Oversight Committee and defined management plan required in the mitigation plan is needed to coordinate and monitor the complex set of mitigations, the acquisition of lands and conservation easements, the monitoring and reporting, use of new information, and other requirements of the mitigation plan to ensure that the conservation needs of grizzly bears are met. This coordinated, calculated approach to full implementation of the mitigation plan, with adaptive management where needed, would alleviate the potential for fragmentation of the southern Cabinets as a result of the proposed Rock Creek Mine.

Summary of fragmentation risks Considering the current conditions in the action area, the proposed action would reduce north to south connectivity across the Rock Creek drainage itself, due to effects of the mine and increased traffic along FR 150. The increased traffic on FR 150 is not expected to create a barrier to grizzly bear crossing the drainage, but would probably affect general movement patterns and would affect grizzly bear use of habitat near the road. The potential for fragmentation due to roads and development would be reduced throughout the rest of the action area, especially within the north to south movement corridor. The effects of full implementation of all conservation measures in the proposed action and mitigation plan, is expected to result in an improvement in the connectivity of habitat within the corridor through proposed access management, closure of the FR 150 loop route, other road closures east of the divide (see Table A4), and acquisition of fee title or conservation easement on mitigation lands that are currently developed or at risk of development. Overall, the measures taken to improve connectivity throughout the north south corridor would compensate for the impacts of reduced connectivity across the Rock Creek drainage.

<u>Conservation Needs of the Species</u>

The Service has identified six priority needs to improve the present status of grizzly bears in the CYE and achieve grizzly bear recovery (C. Servheen in litt. 2005b). The agencies reviewed new scientific information and data available since the 2003 biological opinion and re-evaluated the 2003 mitigation plan to compare it to the six priority conservation needs. The six priority conservation needs are listed below, along with a summary of the proposed, revised mitigation plan measures that specifically address each need.

Three of the six conservation needs are similar to those assessed in Proctor et al (2004). Through population simulations, Proctor et al. (2004) documented extinction risks for the CYE grizzly bear population, and the influence of three factors that could substantially reduce the likelihood of extinction of the grizzly bear population. Over the long-term (100-year period) mortality reduction had the largest effect, while augmentation had the largest positive effect on growth rate over the short-term (10 years). Population growth rates dramatically increased as a result of augmentation over 10 years; even low rates of augmentation (one female per year) reduced the probability of extinction by 33 percent over 25 years. Adding three females per year cut extinction rates in half. Increasing the age of those bears augmented and increasing a 10-year effort to 20-years both lowered the extinction risk slightly. However, mortality reduction had the greatest positive effect on growth rates over a 100-year period and equally strong reductions in extinction probabilities. Finally, linkage enhancement **and** mortality reduction combined had a larger effect on lowering the extinction probability than 10 years of augmentation.

The following is a list of the three priority needs similar to those assessed in Proctor et al. (2004) and a summary of how the proposed action would address each need :

1. Augmentation should be done in the CYE, specifically 12 to 15 subadult females (Proctor et al. 2004) into the Cabinet Mountains within ten years.

In 2005, Montana Fish, Wildlife and Parks announced its plan to continue augmentation of the Cabinet Mountains, with one to two female grizzly bears per year. In 2006, the preferred alternative in the State's DEIS on the Grizzly Bear Management Plan for Western Montana supported the earlier recommendation for augmentation (Montana Department of Fish, Wildlife and Parks 1986). The DEIS recommended 10 to 15 grizzly bears should be augmented into the Cabinet Mountains. They released a six-year old female from the NCDE into the Cabinet Mountains in 2005, and a subadult female in 2006. Kasworm et al. (in litt. 2006) stated that the augmentation program should not be viewed as simply replacing bears lost to human-caused mortality, but should provide for overall increases in the grizzly bear population in the CYE. They estimated that between 12 and 24 female grizzly bears were needed to stabilize the population, again depending upon survival rates and age at the time of relocation.

Montana Fish, Wildlife and Park's augmentation plan fulfills one high-priority conservation need for grizzly bears in the CYE. The proposed action is not associated with the State's plan to augment the CYE. However, the Service has expanded its monitoring effort to monitor the augmented bears. Annual funding for the Service to monitor grizzly bears in the CYE is currently tenuous, dependent upon federal funding. Projected federal funding for the next few years is as of yet not adequate to ensure

continued monitoring of augmented or native grizzly bears through the Service's current program in the CYE (C. Servheen, pers. comm. 2006). Montana Fish, Wildlife and Parks will continue to augment the population if the Service monitors the augmented bears (C. Servheen, pers. comm. 2006). Therefore, in addition to the funding for monitoring bears required in the 2003 mitigation plan, Revett agreed to provide funding to the Service to monitor native bears as well as grizzly bears augmented into the Cabinet Mountains to help ensure augmentation would continue as needed. Further, Revett voluntarily offered to provide funding, if needed, to ensure augmentation efforts continue or increase the potential number of candidate bears that could be located and moved to the Cabinets each year (C. Rife, Revett Silver Company, in litt. 2005b).

The mitigation plan requires that the anticipated loss of one female grizzly bear as a result of the proposed action be offset *prior* to that loss occurring. The plan requires that construction of the mine be deferred until at least six females are relocated to the Cabinet Mountains. The rationale for six bears is found in Kasworm et al. (in litt. 2006). Through simulations, they demonstrated that augmentation to replace the impact of the loss of one reproducing adult female (the loss we anticipate in this biological opinion) would require three to six female grizzly bears depending upon survival rates and age at time of relocation. This requirement for six female grizzly bears of any age is therefore conservative, and offsets any potential loss of a female due to the mine. Two of the six females have been augmented to date. This measure would be complemented by a corresponding long-term reduction in the potential human-caused mortality rate of grizzly bears from that we would expect if there were to be no mine. This reduction is expected to occur both within and outside of the action area as a result of the combined effects of mitigation measures described below and in previous sections of this opinion.

2. Reduction of grizzly bear mortality rates by addressing the causes of human-caused mortality through a) educating the public to reduce bear attractants at homes, farms, hunting camps, and recreation sites, b) hunter education to reduce misidentification kills and minimize attractive ungulate carcasses, and c) controlling human access (via roads).

Specific measures that address this recommendation are listed below. Previous sections of this biological opinion described and detailed how each contributes to fulfilling the recommendation. **Italicized** measures are those that are not reasonably expected to occur in the near future without the funding provided by Revett as required in the mitigation plan, based on past and anticipated levels of government funding. A "**(2006)**" denotes those measures added to the mitigation plan during 2005 and 2006.

- *Montana, Fish, Wildlife, and Parks' grizzly bear specialist in Noxon, prior to construction of the evaluation adit*
- *Montana, Fish, Wildlife, and Parks' wildlife law enforcement officer in Noxon, prior to construction of the evaluation adit*
- *Montana, Fish, Wildlife, and Parks' grizzly bear specialist in Libby, prior to construction of the mine* **(2006)**
- *grizzly bear-resistant garbage containers for employees' personal use* **(2006)**

- *grizzly bear-resistant garbage containers for distribution to the public* **(2006)**
- *grizzly bear-resistant county garbage transfer station near mine entrance, prior to construction of the evaluation adit*
- *funding for making 12 county transfer stations bear-resistant* **(2006)**
- *funding for 20 electric fencing kits* **(2006)**
- *funding ongoing monitoring and research of native grizzly bears in the Cabinet Mountains, beginning prior to construction of the evaluation adit*
- *funding for ongoing monitoring and research of native bears and bears augmented through State program, beginning prior to construction of the evaluation adit* **(2006)**. *From the initial work on the evaluation adit through the 35-year life of the project, funding would be available with which to monitor the grizzly bear population to assess grizzly bear population trend and habitat use, to ensure the mitigation measures were effective.*
- *funding for all sites on the Forest with garbage facilities to be made grizzly bear-resistant* **(2006)**
- *153 acres of high risk grizzly bear habitat within the north south corridor, acquired prior to construction of the evaluation adit by Revett and transferred to the Forest*
- *acquisition or easement of a total of at least 2450 acres of private, high risk-high value lands within the CYE, prior to construction and operation of the mine*
- *a public outreach effort urging support for grizzly bear conservation, sponsored by Revett, prior to construction of the evaluation adit* **(2006)**
- food storage order in BMUs 4, 5, 6, prior to construction of the evaluation adit.
- forest road density management to control access, beginning prior to construction of the evaluation adit. No significant increases in open or total motorized access densities, or decrease in core area.
- food storage order across the CYE on the Forest.

3. Management strategies should include interchange of female grizzly bears between the Cabinet Mountains and the Yaak as a goal, through identification of where bears cross highways to validate and improve existing predictive linkage models.

Specific measures that address this recommendation are listed below. Previous sections of this biological opinion described and detailed how each contributes to fulfilling the recommendation. **Italicized** measures are those that are not reasonably expected to occur in the near future without the funding provided by Revett as required in the mitigation plan, based on past and anticipated levels of government funding. A "**(2006)**" denotes those measures added to the mitigation plan during 2005 and 2006.

- *funds for continuing the ongoing monitoring of bears to assess and identify key connectivity lands between the Yaak and Cabinet Mountains* **(2006)**
- *153 acres of high risk grizzly bear habitat within the north south corridor, acquired prior to construction of the evaluation adit by Revett and transferred to the Forest*
- *acquisition or easement of a total of at least 2450 acres of private, high risk-high value lands within the CYE, prior to construction and operation of the mine*

- Forest road density management to control access, beginning prior to construction of the evaluation adit.

In addition, the proposed action would be compatible with the final three priority conservation needs identified by the Service:

4. Address the needs of bears outside the recovery zone.

The mitigation package would improve current conditions for grizzly bears within the CYE recovery zone. The bear specialists and law enforcement officer would also provide services to areas outside the recovery zone, thus benefiting grizzly bears occurring there. Also, motorized access management for grizzly bears occurring outside the recovery zone improved in 2004, with the Forest Plan amendment.

5. Increase public outreach and involvement

As described in this biological opinion, the proposed action contributes to this measure through measures listed below. **Italicized** measures are those that are not reasonably expected to occur in the near future without the funding provided by Revett as required in the mitigation plan, based on past and anticipated levels of government funding. A "**(2006)**" denotes those measures added to the mitigation plan during 2005 and 2006.

- *a public outreach effort to obtain support for grizzly bear conservation, sponsored by Revett, prior to construction of the evaluation adit.* **(2006)**
- the Forest will organize and lead regularly scheduled meetings, attended by representatives of participating agencies, the interested general public, and representatives of the county commissioners, mining company, local citizen and other non-government groups to review objectives and implementation of the mitigation measures, and review monitoring and research information. **(2006)**
- *Montana, Fish, Wildlife, and Parks' grizzly bear specialist in Noxon, prior to construction of the evaluation adit.*
- *Montana, Fish, Wildlife, and Parks' wildlife law enforcement officer in Noxon, prior to construction of the evaluation adit*.
- *Montana, Fish, Wildlife, and Parks' grizzly bear specialist in Libby, prior to construction of the mine.* **(2006)**

6. Access management

As described earlier in this biological opinion, access management related to the proposed action contributes to this priority conservation need.

- forest road density management to control access, beginning prior to construction of the evaluation adit; no significant increases in open or total motorized access densities, or decrease in core area; potential decreases in road densities and increases in core as a result of acquisition of mitigation habitat.

In summary, the proposed action contributes to each of the six priority conservation needs for recovery of grizzly bears in the CYE.

Species Response to the Proposed Action

Recent trend estimates for the CYE grizzly bear population strongly suggest a decline. The probability of decline was from 1983 through 2002 was 89 percent (Kasworm et al. 2005). Updated analysis through 2005 indicated the probability of decline is 91 percent (Kasworm et al. in litt. 2006b). It is unlikely that at this time habitat is the factor most limiting the grizzly bear population. The existing small population and correspondingly few reproductive-age female grizzly bears are more plausible factors limiting population growth. Grizzly bear reproductive rates are inherently low, because females grizzly bears typically do not breed until age 4 or older, average 2 cubs per litter, stay with cubs for 2 to 3 years, and have few litters during their lifetime. Cub mortality rates are relatively high. Mortality of adult female grizzly bears is especially deleterious to population growth. The population of grizzly bears in the CYE remains vulnerable to extirpation because of small population size (USDI 1999b; Proctor et al. 2004).

Small population size, human-caused mortality and reduced habitat connectivity have long been recognized as significant problems in the CYE grizzly bear population, and in other wildlife populations as well. A population of only 30 to 40 grizzly bears makes any number of human-caused mortalities, in addition to natural mortality, a significant factor in population decline. Human-caused mortality in the CYE is limiting population increase and contributing to extinction risk (Mattson and Merrill 2004; Procter et al. 2004). The number of human-caused mortalities of grizzly bears over the past 24 years is 21, or an average of less than 1 per year. The effect on the population has been significant. The existing human-caused mortality rate, given the small grizzly bear population, is not sustainable with or without the Rock Creek Mine. This presents a management challenge, considering the number of human-caused mortalities (less than 1 per year) compared to the number of people who use or live in grizzly bear habitat in the CYE each year. We are not able to predict and prevent all circumstances that could cause any one specific person, at a specific time and place, to kill or cause the death of a grizzly bear. However, as the human and grizzly bear populations grow, there are actions that agencies and governments can take to reduce the potential for human-caused grizzly bear mortality.

As described in detail earlier in this biological opinion, we expect that one grizzly bear may be killed due to impacts of the mine, but not until during the construction or operation phase of the mine. During those phases of the mine, the number of people living in the area would increase substantially. We do not anticipate mortality of grizzly bears during the initial two to three years of construction and operation of the evaluation adit.

In the March 28, 2005 Order, the court expressed strong concerns that the CYE population was at least not increasing, and concluded that contemplating additional take was “not rational”. In response to the court’s concerns, the agencies reviewed new information available since the 2003 biological opinion and re-analyzed the proposed action and mitigation plan.

As part of our analysis in the 2003 biological opinion, we had calculated annual known, human-caused mortality rates in order to estimate the effects of the proposed mine on the CYE grizzly

bear population. In this analysis, we did not estimate annual rates as there is no relevant research on sustainable mortality in small grizzly bear populations that would lend insight into the rate. In this biological opinion, we relied instead on an analysis of the anticipated effects of the proposed mine in consideration of the most recent estimated rate of trend and probability of decline (Kasworm et al. 2005; Kasworm et al. in litt. 2006b) and projections in Proctor et al. (2004).

As a result, the Forest and Revett agreed to *additional* measures over those already in the 2003 mitigation plan, to ensure that the plan directly addressed each of the primary factors limiting growth of the CYE population:

- small population size,
- human-caused mortality, and
- connectivity,
- as well as the three additional conservation needs of the grizzly bears in the CYE

Through this analysis, we concluded that prior to the proposed Rock Creek Mine project commencing, specific actions were needed that would work collectively to improve the existing status of CYE grizzly bears by stabilizing the population through augmentation and a reduction in human-caused mortality of grizzly bears. Further, such actions to improve the existing environment for grizzly bears were needed, whether or not the Rock Creek Mine project moved forward. Improvements in the current conditions are needed to cultivate a grizzly bear population that is able to sustain some level of human-caused mortality, as the risk of human-caused mortality cannot be entirely eliminated. The plan requires measures that address and alleviate the problems of small population size and existing rates of human-caused mortality, as well as measures to improve and maintain habitat connectivity. Finally, we concluded that the 2003 mitigation plan included measures that addressed these issues within the action area, but did not address these issues across the Cabinet Mountains and the CYE as a whole.

In 2005, several opportunities arose as Revett was advised of the situation caused by the current conditions in the CYE. Revett agreed to provide additional, significant levels of funding for needed conservation measures. This level of funding dedicated to grizzly bear conservation in the CYE is not likely available through limited federal, state or local government funds. Revett agreed to establish a fund to be used for several additional measures that further reduce the potential for human-caused mortality and improve habitat conditions on public and private lands *throughout* the entire ecosystem, beyond the project area. The 2006 mitigation plan includes measures that reduce or offset the impacts of the mine, but also includes several proactive measures that would alleviate problems related to grizzly bear mortality and habitat connectivity that *are not and would not* be attributable to the mine. These measures were necessary in order to improve the current population status of grizzly bears in the CYE to the point the population could sustain potential adverse impacts from the mine and not result in jeopardy to the species.

Table A15 summarizes the total mitigation plan funding proportions directed at the major issues affecting grizzly bears in the CYE. It outlines both current management efforts and proposed management under the mitigation plan. The table summarize how issues central to the recovery of grizzly bears in the CYE are currently addressed, and how the proposed project would address each. The mitigation plan allocates resources to various issues in proportion to needs in reducing

mortality risk, and other risks to CYE grizzly bears.

Without the funding from the project sponsors, most of the grizzly bear conservation measures outlined above would not occur in the near future. Critical needs for augmentation, human-caused mortality reduction and habitat connectivity are now subject to available agency funding or would not occur. Agency budgets have remained flat or been reduced in recent past; the in 2006, the Service had no funding available for most of the recovery actions listed above.

As detailed earlier, the mitigation plan requires the Oversight Committee to oversee and monitor the implementation of all mitigation measures by the Forest and Revett, and review all new information on grizzly bears and grizzly bears in the CYE. If needed, the Oversight Committee would develop appropriate modifications or revisions of the management plan and recommend these to the Forest. This information would come from sources including information from the research and monitoring effort conducted over the life of the mine. The Forest and participating agencies would meet regularly with the interested public and local governments, to review implementation of the plan. We expect that this would increase public trust of agency sponsored efforts and public support for grizzly bear recovery.

Table A15. Major issues affecting grizzly bears in the CYE and mitigation plan funding.

Issue	Current management	Enhanced management	% of mitigation effort	% of mortality
Population size	Low numbers placed opportunistically; Limited monitoring due to limited funding	Augmentation of 2-3 bears annually: • Ongoing for 10-15 years • Monitoring of all placed bears to document survival and reproduction • Increased placement increases genetic health and increases fitness	42%	
Mortality	High human-caused mortality risk • Risks increasing due to increasing development • No bear management specialists, resulting in ongoing conflicts • illegal killing continues	Lower due to: • Two bear management specialists advance education and minimize conflict potential • Dumpsters placed at private homes • Fencing transfer stations • Additional warden reduces potential for illegal killing and advances efficient investigations of bear mortalities	53%	Illegal 20.7% Site conflicts 3.4%
Population Trend	Declining	Stabilized and then increasing due to: • Increased augmentation, with necessary monitoring • Enhanced survival due to new programs and actions: sanitition, outreach, hunter education, bear specialist and warden positions.	Combination of: • 27%:augmentation • 15%: NEPA for Canadian bears • 53%: mortality control	

Table A15. Major issues affecting grizzly bears in the CYE and mitigation plan funding.				
Issue	**Current management**	**Enhanced management**	**% of mitigation effort**	**% of mortality**
Attractants	Minimal efforts	Enhanced attractant control due to: • Bear specialists positions • Bear resistant dumpsters on KNF • Bear resistant dumpsters at homes • Fencing of transfer station	Combination of: • 36%: FWP positions. • 17%: bear resistant dumpsters and transfer stations, and outreach.	Site conflicts 3.4%
Linkage	Minimal efforts	Enhanced efforts due to: • Monitoring of bears in Hwy 2 area • Outreach to local residents regarding sanitation and conflict prevention • Easements and acquisitions possible with identification of key crossing • Increased bear numbers due to augmentation and reduced mortality with eventual occupancy of linkage areas. • Enhanced sanitation in linkage areas, bear resistant dumpsters at private residences	5%	

We conclude that the number and type of measures included in the mitigation plan to reduce human-caused mortality can reasonably be expected to reduce current and future human-caused mortality risks across the CYE, including risks associated with the mine. We expect that the displacement, mortality and fragmentation risks associated with the mine would be fully or more than offset because important aspects of current conditions for grizzly bears in the CYE would be substantially improved (especially few breeding age females and a reduction in human-caused mortality risk), and would continue to improve as time goes by, due in large part to the measures in the mitigation plan, in conjunction with other recovery actions.

The proposed action including the mitigation plan would more than offset the loss of one grizzly bear (due to direct mortality) and the potential reduction in reproduction (or "harm" associated with displacement). The combined effects of measures in the proposed action would ensure the current conditions for bears improved and so would gradually increase the number of grizzly bears in the CYE to levels that could sustain and absorb impacts from the mine and result in a net benefit to the species. The combined measures affect both the project action area and entire CYE. In conjunction with the State's augmentation program, the mitigation plan is expected to contribute to meeting the overall conservation needs of grizzly bears in the CYE (listed above). The measures are reasonably expected to improve the current conditions for grizzly bears by supporting augmentation, reducing the probability of grizzly bear mortality due to the mine, reducing the current rate of human-caused grizzly bear mortality not associated with the mine within and outside the action area, and improving both connectivity within the north-south corridor (273 acres have already been purchased for this purpose) and within the entire CYE, by aiding in the identification of key parcels linking the Cabinet Mountains with the Yaak portion of the ecosystem. Over time, with full implementation of the proposed action and mitigation plan, we expect to see the number of grizzly bears grow, the population stabilize and then increase toward recovery goals.

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 Rock Creek Mine are not considered as cumulative effects because they require separate consultation pursuant to section 7 of the Act (50 CFR 402.14).

The cumulative effects of increased public recreational use of the action area, private land development for homes and business, and the significant amount of roading and forest management activities associated with private corporate timber lands within the action area are expected to continue. Recreational use and timber harvest on private property may have considerable local impacts on grizzly bears in the southern portion of the Cabinet Mountains. The Service believes these cumulative effects would adversely impact grizzly bears in the action area. On Plum Creek lands within the action area, Plum Creek applies timber harvest management direction for grizzly bears conservation, following the principles outlined in a September 15, 1993 letter (Plum Creek Timber Co., Inc. in litt. 1993) to the Service. The guidelines include direction for managing open road density, road location, cover, size of openings, timing of operations, and riparian habitats. These guidelines moderate the impacts of timber harvest on grizzly bears.

Other projects in the action area pose fragmentation risks in the narrow recovery zone. Two small patented mining properties (Way-up and Fourth of July mines) were recently granted a Forest Service right-of-way authorization. Through consultation on this action, terms and conditions were issued to minimize the impact of anticipated incidental take. The Forest concluded that it was unable to entirely restrict access to private land under ANILCA, nor restrict activities conducted on the private lands. Further, more than a dozen other patented mining properties occur in the corridor between the east and west sides of the southern Cabinet Mountains. The Forest has limited jurisdiction to reduce impacts that could occur on these private properties. Large scale mineral development is unlikely on these small patents (J. McKay, pers. comm. 2000) due to the size of the patents and the nature of the mineral deposits. However, potential activities on some of these private properties that could adversely impact grizzly bears include clear-cutting, small-scale mining activity including surface disturbance and blasting, construction of buildings, hunting camps, and livestock operations with food and attractants. Road access is not currently authorized to all patent owners, but the Forest may not have the authority to adequately manage future access to private lands in ways compatible with grizzly bear recovery.

Activities on private land in-holdings, especially on the east side of the Cabinet Mountains, could potentially affect grizzly bear movements within the north-south movement corridor, effectively constricting the secure habitat for bears to less than 2 miles wide in BMUs 4, 5 and 6. The north to south corridor contains expanses of scree habitat (exposed rock) lacking cover, and steep topography. Many private land in-holdings contain cover that would be used by grizzly bears moving through the area. Further constriction of the corridor may force grizzly bears into contact with people, could increase adverse intra-specific conflicts with other bears, or could

displace them from essential habitat to the extent that significant impacts to reproduction and survival result. The impacts of development on private in-holdings would be reduced and in some cases eliminated within the north-south corridor in BMUs 4, 5 and 6 through the acquisition or perpetual easement of 2450 acres as required in the mitigation plan. Revett has recently acquired 273 acres in the north-south corridor, which would be used as mitigation property if the mine is permitted (Carson Rife, Revett, in litt. 2005a). This property has high value to grizzly bears; it was rated as the number two priority by the agencies in their list of priority lands for acquisition or conservation easement. This property, managed for grizzly bear conservation, would contribute to long term habitat connectivity in the north-south corridor and reduce the potential for displacement of bears into the future.

Montana Fish, Wildlife and Parks began its augmentation effort in the Cabinet Mountains with plans to augment one to two female grizzly bears per year in 2005 (Montana Fish, Wildlife and Parks, in litt. 2005). Montana Fish, Wildlife and Parks proposed augmentation in 1986 in *The Grizzly Bear in Northwestern Montana* (1986 FEIS). In 2006, the State released its *DEIS on the Grizzly Bear Management Plan for Western Montana*, which included a preferred alternative to augment the CYE with 10 to 15 subadult male or female grizzly bears, or appropriate adult females, from other areas. In 2005, an adult female was relocated to the Cabinet Mountains from the NCDE; the bear emerged from her den in the CYE in spring, 2006. In 2006, a subadult female was relocated to the Cabinet Mountains, also from the NCDE. Montana Fish, Wildlife and Parks' augmentation plan to relocate grizzly bears, and two (or possibly more) female grizzly bears per year, is consistent and compatible with recent conservation recommendations for the CYE (Proctor et al. 2004), and with the priority conservation needs of grizzly bears in the CYE. Augmentation will significantly improve the short-term conditions for the population of grizzly bears in the CYE. Revett has agreed provide funding to ensure the Service has adequate annual funds to monitor augmented bears.

One population simulation estimated that 13 female grizzly bears would need to be augmented into the Cabinets to stabilize the population (Proctor et al. 2004); another estimated 24 females were needed given current mortality rates (relatively low survival rates) or that 12 were needed if mortality rates were lower (higher survival rates) (Kasworm et al. 2006b). The CYE grizzly bear population would need to be augmented and mortality rates would have to be lowered from existing levels to ultimately reduce the likelihood of extinction (Proctor et al. 2004). The Montana Fish, Wildlife and Parks has a bear management program; however, resources for that program are currently limited in the CYE. Success of Montana Fish, Wildlife and Parks' effort will take several years and must be documented through monitoring augmented bears. Based on the Service's earlier augmentation efforts in the CYE (described previously), we expect that augmentation will be successful over the next decade and significantly improve the status of the CYE grizzly bear population. We consider this program critical to the short-term (10 years) health of the population, and to recovery over the long-term.

The proposed action would increase the human population by about 11 percent in the local area. Without the proposed mine, Sanders and Lincoln Counties were expected to grow by 32 and 15 percent respectively between 1999 and 2020. Within the action area, development of private land in the center of the CYE near Troy continues. Expected increases in human development in or near the action area may displace bears sensitive to human activities and lead to further

constriction of the ecosystem to the north of the action area, impacting grizzly bears in the action area. Human development has inherent risks of habituation, food-related grizzly bear management problems, and increases opportunities for poaching or malicious killing of grizzly bears. Greater sprawl of residences along the Clark Fork River will continue to impact grizzly bears in the southern Cabinet Mountains.
Experience in other grizzly bear ecosystems demonstrates that human population growth can affect grizzly bear populations to varying degrees. The adverse effects of human population growth mentioned above can be moderated where: homes are built adjacent to or within the footprint of existing communities versus rural, dispersed developments; communities implement adequate attractant storage measures; private land owners have access to information on living in grizzly bear habitat; landowners have support in dealing with nuisance bears; hunters and recreationists are informed and aware of grizzly bear conservation needs; and access management on public lands provides adequate grizzly bear security. For instance, the grizzly bear population in the larger Yellowstone grizzly bear ecosystem has grown and expanded its range despite substantial growth in the human population adjacent to and within the ecosystem within the past 20 years. Much of this growth, however, is in part attributable to the large portion of the recovery zone in Yellowstone National Park, where human activity is highly regulated.

Human population growth presents special challenges to maintaining grizzly bear populations as small as the CYE grizzly bear population (see Mattson and Merrill 2004). The human population in Sanders County is projected to gradually increase over the next 35 years, with or without the mine, as is Lincoln County. The communities of Noxon, Heron, Trout Creek, Thompson Falls and Troy are expected to grow. Reduction of human-caused mortality is a key factor in reversing the decline of the CYE grizzly bear population. It is unlikely that sufficient local or state government sources or private sources of funding would be available for most programs or actions to significantly reduce human-caused mortality in the near term. We anticipate that the increased human population growth that is not associated with the mine would result in an additional human-caused grizzly bear mortality in the action area over existing mortality rates over the 35-year life of the mine. However, if the mine were to proceed, the grizzly bear specialist and law enforcement positions, sanitation measures on private and public land, access management on public lands, and the grizzly bear monitoring effort required in the revised mitigation plan would work to substantially reduce, but could not entirely eliminate, the adverse impacts of such human population growth within the Cabinet Mountains portion of the CYE. Without measures such as those in the mitigation plan, we anticipate higher human-caused mortality rates.

CONCLUSION

After reviewing the current status of the grizzly bear, the environmental baseline for the action area, the effects of the proposed Rock Creek Mine and the cumulative effects, it is the Service's biological opinion that the Rock Creek Mine as proposed, is not likely to jeopardize the continued existence of the listed entity of grizzly bears. No critical habitat has been designated for this species, therefore none would be affected.

The Service completed an initial biological opinion for the Rock Creek Mine project on

December 15, 2000 (USDI 2000c) in which we concluded that the proposed action was likely to jeopardize grizzly bears. The Service withdrew this biological opinion in March, 2002, and the Forest subsequently withdrew the ROD.

Subsequently, two significant new actions occurred. Noranda formally withdrew its plan of operations and abandoned several required permits necessary to develop the proposed Montanore mine, west of the Cabinet divide (Noranda Inc. in litt. 2002a, 2002b, 2002c, 2002d). The withdrawal of the Montanore Mine project represented a significant improvement in the baseline for grizzly bears within the action area and within the entire Cabinet Mountains. Second, the Forest agreed to incorporate all of the substantive provisions of the reasonable and prudent alternative required to preclude jeopardy to CYE grizzly bears (as outlined in the 2000 biological opinion for the proposed Rock Creek Mine) into their proposed action. The 2000 biological opinion's reasonable and prudent alternative, incorporated into the 2002 mitigation package, was developed to address adverse impacts of both the Montanore and Rock Creek mines operating in the southern Cabinet Mountains. Although the Montanore Mine was removed from the environmental baseline in the action area, the 2002 mitigation plan and additional measures for the Rock Creek mine were not substantively changed or weakened, and were strengthened in some areas due to inclusion of the measures in the reasonable and prudent alternative. In 2003, the Service completed an amended biological opinion that determined the proposed action was not likely to jeopardize grizzly bears.

In March 2005, as a result of another legal challenge, the court set aside and remanded the 2003 biological opinion to the Service for reconsideration. This current biological opinion addresses the concerns raised by the court, and considers new information including additional human-caused mortality and publications related to viability and trend of the CYE grizzly bear population. This biological opinion analyzed an improved mitigation plan proposed by the Forest, which was developed in consideration of the court's concerns and new information.

This biological opinion analyzed the effects of the proposed action and 2006 mitigation plan on grizzly bears. We concluded that collectively, the measures would reduce, remove, or more than offset the potential adverse effects of the proposed action. The Service believes the mitigation plan addresses the key conservation needs of grizzly bears in the CYE, and ensure that the proposed action would not likely jeopardize grizzly bears. We base our conclusion on the entire analysis found in this document, all information provided by the Forest, discussions with the Forest and with Revett staff, discussions with Montana Fish, Wildlife and Parks biologists, and information in our files.

The Service concludes that the combination of the actions required in the proposed action and mitigation plan would eliminate the likelihood that the proposed action itself would appreciably diminish survival and recovery of grizzly bears, and would in fact improve conditions over the long-term over the existing conditions, ultimately promoting the recovery of the CYE grizzly bear population. The recovery of the CYE population supports survival and recovery of grizzly bears in the listed entity.

The following *summarizes* the primary means by which the proposed action and mitigation plan avoid jeopardy:

1. **Conservation Needs** Results in Procter et al. (2004) indicated that the CYE grizzly bear population had an 85 percent probability of extinction within 100 years. The authors indicated that three actions could significantly reduce the probability of extinction: a) augmentation of the population, most effective on population growth in the short-term, b) reduction of grizzly bear mortality, most effective on population growth in the long-term, and c) enhanced population interchange, which along with reduction of mortality, had the largest effect on reducing extinction probability. Further the Service (in litt. 2005b) included these three actions as priority conservation needs for recovery in the CYE, along with the following three additional needs: d) increased public outreach, e) needs of grizzly bears outside the recovery zone, and f) access management.

   In summary, this biological opinion described and analyzed the mitigation plan measures or other measures expected to occur that fulfill each of the six recommended actions: a) funding to ensure the Service is able to continue to monitor Cabinet Mountains grizzly bears, both native and augmented bears; b) a comprehensive set of required measures expected to reduce human-caused mortality not only within the action area, but throughout the entire CYE; c) funding to ensure and expedite research that would help enable us to identify existing and potential areas of habitat linkage between the Cabinet Mountains and the Yaak portion of the CYE; d) a CYE bear specialist program, increased law enforcement, and a public outreach program sponsored by Revett; and e) no increases in open or total motorized route densities and no loss of core, with potential additional improvements through habitat acquisition. We conclude that these measures would contribute to improving the status of the grizzly bear population in the entire CYE, and be effective at an ecosystem scale to improve the existing conditions for grizzly bears. We also conclude that these measures would contribute to reducing and/or offsetting the potential adverse effects of the proposed action to levels not likely to appreciably diminish survival and recovery of grizzly bears, as analyzed in this biological opinion

2. **Human-caused Mortality Risk** To the extent possible, management actions should reduce potential mortality risks to grizzly bears in an attempt to meet the intent of the CYE Recovery Plan human-caused grizzly bear mortality *goal* of zero.

   In summary, the current Recovery Plan human-caused mortality goal for the CYE population is zero. The Service recognizes that over time, with the number of people in the CYE, this goal is not likely achievable with or without the development of the Rock Creek Mine. The Recovery Plan recognized the amplified risks of human-caused grizzly bear mortality in the CYE due to small grizzly bear population size and possible stochastic events. Given the *current* status of the grizzly bear population, the population would continue its decline with additional unabated loss of subadult or adult female grizzly bears.

   As mentioned in 1. above, the mitigation plan contains a comprehensive package of measures that have been shown in practice to work together to reduce mortality risks to grizzly bears. Mitigation plan measures to reduce the potential for grizzly bear mortality were discussed in detail in this biological opinion. The mitigation plan also requires a

grizzly bear monitoring program that would assist in detecting and identifying the causes of grizzly bear mortality, and in assessing the success of mitigation efforts. However, the mortality risks increase with the direct and indirect affects of the mine and these risks cannot be entirely eliminated over the 35-year life of the mine.

The Service anticipates that no more than one grizzly bear would be killed or removed from the population as a result of the proposed action. We base this expectation on the environmental baseline, existing and past grizzly bear mortality rates, causes of mortalities, and total effects of the mitigation measures. Given the current status of the population, the unmitigated loss of a female due to the proposed action would contribute to the decline of grizzly bears in the Cabinet Mountains, given the potential isolation of grizzly bears in Cabinet Mountains from those in the Yaak portion of the CYE. Unmitigated, female mortality would be especially detrimental if it occurred within the near-term before this population benefits from either natural population growth or the combination of augmentation and reduced human-caused mortality. We anticipate that the loss of a grizzly bear, if it occurs, would occur during the construction or operation phase of the mine.

We expect no net increase in human-caused mortality rates even with the potential mortality due to the mine. According to recent scientific population simulations, augmentation of the population **and** a reduction in mortality are essential factors in reducing the probability of extinction. As explained in this biological opinion, the mitigation package includes examples of most of the kinds of measures known to reduce human-caused mortality. The proposed action reduces the potential for grizzly bear mortalities that could be *attributable to the mine*. The mitigation plan goes further in that it is expected to improve the current environmental baseline conditions for grizzly bears by *reducing current and future rates* of human-caused mortality *not directly or indirectly attributable to the mine*. The combination of augmentation and actions to reduce current rates of human-caused mortality significantly reduces the potential for further decline of the population if a grizzly bear is killed as a result of the mine during the construction or operations phase. We reasonably expect that the measures taken to reduce potential for human-caused mortality, within and outside the action area, would result in no net increase, and more likely a net decrease, in overall human-caused grizzly bear mortality rates within the CYE, even with the one bear lost to the mine itself. The combination of augmentation and reduction in human-caused mortality would contribute to avoiding an appreciable reduction in the numbers, distribution and reproduction of grizzly bears.

Further, construction of the mine would be deferred until at least six females were augmented into the population. This number of females would offset the potential loss of a female grizzly bear due to the effects of the proposed mine (Kasworm et al. 2006b), if such loss were to occur. Further, the State's augmentation effort would continue, with the expressed intent of increasing total number of grizzly bears in the CYE (Kasworm et al. 2006b). Montana Fish, Wildlife and Parks expects to relocate at least one to two (possibly more, see Montana Fish, Wildlife and Parks 2006) female bears per year, to the Cabinet Mountains. Revett would ensure that the Service has annual funding to monitor bears relocated into the Cabinet Mountains. Revett has further agreed to provide funding

for actual augmentation, in the event that Montana Fish, Wildlife and Parks is unable to continue its program. Augmentation would continue to contribute to the persistence of bears in the Cabinet Mountains and to the eventual stabilization and growth of the CYE grizzly bear population.

The Service anticipates some low level of take would also occur in the form of harm (habitat alteration) or harassment, which would occur as a result of initial disturbance (e.g. noise and activity) near the mine site and the resulting displacement of one or two female grizzly bears from key habitats. We anticipate this take would occur through impaired reproduction in these females, and would occur during the construction phase of the mine, as adult female bears now using the Rock Creek drainage would have to adjust to a relatively sudden and substantial increase in human activity within the action area. This type of take is difficult to quantify and detect, and the likelihood of its occurring is based in part on the nature of individual bears using the action area. However, to offset or minimize such impacts: a) the Forest would continue to provide substantial levels of core habitat and limit motorized route densities in the affected BMUs to levels that are reasonably expected to allow most grizzly bears alternative habitats for use if displacement occurs; b) private land acquisitions and easements on 2450 acres would contribute to mitigating and alleviating the displacement effects of the mine over the long term by securing existing and additional core habitat for perpetuity; c) over the long term, the augmentation program and reduction in human-caused mortality rates would also contribute to alleviating and offsetting the effects of any loss of reproductive potential caused by displacement. Based on existing scientific information on displacement, we expect that within a year or two, the potential for impaired reproduction would diminish as female bears adjust, by using alternative habitats within their home ranges or habituating to the routine disturbance generated by the mine.

We conclude that our projections of anticipated human-caused mortality and harm or harassment related to the mine, when added to other human-caused mortality, would be within the range of mortality that would not lead to population decline. The effects of an anticipated human-caused grizzly bear mortality and the impaired reproduction (resulting from displacement) on the population would be more than offset by both existing and improved habitat conditions, the net reduction in existing and anticipated future grizzly bear mortality rates, and augmentation (Kasworm et al. 2006b; Proctor et al. 2004). Therefore, we conclude that the effects of the anticipated levels of human-caused female grizzly bear mortality and the temporarily reduced reproductive potential described in this biological opinion would not appreciably diminish the likelihood of the survival and recovery of grizzly bears.

3. **Fragmentation** Reduce or minimize displacement effects of the mine to maintain and improve habitat connectivity within the Cabinet Mountains, and between the Cabinets and the Yaak portions of the CYE. In particular, ensure grizzly bear use of the habitat within the affected BMUs (4, 5 and 6) and movements between BMUs to the north and south of these BMUs to allow (a) adequate use of essential habitat by and movement of grizzly bears within their home ranges, (b) exploratory movements, (c) breeding behaviors and movements and genetic interchange; and (d) dispersal.

Interchange of grizzly bears between the Cabinet Mountains and the Yaak is a recovery goal. Population and habitat connectivity within the CYE grizzly bear population would contribute to significantly reducing the likelihood of extinction. The mitigation plan requires funding for continued research aimed at identifying key areas of connectivity between these two portions of the CYE. The mitigation plan also requires purchase of properties or conservation easement on 2450 acres. Key private land parcels have been identified and ranked according to habitat value for grizzly bears and risks of development that would affect connectivity. These purchases or easements would enhance and promote long-term connectivity within the narrow Cabinet Mountains portion of the CYE.

Acquisition of 153 acres of mitigation properties would be required within the north-south corridor, and must be approved by the Service to preclude significant fragmentation of the north-south corridor. Based on recent property purchased by Revett (273 acres) within the north-south corridor, more than 153 acres of key habitat would be acquired for grizzly bear conservation within the corridor. A total of 2450 replacement acres are required to offset displacement effects of the mine. A portion of the additional acres would likely be within the north-south corridor as well, and would improve long-term habitat security and facilitate movement of bears and use of habitat within BMUs 4, 5, and 6, and potentially BMUs 7, 8 and 22. These mitigation measures would directly and indirectly reduce the connectivity impacts of the mine and offset habitat loss and displacement due to human-caused disturbance.

Table A16 summarizes access management and habitat effectiveness conditions within the action area with implementation of the proposed action. Key Forest Plan standards are met, and habitat effectiveness is 70 percent or greater in six of seven BMUs. With few exceptions, open and total motorized route access would be managed at levels similar to or better than the average reported in grizzly bear research in the CYE (Wakkinen and Kasworm 1997). Core areas within BMUs are substantial and would not decrease. BMU 6 has core area comparable in size to, and five of the remaining six BMUs exceed the average core area size reported for female grizzly bears in the CYE. The Forest would improve conditions for grizzly bears related to human access management as opportunities arise with the acquisition or perpetual conservation easement of the mitigation properties. Proposed access management would contribute to enhancing north south connectivity in the action area.

We conclude that fragmentation of the north south corridor would be avoided by existing and proposed access management in combination with the acquisition of mitigation properties identified to specifically remedy fragmentation issues. The risks of fragmentation and displacement would be reduced to levels that would not significantly impair the movement of grizzly bears within BMUs 4, 5, and 6 and therefore would not contribute to an appreciable reduction in the likelihood of the survival and recovery.

Table A16. Projected access management and habitat effectiveness (HE) conditions with implementation of Alt. 5 for the proposed Rock Creek Mine[5.]				
BMU	**% Core[1]**	**% OMRD > 1 mi/mi^2 (2)**	**% TMRD >2 mi/mi^2 (3)**	**% HE (est) (4)**
2	77	17	14	83
4	63	36	25	63
5	59	26	23	75
6	54	33	32	70
7	67	23	20	80
8	56	32	23	77
22	51	38	41	71

[1] For comparison, 55 percent of an average female home range was core area (Wakkinen and Kasworm 1997).
[2] For comparison, 33 percent of an average female home range exceeded 1 mile per square mile open motorized route density (Wakkinen and Kasworm 1997).
[3] For comparison, 26 percent of an average female home range exceeded 2 miles per square mile total motorized route density (Wakkinen and Kasworm 1997).
[4] For comparison, previous Forest Plan standard for habitat effectiveness was 70 percent of BMU.
[5] Percents are based on current conditions and could vary if access conditions change due to other actions within a BMU. However, Forest actions will not increase route densities or decrease core in BMUs 4,5, and 6 throughout life of mine.

Further, the 2004 Kootenai Forest Plan amendment requires that 20 of 22 BMUs (91 percent) in the CYE reach at least 55 percent core area or more (the average female home range core size) (see Appendix D). The amendment will eventually result in increasing core habitat within the CYE by 11,170 acres to 943,513 acres (or about 57 percent of the CYE). Currently, 16 of 22 BMUs (73 percent) in the CYE provide at least 55 percent core area or more. Of nine BMUs managed solely by the Forest and in the Cabinet portion of the CYE, eight provide 55 percent core area or more; one provides 54 percent. This environmental baseline contributes to habitat connectivity throughout the CYE.

The combination of reduced rates of human-caused mortality, augmentation of the population, and maintenance or re-establishment of habitat connectivity is expected to more than offset impacts of the mine. This combination of actions is expected to contribute to the eventual stabilization and recovery of the CYE grizzly bear population. We conclude that the proposed action, which fully or partially supports this combination of actions, would not appreciably diminish the likelihood of the survival and recovery of grizzly bears.

4. **Oversight and Implementation** Establish the processes and infrastructure needed to ensure that a) the mitigation plan is fully implemented and that mitigation measures are timely and effective; b) the revised mitigation plan is coordinated and effectively implemented; and c) adaptive management is used when needed over the 35 year life of the mine.

In summary, the Forest has agreed to form and lead an Oversight Committee that develops and oversees implementation of the proposed action and mitigation plan.

Committee members would include participating agencies, including Montana Fish, Wildlife and Parks and MDEQ. The Service would participate as an advisor to the group. The Oversight Committee would be responsible for overseeing the full implementation of the mitigation plan measures. The committee would serve as a forum to disseminate progress reports, address concerns, and provide general information regarding the mine to the public. The committee would review new grizzly bear information, including that collected by the required monitoring and research effort, grizzly bear specialist and law enforcement officer, and determine whether the proposed action and mitigation measures are effective. If not, the Forest and Revett would be responsible to take action to remedy the situation, which may include using adaptive management to fully meet the intent and desired goals of the mitigation package, thus avoiding jeopardy. The Service would review any proposed modifications, additions or revisions of the management plan or mitigation plan as appropriate under the provisions of section 7 of the Act.

The Service concludes that with the establishment of an Oversight Committee, the complex and numerous aspects of the proposed action and the mitigation plan would be effectively implemented to reduce the impacts of the proposed mine to levels that are not likely to appreciably diminish the likelihood of survival and recovery of grizzly bears.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulations pursuant to section 4(d) of the Act prohibits 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 regulation 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 further 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, breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, carrying out 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 deemed by the Service as necessary to minimize or reduce the amount or extent of the anticipated level of incidental take of grizzly bears. The measures described below are non-discretionary, and must be undertaken by the Forest so that they become binding conditions of any grant or permit issued to Revett, as appropriate, for the exemption in section 7(o)(2) to apply. The Forest has a continuing duty to regulate the activity covered by this incidental take statement. If the Forest 1) fails to assume and implement the terms and conditions or 2) fails to require that Revett 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 Forest must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement {50 CFR § 402.14 (i)(3)}.

Amount or Extent of Take Anticipated

High motorized route densities increase the risk of incidental take of grizzly bears by habituating some bears, and modify habitat to levels that displace some bears, both are activities that may significantly impair breeding, feeding, and sheltering. Research in the NCDE (Mace and Manley 1993, Mace et al. 1996) and CYE (Wakkinen and Kasworm 1997) revealed significant displacement of female grizzly bears from highly roaded habitat. Displacement of grizzly bears from highly roaded habitat is significant when it keeps them from preferred or otherwise available habitat to the extent it reduces breeding, feeding or sheltering.

The proposed action would not increase motorized route densities or decrease core areas and so is in compliance with the Service's 2004 incidental take statement on the Forest Plan (USDI 2004). Both motorized route densities and core area percentages in the action area BMUs, specifically those most impacted by the mine (BMUs 4, 5, and 6), do not change or would slightly decrease as a result of the proposed action. Motorized route densities may decline (improve) further and core areas may increase (improve) as mitigation properties are acquired. For most Forest access management actions that comply with the 2004 incidental take statement, we would not anticipate incidental take of grizzly bears over that anticipated in our incidental take statement. However, the Service concludes that the proposed Rock Creek Mine would result in displacement effects to grizzly bears in the Rock Creek drainage that are greater than those associated with usual forest management activities and would continue for a longer period of time. The proposed action would result in two types of incidental take: take in the form of harm or harassment due to displacement and due to habituation and resulting mortality.

Indirect take due to harm or harassment may occur due to displacement of grizzly bears, specifically adult female bears, from essential habitat. Although the project conforms with the 2004 biological opinion and incidental take statement, the disturbances generated by increased road use and human activity exceed that anticipated in 2004. Displacement of female grizzly bears from key habitats near the mine site and associated roads could result in their failure to obtain adequate food resources, which in turn could result in reduced fitness and/or reproductive success. We expect incidental take as some impairment of normal breeding and feeding behavior of adult females that affects reproduction, either through failure to breed or failure to complete a pregnancy.

We do not expect subadult or cub grizzly bear mortality as a result of such displacement. We do not expect mortality, injury, or significant impairment of breeding, feeding or sheltering of male grizzly bears as a result of displacement.

It is the biological judgment of the Service that one or possibly two adult female grizzly bears attempting to use this area would be affected by the potential long-term displacement from portions of the areas affected by the proposed mine, approximately 7000 acres. Female grizzly bears are already displaced from 5656 acres of this area because of disturbance caused by existing open motorized routes, but disturbance levels would increase due to the proposed action. As described in the biological opinion, the premise that one or two adult female grizzly bears would be impacted over time is based upon (a) information from the Cabinet Mountains related

to the number of females with young (Kasworm et al. 2002; Kasworm et al. 2005a); (b) the existing population estimate of grizzly bears in the southern portion of the Cabinet Mountains (Kasworm et al. 2005a); (c) the lack of detectable significant increases in the population as a whole since 1983 (Kasworm 2001, Kasworm et al. 2005a); and (d) the existing disturbances in the Rock Creek drainage and the east side of the divide. This number of adult females may represent two of three to five total adult female bears currently living in the Cabinet Mountains. (If we use a conservative estimate of 10 bears in the Cabinet Mountains, approximately 0.284, or approximately three of these bears would be adult females. If we use the upper estimate of 15 total bears, the number of adult females in the Cabinets could be five.)

The Service anticipates that incidental take of grizzly bears resulting from the displacement from mine activities associated directly or indirectly with the Rock Creek Mine would be difficult to quantify or detect. As described earlier in this opinion, grizzly bears are typically independent and vary in their responses to disturbance. We are unaware of scientific or commercial information available that has quantified the effects of disturbance or displacement on the reproductive or recruitment potential of grizzly bears. We are unaware of scientific or commercial information that could be used to quantify the exact level of incidental take associated with displacement effects, which would manifest itself through impaired breeding and/or feeding in one or two adult females. Where incidental take is difficult to quantify, we use surrogate measures to gauge the impact of the take on the species and determine whether anticipated levels of take would be exceeded. Based on research related to the displacement of grizzly bears from roads and roaded habitat (Mace and Manley 1993, Mace et al. 1996, Wakkinen and Kasworm 1997), in this case we will use the surrogate measures of open motorized route density, total motorized route density, and core to reflect the level of anticipated take and the point at which that level would be exceeded. In this case, we use the proposed levels of open and total motorized route density and core area in BMUs 4, 5, and 6, which limit the amount of human access and associated disturbances in grizzly bear habitat. If the proposed route densities are exceeded or if core area is decreased due to the proposed action, then the amount of incidental take anticipated may be exceeded.

Although we cannot accurately quantify incidental take through displacement, we expect that any displacement effects that result in decreased fitness of adult females to a degree that it impaired reproductive fitness would be relatively low based on the rationale found in the biological opinion. Over 35 years, not all female grizzly bears with home ranges encompassing portions of the Rock Creek drainage would be significantly impacted. Further, there are already existing human activities along FR 150 and lower elevation habitat within the drainage and along the Clark Fork River that already impart disturbance effects on grizzly bears, but bears are known to use the area in general. Grizzly bears that utilize the area are likely conditioned to some level of human activities. The best information suggests that there initially would be increased displacement effects on female grizzly bears using the Rock Creek drainage once construction of the mine begins and human activity levels rapidly and significantly increase along FR 150. The mine would cause higher levels of disturbance on 5656 acres currently near roads, and affect an additional 1400 acres. The displacement of female bears would be more pronounced and long term at lower elevations in the drainage, particularly in spring habitat, but could extend initially throughout larger portions of the drainage for a time.

Incidental take due to harm would also occur in the form of injury or mortality of grizzly bears as a result of human actions. We anticipate that incidental take attributable to the proposed mine is most likely to result through habituation and food conditioning of grizzly bears or increased human-grizzly bear encounters, which increases the chance of their removal through management control actions or illegal shooting or legal defense of life. Increased risk of habituation and food conditioning of grizzly bears and encounters are possible with the rapid influx of workers and their families to the action area during construction of the mine and increases in recreation in the area, leading to increased levels of food, garbage and other human-related attractants. As described earlier, the mitigation plan incorporated many measures to reduce food habituation of bears, attractants and adverse encounters between people and bears. However, even with full implementation of the mitigation plan and effective use of education and information and law enforcement, there remains a reasonable anticipation that one grizzly bear would be killed as a result of direct or indirect mine-related activities at some time during the more than 35-year duration of the mine.

The Service expects the existing baseline condition of the action area related to Forest access management and the full implementation of the mitigation plan would reduce the potential for human-caused mortalities of grizzly bears related to the proposed mine to no more than one mortality throughout the life of the mine. This premise is based on the estimated number of grizzly bears in the Cabinet Mountains (fewer than 15), the projected number of augmented grizzly bears, and on the number and causes of past known, human-caused grizzly bear mortality in the Cabinet Mountains (four from1982 through 2005) (Kasworm et al. 2005).

All human-caused grizzly bear mortality within the action area would be investigated to determine whether the take could reasonably be attributed to the direct or indirect effects of the proposed mine. Take at the mine site, or bears directly killed by mine employees would be attributable to the mine. Take of a grizzly bear on private or public land would require an investigation to determine whether mortality could reasonably be attributed to the effects of the Rock Creek Mine. Grizzly bears may become habituated and food conditioned for reasons not attributable to the mine, and these bears may eventually run into conflict at the mine, in residential areas occupied by mine employees, or on public lands used by mine employees and their families. Grizzly bears may be struck by vehicles, however we do not anticipate this type of mortality would be attributed to the mine because of the mitigation plan measures, therefore such take is not exempted. Hunter-related grizzly bear mortality would result in the Service reinitiating consultation on Montana's grizzly bear management program (Montana Fish, Wildlife, and Parks 2001).

All human-caused mortality of grizzly bears within the CYE is investigated by the Service, Montana Fish, Wildlife and Parks, and/or Forest Service law enforcement. Human-caused grizzly bear mortality within the action area would be evaluated as to whether it could reasonably be attributed to the effects of the Rock Creek mine. The take of one grizzly bear deemed attributable to the mine would trigger re-evaluation of the situation by the Service to determine whether additional measures are needed to reduce the potential for future mortality. In addition, should the monitoring of the attractant related conflicts document that black bears are gaining food rewards in the action area, the Service shall determine whether additional measures should be implemented to reduce the potential for future mortality of grizzly bears. If the

human-caused grizzly bear mortality attributable to the mine exceeded one bear, reinitiation of consultation would be required.

Effect of the Take

In the accompanying biological opinion, the Service determined that this level of anticipated take is not likely to result in jeopardy to the species. As described in the biological opinion, some low level of indirect incidental take may occur as a result of displacement of females from essential habitat, which would impair reproduction but would not result in the death of a subadult or adult bear. Several factors moderate the impact of this displacement, as discussed in the biological opinion. Habitat management in the action area, especially motorized access management, provides large blocks of interconnected core habitat, and other areas have relatively moderate road densities. Based on research and road density analysis in the CYE and Selkirk ecosystem, the baseline levels of open and total motorized route density and core area would substantially moderate the displacement effects of the action within the Rock Creek drainage. Grizzly bears have large home ranges. Those female grizzly bears that use the Rock Creek drainage would likely have alternative habitat to use if displaced. The mitigation plan requires that a total of 2450 acres be acquired to compensate for the 7044 acres if disturbance, and be managed for grizzly bear habitat. Also, we anticipate that the impacts of disturbance within the Rock Creek drainage on female grizzly bears would decline over time in quality seasonal habitats at higher elevations and further from the roads and mine site as the females habituate to some degree to the disturbance levels and/or select other areas of their home range. Disturbance related effects that impair breeding, feeding or sheltering would likely decline to low levels over time. Further, the proposed action would result in improvements in access management due to 2450 acres of habitat acquisition or easement, which is expected to further reduce the overall displacement effects of the mine.

Currently, known human-caused mortality in the CYE is skewed toward females. At this time human-caused mortality of female grizzly bears in the CYE exceeds levels that are sustainable and promote recovery. Whether or not this level of female grizzly bear mortality will continue is unknown. However, the proposed action includes a suite of actions that are expected to diminish the potential for human-caused mortality, both that mortality attributable to the mine and not attributable to the mine. The survival of female grizzly bears is essential to the persistence and growth of the CYE grizzly bear population. Grizzly bear recovery efforts will continue to work toward reducing human-caused mortality.

The Service concludes that the unmitigated loss of one grizzly bear due to the mine over 35 years could affect the length of time needed for recovery of grizzly bears in the CYE. If one female is killed over a 35 year period, the length of time needed for recovery would be more prolonged. Recovery would be most impacted with the loss of an adult female, and less so with the loss of a female cub. Further, the unmitigated loss of one female *prior* to the time the population experiences some level of recovery, specifically population stabilization or growth, would appreciably reduce the already diminished long-term survival prospects of the grizzly bear population in the CYE.

However, we anticipate that take would not occur until during either the construction phase of the mine itself or the operational phase, due to the large increase in number of mine employees and associated human population growth in the area. Therefore, the construction phase of the mine would proceed only after at least six female grizzly bears were augmented into the Cabinet Mountains. This number of female bears would minimize the impact of the loss on the population in the event a female grizzly bear was killed (Kasworm et. al. 2006). Also, as described earlier in this opinion, we also expect that the suite of measures in the mitigation plan would work concurrently and pro-actively to reduce rates of human-caused grizzly bear mortality from current levels. The mitigation plan would work to reduce potential human-caused mortality both attributable to the mine and not attributable to the mine, and both within and outside the action area. The mitigation plan would fully offset the impacts of any take that does occur due to the mine by reducing the current rates of human-caused mortality of grizzly bears across the entire CYE, including the mortality of grizzly bears not attributable to the mine. Therefore, we anticipate that full implementation of the proposed action and mitigation plan would result in a net reduction in future potential human-caused grizzly bear mortality rates in the CYE.

Reasonable and Prudent Measures

This biological opinion includes reasonable and prudent measures (RPMs) to minimize incidental take. These measures, which are described below, are nondiscretionary and must be implemented by the Forest in order for the exemption in §7(o)(2) to apply. The Forest has a continuing duty to regulate the activities that are covered by this incidental take statement. If the agency fails to adhere to the terms and conditions of the incidental take statement, the protective coverage of §7(o)(2) may lapse. Should the amount or extent of incidental taking be exceeded, or any of the mitigation and conservation efforts be modified, the Forest must confer with the Service immediately to determine if reinitiation of consultation is required.

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

1. Reduce the potential for incidental take of grizzly bears resulting from displacement from essential habitat.

2. Reduce the potential for incidental take of grizzly bears resulting from habituation and food conditioning.

3. Monitor and record all conflicts between people and grizzly bears, and people and black bears.

Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the Act, the Forest must, in addition to implementing the mitigation plan as proposed, comply with the following terms and conditions which implement the reasonable and prudent measures described above. These terms and conditions are non-discretionary.

1. The following terms and conditions implement RPM 1 :

   a) Forest actions shall not result in a net decrease of core area, nor a net increase open or total motorized route densities within BMUs 4, 5, and 6 during the life of the proposed mine.

   b) The Forest shall ensure that reductions in open and/or total motorized route densities or increases in core areas made possible by acquisition of or obtaining conservation easements on mitigation habitat shall be completed within 3 years of acquisition or easement. Improvements shall constitute the baseline from which term and condition 1.a. above is then measured during the life of the mine. At a minimum, upon acquisition or easement, the Forest and Service shall determine whether, where legally possible, the Forest shall temporarily immediately close access routes to reduce open motorized route densities. Final planning processes would then be conducted.

   c) Within one year of issuing the permit for the evaluation adit the Forest shall berm or barrier Bear Creek road (FR 4784) to increase core area in BMU 5 for the life of the mine.

   d) Currently, a portion of Midas Howard Creek Road (FR 4778) is restricted year-long; the South Fork Miller Creek Road (FR 4724) is partially open year-long and has a spring closure on about 6 miles of the route. These closures shall remain in place for the life of the mine to increase grizzly bear security in spring habitat. Additional closures may occur through separate planning processes and may occur due to information gained through the monitoring and research effort.

   e) The Forest shall ensure that land exchanges related to mitigation properties would not result in a loss of MS-1 grizzly bear habitat in the CYE, unless such loss results in significant habitat benefits for grizzly bears, as agreed to by the Service.

   f) The Forest shall ensure that administrative use levels on restricted roads in BMUs 2, 4, 5, 6, 7 and 8 shall be limited to no more than 57 round trips per year divided by spring, summer and fall seasons.

   g) Access management changes shall be monitored and included in the annual Kootenai National Forest monitoring reports.

2. The following terms and conditions implement RPMs 2 and 3 :

   a) Prior to the construction of the evaluation adit, the Forest shall ensure that Revett shall provide funding for the grizzly bear specialist and the law enforcement officer for a period of no less than 5 years. The mitigation plan requires funding for these positions throughout the life of the mine. This up-front funding would ensure the necessary funding to comply with the mitigation plan in the event of a temporary lapse of activity at the mine between the evaluation adit and

construction phases. The mitigation plan requires the positions remain active in the event of temporary shutdowns. If after the evaluation adit phase, Revett withdraws its plan of operation or rescinds permits with the intention of not moving forward with development of the mine, this term and condition would not be required.

b) Prior to the construction of the mine, the Forest, Montana Fish, Wildlife and Parks bear specialists and Service grizzly bear personnel, shall assess the 16 county garbage transfer stations other than the site near the mine entrance. The group shall work with the counties to prioritize the sites and set a schedule for upgrading the sites to grizzly bear-resistant, at those sites deemed in need of such action.

c) Prior to construction of the mine, the Forest shall ensure that Revett provide funding for five years of salary and expenses for the additional grizzly bear specialist position, to be funded for the life of the mine (as in 2a above).

d) The Forest shall seek approval to give the State law enforcement officer authority to enforce the food storage order on the Forest within 2 years of issuing the permit to proceed with the evaluation adit.

e) Any grizzly bear mortality within the action area shall be investigated by the Service, Forest and Montana Department of Fish, Wildlife and Parks. If deemed attributable to the effects of the mine, additional measures as needed and as approved by the Service shall be taken to prevent additional grizzly bear mortality.

f) The Forest shall monitor grizzly bear and black bear sanitation incidents in BMUs 2, 4, 5 ,6, 7, and 8 and take corrective action through Forest enforcement of the food storage order and/or other adequate remedy, or through activities coordinated or conducted by the grizzly bear management specialist and/or Oversight Committee. Incidences involving black bears will be reviewed by the grizzly bear management specialists and the Service to assess whether the conditions leading to the incident may also be a risk to grizzly bears in the area.

g) The Forest shall work with the grizzly bear specialist on public outreach programs that will advance awareness of grizzly bear conservation issues among the public in and surrounding the Cabinet Mountains.

Reporting Requirements

a) By April of the each year, the Forest shall prepare an annual report of grizzly bear and black bear sanitation incidents and corrective measures taken during the previous year.

b) By April of each year, the Forest shall prepare an annual report that summarizes actions taken to comply with the above terms and conditions implementing RPMs 1, 2, and 3 during the previous year .

The reasonable and prudent measures and implementing terms and conditions are designed to minimize the impact of incidental take that might otherwise result from the proposed Rock Creek Mine. If during the course of the proposed action, the level of take (one grizzly bear during life of the mine) is exceeded, such incidental take would require reinitiation of consultation. If terms and conditions implementing reasonable and prudent measure 1 are not adhered to, this may indicate that the level of exempted take due to displacement has been exceeded. The Service retains the discretion to determine whether this is the case and reinitiation of consultation is required. The federal agency must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the reasonable and prudent measures.

REINITIATION NOTICE

This concludes formal consultation on the proposed Revett Silver Company Rock Creek mine as proposed by the Kootenai National Forest. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded ; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. The Service retains the discretion to determine whether the conditions listed in (1) through (4) have been met and reinitiation of formal consultation is required. In instances where the amount or extent of incidental take is exceeded, reinitiation of consultation is required.

R. Mark Wilson — 10-11-06

R. Mark Wilson, Field Supervisor — Date
Montana Ecological Services Field Office

REFERENCES

Aune, K.A. and W.F. Kasworm. 1989. Final report: East front grizzly studies. Montana Department of Fish, Wildlife and Parks, Helena. 332 pp.

Aune, K.A. and T. Stivers. 1984. Ecological studies of the grizzly bear in the Pine Butte Preserve. Montana Department Fish Wildlife and Parks. Helena. 154 pp.

Boyce, M.S., E.M. Kirsch and C. Servheen. 2002. Bet-hedging applications for conservation. J. Biosci. 27 (Suppl. 2) 385-392.

Christenson, A.G. and M.J. Madel. 1982. Cumulative effects analysis process. U.S. Forest Service, Kootenai National Forest, Libby, Montana 53pp.

Chruszcz, B., A.P. Clevenger, K.E. Gunson, and M.L.Gibeau. 2003. Relationships among grizzly bears, highways and habitat in the Banff-Bow Valley, Alberta, Canada. Can. Journal of Zoology. 81:1378-1391.

Craighead, F.C. and J.J. Craighead. 1972a. Grizzly bear prehibernation and denning activities as determined by radio tracking. Wildlife Monographs 32. 35 pp.

Craighead, F.C. and J.J. Craighead. 1972b. Radio tracking of grizzly bears and elk in Yellowstone National Park, Wyoming, 1959-1960. pp 55-62 *in* P.H. Oehser, ed. National Geographic Society Research Reports, 1955-1960. National Geographic Society, Washington, D.C.

Cronin, M., R. Shidler, J. Hechtel, C. Strobeck, and D. Paetkau. 1999. Genetic relationships of grizzly bears in the Prudhoe Bay region of Alaska: Inference from microsatellite DNA, mitochondrial DNA, and field observations. The Journal of Heredity 90(6):622-628.

Craighead, J.J., J.S. Sumner and J.A. Mitchell. 1995. The grizzly bears of Yellowstone: their ecology in the Yellowstone ecosystem, 1959-1992. Island Press, Washington, D. C. 535 pp.

Dood, A.R, R.D. Brannon and R.D. Mace. 1986. Management of grizzly bears in the Northern Continental Divide ecosystem. Transactions of the North American Wildlife Natural Resources Conference 51pp.

Egbert, A.L. and A.W. Stokes. 1976. The social behavior of brown bears on an Alaskan salmon stream. International Conference on Bear Research and Management 3:41-56.

Gibeau, M., S. Herrero, B.N. McLellan, J.G. Woods. 2001. Managing for grizzly bear secure areas in Banff National Park and the central Canadian Rocky Mountains. Ursus 12:121-130.

Glenn, L.P., J.W. Lentfer, J.B Faro and L.H. Miller. 1976. Reproductive biology of female brown bears (*Ursus arctos*), McNeil River, Alaska. Pages 381-390 *in* M.R. Pelton, J. W. Lentfer, and G. E Folk, Jr., eds. Bears–their biology and management. IUCN Publ. New Series 40.

Greer, K.R. 1985. Montana statewide grizzly bear mortalities, 1983-84. Montana Department of Fish, Wildlife and Parks, Helena. 51pp.

Gunther, K. 1994. Bear management in Yellowstone National Park 1960-93. International Conference on Bear Research and Management 9(1): 549-56

Gunther, K.A., M.T. Brucino, S. Cain, K. Frey, L. Hanauska-Brown, H.A. Haroldson and C.C. Schwartz. 2005. Grizzly bear-human conflicts in the Greater Yellowstone Ecosystem. Pages 57-60 *in* C.C. Schwartz, M.A. Haroldson, and K. West, editors. Yellowtone grizzly bear investigations: annual report of the Interagency Grizzly bear Study Team, 2004. U.S. Geological Survey, Bozeman, Montana.

Harding, L. and J.A. Nagy. 1980. Responses of grizzly bears to hydrocarbon exploration on Richards Island, Northwest Territories, Canada. Int. Conf. Bear Biol. And Manage. 3:277-280.

Hedrick, P.W. 1995. Gene flow and genetic restoration: the Florida panther as a case study. Conservation Biology 9:996-1007.

Hedrick, P.W. 2001. Conservation genetics: where are we now? Trends in Ecology and Evolution 16:629-636.

Herrero, S. 1978. A comparison of some features of the evolution, ecology, and behavior of black and grizzly/brown bears. Carnivore 1(1):7-17.

Hornocker, M.G. 1962. Population characteristics and social and reproductive behavior of the grizzly bear in Yellowstone National Park. M.S. Thesis, Montana State University. 94 pp.

Interagency Grizzly Bear Committee. 1986. Interagency grizzly bear guidelines. U.S. Forest Service, Missoula, Montana. 100 pp.

Interagency Grizzly Bear Committee. 1987. Grizzly bear compendium. National Wildlife Federation, Washington, D.C. 540 pp.

Interagency Grizzly Bear Committee. 1994. Interagency Grizzly Bear Committee -Taskforce report: grizzly bear/motorized access management. U.S. Forest Service, Missoula, Montana 7 pp.

Interagency Grizzly Bear Committee. 1998. Interagency Grizzly Bear Committee -Taskforce report: Selkirk/Cabinet-Yaak grizzly bear recovery areas, interim access management rule set. 8 pp.

Jonkel, C. and I. M.Cowan. 1971. The black bear in the spruce-fir forest. Wildlife Monographs 27:55 pp.

Jope, K.L. 1985. Habituation of grizzly bears to people, a hypothesis. International Conference on Bear Research and Management. 5:322-327.

Kasworm, W.F. 2001. Preliminary grizzly bear population trend estimates in the Cabinet-Yaak Recovery Zone, 1983-2000. Internal memo, U.S. Fish and Wildlife Service, Libby Montana.

Kasworm, W.F. 2003. 2002 population demographics and status for the CYE in relation to the grizzly bear recovery plan (USFWS 1993). Internal memo, U.S. Fish and Wildlife Service, Libby, Montana.

Kasworm, W.F. and T.L. Manley. 1988. Grizzly bear and black bear ecology in the Cabinet Mountains of northwest Montana. Montana Department of Fish, Wildlife, and Parks, Helena. 122 pp.

Kasworm, W.F. and T.L. Manley. 1990. Road and trail influences on grizzly bears and black bears in northwest Montana. International Conference on Bear Research and Management. 8:79-84.

Kasworm, W.F. and T.J. Thier. 1994. Cabinet-Yaak ecosystem grizzly bear and black bear research 1993 progress report. U.S. Fish and Wildlife Service, Missoula, Montana 57 pp.

Kasworm, W.F., T.J. Thier, and C. Servheen. 1998. Grizzly bear recovery efforts in the Cabinet/Yaak ecosystem. Ursus 10:147-153.

Kasworm, W.F., H. Carriles and T.G. Radandt. 2000. Cabinet-Yaak grizzly bear recovery area 1999 research and monitoring progress report. U.S. Fish and Wildlife Service, Missoula, Montana. 48 pp.

Kasworm, W.F., H. Carriles and T.G. Radandt. 2002. Cabinet-Yaak grizzly bear recovery area 2001 research and monitoring progress report. U.S. Fish and Wildlife Service, Missoula, Montana. 48 pp.

Kasworm, W.F., H. Carriles and T.G. Radandt. 2004. Cabinet-Yaak grizzly bear recovery area 2003 research and monitoring progress report. U.S. Fish and Wildlife Service, Missoula, Montana. 62 pp.

Kasworm, W.F., H. Carriles and T.G. Radandt. 2005. Cabinet-Yaak grizzly bear recovery area 2004 research and monitoring progress report. U.S. Fish and Wildlife Service, Missoula, Montana pp.

Kasworm, W.F., H. Carriles and T.G. Radandt. 2006a. Excerpts from *In prep* Cabinet-Yaak grizzly bear recovery area 2004 research and monitoring progress report. *Used with permission.* U.S. Fish and Wildlife Service, Libby, Montana.

Kasworm, W.F., M. Proctor, C. Servheen, T. Manley, J. Brown, and J. Williams. 2006b. Simulations of grizzly bear population augmentation on trend estimates in the Cabinet-Yaak recovery zone. January 26. Unpublished report. U.S. Fish and Wildlife Service, Missoula, Montana. 8 pp.

Keller, L.K. and D.M. Waller. 2002. Inbreeding effects in wild populations. Trends in Ecology and Evolution 17:230-241.

Kendall, K. 2006. Pers.comm. during oral report to the NCDE Subcommittee: Northern Divide Project; May 9 2006, Missoula, Montana. U.S. Geologic Survey, East Glacier, Montana.

Kistchinksii, A.A. 1972. Life history of the brown bear (*Ursus arctos L.)* in northeast Siberia. Pages 67-73 *in* S. Herreo ed. Bears: their biology and management. IUCN Publ. New Series 23.

Knight, R., B.M. Blanchard and K. Kendall. 1981. Yellowstone grizzly bear investigations: annual report of grizzly bears. 1980. U.S.D.I. Natl. Park Serv. Interagency Grizzly Bear Study Team, Bozeman, Mont. 55pp.

Mace, R.D. and T.L. Manley. 1993. South Fork Flathead River grizzly bear project: progress report for 1992. Montana Department of Fish, Wildlife and Parks, Helena. 34 pp.

Mace, R.D., J.S. Waller, T.L. Manley, L.J. Lyon and H. Zuuring. 1996. Relationships among grizzly bears, roads and habitat in the Swan Mountains, Montana. British Ecological Society. Journal of Applied Ecology, 33, 1395 - 1404.

Mace, R.D., J.S. Waller, T.M. Manley, K. Ake and W.T. Wittinger. 1999. Landscape evaluation of grizzly bear habitat in western Montana. Conservation. Biol. 13:367-377.

Madel, M.J. 1996. Rocky Mountain front grizzly bear management program: four year progress report. Montana Fish, Wildlife and Parks. Helena.

Maguire, L.A. and C. Servheen. 1992. Integrating biological and social concerns in endangered species management; augmentation of grizzly bear populations. Conservation Biology 6:426-434.

Mattson, D.J. 1993. Background and proposed standards for managing grizzly bear habitat and security in the Yellowstone ecosystem. Cooperative Park Studies Unit, University of Idaho, Moscow. 17 pp.

Mattson, D.J. and R.R. Knight. 1991. Effects of access on human-caused mortality of Yellowstone grizzly bears. U.S. National. Park Service. Interagency Grizzly Bear Study Team Report 1991B, Bozeman, Montana 13 pp.

Mattson, D.J. and Merrill. 2004. A model-based appraisal of habitat conditions for grizzly bears in the contiguous United States. Ursus 15 Workshop Supplement: 76-89.

Mattson, D.J., R.R. Knight and B.M. Blanchard. 1987. The effects of developments and primary roads on grizzly bear habitat use in Yellowstone National Park, Wyoming. International Conference on Bear Research and Management. 7:259-273

Mattson, D.J., B.M. Blanchard and R.R. Knight. 1992. Yellowstone grizzly bear mortality, human habituation, and whitebark pine seed crops. Journal of Wildlife Management. 56:432-442.

McLellen, B.N. 1989a. Effects of resource extraction industries on behavior and population dynamics of grizzly bears in the Flathead drainage, British Columbia and Montana. Ph.D. Thesis, University of British Columbia, Vancouver. 116 pp.

McLellen, B.N. 1989b. Dynamics of a grizzly bear population during a period of industrial resource extraction. I. Density and age-sex composition. Canadian Journal of Zoology. 67:1856-186.

McLellen, B.N. 1989c. Dynamics of a grizzly bear population during a period of industrial resource extraction. II. Mortality rates and causes of death. Canadian Journal of Zoology. 67:1861-1864.

McLellen, B.N. and R. Mace. 1985. Behavior of grizzly bears in response to roads, seismic activity and people. Preliminary report. Canada Border Grizzly Project, Cranbrook, B.C. 53 pp.

McLellen, B.N. and D.M. Shackleton. 1988. Grizzly bears and resource extraction industries: effects of roads on behavior, habitat use and demography. Journal of Applied Ecology. 25:451-460.

McLellen, B.N. and D.M. Shackleton. 1989a. Grizzly bears and resource-extraction industries: habitat displacement in response to seismic exploration, timber harvesting and road maintenance. Journal of Applied Ecology 26, 371-380.

McLellen, B.N. and D.M. Shackleton. 1989b. Immediate reactions of grizzly bears to human activities. Wildlife Society Bulletin 17:269-274.

McLellen, B.N., F.W. Hovey, R.D. Mace, J.G. Woods, D.W. Carney, M.L. Gibeau, W.L. Wakkinen and W.F. Kasworm. 1999. Rates and causes of grizzly bear mortality in the interior mountains of British Columbia, Alberta, Montana, Washington, and Idaho. Journal of Wildlife Management 63(3):911-920.

Montana Department of Commerce 2003. Montana population projections. Report prepared by NPA Data Services Inc., dated July 2001. Website: www.commerce.stste.mt.us.

Montana Department of Environmental Quality and USDA Forest Service. 1995. Draft environmental impact statement ASARCO Rock Creek project. Montana Department of Environmental Quality, Helena, Montana and Kootenai National Forest, Libby, Montana.

Montana Department of Environmental Quality and USDA Forest Service. 1998. Draft supplemental environmental impact statement ASARCO Rock Creek project. Montana Department of Environmental Quality, Helena, Montana and Kootenai National Forest, Libby, Montana.

Montana Department of Environmental Quality and USDA Forest Service. 2001. Final environmental impact statement for the Rock Creek Mine Project. Kootenai National Forest, Libby, Montana.

Montana Department of Fish, Wildlife and Parks. 1986. The grizzly bear in northwestern Montana. Final environmental impact statement. Montana Department of Fish, Wildlife and Parks, Helena. 59 pp.

Montana Department of Fish, Wildlife and Parks. 2001. Draft conservation plan for grizzly bear in Montana. Montana Department of Fish, Wildlife and Parks, Helena. 59 pp.

Montana Fish, Wildlife and Parks. 2005a. Grizzly bear management and conflict report for 2004. Montana Department of Fish, Wildlife and Parks, Region 1, Kalispell. 59 pp.

Montana Fish, Wildlife and Parks. 2005b. Memo from Jim Williams, Montana Fish, Wildlife, and Parks to Chris Servheen, U.S. Fish and Wildlife Service. Re: statement of intention. March 8. Montana. Montana Department of Fish, Wildlife and Parks, Kalispell. 1 pp.

Montana Fish, Wildlife and Parks. 2006a. Grizzly bear management plan for western Montana. Draft environmental impact statement, 2006-2016. June. Montana Fish, Wildlife and Parks, Helena. 143 pp.

Montana Fish, Wildlife and Parks. 2006b. News release: FWP moves female grizzly bear to west Cabinets. Region One. Aug. 17. Montana Fish, Wildlife and Parks, Kalispell.

Mundy, K.R.D., and D.R. Flook. 1973. Background for managing grizzly bears in the national parks of Canada. Canadian Wildlife Service Report. Series No. 22. 35 pp.

Murie, A. 1944. The wolves of Mount McKinley. U.S.D.I. National Park Service Fauna serial No. 5. U.S. Gov. Printing Office, Washington, D. C. 238 pp.

Murie, A. 1962. Mammals of Mount McKinley National Park, Alaska. Mount McKinley Natural Historical Association 56 pp.

Nielsen, S., S. Herrero, M. Boyce, R. Mace, B. Benn, M. Gibeau, and S. Jevons. 2005. Modelling the spatial distribution of human-caused grizzly bear mortalities in the central Rockies ecosystem of Canada. Final report of the Eastern Slopes Grizzly Bear Project.

Noranda Incorporated. 2002a. Letter from Noranda Inc. to USDA Forest Service, Kootenai National Forest stating their decision to abandon the Montanore copper-silver project in Lincoln and Sanders Counties. 2 p.

Noranda _____. 2002b. Letter from Noranda Inc. to Montana Dept. of Environmental Quality stating their decision to abandon the Montanore copper-silver project in Lincoln and Sanders Counties and relinquishing air quality permit 2613. 1 p.

Noranda _____. 2002c. Letter from Noranda Inc. to Montana Dept. of Environmental Quality stating their decision to abandon the Montanore copper-silver project in Lincoln and Sanders Counties and relinquishing operating permit #00150 and MPDES permit MT-030279. 2p.

Noranda _____. 2002d. Letter from Noranda Inc. to U.S. Army Corps of Engineers stating their decision to abandon the Montanore copper-silver project in Lincoln and Sanders Counties and relinquishing tailings impoundment permit 199270047. 1 p.

Palmisciano, D. 1986. Grizzly mortality update. Unpublished report. Montana Department of Fish, Wildlife and Parks, Bozeman. 2 pp.

Pearson, A.M. 1975. The northern interior grizzly bear *Ursus Arctos L.* Canadian Wildlife Service Report Serial Number 34, Ottawa. 86 pp.

Primm, S., and S. Wilson. 2004. Re-connecting grizzly bear populations: prospects for participatory projects. Ursus 15(1) Workshop supplement:104-114.

Proctor, M.F., C. Servheen, S.D. Miller, W.F. Kasworm, and W.L. Wakkinen. 2004. A comparative analysis of management options for grizzly bear conservation in the U.S. - Canada trans-border area. Ursus 15 (2): 145-160.

Proctor, M.F., B.N. McLellan, C. Strobeck, and M.R. Barclay. 2005. Proc. Of the Royal Soc. B. doi:10.1098/rspb.2005.3246. Published online.

Quenette, P.Y., M. Alonso, L. Chayron, P. Cluzel, E. Dubarry, D. Dubreuil, S. Palazon, and M. Pomarol. 2001. Preliminary results of the first transplantation of brown bears in the French Pyrenees. Ursus 12:115-120.

Reynolds, P.E., H.V. Reynolds and E.H. Follman. 1984. Responses of grizzly bears to seismic surveys in northern Alaska. Proceedings of the International Conference on Bear Research and Management 6:169-175.

Rife, C. 2005. Letter from Carson Rife, Revett RC Resources to Mark Wilson and Anne Vandehey, U.S. Fish and Wildlife Service. August 15. U.S. Fish and Wildlife Service, Helena, Montana. 8 pp.

Rogers, L.L. and S.M. Rogers. 1976. Parasites of bears: a review. International Conference on Bear Research and Management. 3: 411-430.

Ruediger, B., J.J Claar, and J.P. Gore. 1999. Restoration of carnivore habitat connectivity in the northern Rocky Mountains. *In* Evink, G.L., P. Garrett and D. Zeigler, ed.s. Proceedings of the third international conference on wildlife ecology and transportation. FL-ER-73-99. Florida Dept. of Transportation, Tallahassee, Florida. 330 pp.

Russell, R.H., J.W. Nolan, N.G. Woody, G.H. Anderson and A.M. Pearson. 1978. A study of the grizzly bear (Ursus Arctos) in Jasper National Park: A progress report 1976 and 1977. Parks Canada, prepared by Canadian Wildlife Service, Edmonton, Alberta. 95 pp.

Schwartz, C.C. and M.A. Haroldson. 2001. Yellowstone grizzly bear investigations: annual report of the Interagency Grizzly Bear Study Team, 2000. U.S. Geological Survey, Bozeman, Montana.

Schwartz, C.C. and M.A. Haroldson. 2002. Yellowstone grizzly bear investigations: annual report of the Interagency Grizzly Bear Study Team, 2001. U.S. Geological Survey, Bozeman, Montana.

Servheen, C. 2003. 2002 population demographics and status for the NCDE in relation to the grizzly bear recovery plan. Unpublished internal memo, U.S. Fish and Wildlife Service, Missoula, Montana.

Servheen, C. 2004. 2003 population demographics and status for the NCDE in relation to the grizzly bear recovery plan . Unpublished internal memo, U.S. Fish and Wildlife Service, Missoula, Montana.

Servheen, C. 2005a. NCDE human-caused mortality issues. PowerPoint presentation. Missoula, Montana. 17 pp.

Servheen, C. 2005b. Recovery needs for grizzly bears in the Cabinet Yaak ecosystem. Internal memo. U.S. Fish and Wildlife Service, Missoula, Montana. 1pp

Servheen, C. 2006. 2005 population demographics and status for the NCDE in relation to the grizzly bear recovery plan. Unpublished internal memo, U.S. Fish and Wildlife Service, Missoula, Montana.

Servheen, C., W.F. Kasworm, and T.J. Thier. 1995. Transplanting grizzly bears as a management tool-results from the Cabinet Mountains, Montana, USA. Biological Conservation. 71(261-268).

Servheen, C., F. Hovey, B. McLellen, R. Mace, W. Wakkinen, W. Kasworm, D. Carney, T. Manley, K. Kendall and R. Wielgus. 1994. Unpublished. Draft: Report of the Northern Ecosystems researchers on grizzly bear population trends in the North and South Forks of the Flathead River, and the Blackfeet Indian Reservation of the NCDE; the Cabinet-Yaak ecosystem; the Selkirk ecosystem; and future data needs to improve trend estimates. Unpublished report to the IGBC, December 14, 1994, Denver, CO. 12 pp.

Servheen, C. M. Haroldson, K. Gunther, K. Barber, M. Brucino, M. Cherry, B. DeBolt, K. Frey, L. Hanauska-Brown, G. Losinski, C. Schwartz, B. Summerfield. 2004. Unpublished. Yellowstone mortality and conflicts reduction report. April 7. Report to the Yellowstone Ecosystem Committee. 29 pp.

Schoen, J.W., L.R. Beier, J.W. Lentfer and L.J. Johnson. 1987. Denning ecology of brown bears on Admiralty and Chichagof islands. Proceedings of the International Conference on Bear Research and Management. 7:293-304.

Summerfield, B, W. Johnson, and D. Roberts. 2004. Trends in road development an daccess management in the Cabinet-Yaak and Selkirk grizzly bear recovery zones. Ursus 15z(1) Workshop supplement:115-122.

Swenson, J.E., F. Sandegren, S. Brunberg and P. Wabakken. 1997. Winter den abandonment by brown bears Ursus arctos: causes and consequences. Wildl. Biol. 3(1):35-38.

Tyers, D. 2006. New World Mine rehabilitation and bears in the Cooke City basin. Unpublished draft. *Used with permission*. U.S. Forest Service. Gardiner, Montana. 42 pp.

U.S. Census Bureau. 2003. State and county quick facts: geography. Website: www.census.gov. February 27, 2003.

USDA Forest Service. 1982. Lolo National Forest plan. Lolo National Forest, Missoula, Montana.

USDA Forest Service. 1987. Kootenai National Forest Plan. Kootenai National Forest, Libby, Montana.

USDA Forest Service. 1998a. Forest plan monitoring and evaluation report fiscal year 1997, Kootenai National Forest. Kootenai National Forest, Libby, Montana 121pp.

USDA Forest Service. 1998b. Final biological assessment of threatened, endangered and proposed species for the proposed ASARCO Rock Creek Mine. Supervisor's Office Kootenai National Forest. Libby Montana.

USDA Forest Service. 1999. Forest plan monitoring and evaluation report fiscal year 1998, Kootenai National forest. Kootenai National Forest, Libby, Montana. 78pp.

USDA Forest Service. 2000. Harpole/Skranak Record of Decision. Kootenai National Forest, Libby, Montana.

USDA Forest Service 2002a. Terrestrial, threatened and endangered species mitigation plan for the proposed Sterling Rock Creek Mine. Revision dated December 30. Kootenai National Forest. Libby, Montana 12 pp.

USDA Forest Service 2002b. Updated baseline and alternative V analysis for the Rock Creek Mine project. Unpublished. report dated December 18 2002. Kootenai National Forest. Libby, Montana. 21 pp.

USDA Forest Service. 2002c. Letter from the Kootenai National Forest identifying the intent to close the Bear Creek road. Kootenai National Forest. Libby, Montana. 2 pp.

USDA Forest Service. 2003. Record of decision for the Rock Creek Project. Kootenai National Forest, Libby, Montana. 89 pp.

USDA Forest Service. 2004. Record of decision for motorized access management within the Selkirk and Cabinet-Yaak grizzly bear recovery zones. Kootenai, Lolo, and Idaho Panhandle National Forests, Libby, Montana. 90 pp.

USDA Forest Service. 2006a. Selkirk and Cabinet-Yaak grizzly bear recovery zones 2005 annual compliance monitoring summary report. *In* letter from Bob Castenada, U.S. Forest Service to Mark Wilson, U.S. Fish and Wildlife Service. May 24. 8pp.

USDA Forest Service. 2006b. Terrestrial threatened and endangered species mitigation plan for the proposed Revett Rock Creek Mine. Kootenai National Forest, Libby, Montana. DATE 14 pp.

USDA Forest Service, Idaho Department Fish and Game, Washington Department Wildlife, U.S. Fish and Wildlife Service, and Montana Department of Fish, Wildlife, and Parks. 1988. Cumulative effects analysis process for the Selkirk/Cabinet-Yaak grizzly bear ecosystems. 32 pp.

USDA Forest Service, Montana Department of State Lands, Montana Department of Health and Environmental Sciences, and Montana Department of Natural Resources and Conservation. 1992. Final environmental impact statement Noranda Minerals Corp. Montana Reserves Company joint venture Montanore project.

USDA Forest Service, Montana Department of State Lands, Montana Department of Health and Environmental Sciences, and Montana Department of Natural Resources and Conservation. 1993. Record of Decision Noranda Minerals Corp. Montana Reserves Company joint venture Montanore project. .

USDA Forest Service, Montana Fish, Wildlife and Parks, Confederated Salish and Kootenai Tribes, Blackfeet Tribe, U.S. Fish and Wildlife Service. 2002. NCDE grizzly bear distribution map. U.S. Forest Service, Northern Region. Missoula, Montana.

USDI Fish and Wildlife Service. 1982. Biological opinion on the Lolo National Forest Plan. U.S. Fish and Wildlife Service, Helena, Montana 8pp.

USDI Fish and Wildlife Service. 1983. Biological opinion on the 1982 proposed Kootenai National Forest Plan. U.S. Fish and Wildlife Service, Helena, Montana 8pp.

USDI Fish and Wildlife Service. 1985. Biological Opinion on the 1985 proposed Kootenai National Forest Plan. U.S. Fish and Wildlife Service., Helena, Montana 8pp.

USDI Fish and Wildlife Service. 1993a. Grizzly bear recovery plan. U.S. Fish and Wildlife Service, Missoula, Montana. 181 pp.

USDI Fish and Wildlife Service. 1993b. Final biological opinion on the construction and operation of the Montanore project. U.S. Fish and Wildlife Service, Denver, Colorado. 45 pp.

USDI Fish and Wildlife Service. 1995. Incidental take statement: amendment to June 26, 1985 biological opinion on the Kootenai National Forest Plan. U.S. Fish and Wildlife Service, Helena, Montana. 15 pp.

USDI Fish and Wildlife Service. 1998. Biological opinion on access requests for the Way-up and Fourth of July mines. U.S. Fish and Wildlife Service, Helena, Montana.1999.

USDI Fish and Wildlife Service. 1999a. Amendment to the incidental take statement for the Biological opinion on access requests for the Way-up and Fourth of July mines. U.S. Fish and Wildlife Service, Helena, Montana.

USDI Fish and Wildlife Service. 1999b. 12 month finding on the petition to change the status of grizzly bears in Selkirk to endangered warranted but precluded (64 FR 26725) May 17 1999.

USDI Fish and Wildlife Service. 2000a. Biological opinion on the Bull Lake Estates Project, Kootenai National Forest. U.S. Fish and Wildlife Service, Helena, Montana. 37 pp.

USDI Fish and Wildlife Service. 2000b. Grizzly bear recovery in the Bitterroot ecosystem final environmental impact statement. U.S. Fish and Wildlife Service, Denver, Colorado.

USDI Fish and Wildlife Service. 2000c. Biological opinion for the effects to grizzly bear and bull trout from the implementation of proposed actions associated with plans of operation for Sterling Corporation Rock Creek Silver/copper Mine. U.S. Fish and Wildlife Service, Helena, Montana. 132 pp.

USDI Fish and Wildlife Service. 2001. Letter from Mark Wilson, U.S. Fish and Wildlife Service, to Bob Castaneda, U.S. Forest Service. March 6. U.S. Fish and Wildlife Service, Helena, Montana. 1 pp.

USDI Fish and Wildlife Service. 2002. Biological opinion for the Idaho Transportation Department, Junction State Highway-1, Northeast Boundary County Project. U.S. Fish and Wildlife Service, Spokane, Washington. 43 pp.

USDI Fish and Wildlife Service. 2003. Biological opinion and conference opinion on the effects to grizzly bear and bull trout and Canada lynx of the proposed Rock Creek silver/copper mine. U.S. Fish and Wildlife Service, Helena, Montana.

USDI Fish and Wildlife Service. 2004. Biological opinion for the effects to grizzly bear and bull trout from the proposed amendment to the Kootenai and Idaho PanHandle National Forest Plans. U.S. Fish and Wildlife Service, Spokane, Washington.

USDI Fish and Wildlife Service. 2004b. Letter from Mark Wilson, U.S. Fish and Wildlife Service, to Bob Castaneda, U.S. Forest Service. December. U.S. Fish and Wildlife Service, Helena, Montana. 1 pp.

USDI Fish and Wildlife Service. 2006. Letter from Director, U.S. Fish and Wildlife Service, to Regional Directors, Regions 1,2,3,4,5,6 and 7, U.S. Fish and Wildlife Service. March 6. U.S. Fish and Wildlife Service, Washington, D.C. 2 pp.

Wakkinen, W.J. and B.K. Johnson. 2005. Selkirk Mountains grizzly bear ecology project. December 2003-2004. Idaho Department of Fish and Game. Boise.

Wakkinen, W.J. and W.F. Kasworm. 1997. Grizzly bear and road density relationships in the Selkirk and Cabinet-Yaak Recovery Zones for the Interagency Grizzly Bear Committee. U. S. Fish and Wildlife Service. Libby, Montana. 28 pp.

Wakkinen, W.J. and W.F. Kasworm. 2004. Demographics and population trends of grizzly bears in the Cabinet-Yaak and Selkirk Ecosystems of British Columbia, Idaho, Montana, and Washington. Ursus. 15(1) Workshop Supplement: 65-75 pp.

Waller, J. S. and C. Servheen. 1999. Documenting grizzly bear highway crossing patterns using GPS technology. Pgs. 21-23 In: Evink, G.L., P.Garrett and D. Zeigler, eds. Proceedings of the Third International Conference on Wildlife Ecology and Transportation. FL-ER-73-99. Florida Department of Transportation, Tallahassee, Florida. 330 pp.

Waller, J. S. and C. Servheen. 2005. Effects of transportation infrastructure on grizzly bears in northwestern Montana. Journal of Wildlife Management. 69(3):985-1000.

Wenum, E. 2002. Managing northwest Montana's black bears: an innovative approach. 5-year progress report. Region 1, Montana Fish, Wildlife and Parks. Kalispell, Montana. 32 pp.

Wenum, E. 2005. Managing northwest Montana's black bears: in the urban interface. 2004 report. February. Region 1, Montana Fish, Wildlife, and Parks. Kalispell, Montana. 15 pp.

Yonge, S.R. 2001. The ecology of grizzly bears and black bears in the Cooke City, Montana area. M.S. thesis. Montana State University, Bozeman. 90 pp.

APPENDICES

Appendix A

Alternative V — Rock Creek Project with Tailings Paste Deposition and Alternate Water Treatment (Preferred Alternative)

The major modifications distinguishing this alternative from Alternative IV are the deposition of tailings as a paste, an alternate water treatment system, an enclosed rail loadout facility, and relocation of the evaluation adit support facilities (see Figure 2-26). There is also a modification to the mill site and mine portal to improve mine to mill ore transport efficiency (see Figure 2-27). Table 2-12 lists the significant issues pertinent to this project and indicates which of the following sections addresses mitigating measures for those issues. Chapter 4 contains a more detailed discussion of how the mitigating measures would reduce or eliminate environmental impacts.

TABLE 2-12
Alternative V Modifications and Mitigations

Significant Issues	Categories							
	Mine Plan & Ore Processing	Tailings Disposal	Water Use & Manage-ment	Transpor-tation	Utilities	Employment	Reclama-tion	Monitoring & Mitigation Plans
Surface & Ground Water Quality		x	x	x	x		x	x
Fish, Wildlife, and T&E Species	x	x	x	x	x		x	x
Impoundment/Paste Facility Stability		x						
Socioeconomics	x							
Old Growth Ecosystem	x							
Wetlands and Non-wetland Waters of the U.S.	x	x						x
Public Access/Traffic Safety	x			x				
Aesthetic Qualities	x	x			x		x	

In addition, to the major modification mentioned above, Alternative V includes the following applicable modifications, mitigations, and monitoring plans from Alternatives III and/or IV as well as components from Alternative II. These items are listed below. The alternative shown in parentheses at the end of each bullet statement indicates the source of the modification or mitigation. A description of these items has been incorporated into the Alternative V description to provide the reader with a full description of this alternative and to reduce the amount of searching through the previous alternatives to determine what exactly was carried forward.

Modifications:

- Alternate mill and mine portal location at confluence of east and west forks of Rock Creek (Alternative IV) and subsequently shorter combined access road and utility corridor

- Alternate rail loadout location near Miller Gulch (Alternative III)

- Alternate location for wilderness air-intake adit (Alternative III)

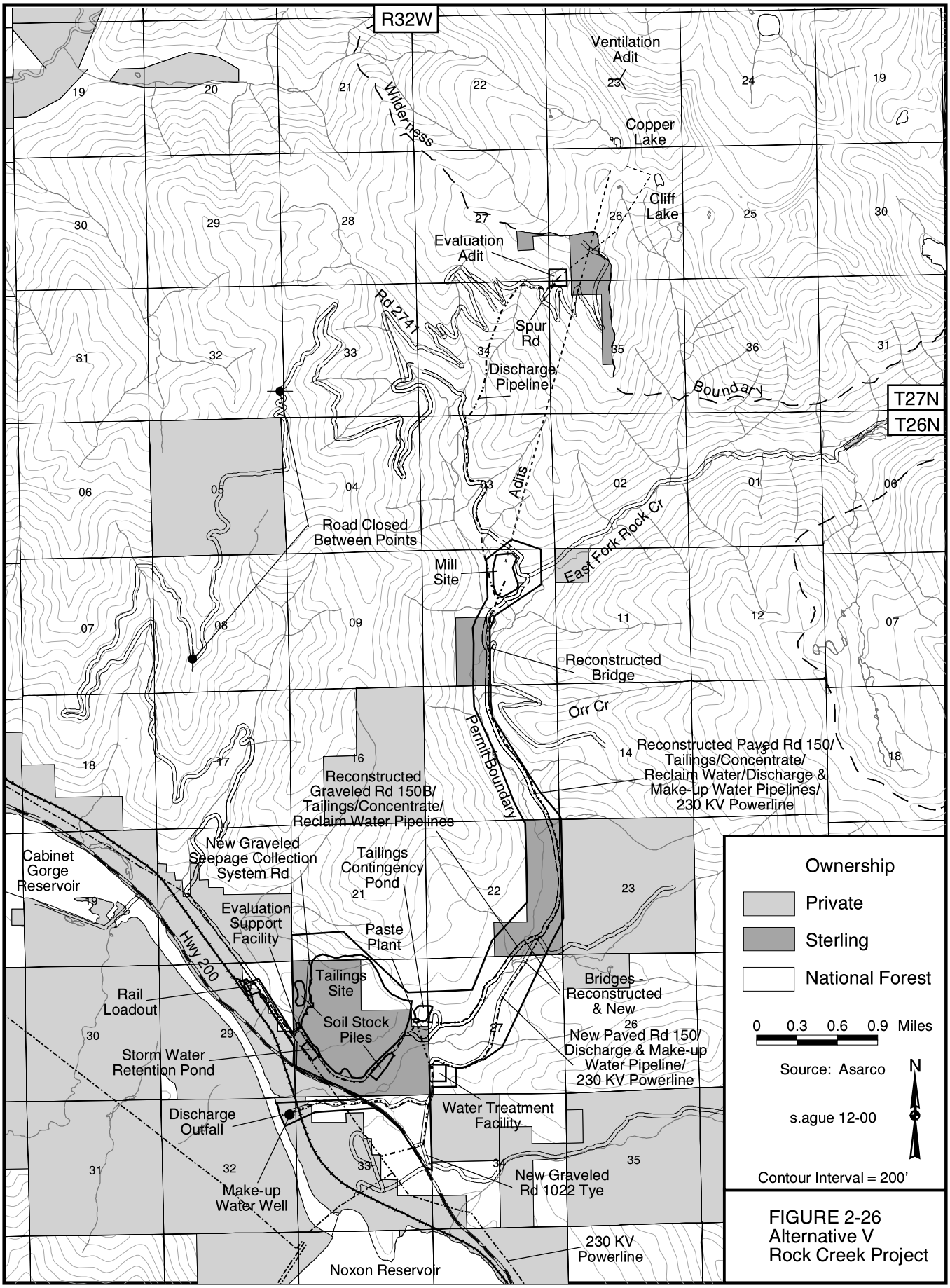
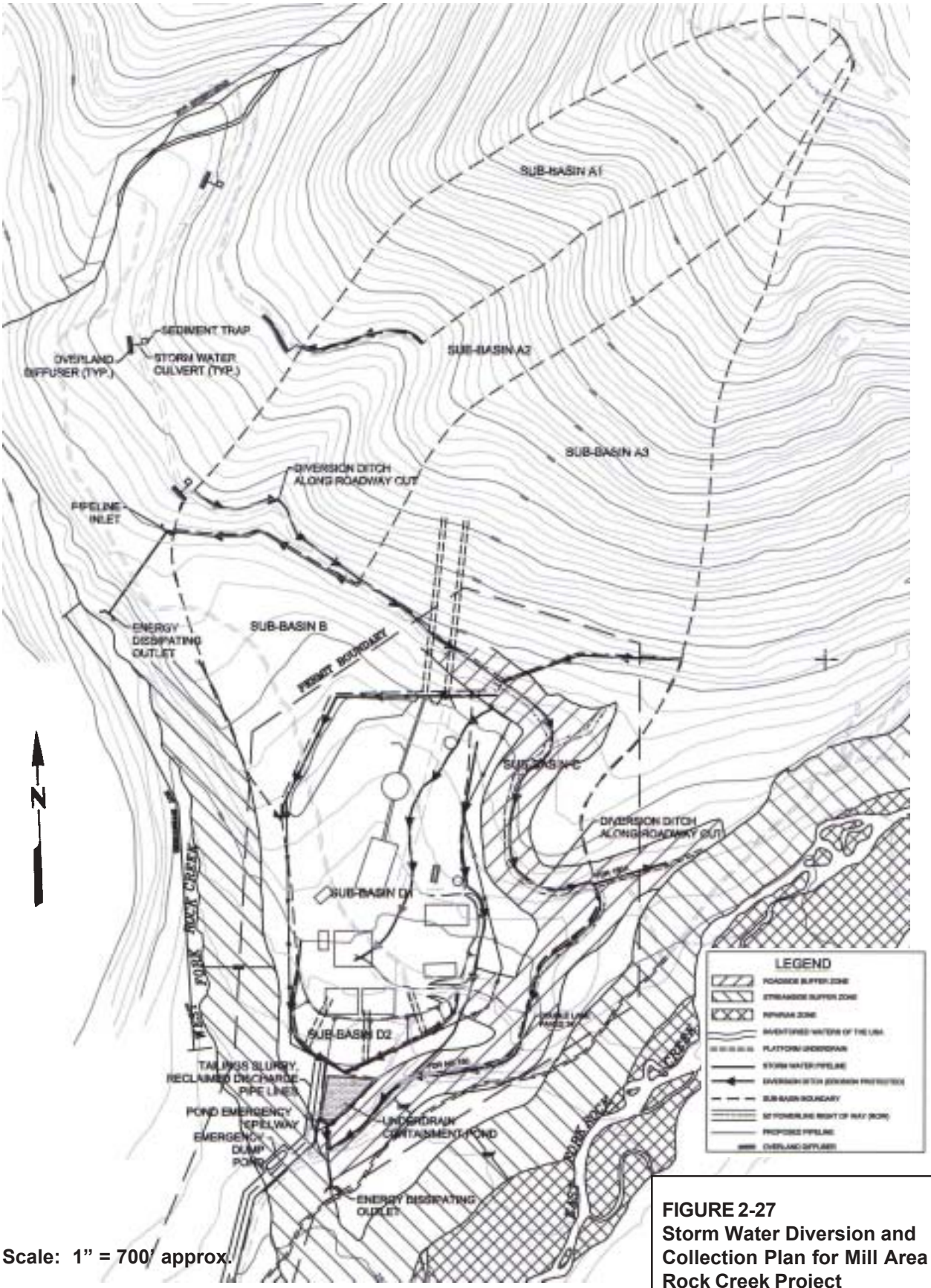


FIGURE 2-26
Alternative V
Rock Creek Project



Scale: 1" = 700' approx.

SOURCE: Water Management Plan, Hydrometrics, Inc., 1997

FIGURE 2-27
Storm Water Diversion and Collection Plan for Mill Area Rock Creek Project

Mitigations:

- Rock mechanics monitoring plan (subsidence control) (Alternative III)
- Rock mechanics and hydrogeologic sampling, testing and monitoring program to include rock geochemical testing program (Alternative III)
- Visual and sound mitigations for the mill site (Alternatives III and IV), and ventilation and evaluation adits (Alternative III)
- Technical panel review of final tailings storage facility design (paste facility under Alternative V) (Alternatives III and IV)
- Starter dams constructed with mine waste rock toe buttresses (Alternative III)
- More permeable areas within tailings storage facility sealed with excavated clays (Alternative III)
- A transportation management plan (Alternative III)
- Visual mitigations for the utility corridor and tailings impoundment site (paste facility site under Alternative V) (Alternative III)
- Revised grading and revegetation plans for the mill site to mitigate visual impacts (Alternative IV) and development of a vegetation management plan (Alternative III)
- Deeper soil salvage (24 to 36 inches) and replacement depths (average of 24 inches) to facilitate revegetation (Alternative III)
- 300-foot streamside buffer zone around mill (Alternative IV)
- 100-foot visual buffer between FDR No. 150 and mill site (Alternative IV)
- More detailed long-term reclamation monitoring plan than Alternative II (Alternative III)
- More detailed aquatics/fisheries, wildlife, threatened and endangered species monitoring and mitigation plans than under Alternative II (see Appendix K), including a sediment source reduction plan (see Alternative III) (see Erosion and Sediment Control)
- A comprehensive, long-term water monitoring plan which includes monitoring lake levels at Cliff and Copper lakes to be coordinated with subsidence control and fisheries/aquatics monitoring plans (Alternative III)
- An alert level and contingency/corrective action plan for each monitoring plan (Alternative III)
- Maintenance of the wastewater treatment system and possible long-term post-closure waste water treatment (Alternative III)

- Revisions to the applicant's wetlands mitigation and monitoring plans (Alternative III)
- All reasonable options to an air intake ventilation adit in the CMW would be pursued (Alternative III)
- Cultural monitoring during surface disturbing activities (Alternative III)

Evaluation Adit

The proposed evaluation adit would be driven prior to other work on the Rock Creek Project in an attempt to better understand the configuration of the ore body. During the mine production phase, this adit would serve as an additional ventilation (exhaust) opening and as a secondary escapeway, when the two adits met. Conventional mining methods would be employed during the 1-year evaluation adit construction period. Existing roads would provide access and an estimated 8.3 acres would be disturbed. While most of the pertinent information about the evaluation adit is included below, more details on the evaluation adit can be found in the Rock Creek Evaluation Adit License Application (ASARCO Incorporated 1992).

The adit portal would be located at about 5,755 feet elevation. About 59,000 tons of waste rock and 119,000 tons of ore would be excavated from the proposed adit (18 feet high by 18 feet wide with an estimated length of 6,592 feet at a decline of 10 percent). Unmineralized or barren waste rock would be end-dumped near the portal to form a flat-topped pile sloping downhill to its angle of repose. Mineralized material would be placed in a stockpile near the portal for later processing when the mill was in operation. A lined storm water containment pond would also be constructed on the portal pad.

Several facilities are proposed to be constructed for the evaluation adit (Figure 2-28). A few of these facilities would be located at the evaluation adit portal site. A 40-foot by 80-foot temporary steel shop building on a concrete slab would be constructed on top of the initial waste material removed from the adit. This building would provide warehouse space, indoor work space, a lunchroom, and lavatories. Two propane-fired generators (545 kW and 735 kW) would be located in a lean-to attached to this building to provide power during adit construction rather than the diesel generators proposed under Alternatives II-IV. An above-ground propane tank would be located near the shop building at the adit site. All exterior lights would be shielded or baffled from viewpoints in the Clark Fork Valley. Upon completion of the evaluation adit, all facilities would be either removed from the permit area or moved to the mill site for use during mining.

Excess water from the evaluation adit and the storm water containment pond overflow would be pumped through a temporary 6-inch polyethylene pipeline to a temporary wastewater treatment system at the lower support facilities site prior to discharge. This system would consist of a portable reverse osmosis unit and a pilot anoxic biotreatment system. (See the Water Use and Management section below for more detail on these systems.) Discharges must comply with MPDES limits. Sterling would install the portion of temporary mine water discharge pipeline between the evaluation adit and the support facilities site with a cable and winch instead of dragging it through the woods with a tractor. This would minimize vegetation clearing and erosion on the steep hillside below the evaluation adit. This pipe would be removed in a similar fashion when the mine reached the evaluation adit or through the reclamation of the evaluation adit whichever came first; the evaluation adit water would then be routed through the mine water drainage and collection system.

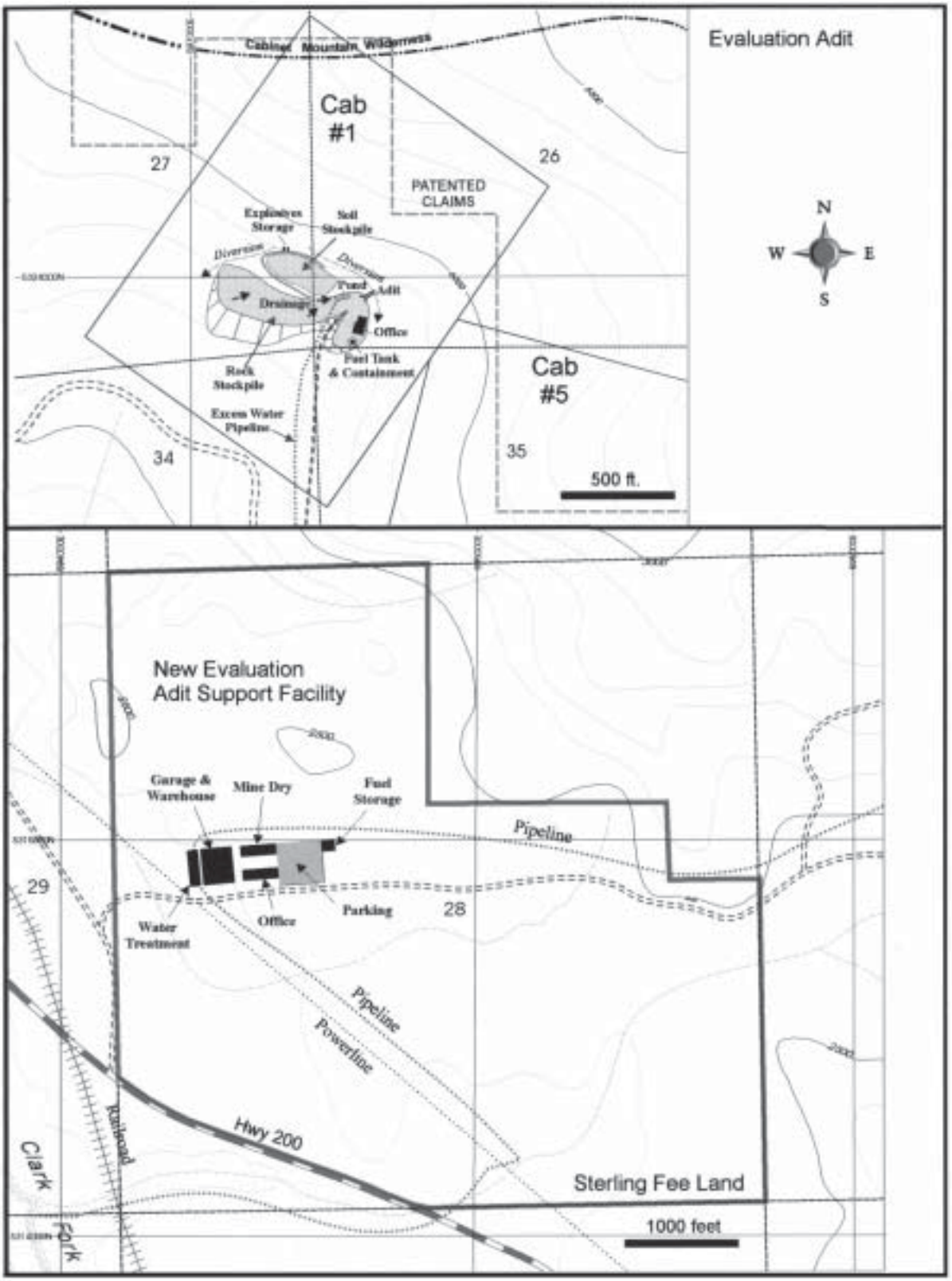


FIGURE 2-28
Evaluation Adit and Support Facilities
Rock Creek Project

Source: ASARCO, Incorporated 1999.

Additional support facilities would be located within the paste facility footprint (see Figure 2-28) rather than in Section 22 as proposed under Alternatives II-IV. These include: an office situated in a 12-foot by 60-foot trailer or other similar structure; a changehouse/dry set up in another trailer; a garage and warehouse located in a pre-engineered steel building on a concrete slab; a graded, graveled employee parking lot; and a soil stockpile. A 500-gallon above-ground gasoline storage tank in a lined containment structure would be located near the garage and warehouse. The support facilities site would be supplied with electrical power from a local distribution line.

Extensive data collection, sampling and monitoring would be required during the construction of the evaluation adit. Rock geochemical characterization, monitoring and mitigations are discussed in the Acid Rock Drainage and Metals Leaching Plan in Appendix K. This plan includes provisions for waste rock handling during adit construction as well as contingency needs should premature project closure occur before mine construction and development begins. The evaluation adit data collected and evaluated through this plan and rock mechanics and hydrological data collected through the Evaluation Adit Data Evaluation Plan (EADEP) would be used to modify mine designs and operations to keep impacts at or below the levels disclosed in Chapter 4.

Mine Plan

Mine and Mill Operations. The mine plan would remain the same as described for Alternatives II through IV. The entire mill complex, including the mine portals, surface conveyor, SAG mill, office building, shop, sewage treatment plant and warehouse, would be located at the confluence of the east and west forks of Rock Creek as described for Alternative IV. However, the mine portal would be moved to the west side of FDR No. 150 just north of the coarse ore storage (see Figure 2-27). This aligns the adits with the mill facilities and eliminates two transfer points on the ore conveyor belt system. There would be no mine facilities on the east side of FDR No. 150 at the confluence mill site other than storm water control features. This alternative mine/mill site, as shown on Figure 2-27, would be located above the 10-foot flood stage (about 100-year flood event) with a minimum 300-foot buffer between the mill site and the east and west forks of Rock Creek to create a riparian buffer zone. It would be sited on cut-and-fill pads located at the toe of the southwest facing ridge at the confluence. The layout would afford a reasonably compact mill site arrangement.

Mill Site and Mine Adit Construction. The portal location would be placed at an elevation of 3,040 feet and would be within the mill site. Each of the access adits would be about 15,530 feet long and about 1 million tons of waste rock would be produced during their construction. The waste rock would be used in part to construct the mill site pad, potentially raising the ground level at the mill site by a maximum of 50 feet. This elevated pad would increase mill site visibility from surrounding Forest Service roads and wilderness viewpoints that are located above the mill site. A maximum pad height of 50 feet and retention of a minimum 100-foot vegetative buffer around the pad would help limit mill site visibility from the portion of FDR No. 150 that surrounds the site. Additional rock excavated from the adits beyond that needed to construct the pad would be used for foundation material at the tailings paste facility. Hauling of waste rock from the adits to the tailings paste facility site would only occur between August 1 and March 31 as a mitigation to impacts on harlequin ducks. There would be no separate waste rock dumps under this alternative. Directional grouting prior to blasting would be used during adit construction to minimize seepage into the adits during construction and mine operation. Monitoring of ground water and rock mechanics and geochemical rock characterization would continue during adit and mine construction as described in Appendix K.

Mill Site Mitigations. Aesthetic impacts of the mill and mine-related facilities would be minimized because Sterling would be required to implement the following mitigations:

- plant or retain a vegetative buffer of sufficient width between FDR No. 150 and mill site (minimum 100-foot buffer), the waste water treatment facility, and the substation in the lower Rock Creek drainage for visual screening;
- treat and/or paint permanent (life-of-mine) structures within the project area to visually blend with the surrounding landscape;
- shield or baffle exterior lights from viewpoints in the Clark Fork Valley;
- operate all surface and mill equipment so that sound levels do not exceed 55 dBA measured 250 feet from the mill;
- replace above-ground vehicle back-up beepers with discriminating back-up alarms that sense movement behind a vehicle if allowed by OSHA.

Mine Ventilation and Wilderness Air-Intake Adit. Electric ventilation fans would initially use the conveyor adit for intake and the service adit for exhaust. However, Sterling would use the evaluation adit for air exhaust ventilation during the operation phase once the mine intercepted the evaluation adit and might possibly require a separate air-intake ventilation adit in the wilderness towards the end of mine life. Intake and exhaust ventilation fans in the exploration and mine adits would be adjusted so that they generate less than 82 dBA measured 50 feet downwind from the portal entrances.

If in the future, monitoring showed a need to provide additional ventilation for mine personnel health and safety as required by the Mine Safety and Health Administration (MSHA) rules and regulations, it may be necessary to drive an adit to the surface in the wilderness to provide an additional air intake and a secondary escapeway from the mine about year 20 of mine operation. The air-intake ventilation adit would be driven from the underground workings; there would be no need for the creation of a waste rock dump at the adit portal in the wilderness. Fans would be located no closer than 200 feet underground from the wilderness adit opening. A process would be developed to ensure locating an air-intake ventilation adit in the CMW would be the last choice among potential ventilation options. Other options could include an upgrade of the existing ventilation system and closure of portions of the exhausted underground workings. If Sterling and the agencies determine that other methods of expanding ventilation capacities are reasonable Sterling would implement other ventilation techniques prior to being permitted to construct the wilderness adit/portal. If it was deemed necessary to construct the air-intake ventilation adit in the CMW, Sterling would conduct a detailed study verified by a site visit with the agencies prior to excavation to evaluate variations in topography and rock formations. Other site-selection criteria would consider possible post-closure use of the adit for bat habitat. The agencies would evaluate the compatibility of this post-mine use with restoration of premining appearance and configuration to address visual impacts. For purposes of analysis in this EIS, the agencies have assumed that the air-intake ventilation adit would be located about 400 feet north of the west ridge of Saint Paul Peak and would disturb about 800 square feet. The wilderness air-intake ventilation adit would be located so as to minimize visual impacts and reduce noise impacts to 45 dBA (measured 50 feet from the ventilation portal). If necessary to achieve this level, specially designed low-noise fan blades or active noise-suppression equipment would be used. Sterling would contact the Forest Service prior to construction for approval of final siting and construction methods.

Mine Plan. The room-and-pillar system of mining is used for most flat-lying or nearly flat-lying ore deposits where the ground is hard and firm, and where artificial means of support would be too costly. Room-and-pillar is one of four common types of open stope (underground excavation) methods.

In room-and-pillar mining, some ore is left unmined to give support to the mine roof. The slot-pillar system is similar to room-and-pillar. Rather than a regular pattern of rooms and square pillars, a slot pillar is longer in one direction, creating a system of rectangular pillars and rooms. This design is used when more ground support is needed. Generally, a regular pattern of pillars is more efficient than an irregular one, and the size and spacing of support pillars varies depending on local ground conditions (Earll et al. 1976).

Sterling proposes to use a combination of room-and-pillar and slot-pillar designs[10]. The majority of the mine layout would use a regular pattern of rooms and pillars. A design layout similar to the Troy Mine is proposed. The determination of when to use a regular pattern versus a slot pillar approach would be made after examining local ground conditions and rock mechanics data.

Sterling would be required to provide an updated preliminary mine design for agency review and approval prior to exploration and mine start-up. The agencies would conduct a second review of the mine design to determine its suitability for actual conditions during mine adit construction. Specifics of this review would focus on general design approach, design criteria and methodology, rock mechanics test data from the Rock Creek deposit,[11] proposed room-and-pillar sizing and layout, identification of zones of rock instability and potential subsidence, and mitigations for these areas. Given the expected changes in planning any underground mine development, Sterling would submit updated detailed mine plans for agency review prior to entering areas where mining could have deleterious environmental impacts if adequate precautions were not taken. This would ensure development was meeting the environmental objectives and intentions of the original design. Approval of the mine plan would be contingent on demonstrating that the risk to Copper and Cliff lakes and the potential for subsidence would be minimized, based on hydrogeologic and applicable engineering analyses. Secondary pillar recovery would not be allowed.

The average depth of the ore body is 900 feet below the surface except where the ore approaches the outcrop interfaces. In order to protect against surface subsidence, hydrofracturing and leakage to the surface, Sterling would be required to leave a minimum of 450 feet of overburden over the mine workings particularly near the ore outcrops located in the northeast and southeast portions of the orebody and in Copper Gulch. Additionally, Sterling would not be allowed to mine closer than 1,000 feet from the outcrops and would not cross the Moran Fault (MT DEQ 2001). These limits would be modified based on site-specific rock mechanics and hydraulic information gathered as a result of the ongoing mining operation and the required Rock Mechanics Monitoring Plan.

A buffer of 1,000 feet around Cliff Lake, ore outcrop zones, the Copper Lake fault, and the Moran Fault would remain unmined until the hydrogeology of this area is better characterized through the monitoring process. In the Copper Lake Fault area where ore thicknesses exceed 100 feet, Sterling proposes to leave a large barrier pillar between the fault zone and the active mine area. The function of the barrier pillar would be to provide stability in this area of large ore horizon thickness and potential

[10] The pillars would be 45 feet square and drives and cross-cuts 45 feet wide. Ore recovery is projected at 65-75 percent. As ore thickness increased and/or overburden decreased more ground support may be necessary. Again, using a design from the Troy Mine, Sterling proposes to use a slot-pillar approach. The pillars would be 30 feet wide while the drives would be 50 feet wide. The overall length of the slot pillar would vary but could be on the order of several hundred feet long. Ore recovered using this approach is reduced (10 percent at Troy Mine), however ground support is improved.

[11] Rock mechanics data would initially be obtained during construction of the evaluation adit as outlined in the Rock Mechanics Monitoring Plan and the Evaluation Adit Data Evaluation plan described briefly in this document and in more detail in Appendix K of the final EIS.

poor ground conditions. The dimensions and location of the barrier pillar(s) would be determined after assessing local ground conditions.

In areas where the proposed ore extraction thickness exceeded the capacity of designed pillars, Sterling proposes to use a horizontal pillar to facilitate extraction over the entire ore height. A horizontal pillar is a section of unmined material left in place between two rooms stacked one on top of another (see Figure 2-9). Using a design from the Troy Mine, Sterling expects to use this approach when ore thicknesses exceed 75 feet.[12] Although ore recovery would be reduced to 52 percent from 75 percent using this design, it would allow for ore extraction over the entire ore column.

Conventional drilling, blasting, rock bolting, and mucking methods would be used underground. Broken ore would be processed by an underground crusher and then transported to the surface via conveyor belt for further processing. A surface conveyor belt would transport ore from the adit portal to the mill. A maximum of 2,500 cubic yards of ore mined during the construction period would be stockpiled at the mill site for treatment following construction of mill facilities. Waste rock generated underground during the production period would be stored in mined-out areas.

Seasonal storage of mine water within underground mine workings is proposed to regulate outflow through the water treatment system. By year 27, a 207.7-million-gallon reservoir would be established in worked out portions of the mine to handle maximum water storage requirements. This would equate to a maximum storage capacity of about 64 acres with water 10 feet deep. The area and volume required for storage would be increased throughout the mine life on an as-needed basis by modifying the mining method to create the storage areas. The ore in the storage areas would be mined using conventional methods except that barrier pillars would be left in place along either side of the storage area.

Rock geochemical characterization, monitoring and mitigations, for determining suitability of waste rock to be used for mill pad construction, road gravel, and paste facility toe buttresses and finger drains, are discussed in the Acid Rock Drainage and Metals Leaching Plan in Appendix K. This plan includes provisions for waste rock handling during operation as well as contingency needs should premature project closure occur. The evaluation adit geochemical data collected and evaluated through this plan and rock mechanics and hydrological data collected through the EADEP would be used to modify mine designs and operations to keep impacts at or below the levels disclosed in Chapter 4. The facilities, designs and plans must be approved prior to mine construction and operation.

Reduced-emission diesel engines would be used in place of standard diesel engines underground. Electric underground ore trucks would also be used. These modifications would reduce concentrations of noxious gases released to the atmosphere and underground workings.

Surface Disturbance

A total of about 482 acres would be disturbed within the permit area of 1560 acres under Alternative V (see Table 2-2). Land encompassed by the proposed permit boundary is 48 percent privately held and 52 percent NFS lands. The Forest Plan would be amended so that management allocations on 147 acres would be consistent with the intended use.

[12] Vertical pillars would be 30 feet wide, rooms 50 feet wide, and the horizontal pillar 40 feet thick. In this manner a 200-foot thick ore horizon could be mined with two 80-foot-tall rooms with the intervening 40-foot horizontal pillar.

Ore Production Schedule

Ore production scheduling would be similar to that described for Alternative IV (see Table 2-11). Sterling would develop an underground mine that would produce 10,000 tons of ore per day, or 3.5 million tons per year. Ore reserves are estimated to range between 136 and 144 million tons averaging 1.65 troy ounces per ton of silver and 0.68 percent copper. About 65 percent of the ore body would likely be mined, with about 35 percent remaining as pillars and other structural support. Actual underground conditions would govern the amount of ore removed.

Based on these figures, Sterling would mine and mill between 88 million tons and 108 million tons of ore giving the mine an anticipated production life of 25 to 30 years and a total project life of 33 to 37 years depending upon the actual amount of ore reserves and the ore extraction rate (see Table 2-11). Based on milling efficiencies at the Troy Mine, Sterling anticipates a milling efficiency of 85 percent. That is, about 85 percent of the copper minerals and silver in the mined ore would report to the concentrate, while 15 percent would remain in the tailings.

Ore Processing and Shipment

The ore-processing facility or mill would remain generally the same as is described for the proposed action, Alternative II, but would be located at the confluence of the east and west forks of Rock Creek as described for Alternative IV. The primary difference from the other action alternatives is that there would be no tailings thickener facility at the mill site due to the change in tailings disposal (see Paste Deposition of Tailings below). The thickener would not be necessary as the tailings would be dewatered at the paste production plant adjacent to the tailings paste facility. However, the emergency dump pond and the storm water pond would be enlarged to provide additional water storage (see Figure 2-27).

Sterling modified the milling operation to reduce particulate emissions under Alternative V. The surface dry milling operation or secondary crushing would be replaced with a semi-autogeneous (SAG) mill, a fully wet milling operation. Concentrate would be sent from the mill to the rail loadout facility as a slurry in a 3-inch HDPE-lined steel pipe with leak detection sensors and buried in the same corridor as the tailings and water pipelines. The rail-loadout process including concentrate dewatering, drying, and storage and railcar loading would take place within an enclosed building. Covered railcars would eliminate the use of a tackifier that would have been needed to minimize dust generation during transport to the smelter. Approximately 13 railcars of concentrate per week would be removed from the site. Reclaimed concentrate water would be piped to the paste plant and then to the mill for reuse.

Paste Deposition of Tailings

Facility Design. The conceptual tailings paste facility design has undergone an engineering review for feasibility and stability (Klohn-Crippen 1998). The tailings paste facility design would be finalized as additional site information was obtained from the final design investigation process. Technical review of the final design would be made by a technical review panel established by the agencies. Review would encompass the technical aspects of design including the short- and long-term stability of the tailings storage facility. If supplemental rock and tailings characterization data and geochemical testing showed a potential for acid generation not presently anticipated, the review would also include consideration of some form of a seepage-inhibiting layer or liner beneath the impoundment. The technical review panel would assist in the development of the QA/QC protocols. The panel would

ensure that any environmental impacts associated with final design remained within the scope of those impacts identified in the final EIS. If the final design generated additional impacts and they could not be mitigated to remain within this scope, then further MEPA/NEPA documentation would be required. The agencies would have to review and approve the final design prior to construction.

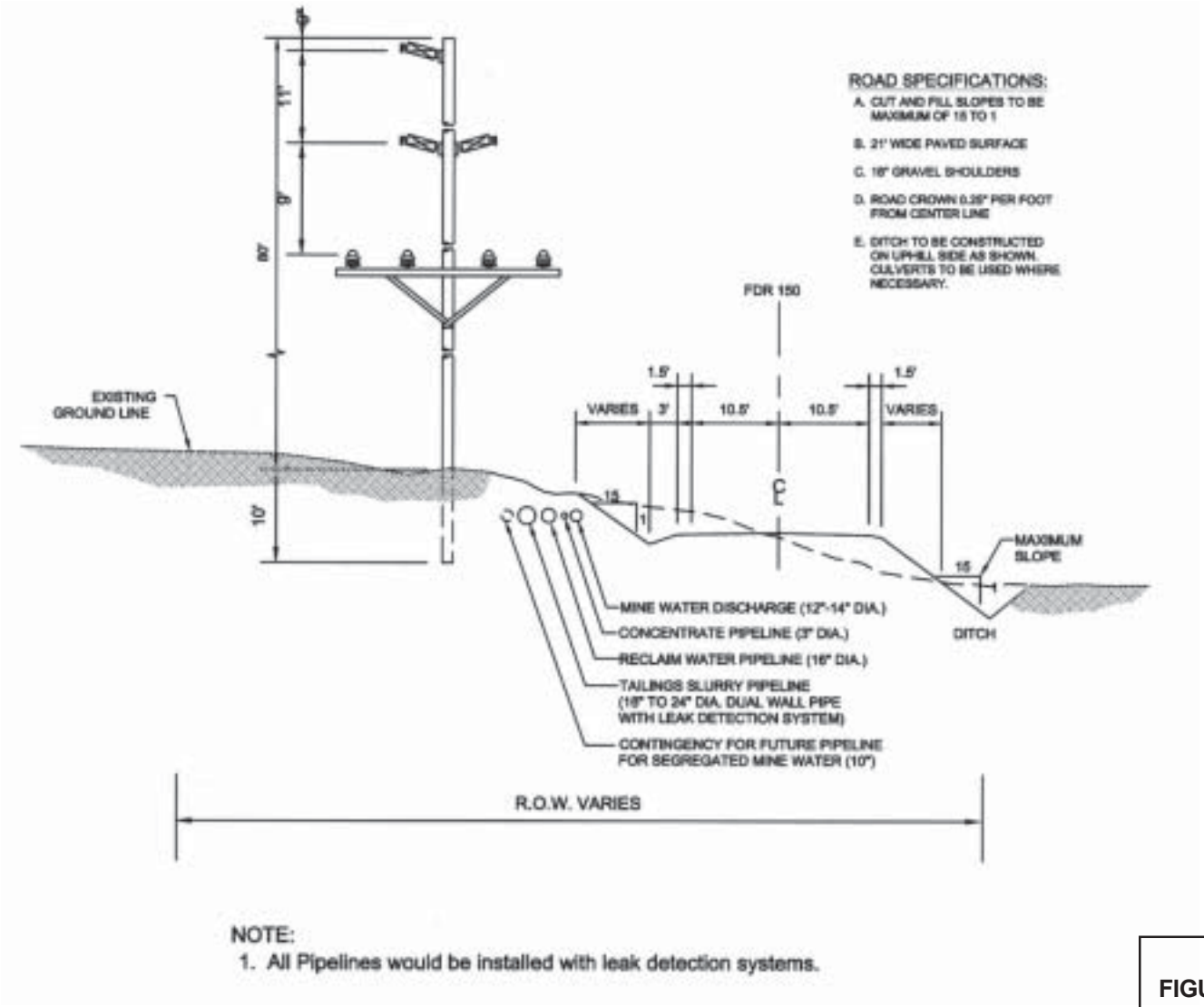
Tailings Transport. Tailings would be transported 4.1 miles from the mill to the paste plant as a slurry (30 percent tailings, 70 percent water) in a 16- to 24-inch, urethane-lined, steel pipeline (a double-walled pipeline) with leakage detection devices. This pipeline, the 16-inch return process water line (which would also be used as the make-up water line), and the concentrate pipeline would be buried at least 24 inches deep (see Figure 2-29). Burying the pipelines will provide better protection from vandalism, eliminate the visible presence of the pipelines, and facilitate concurrent reclamation in the pipeline corridor along most of the route between the mill and the paste plant. The pipelines would be visible at the three above ground crossings of Rock Creek, West Fork of Rock Creek, and Engle Creek. All lines would be encased in a larger steel pipe at creek crossings adjacent to or near bridge crossings to guard against the unlikely event of a leak or rupture.

Paste Production. In general, the tailings would be delivered to the paste plant and dewatered to make a paste with a known proportion of water (approximately 20 percent by weight). This paste would be applied to the ground surface after sediment and erosion control features are in place and soil has been salvaged, and the foundation has been prepared as described under Alternatives III and IV including the use of excavated clays to seal permeable areas of footprints.

The paste plant building, approximately 80-feet by 80-feet by 110-feet high, would be located on the hillside adjacent to the tailings paste facility site. The building would be built into the hillside and painted to help reduce its visual impact. Trees and vegetation surrounding the paste plant would be retained or planted to help visually blend the plant site with adjacent hillsides. Sterling would conduct a site study verified by a visit with the Agencies prior to final siting of the plant and access road to select a location that would reduce plant visibility and avoid harlequin duck habitat to the extent possible.

The paste plant would be designed to receive, dewater, mix, and pump 10,000 tons of tailings per day, 365 days per year. The paste process schematic is shown in figures 2-30 and 2-31. The tailings slurry would be deposited into a tailings surge tank and then fed into two cyclone/separators. The cyclone underflow, composed of the coarser tailings, would be discharged into a coarse tails storage tank (25-foot-diameter by 50-foot-high) and could be discharged at a rate of 50 tons per hour (tph). The overflow, composed of primarily finer tailings, would be fed through a distributor box into one or more of the four 32-foot-diameter by 60-foot-high paste dewatering tanks. The tailings would be discharged from each tank at a rate of 67 tph. Maximum discharge rate could reach 90 tph to allow for maintenance of one tank while continuing paste production in the other three tanks.

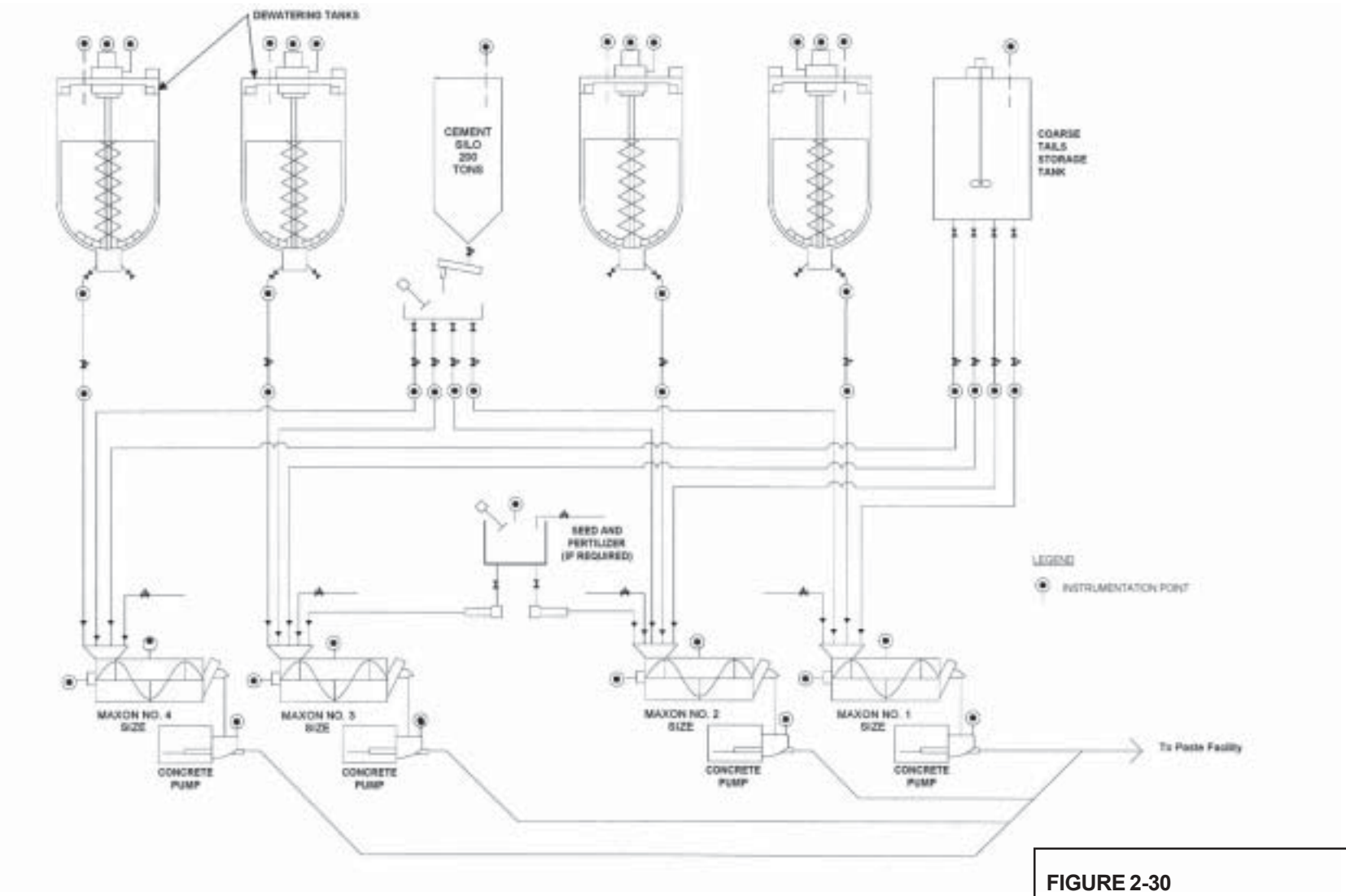
Process water for paste production would come from the water discharged from the paste dewatering tanks. Process water would be stored in a 30,000-gallon tank; excess water would be pumped back to the mill for reuse or discharged from the mill to the waste water treatment facility for disposal.



NOTE:
1. All Pipelines would be installed with leak detection systems.

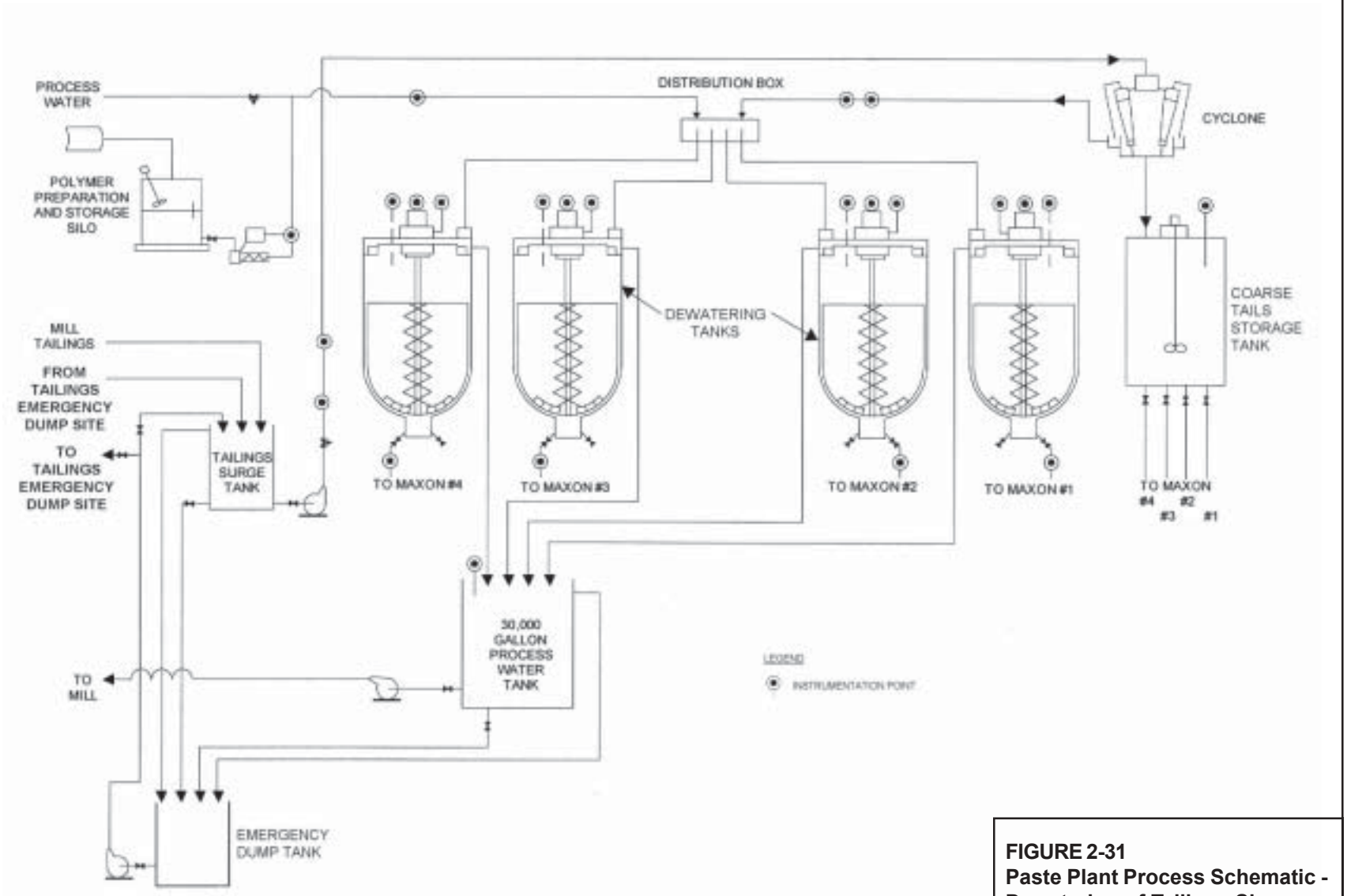
SOURCE: Water Management Plan, Hydrometrics, Inc., 1997

FIGURE 2-29
Pipeline Corridor Drawing
Rock Creek Project



SOURCE: Golder Associates Ltd., Evaluation of Surface Paste Placement, 1996

FIGURE 2-30
Paste Plant Process Schematic - Paste Production and Mixing
Rock Creek Project



SOURCE: Golder Associates Ltd., Evaluation of Surface Paste Placement, 1996

FIGURE 2-31
Paste Plant Process Schematic - Dewatering of Tailings Slurry
Rock Creek Project

The success of the paste process is dependent on the strict control of paste parameters such as moisture content. Prior to the implementation of a paste program, Sterling would be required to develop and submit for Agency approval a comprehensive paste plant operations manual. This manual would address plant operations, paste parameter tolerances, contingencies for paste not meeting specifications, monitoring of the paste production process, and reporting to the Agencies. The technical advisory board empaneled to assist with the design review of the paste impoundment would assist in the development of the QA/QC protocols.

The full plant tailings paste would be produced by combining the fine tailings paste from the dewatering tanks, the coarser tailings in the coarse tails storage tank, and additional process water as needed. Supplemental material such as a binder (Portland cement[13], fly ash, or slag cement) or seed and/or fertilizer to facilitate reclamation would be added as needed. Each dewatering tank would have a separate mixer capable of handling the maximum discharge from the dewatering tank plus the coarse material from the storage tank. The paste production would be monitored and regulated so that the resultant paste would have a consistency comparable to concrete exhibiting a 7-inch slump; this means positive displacement pumps would transport the paste via a high-pressure pipeline to the disposal location at the tailings paste facility.

The dewatering tanks would be designed to allow for continuous feed of tailings and production of paste even when one tank was off line for maintenance or repairs. The surge capacity of the dewatering tanks and the coarse tailings agitated storage tank would allow the paste production system to be shut down for 7 hours without stopping the tailings slurry feed from the mill or before using a tailings slurry feed containment site adjacent to the plant. In addition, each mixer has a surge capacity of 15 tons or approximately 10 minutes of down time for one mixer/pump pair without shutting down the paste production process.

A 7-acre contingency tailings slurry feed containment site would be placed near the paste production plant to contain approximately 6 days of tailings production should the paste production plant be totally disabled or in the event of a major failure beyond the control of the plant design (see Figure 2-26). This facility would be designed using traditional slurry impoundment design methods with a dam or embankment and would be lined with low permeability native materials (clay-type soils) and a synthetic liner to control seepage. The tailings stored in the containment pond would be dredged from the pond and reintroduced into the plant for disposal as a paste after the plant resumed operation. A paste plant shutdown of more than 6 days would result in the suspension of milling.

Tailings Paste Deposition. The location of the paste plant was selected to utilize a hillside location adjacent to the paste facility for convenient tailings materials handling and disposal. The paste plant design provides operational flexibility and avoids duplication in pump transport. Positive displacement pumps with a combined design capacity of approximately 680 dry tph would be used in an arrangement that would allow one pump to be shut down for either preventative or unscheduled maintenance. The paste would be pumped to the paste delivery system.

[13] Addition of cement to the tailings paste would be dependent upon the results of geochemical data collected from the evaluation adit (see Acid Rock Drainage and Metals Leaching Plan and the Evaluation Adit Data Evaluation Plan in Appendix K for more detail). Any requirement for cement as a means to prevent or minimize acid rock drainage could further be modified over time as a result of continued geochemical testing during mine operation. Cement could also be required if the technical review panel determined during final design reviews it was necessary for stability purposes.

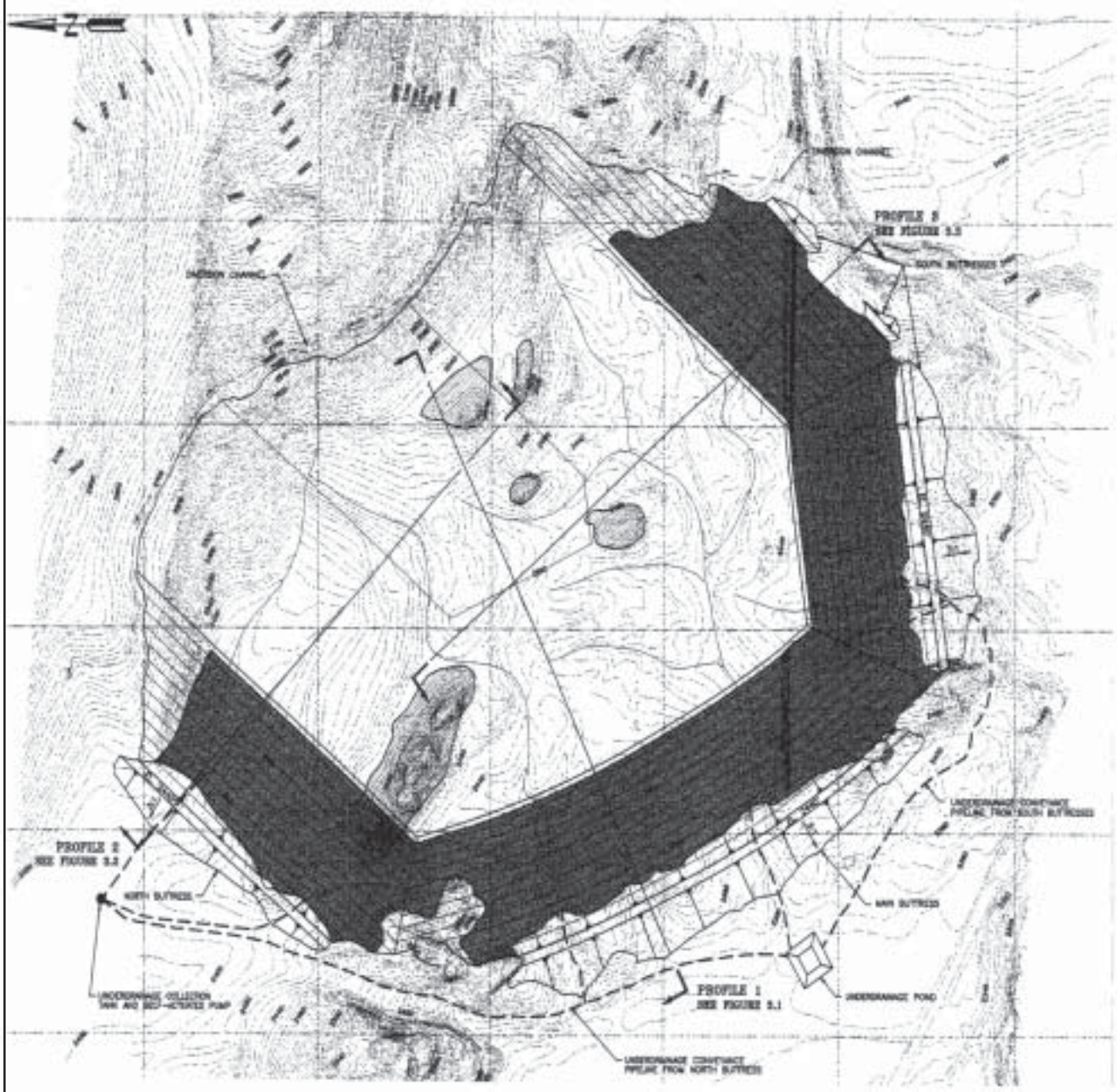
There are two primary paste deposition options for Alternative V and one combined paste deposition option. These options are named according to the direction in which the paste is deposited and the landform is built (see Figures 2-32, 2-33, and 2-34). These options are termed Bottom-Up option (Alternative V-a), Top-Down option (Alternative V-b), and Combined option (Alternative V-c).

The Bottom-Up option would initially involve spigotting paste from the lower elevations and moving the spigot point upslope. The Top-Down option would result in deposition of the paste by spigotting the paste from the upper-most slopes and moving the spigot point towards the highway; the deposit would gradually progress to the southern most portion of the deposit site. Under the Combined option the direction of paste deposit and spigot location would depend on the method being used at the time as described for the Bottom-Up and Top-Down options. The combined option would be used on a seasonal basis each year or alternate between a number of years with each of the first two options. The tailings paste facility would encompass approximately 324 acres for the paste facility and another 44 acres for associated features, such as soil stockpiles, under all options but acreage would vary slightly based on the final approved design.

A series of toe buttresses would be required for all options to assist in containing the paste on the downslope sides, improving slope stability, and retaining sediment eroding off the slopes. Under these conceptual designs, the buttresses would reach an ultimate height of approximately 80 feet (elevation of 2440 feet), but the actual height would depend upon engineering behavior of foundation soils to be analyzed in more detail in the final design. The toe buttresses would be located in approximately the same location as the starter-dams for the tailings impoundment designs in Alternatives II through IV. The buttresses would be built during initial stages of mine development as rock was salvaged from within the proposed paste deposit footprint or became available during adit construction. The buttresses would consist predominantly of rockfill totaling approximately 1,360,000 cubic yards. The rockfill could be obtained from rock outcrops within the deposit site, borrow areas within the deposit site, and waste rock produced from mine adit development (see Table 2-13 for preliminary estimates of materials obtained from these sources). Waste rock from the adits would be hauled to the tailings paste facility site and used immediately for buttress construction to avoid rehandling this material or the need for a waste rock dump at the mill site. The waste rock could only be hauled between August 1st and March 31 to minimize impacts to harlequin ducks.

TABLE 2-13
Preliminary Volumes of Paste Facility Toe-Buttress Waste Rock Requirements

Source	Quantity (Cubic Yards)
Rock Outcrops	480,000
Borrow Areas	130,000
Mine Waste	750,000
Total	**1,360,000**



LEGEND:

- DESIGN CONTOUR AND EL. FEET
- INTERMEDIATE DESIGN CONTOUR
- DIVERSION CHANNEL AND DIRECTION OF FLOW
- EXISTING GROUND SURFACE CONTOUR AND EL. FEET
- FINGER DRAINS
- LIMITS OF BLANKET DRAIN SYSTEM
- POTENTIAL BORROW AREAS (ROCK OUTCROP)
- UNDERDRAIN CONVEYANCE PIPELINE

NOTE:

1. THIS PLAN DEPICTS THE GEOMETRIC SHAPE OF THE FACILITY AND DOES NOT SHOW TOPOGRAPHY RESHAPING FOR RECLAMATION.

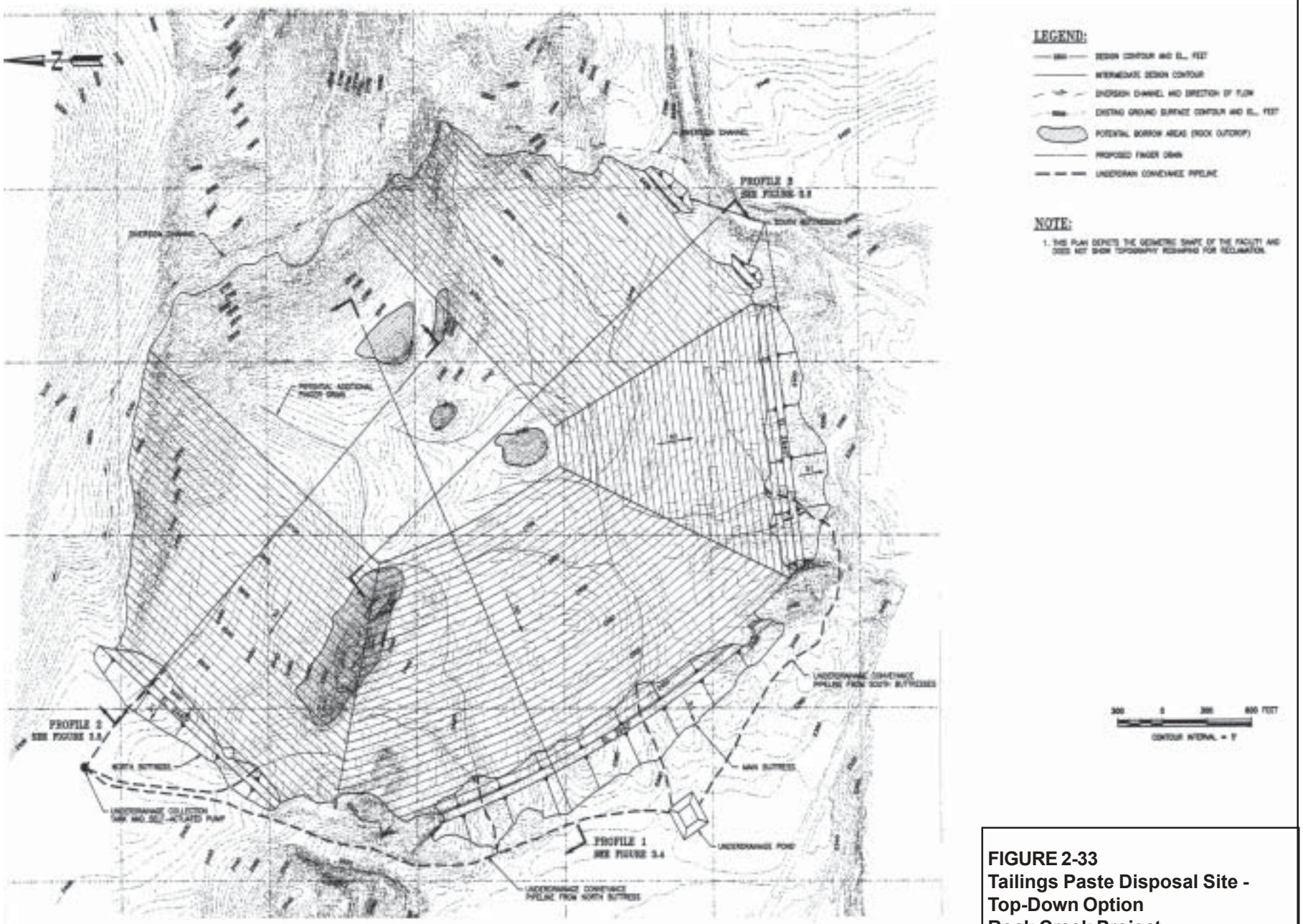
NOTE:

1. THIS PLAN DEPICTS THE GEOMETRIC SHAPE OF THE FACILITY AND DOES NOT SHOW TOPOGRAPHIC RESHAPING FOR RECLAMATION.

2. THE OUTER SLOPES OF THE BOTTOM-UP OPTION COULD BE REDUCED OR FLATTENED TO REDUCE VISUAL IMPACTS (KLOHN-CRIPPEN 1997).

SOURCE: Dames and Moore, Alternate Tailings Impoundment Design, 1992

FIGURE 2-32
Tailings Paste Disposal Site - Bottom-Up Option
Rock Creek Project



SOURCE: Dames and Moore, Alternate Tailings Impoundment Design, 1992

FIGURE 2-33
Tailings Paste Disposal Site - Top-Down Option
Rock Creek Project

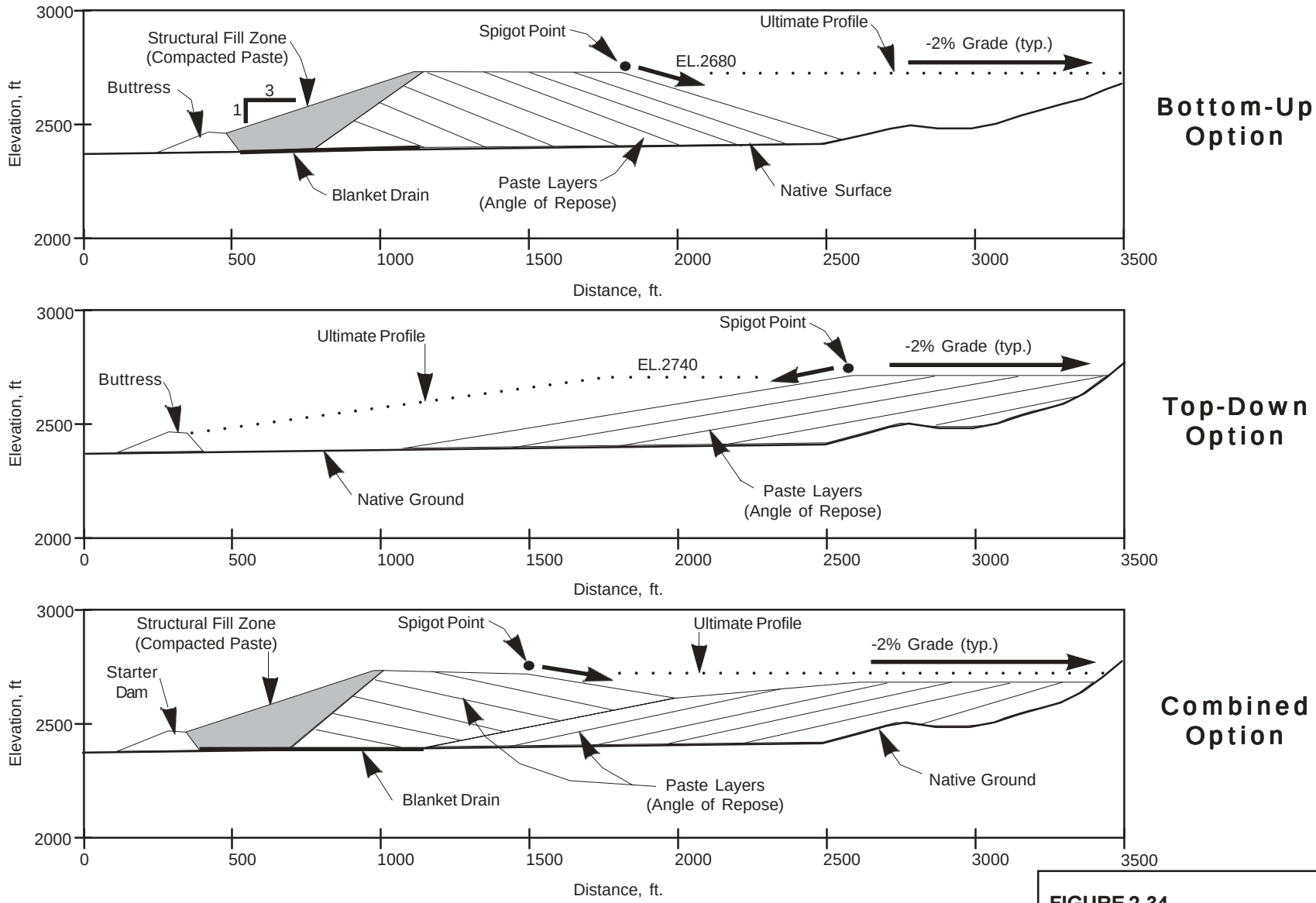


FIGURE 2-34
Paste Deposition Options
Cross Sections
Rock Creek Project

The paste pipeline would be located either on the crest of the toe buttress for the Bottom-Up option or along the upper end of the deposition site for the Top-Down option. The location of the spigot or spigots for the Combined option would depend upon the method(s) being used at the time. Under all options, a low load-bearing crawler crane would be used to position the pipe and spigotting would commence. Once a layer or a lift of paste had been completed, the crane, pipes, and spigot would be relocated further down the row onto the oldest portion of the previous paste layer, or to a new row if the previous one had been completed. A new layer of paste would then be spigotted onto the previous layer(s). There may be some delay in relocating the crane when using the Top-Down option as the paste would need to solidify or compact enough to support the equipment. Although earliest reports (Golder Associates 1996) proposed paste deposit lifts of 3 to 4 feet, a later report recommends that the lifts be reduced to 1 foot until actual field construction experience indicates that a thicker lift can be deposited to ensure paste facility stability (Knight Piesold 1997).

In the Bottom-Up option and the Bottom-Up portion of the Combined option, a structural zone of compacted paste would be constructed upslope of the toe buttresses to permit the construction of a 3:1 slope. The paste would be spigotted behind the structural zone at its angle of repose. The outer slope of the structural zone would crest at an elevation of approximately 2680 feet (320 feet high) (see Figure 2-32). The Top-Down option would be constructed at the angle of repose (approximately 5:1), resulting in longer overall side slopes than the Bottom-Up option. Compaction of slopes would only occur if found to be necessary under the Top-Down option. This would depend on actual field experience. The Top-Down option would have a crest of approximately 2740 feet (380 feet high); although the crest is slightly higher it would be positioned farther away from the highway (see Figure 2-33). The Combined option would have some flatter slopes on the upper portions of the deposit and steeper slopes closest to the highway. The Combined option would have an ultimate elevation somewhere between the first two options, the actual elevation would depend upon when the Bottom-Up component was begun relative to the Top-Down component. It may be possible in final design for either the Bottom-Up or combined option to flatten the outer slopes and deposit the remaining mass of the tailings facility closer to Government Mountain and away from Montana Highway 200 such that the resultant landform would more resemble the Top-Down option. Topographic relief of the upper surface of the paste facility constructed by any of the options could be created by preferential spigotting of the paste and the paste could also be reshaped by dozer to achieve the final grading prior to reclamation. However, this does not mean that the outer slopes of the Bottom-Up option cannot be reduced or flattened to reduce visual effects. Manipulation of the paste to vary the side slopes could be done more easily during construction under the Top-Down option than under the Bottom-Up option. The paste material would be reclaimed on the surface and outer edges when final grade was achieved and timing of reclamation varies somewhat depending upon the option used (see Reclamation).

A system of basin drains would be incorporated into any of the options to maximize recovery of seepage of residual process water in the paste and storm water infiltration through the paste. A blanket drain adjacent to the outer slopes and beneath the compacted structural zone would be constructed to maintain a drainage of the structural zone under the Bottom-Up option and the Bottom-Up portion of the Combined option. For all options an extensive system of finger drains would be constructed beneath the paste facility. Conceptually these drains would consist of 4-inch diameter, slotted pipe surrounded by a zone of crushed rock 10 feet wide and 2 feet thick. The actual location of these finger drains would be determined during the final design. The water collected by the finger drains would be routed to a single collection pond located outside the main buttresses (see figures 2-32 and 2-33), pumped back to the paste plant and, if not needed for paste production, returned to the mill for reuse. Seepage water collected in the paste facility underdrain after mine shutdown would be routed to the water treatment facility for

treatment. This procedure would continue until such time that the quality of seepage water would allow direct discharge without treatment.

Land would be cleared and topsoil salvaged in advance of paste deposition (see Reclamation for more detail). While a tailings impoundment would require the entire footprint of the impoundment to be cleared or disturbed prior to construction of the impoundment, the paste deposit alternative restricts disturbance to the active areas. There would be more land disturbed initially under the Bottom-Up option due to construction of the toe buttresses and blanket drain than under the Top-Down option (see Table 2-14).

TABLE 2-14
Summary of Estimated Active Versus Reclaimed Areas Over Time for Alternative Paste Facility Construction Scenarios

Year	Area of Active Disturbance	Area at Final Grade (reclaimable area)	Total Area	Comments
BOTTOM-UP CONSTRUCTION SEQUENCE				
YR 0	0 acres	0 acres	0 acres	
YR 7	78 acres	0 acres	78 acres	Southern face under construction
YR 19	190 acres	0 acres	190 acres	Southern face completed
YR 21	97 acres	115 acres	212 acres	25% of top completed to final elevation
YR 31	74 acres	190 acres	264 acres	50% of top completed to final elevation
YR 33	41 acres	250 acres	291 acres	75% of top completed to final elevation
YR 34	0 acres	305 acres	305 acres	100% of top completed to final elevation
TOP-DOWN CONSTRUCTION SEQUENCE				
YR 0	0 acres	0 acres	0 acres	
YR 7	57 acres	2 acres	59 acres	5:1 depositional surface started across ½ of northern boundary
YR 10	110 acres	4 acres	114 acres	5:1 depositional surface completed across northern boundary
YR 14	105 acres	48 acres	153 acres	25% of top completed to final elevation
YR 20	119 acres	80 acres	199 acres	50% of top completed to final elevation
YR 26	121 acres	135 acres	255 acres	75% of top completed to final elevation
YR 33	93 acres	211 acres	304 acres	
YR 34	0 acres	305 acres	305 acres	100% of top completed to final elevation

Note: Disturbed acreages do not include soil stripping in advance of paste deposition. If soil is removed for a distance of 500 feet in advance of paste deposition, an additional 30 acres of disturbance can be assumed.

Source: Hydrometrics 1997a

Storm Water Control

All storm water detention and retention ponds would be lined with 30-mil HDPE liners for primary seepage containment. The mill pad underdrains would provide secondary collection for the mill site. Underdrains or blanket drains according to final design specifications would provide secondary collection of storm water seepage through the tailings paste facility.

The lined storm water pond at the mill would be enlarged along with all diversions to handle a 100-year/24-hour storm event. Storm water at the adit portal and mill sites would be collected and

recycled to the mill for reuse. Water collected from the outer slopes of the mill pad and the mill site underdrains would only be allowed to discharge under conditions specified in the revised MPDES permit (see Appendix D). Otherwise water from the underdrain containment pond would be pumped back to the mill for reuse. Storm water diverted from undisturbed lands above and adjacent to the mill would be discharged through overland flow diffusers or energy dissipating outlets outside the 300-foot streamside-buffer zone (see Figure 2-27).

Since the tailings paste facility and the undisturbed portion of the disposal site would not retain storm water like an impoundment, one or two lined storm water ponds would be constructed at the lower elevations in the tailings disposal site (see Figure 2-26). These ponds would be removed and reclaimed after the tailings facility was completed and reclaimed. These ponds also would be sized to handle the runoff from the active portion of the tailings paste facility site during an 100-year/24-hour storm event. Water collected in the storm water pond could be pumped to the paste plant and then to the mill as process water or used for irrigating reclaimed portions of the tailings paste facility if water quality was acceptable.

Sediment and runoff control of the tailings facility would be handled in two methods. First, limiting unreclaimed areas to the active disposal areas would minimize sediment and runoff. Second, localized sediment retention structures and BMP's would be used in the downslope perimeter of the active panels for control, sampling and recovery of drainage from the tailings paste facility, sediment, and storm water runoff. These structures and collection ditches would act as storm water diversions to channel the water and sediment from the active portion of the tailings paste facility into the tailings facility site storm water ponds. The ditches would also be sized to accommodate a 100-year/24-hour storm event.

Storm water from undisturbed lands above the tailings paste facility would be diverted around the active portions into the north fork of Miller Gulch and to Rock Creek during mine operations. Runoff from reclaimed and fully revegetated, stabilized portions of the tailings paste facility would be diverted to settling basins before mixing with runoff from undisturbed areas. Settling ponds for runoff from newly reclaimed areas along the perimeter of the tailings paste facility would be unlined and would discharge through a constructed drainage network to existing drainages. However, settling ponds on the upper portion of the paste facility would require lining to prevent excess infiltration of water. Storm water from reclaimed areas that were not fully stabilized would be captured along with runoff from the active areas of the tailings paste facility. Undisturbed portions of the paste facility would either drain into existing drainages or be diverted away from active areas, soil stockpiles, and the storm water pond. All these diversions would be sized to handle a 100-year/24-hour storm event. These diversions would be reclaimed and permanent drainage ways established when mine operations ended and the site was fully reclaimed.

The final design for the storm water and sediment control structures at the paste facility must be approved by the Agencies prior to being constructed.

Water Use and Management

A detailed water balance would be refined annually for estimating water use, seepage, and discharges. Actual volumes for a number of water balance variables would be measured to update previously projected calculations. These would include measurements of precipitation; evaporation; mine and adit inflow, outflow, and storage; inflow to the tailings facility; seepage from the tailings

facility; seepage collected by the perimeter recovery system; outflow to the treatment system; and discharge to the Clark Fork River.

Baseline data and the similarity of site conditions to the Troy Mine site indicate that acid drainage is not expected. Additional data collected during evaluation adit construction, mine development, and operations would be required to refine predictions of the potential for long-term acid drainage, and to assess the acid drainage potential of waste rock prior to its use as construction material. A representative underground sampling and acid-base testing and monitoring program would be developed and implemented on rock from the adits, ore zones, above and below the ore zones, and in the barren zone as described in Appendix K. The results would help identify materials to be segregated to prevent production of acid leachate or drainage.

The agencies would require a bond for long-term monitoring and maintenance, and possible long term post-closure water treatment in order to ensure ground and surface waters would be protected from unanticipated impacts.

Evaluation Adit Construction Water Requirements. Water requirements for driving the evaluation adit would average 30 gallons per minute (gpm) during the drilling cycle. Additional water may be needed for dust control in the adit. A small amount of potable water would also be needed for the lavatory and lunchroom in the shop.

Water for drilling would initially be hauled to the site from a makeup water well at the confluence of Rock Creek and the Clark Fork River (see Figure 2-26). A lined pond, with a capacity of about 30,000 gallons, would be constructed near the evaluation adit portal to collect site runoff and store the hauled water. A barrier would be erected around the pond to exclude wildlife. A diversion berm would be constructed above the portal and soil stockpile to divert natural runoff around disturbed areas (Figure 2-28).

A pump in this pond would provide water for drilling during the initial evaluation adit construction phase. Excess water encountered in the adit during this phase would be pumped to the pond. After the adit had advanced approximately 350 feet, an 18-foot by 18-foot by 40-foot (97,000-gallon) mine sump would be excavated to function as the evaluation adit water sump. An oil skimmer and pressure filter would be located at this sump to remove oils and grease and suspended solids from the water supply.

Excess water from the adit sump and pond overflow would be pumped through a temporary 6-inch polyethylene pipeline through a biotreatment system and an ion exchange treatment plant for treatment prior to discharge. This pipe would be removed when the mine reached the evaluation adit; then the evaluation adit water would be routed through the mine water drainage and collection system described below. Discharges must comply with the proposed MPDES limits. The evaluation adit is estimated to generate approximately 168 gpm once it was fully constructed.

Potable water would be trucked to the adit site and stored in a tank in the shop until a suitable source was found in the adit. Two wells would be installed to supply the support facility. Sewage from the adit shop and the office and the mine dry at the support facilities would drain to conventional septic tanks and drainfield systems. If, according to DEQ, either or both of the proposed sites or their alternate locations were not suitable for a drainfield, then a holding tank would be installed. This tank would be pumped periodically and hauled to a municipal sewage disposal facility (ASARCO Incorporated 1992).

Mine Operation Requirements. Water use and supply for evaluation and underground mining operations would remain the same as described for Alternatives II through IV. Figure 2-35 provides a schematic diagram of project water handling for mine operation during the end of mine life. Table 2-15 provides additional water balance detail through the mine production period.

Additional water balance detail can be found in the applicant's Alternative V Water Management Plan (Hydrometrics, Inc. 1997). During full production, the mill would require 3,788 gpm of process water. Process water for the mill would come from five sources: reclaimed tailings slurry water, mine discharge water, reclaimed concentrate slurry water, mill site and tailings paste facility site storm water, and if needed, make-up-well water. Process water would remain in an essentially closed loop. Approximately 5 to 10 percent of the flow in the process loop will be diverted to the waste water treatment system and fresh water added to the circuit on an ongoing basis to prevent buildup of excess constituents in the process water. Because the amount of mine water discharge and available reclaim water from the tailings paste plant and the dewatering system at the rail loadout would vary seasonally, a make-up water well has been planned in the Clark Fork River alluvium capable of supplying full make-up water requirements. The location of this proposed well near the confluence of Rock Creek and the Clark Fork River is shown on Figure 2-26. A buried 12-inch steel pipeline would connect with an antisiphon device to the reclaim water line thus carrying water to the mill.

As illustrated in Figure 2-35, mine inflow not used for mill makeup or stored in the mine would be routed to the water treatment facility prior to discharge in the Clark Fork River below Noxon Dam. The rate of mine inflow would vary throughout the mine's life in proportion to the total volume of ore excavated. The rate of mine inflow routed to the water treatment facility would also vary throughout the year in response to climatic conditions, especially precipitation. Figure 2-36 illustrates the estimated average annual flow to the water treatment facility by project year. The table also illustrates the anticipated maximum and minimum flow to the water treatment facility by project year. Discharge flow is estimated at 550 gpm–year 1; 937.7 gpm--year 10; 1,342.7 gpm–year 20; and 2,043.1 gpm--year 30 or end of mine life.

By the end of mine operation, up to 207.7 million gallons of mine and adit water potentially would require storage in an underground reservoir. This reservoir could require a 64-acre pond 10 feet deep. Excess water would be held in or released from storage depending on the ability of the wastewater treatment systems to treat the volume of water to MPDES permit limits. For example, should a problem develop with the mine water treatment system, excess mine water could be stored in the mine for a short time until the problem with the water treatment system was corrected. During the wet season, excess mine water would likely be stored underground. During the dry season, stored water would be released and directed to the water treatment system.

Mine effluent typically would be expected to contain high concentrations of suspended solids at a relatively neutral pH and some dissolved metals similar to the Troy mine. This would contribute a significant portion of the total metals load to mine effluent. Initial removal of suspended solids would be accomplished using two 100,000-gallon mine sumps to settle out the solids, by adding chemicals to flocculate (clump) the particles if necessary, and subsequent filtration. Water would be pumped from the mining face to these sumps for the main mine water supply.

TABLE 2-15
Water Balance Summary - Average Mine Production Yearly Project Flows - Alternative V

	Line #	1	2	3	4	5	6	7	8	9	10	15	20	25	30
Adit Balance															
Inflow															
Adit Inflow	46	694.3	709.1	765.4	821.8	878.3	934.7	990.9	1047.4	1103.9	1160.2	1442.1	1724.2	2006.0	2288.1
Ore Water	60	19.3	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2
Outflow															
To Biotreatment	119	327.4	173	215.1	266.8	303.4	345.2	383.3	425.5	466.8	541.2	759.4	852.2	1132.9	1392.1
Mill Reservior	120	366.9	536.1	548.2	544.7	556.2	559.1	561.9	561.2	561.1	561.1	496.7	562.8	563.2	549.0
Mine Workings Storage	121	0	0	2.1	10.3	18.6	30.5	45.7	60.7	76.0	57.9	185.9	309.1	310.0	347.0
Ore Water	60	19.3	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2
	SUM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mill Balance															
Inflow															
Water in Ore	60	19.3	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2
From Mill Reservoir	63	2485.0	3759.7	3759.7	3759.7	3759.7	3759.7	3759.7	3759.7	3759.7	3759.7	3759.7	3759.7	3759.7	3759.7
Outflow															
Concentrate Slurry	61	41.6	62.9	62.9	62.9	62.9	62.9	62.9	62.9	62.9	62.9	62.9	62.9	62.9	62.9
Tailings	62	2462.8	3726.0	3726.0	3726.0	3726.0	3726.0	3726.0	3726.0	3726.0	3726.0	3726.0	3726.0	3726.0	3726.0
	SUM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Paste Plant Balance															
Inflow															
Tailings	100	2462.8	3726.0	3726.0	3726.0	3726.0	3726.0	3726.0	3726.0	3726.0	3726.0	3726.0	3726.0	3726.0	3726.0
Concentrate Load-Out Facility Return	103	39.8	60.2	60.2	60.2	60.2	60.2	60.2	60.2	60.2	60.2	60.2	60.2	60.2	60.2
Outflow															
Paste to Paste Fill Area	102	263.9	399.2	399.2	399.2	399.2	399.2	399.2	399.2	399.2	399.2	399.2	399.2	399.2	399.2
Dust Suppression & Irrigation	103	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	1.1	1.1	3.5	3.6	4.7	4.7
Paste Plant Reclaim	104	2238.7	3387.0	3387.0	3387.0	3387.0	3387.0	3387.0	3385.9	3385.9	3385.9	3383.5	3383.5	3382.4	3382.4
	SUM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0.0	0
Mill Reservoir Balance															
Inflow															
Paste Fill Area Runoff	107	34.3	42.3	50.0	81.8	81.8	81.8	81.8	83.4	83.6	83.6	120.9	84.0	84.7	84.7
Paste Plant Reclaim	108	2238.7	3387.0	3387.0	3387.0	3387.0	3387.0	3387.0	3385.9	3385.9	3385.9	3383.5	3383.5	3382.4	3382.4
Waste Water	109	14.6	14.6	14.6	14.6	14.6	14.6	14.6	14.6	14.6	14.6	14.6	14.6	14.6	14.6
Plant Runoff	110	53.1	53.1	53.1	53.1	53.1	53.1	53.1	53.1	53.1	53.1	82.3	53.1	53.1	53.1
Makeup From Mine Water	114	366.9	536.1	548.2	544.7	556.2	559.1	561.9	561.2	561.1	561.1	496.7	562.8	563.2	549.2
Makeup From Contingency Well	115	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Outflow															
To Mill	111	2485.0	3759.7	3759.7	3759.7	3759.7	3759.7	3759.7	3759.7	3759.7	3759.7	3759.7	3759.7	3759.7	3759.7
Overflow to Biotreatment System	113	222.6	273.4	293.2	321.5	333.0	335.8	338.7	338.6	338.6	338.6	338.4	338.3	338.2	324.0
	SUM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

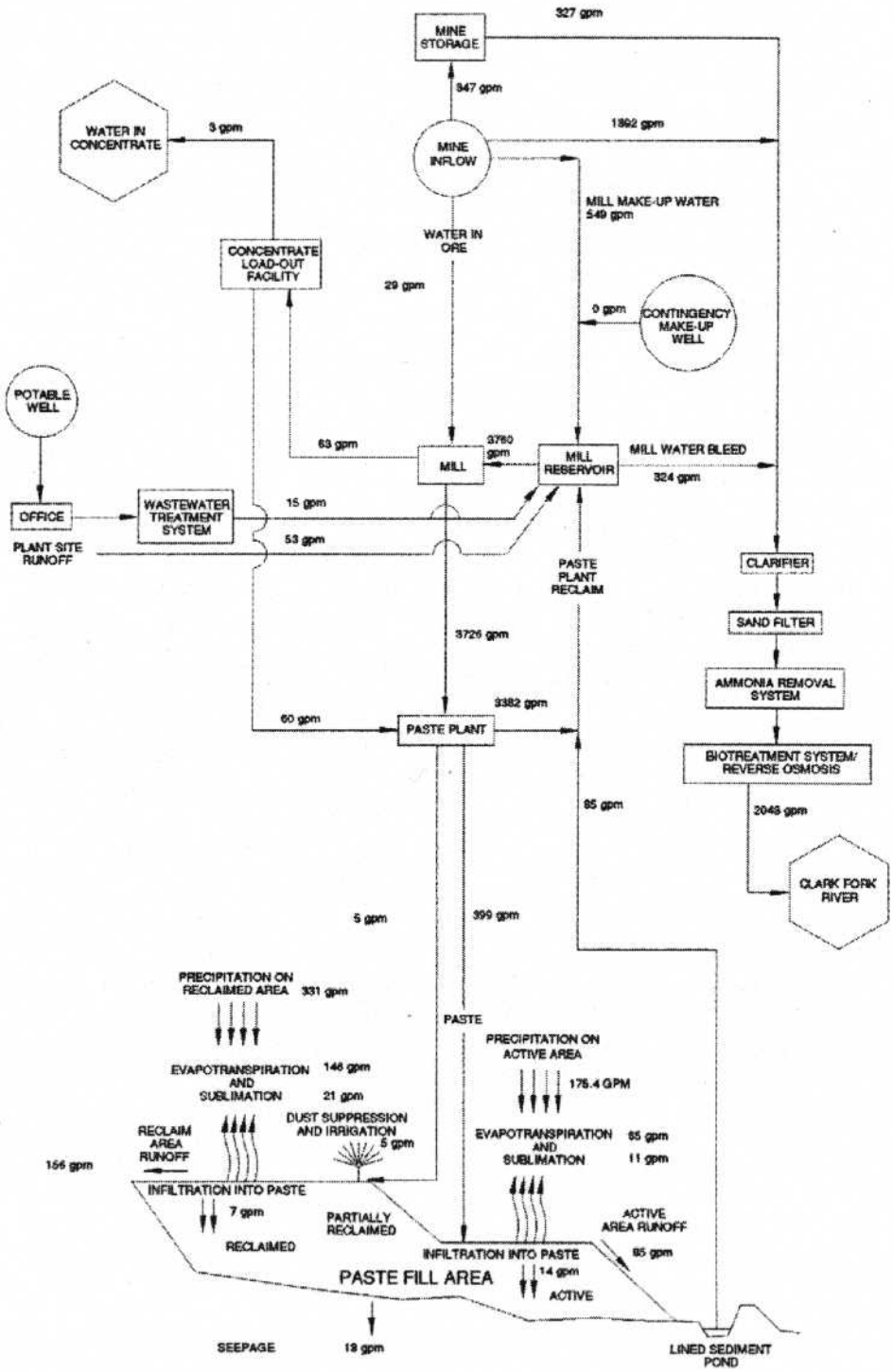
TABLE 2-15
Water Balance Summary - Average Mine Production Yearly Project Flows - Alternative V (Cont'd)

	Line #	1	2	3	4	5	6	7	8	9	10	15	20	25	30
Paste Fill Area Balance															
Paste Fill Active Area Calculations															
Inflow															
Precipitation	86	87.6	87.6	104.0	169.3	169.3	169.3	169.3	172.8	173.1	173.1	257.3	174.1	175.4	175.4
Water in Paste from Paste Plant	102	263.9	399.2	399.2	399.2	399.2	399.2	399.2	399.2	399.2	399.2	399.2	399.2	399.2	399.2
Outflow															
Sublimation	90	5.6	5.6	5.6	10.8	10.8	10.8	10.8	11.0	11.0	11.0	10.9	11.1	11.2	11.2
Infiltration of Precip. into Paste	93	7.0	7.0	8.3	13.5	13.5	13.5	13.5	13.5	13.8	13.8	20.6	13.9	14.0	14.0
Evapotranspiration	94	32.7	32.7	40.1	63.3	63.3	63.3	63.3	64.5	64.6	64.6	104.9	65.0	65.5	65.5
Runoff Return to Paste Plant	95	42.3	42.3	50.0	81.8	81.8	81.8	81.8	83.4	83.6	83.6	120.9	84.0	84.7	84.7
Water Retained in Paste	102	263.9	399.2	399.2	399.2	399.2	399.2	399.2	399.2	399.2	399.2	399.2	399.2	399.2	399.2
	SUM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Paste Fill Reclaimed Area Calculations															
Inflow															
Precipitation	72	0.0	0.0	0.0	0.0	0.0	0.0	0.0	73.6	79.2	79.2	251.4	252.2	330.6	330.6
Dust Supression & Irrigation	83	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	1.1	1.1	3.5	3.6	4.7	4.7
Outflow															
Sublimation	76	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	5.0	5.0	10.6	16.1	21.1	21.1
Infiltration of Precip. into Paste	79	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	1.6	1.6	5.0	5.0	6.6	6.6
Evapotranspiration	80	0.0	0.0	0.0	0.0	0.0	0.0	0.0	32.1	35.0	35.0	120.1	111.6	146.3	146.3
Runoff	81	0.0	0.0	0.0	0.0	0.0	0.0	0.0	35.0	37.5	37.5	115.7	119.5	156.7	156.7
Dust Supression & Irrigation	83	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	1.1	1.1	3.5	3.6	4.7	4.7
	SUM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mine Workings Storage Balance															
Inflow															
Inflow to Storage	124	0.0	0.0	2.1	10.3	18.6	30.5	45.7	60.7	76.0	57.9	185.9	309.1	310.0	347.0
Outflow															
Outflow from Storage	125	0.0	0.0	2.1	1030	18.6	30.5	45.7	60.7	76.0	57.9	67.7	152.2	328.9	327.0
Change in Storage	s121-f122	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	118.2	157.0	-18.9	20.0
	SUM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Treatment System															
Inflow															
Direct flow From Mine Workings	130	327.4	173.0	215.1	266.8	303.4	345.2	383.3	425.5	466.8	541.2	759.4	852.2	1132.9	1392.1
Flow from Mine Workings Storage	132	0.0	0.0	2.1	10.3	18.6	30.5	45.7	60.7	76.0	57.9	67.7	152.2	328.9	327.0
Overflow from Mill Reservoir	131	222.6	273.4	293.2	321.5	333.0	335.8	338.7	338.6	338.6	338.6	338.4	338.3	338.2	324.0

TABLE 2-15
Water Balance Summary - Average Mine Production Yearly Project Flows - Alternative V (Cont'd)

	Line #	1	2	3	4	5	6	7	8	9	10	15	20	25	30
Outflow															
To Clark Fork River	133	550.0	446.4	510.4	598.6	655.0	711.5	767.7	824.8	881.4	937.7	1165.5	1342.7	1800.0	2043.1
	SUM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Concentrate Load-Out Facility															
Inflow															
Concentrate Slurry	68	41.6	62.9	62.9	62.9	62.9	62.9	62.9	62.9	62.9	62.9	62.9	62.9	62.9	62.9
Outflow															
Water in Concentrate	69	1.8	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7
Concentrate Return Water	70	39.8	60.2	60.2	60.2	60.2	60.2	60.2	60.2	60.2	60.2	60.2	60.2	60.2	60.2
	SUM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Note: All values are in gallons per minute (gpm).
Line # = Line number from water balance model, see Water Management Plan for Alternative V (ASARCO 1997).



SOURCE: Water Management Plan, Hydrometrics, Inc., 1997

FIGURE 2-35
Alternative V Schematic Diagram of Project Water Handling Production Final Year Rock Creek Project

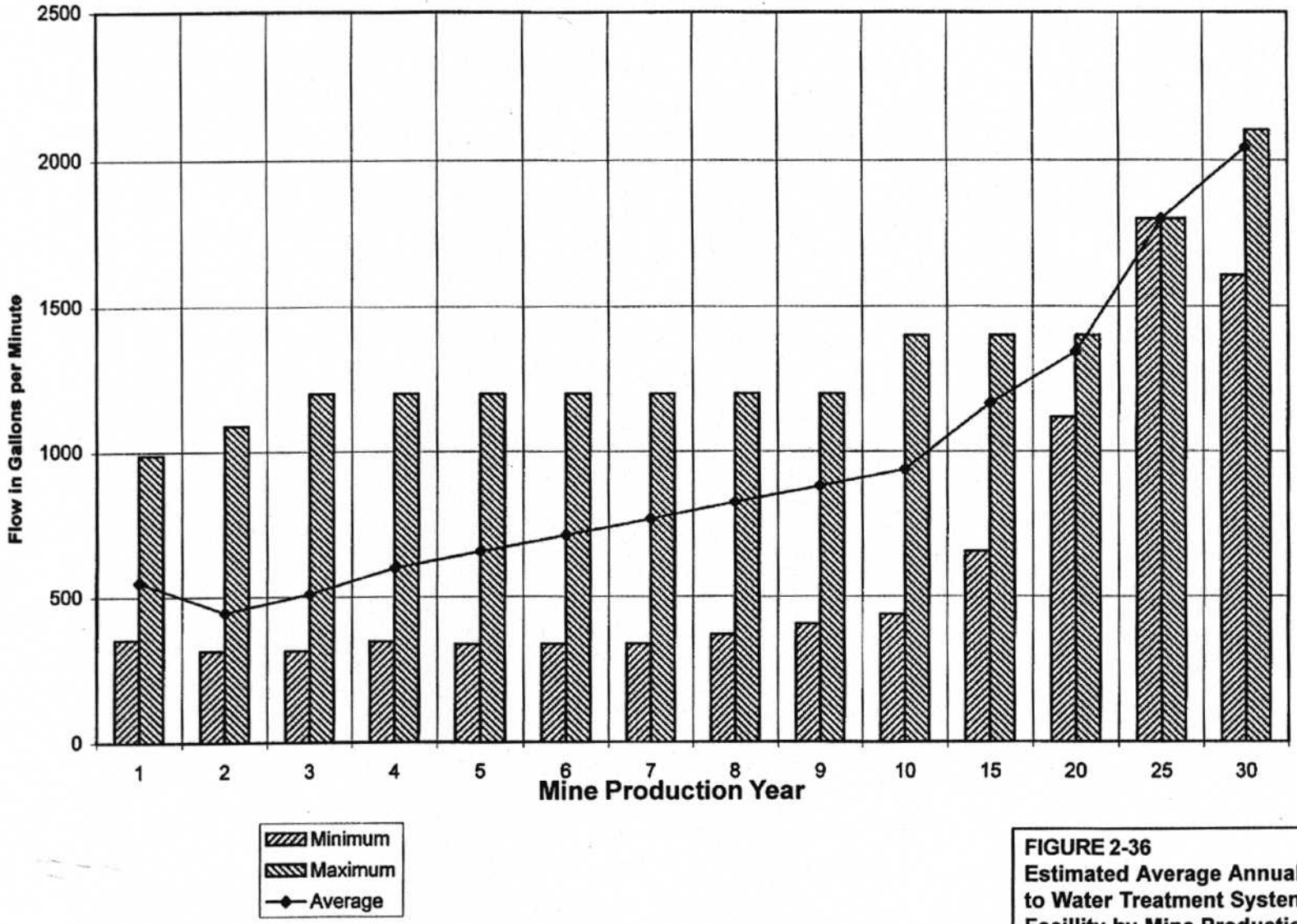


FIGURE 2-36
Estimated Average Annual Flow to Water Treatment System Facillity by Mine Production Year Rock Creek Project

Segregation of water within the mine and underground workings would be considered in the later stages of active mining. Such segregation could potentially reduce the volume of water requiring treatment prior to discharge. Segregation would be accomplished by separating ground water inflow from non-active mining areas and conveying this water in a separate pipeline to the water treatment facility. This water should be lower in suspended solids, heavy metals, ammonia and nitrate than water from the active mining area. This water may not require treatment prior to discharge or may only require partial treatment to meet discharge permit limits.

Water originating within the mill site also would be collected and routed to a drainage sump at the mill site for use as process water. Water filters and an oil skimmer would be located in the mill area to remove suspended solids and oil and grease from the water supply. Filter backwash would be sent with tailings to the tailings paste plant. Filtered water from mine and mill sumps in excess of the requirements for mine development and mill make-up water would flow through a buried pipeline to the water treatment facility before discharging to the Clark Fork River.

Reclaim water from the paste plant and the concentrate dewaterer at the rail loadout would either be returned to the mill for reuse as process water or to the waste water treatment facility for treatment prior to discharge to the Clark Fork River. This excess water would be discharged through a clarifier and sand filtration unit or other similar unit to remove suspended solids before being routed to the water treatment system for nitrate removal.

General Waste Water Treatment. Two waste water treatment systems designed primarily for nitrate removal would be installed: an anoxic (low oxygen content) semi-passive biotreatment system and a reverse osmosis treatment system. Neither system would be designated as the primary or back-up system. A portable version of the reverse osmosis system would be built to handle mine discharge water from the evaluation adit and placed at the support facilities site. This unit would be moved to the water treatment facility site if a decision was made to continue with the mining operation and expanded to accommodate greater flows that would occur during mine construction and operation. It may take some time for the biological treatment system to become fully operational during mine start-up when variable flows and conditions would be expected; the reverse osmosis system would have the primary water treatment role during evaluation and mine start-up compared to the passive biotreatment system under Alternative II. Sterling expects that the biotreatment system would become the main treatment system; however, the reverse osmosis system would still be available to operate during bioreactor upsets or if higher treatment efficiencies were required. Also as noted, the quantity (flow rate) of excess mine water directed to the water treatment facility could be reduced during such situations by diverting excess mine water to the in-mine storage area.

A schematic diagram of the biotreatment waste water process is found in Figure 2-37. Figure 2-37 displays the proposed layout of the water treatment facilities. At the final design stage, modifications to the treatment system may be made depending on a number of factors, including the actual discharge water characteristics, the final MPDES permit limits, and the technology available at the time. All modifications would still have to result in compliance with MPDES permit limits and not result in impacts significantly different from or greater than those identified in the final EIS. If any did occur, then the modifications would be subject to the appropriate level of additional MEPA/NEPA analysis.

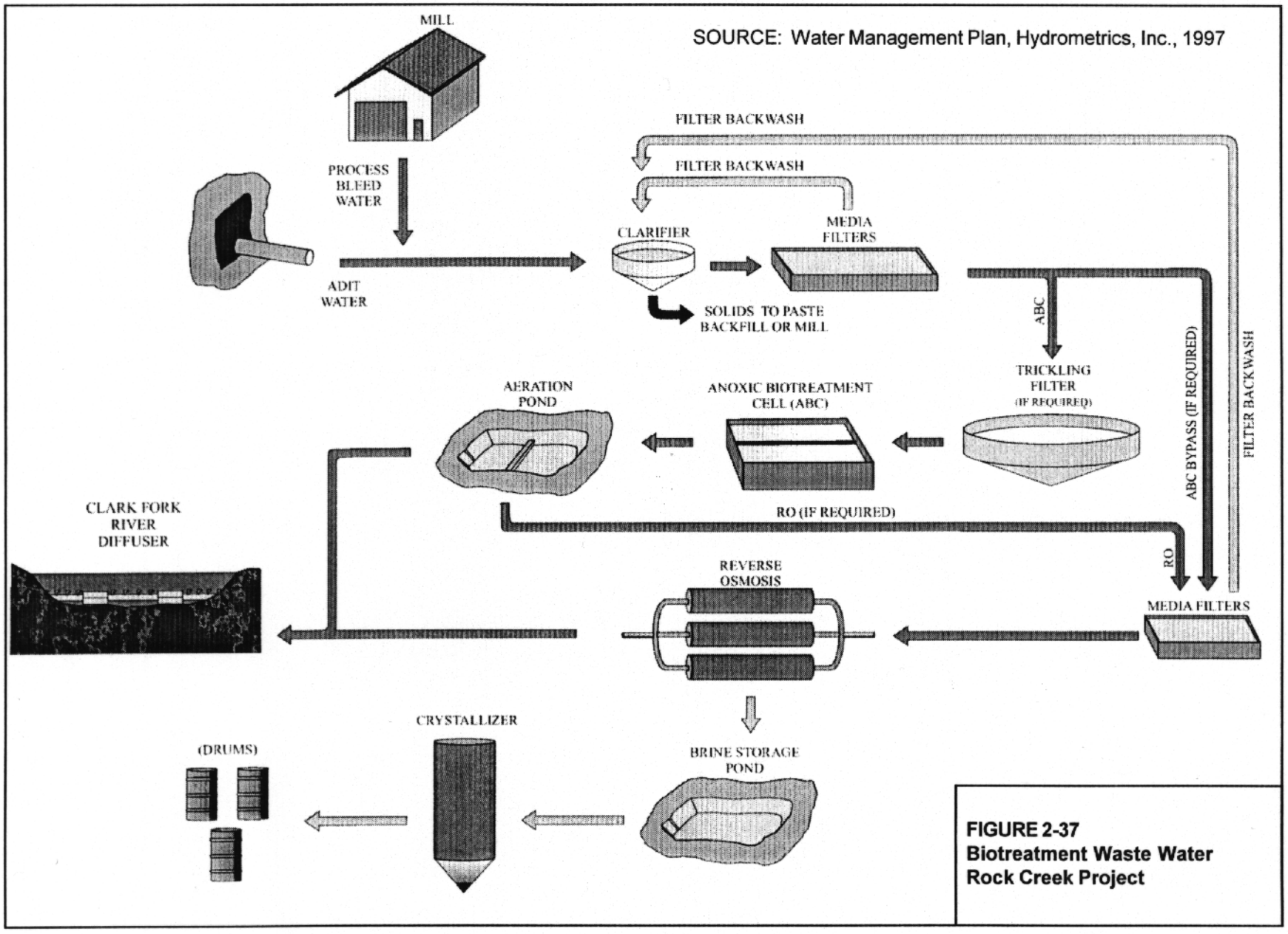
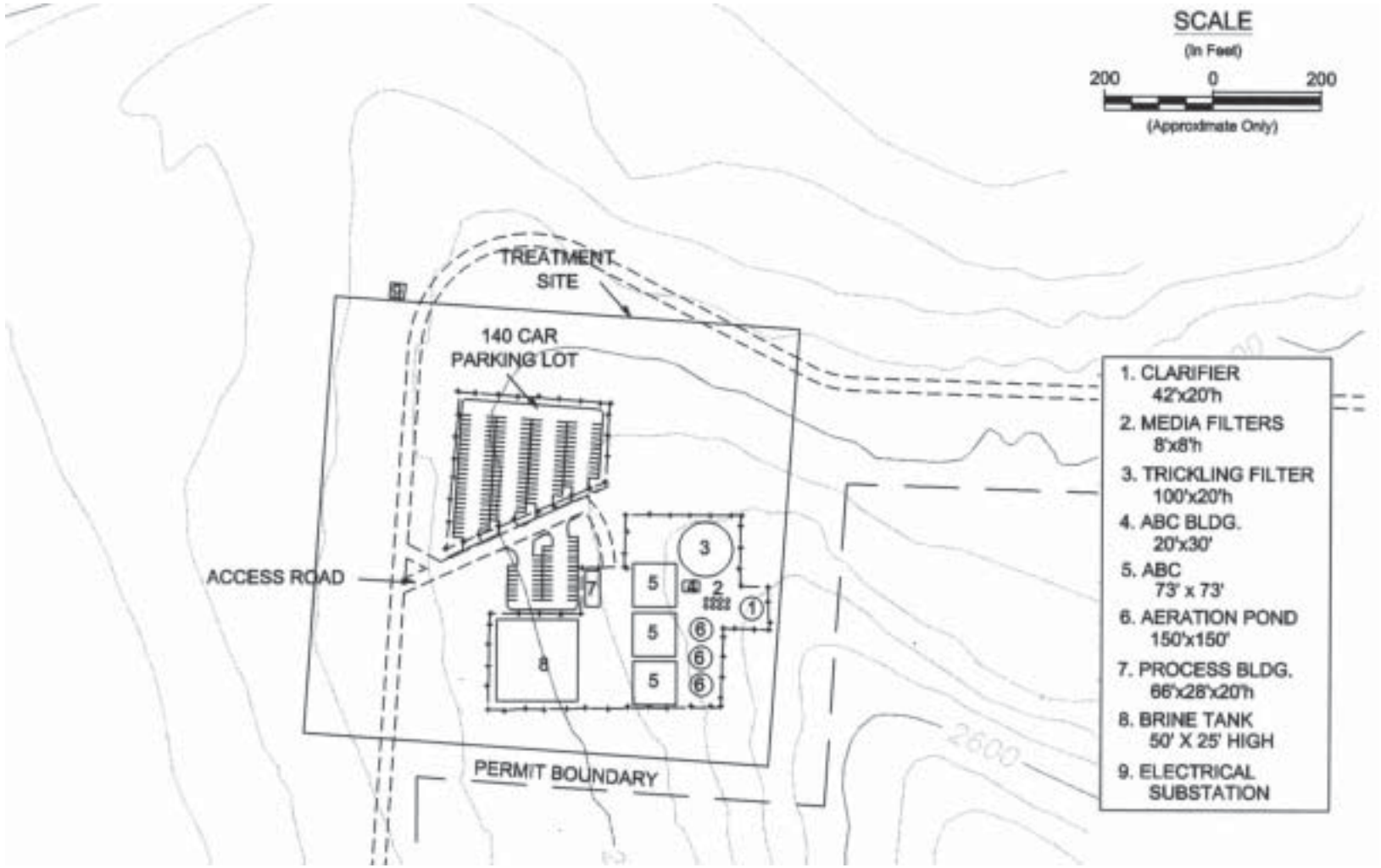


FIGURE 2-37
Biotreatment Waste Water
Rock Creek Project



NOTE:
As illustrated, the aeration pond is sized for 2,300 gpm operation.
All other facilities are sized for 650 gpm operation.

SOURCE: Water Management Plan, Hydrometrics, Inc., 1997

FIGURE 2-38
Water Treatment Facility Plan
Rock Creek Project

Mine water would flow through a buried pipeline to the water treatment facility. Sedimentation tanks (clarifiers) would remove a high percentage of suspended solids in the discharge water (at least 95 percent). The sludge from the clarifiers would be taken to the paste plant and incorporated into the tailings paste for deposition. Water leaving the clarifiers would also flow through sand filters for final suspended solids removal (80 percent of the remaining fraction). The partially treated water would then be directed to one or both of the water treatment systems depending on system capacity, amount of flow, and other variable conditions.

Anoxic Biotreatment System. The semi-passive biological system for treating mine water would consist of one or more anoxic biotreatment cells, containing gravel-packed, attached-growth denitrification reactors. An in-ground concrete biotreatment cell designed to treat 650 gpm would be 6 feet deep and 73 x 73 feet in area (5,330 ft^2). Four of these wells would be constructed to treat 2,300 gpm (maximum design flow). These cell dimensions are based on preliminary design data for 80 percent nitrate-nitrogen removal at 6°C.

The pretreated (clarified and filtered) water would flow through a trickling filter to convert the ammonia to nitrate (nitrification). The trickling filter may need to be enclosed or insulated to allow for proper functioning during colder seasons.

The biotreatment process would rely on methanol as the carbon source for the denitrification process instead of the manure and straw included in the passive biotreatment system proposed and discussed for Alternatives II through IV. Methanol at a concentration of approximately 60 mg/L would be continually added to the influent water. Methanol concentrations would be monitored and adjusted as necessary to achieve optimal nitrogen removal. A 300-gallon tank (approximate volume) would be located adjacent to the biotreatment system building for initial use of the biotreatment process. A larger tank would be installed if biotreatment proves to be successful. Daily methanol consumption, if the biotreatment system was the primary waste water treatment system, would range from several gallons during initial startup to approximately 250 gallons during maximum discharge of 2,300 gpm. Phosphorus may also need to be added for microbial growth. It is estimated that approximately 1 milligram of phosphate (as phosphorus) would have to be added for every 30 milligrams of nitrate (as nitrogen) removed.

Mine water and methanol would enter the bottom of the biotreatment cell(s), and upwards flow through the cells would be controlled by a pump. The cell(s) would be filled with gravel and inoculated with several hundred gallons of sludge taken from the nitrogen-removal recycle loop at the Kalispell wastewater treatment plant. The cell(s) should not require reinoculation. The biotreatment cell(s) would not generate sludge or reject material requiring disposal. Nitrate would be converted to nitrogen gas (denitrification) and methanol to carbon dioxide; these nontoxic gaseous by-products would be vented to the atmosphere. Relatively small amounts of biomass may be generated which would discharge to the aeration pond where it would be broken down.

After biological treatment for nitrate removal, the effluent would flow to an aeration pond with a 12-hour minimum residence time prior to reaching the final monitoring point before discharging to the Clark Fork River. The aeration pond would be lined with 30 mil HDPE. The aeration pond would include a calm pre-discharge zone and a multi-level discharge structure to minimize suspended solids in the effluent. Excess methanol and biomass from the biological nitrate removal system would be reduced through aerobic biological action. Dissolved hydrogen sulfide, if present, would also be reduced through aeration. However, sludge containing small quantities of heavy metals may build up in the aeration pond

over time. Sampling of this sludge will be required to determine the most appropriate method of site reclamation after the mine is shut down and mine wastewater treatment is no longer required (see Revegetation). At the full flow rate of 2,300 gpm near the end of mine life, the required ten-foot-deep pond would encompass approximately one-half acre. If the effluent did not meet discharge limits, it would be returned to the treatment facility for further treatment.

Reverse Osmosis Water Treatment. Reverse osmosis (RO) was selected for several reasons as the second water treatment system instead of ion exchange, which was proposed in the draft EIS. The reverse osmosis system is less complex, requires less operator attention, generates a smaller waste stream, and has no added chemicals. In addition, reverse osmosis technology has been proven to be capable of removing dissolved pollutants, such as nitrate, from water in many large capacity waste water treatment facilities throughout the world. Because the reject water or waste stream cannot be easily disposed of at the project site, the reverse osmosis system would operate at a high recovery rate to minimize the waste volume.

The reverse osmosis would most likely be the primary waste water treatment system used during evaluation and early stages of mine operation. When the biotreatment system became fully operational, the reverse osmosis systems would primarily be used during biotreatment system upsets or maintenance. It may also be used as a polishing step when the effluent did not meet standards. During such an event a portion of the biotreatment system effluent would be treated with reverse osmosis such that the recombined effluent from both systems met the limits of the MPDES permit.

The reverse osmosis system would be housed in a building approximately 66 feet long, 28 feet wide, and 20 feet high. It would contain reverse osmosis units sufficient to treat flows up to 650 gpm, the maximum flow expected in year 5 of production and year 10 of project life. The modular nature of reverse osmosis would allow simple installation of additional reverse osmosis units if reverse osmosis were still required for the treatment of 100 percent of the mine discharge in later years of mine operation. These units are complete with high-pressure pumps, cartridge filters, membrane modules and all other necessary equipment. This operation would probably require one operator around-the clock initially and after operations had been finalized, only a day-shift operator. The clarifier and media filters would probably be located outside the reverse osmosis building.

Once the influent water had undergone pretreatment for removal of suspended solids, the reverse osmosis could run continuously and reduce dissolved ion concentrations, including nitrate, nitrite, ammonia, and metals, by more than 90 percent. As flows increased during the life of the project, additional modules could be incorporated easily into the existing facility. Routine maintenance would include instrument calibration, chemical cleaning, and periodic membrane replacement. Membranes would require replacement every three to five years.

Only minimal quantities of brine (liquid waste from the reverse osmosis process containing elevated levels of nitrate, nitrite, ammonia, metals, and other ions) would be generated if the biotreatment becomes the primary treatment system with occasional use of the reverse osmosis. The waste brine that is generated, approximately 10 percent of system inflow when reverse osmosis treatment is required, would either be stored and gradually blended back into the biotreatment treatment system or crystallized/evaporated. The waste would not be classified as a hazardous waste as defined in 40 CFR 261.21-261.25. The brine or crystallized solid would not be ignitable, corrosive, or reactive and it would be non-toxic based on EPA's Toxicity Characteristic Leaching Procedure (TCLP) criteria (Hydrometrics

1997a). Estimated concentrations of waste brine presume no nitrogen removal by biotreatment. Waste brine concentrations would decrease in direct proportion to nitrogen removal efficiencies in biotreatment.

The brine would be stored in 500,000 gallon, epoxy-coated, covered, vertical, bolted steel tanks (60 feet in diameter and 25 feet high). A single tank would provide 5 days of brine storage for the initial 650 gpm reverse osmosis facility. Three tanks would be required to hold approximately 5 days of brine storage for estimated maximum mine operation waste water flow of 2,300 gpm.

A crystallizer/evaporator would be installed on site to treat any reverse osmosis brine generated. The brine would be reduced to one 55-gallon drum of waste per day for every 250 gpm of water treated (one drum of crystallized solid waste per 360,000 gallons of water treated). This waste would either be stored in drums or in a tanker trailer based on the actual waste volume being produced. It is anticipated that over 99 percent of the heavy metals originally present in the mine wastewater would be removed by pretreatment through clarification and filtration prior to treatment in the reverse osmosis system so only one percent of the metals would remain in the crystallized brine. The end product would be a solid which could be disposed as a regulated waste in an approved landfill such as those in Missoula, Kalispell, and Spokane or used by fertilizer companies in western Montana, Idaho, eastern Washington, and Canada.

After excess water from the proposed project was treated by settling, filtration, and the waste water treatment systems, treated effluent would be discharged to the Clark Fork River from a proposed outfall and engineered in-stream diffuser downstream from Noxon Reservoir. The purpose of the diffuser would be to distribute treated water though a perforated steel pipe to allow more mixing with river water. The in-stream diffuser also would reduce discharge velocities.[14] The diffuser would be located approximately 750 feet above the confluence of the river and Rock Creek and would run the entire width of the river. The diffuser would need to be in place prior to construction of the evaluation adit for discharge of water generated during that phase of the project. Prior to installation, a design study would be performed to reevaluate streamflow conditions and streambed characteristics at the selected outfall location. The diffuser design would be finalized after the study was complete, and an appropriate method of anchoring would be selected. If the diffuser was relocated from the proposed location, the agencies would need to determine how or if that affected the impact of the discharge to the river and if the MPDES permit limits needed to be adjusted. If the changes were significant, then additional MEPA/NEPA analysis would probably be required.

A sewage treatment facility would be incorporated into the mill complex design. This facility would contain the standard aeration tank with activated sludge, a settling tank with a sludge return to the aeration tank, and a chlorine contact chamber. Effluent from the contact chamber would be directed to the tailings disposal system, and sludge would be disposed of at an approved off-site facility.

Transportation

Access to the evaluation adit and the minor improvements to FDR No. 2741 would remain the same as for Alternatives III and IV. During construction of the evaluation adit, access to the evaluation adit site would be via existing FDR No. 150 and Chicago Peak Road, FDR No. 2741, and a short spur

[14] The diffuser would be fixed at the bank on concrete thrust blocks and surrounded by cobble riprap to provide shoreline protection. It would lie in the river channel, perpendicular to the flow of the river. The perforations of the diffuser system would be designed to reduce the discharge velocity to less than 2 feet per second, and allow mixing to occur across a broad cross-sectional profile of the river.

road. Improvements to existing FDR No. 2741 would include a minimum road width of 14 feet, improved or added road turnouts about every 1,000 to 1,500 feet, and a reconditioning of the road surface for year-round use and maintenance. Minor amounts of clearing may be necessary for turnouts and for snowplowing. The short spur road would need a 14-foot wide surface to accommodate equipment. This work would be done in consultation with the Forest Service.

Employees would use the parking lot at the alternate support facility site along the existing FDR No. 150 (figures 2-26 and 2-28) and would be transported in four-wheel-drive vans to the adit along FDR Nos. 150 and 2741. This would limit mine-related traffic to the minimum number of vehicles needed to transport work crews and supplies to the adit.

Because of the year-long schedule for adit construction, it would be necessary to plow snow on FDR No. 2741 for one winter. Snowplowing for a portion of FDR No. 150 would occur over mine life. Snow removal and disposal would follow Forest Service guidelines.

FDR No. 150 would be realigned with Montana Highway 200 as described for Alternatives III and IV to meet applicable MDT siting requirements. This alternate route for FDR No. 150 would intersect Montana Highway 200, 0.23 miles west of FDR No. 1022 (McKay Creek Road). This route would then proceed westerly and northerly over NFS lands and Sterling land as for Alternatives III and IV. However, FDR No. 150 would connect to an old existing road in the vicinity of the waste water treatment plant if final siting proved the old road to be suitable. This modified alignment would take advantage of an existing road farther away from Rock Creek and reduces the amount of new construction. This existing road would be upgraded and paved and a new segment constructed to connect to existing FDR No. 150 approximately 0.25 miles above the confluence with Engle Creek as described for Alternative III. This alternate road would need to be constructed prior to closure of existing FDR No. 150 at the tailings facility site. FDR No. 150 below the mill would have minimum width shoulders to provide structural support to the driving lane. The shoulders would not be conducive to parking along road and no turnouts would be provided to minimize stopping along the road. Sterling would time its road closure schedule for FDR No. 150 to accommodate essential local access needs.

The relocated portions of FDR No. 150 and the parking lot at the proposed waste-water treatment facility site would be constructed during the first part of the development phase (year 2) to keep construction related-traffic away from Rock Creek, to provide a road capable of handling the expected mine construction-related and public levels of traffic, and to allow for busing of mine adit construction workers to the mill site and mine portal. Access to the evaluation adit support facilities, paste plant, and the tailings paste facility site from the mill would require mine vehicles to travel down FDR No. 150 to Montana Highway 200 and then northwest on the highway to Government Mountain Road and then southeast on FDR No. 150B.

All roads used during mine operation between the mill, the mine, the paste plant, the water treatment facility, the highway, and the rail loadout facility would be paved or graveled (see Table 2-16 and Figure 2-26). FDR No. 150 above the mine and the Chicago Peak Road, FDR No. 2741, would not be paved. The service road, FDR No. 150B, around the outer edge of the tailings disposal site from the paste plant to Government Mountain Road would be paved; a short stretch of maintenance road along the west side of the disposal site would be graveled. FDR No. 150B from the paste plant to the junction with FDR No. 150 would be reconstructed as a gravel road and used only for pipeline maintenance after mine production begins. FDR No.150B would be gated at both ends and access would be restricted to mine-related traffic. A 10-foot wide gravel maintenance road would be constructed along the cross-country

portion of the discharge water pipeline between the Clark Fork River and FDR No. 150. A small parking lot for 6-8 vehicles would be required at the paste plant for operators and mine management vehicles and supply deliveries. Additional gravel roads or maintenance trails would be required to provide access to the utility corridor where it does not follow FDR No. 150. Sterling would be responsible for maintaining these mining-related roads and trails. Maintenance of FDR No. 150 would be Sterling's responsibility, unless additional use by the Forest Service or other interests warranted a cost-share agreement.

TABLE 2-16
Summary of Roads To Be Used
Under Alternative V

Road	Section	Type	Length	Width	Access
FDR No.150	Hwy 200 to mill site	Paved	5.04 mi	24 ft	Open
FDR No.150	Mill site to FDR No.2741	Gravel	2.8 mi	14 ft	Open
FDR No.2741	FDR No.150 to evaluation adit portal spur road	Gravel	4.6 mi	14 ft	Open only when there is no snow, plowed during year 1, but no public parking/turnarounds available during winter
FDR No.150B	FDR No.150B to paste plant road	Gravel	1.07 mi	14 ft	Locked gates/Sterling pipeline maintenance access only
FDR No.150B	Paste plant road to Government Mtn. Rd.	Paved	1.52 mi	14 ft	Sterling and supply traffic only
FDR No.150	Government Mtn. Rd. From FDR No.150B to rail loadout facility	Gravel	0.25 mi	24 ft	Open, county road
Access Rd.	FDR No.150 to parking area/waste water treatment plant	Paved	0.15 mi	24 ft	Sterling visitor, and supply traffic only
Access Rd.	North from 150B along west side of disposal site	Gravel	0.57 mi	10 ft	Sterling maintenance only
Access Rd.	From Hwy 200 to Clark Fork River	Gravel	0.75 mi	10 ft	Sterling pipeline maintenance only
Access Rd.	FDR No.150B to paste plant	Paved	0.98 mi	14 ft	Sterling and supply traffic only

One existing bridge on FDR No. 150 over Rock Creek near the mill site would be replaced. Bridges to be constructed or reconstructed over Engle and Rock creeks would be realigned nearly perpendicular to the stream. An extension to the culvert on the West Fork of Rock Creek above the last bridge on FDR No. 150 is proposed. The existing bridge over Rock Creek near the junction of FDR Nos. 150B and 150 would not be reconstructed because there would be no concentrate hauled from the mill to the rail loadout facility; however some repairs may be necessary to provide safe crossings for trucks hauling waste rock to the paste facility site during mine development. If this bridge deteriorated during mine operation and the Forest Service determined it was unsafe, it would be removed by Sterling. Road construction activities include: FDR No. 150 reconstruction in close proximity to Rock Creek, associated bridge construction, reconstruction below the proposed mill site would most likely be conducted during the last half of the year of evaluation adit construction between August 1 and March 31. Construction activities would take place only during periods of low flow and dry weather to minimize impacts to the stream and harlequin ducks.

Truck hauling of concentrate from the mill to the rail loadout facility would be replaced by pipeline transport of the concentrate. This would eliminate eight trucks per day making the round trip between the mill and the loadout facility.

Prior to mine construction, Sterling must submit a traffic management plan to reduce total average daily traffic (ADT) to the mill site and to mitigate impacts on harlequin duck as well as grizzly bears. This plan would address evaluation, construction,[15] and operation mine-related traffic (excluding public recreation, Forest Service, logging traffic and other private and public traffic). A travel lane would need to be maintained for traffic on FDR No. 150 during road construction and reconstruction. The traffic plan would also need to allow private landowners reasonable access to their property, and public access to NFS lands. In addition, emergency medical access to the mill and mine sites would need to be considered in the plan. The plan must include provisions for busing employees during mine construction and operation between the waste water treatment facility area and the mill and mine. Mine construction workers would be bused from the support facilities site until FDR No. 150 had been relocated and a parking lot at the waste water treatment plant had been constructed. A parking lot capable of handling the parking needs of the largest shift plus visitors to the mine, estimated at 150 to 175 vehicles, would be necessary (see Figure 2-38). Busing employees would then continue from this location and would reduce the mine construction- and operation-related traffic to primarily supply vehicles, mine management vehicles, and two or three buses twice per shift including the administrative workers shift.

A portion of FDR No. 150B may be removed and reclaimed after the tailings paste facility has been reclaimed and the paste treatment plant decommissioned, removed, and reclaimed. The need for closure, reclamation, or modification of Forest System roads used by Sterling during mine operation to gravel or dirt roads would be determined by the KNF at mine closure. The post-mining treatment of roads would depend on forest land uses, needed road densities, and KNF's ability to maintain paved roads versus gravel or dirt roads. Road closures are described in the Threatened and Endangered Species Mitigation plan for this alternative.

[15] Mine related construction traffic would be limited to 30 roundtrips per month on FDR No. 150B between April 1 and July 31 and unlimited traffic from August 1 to March 31.

Utilities

Evaluation Adit Electrical Supplies. Alternative V replaces the diesel generators with two propane-fired generators (545 kW and 735 kW). The support facilities would be supplied with power from a local distribution line along Government Mountain Road as described for Alternatives II through IV.

Pipelines. A single utility corridor would be developed along FDR No. 150 and would include the transmission powerline, a tailings slurry pipeline, ore concentrate pipeline, mine discharge pipeline, and return water pipeline (see Figure 2-29). The pipelines would split into two corridors at the junction of FDR Nos. 150 and 150B. The tailings slurry pipeline and concentrate pipeline and a return water line would follow or parallel the FDR No.150B road alignment to the paste plant. The concentrate pipeline and return water line would continue along FDR No. 150B and a short stretch of the Government Mountain Road to the rail loadout facility. The mine water discharge line and a return reclaim water line would follow the new FDR No. 150 alignment to the waste water treatment plant and the discharge line would continue to the discharge outfall in the Clark Fork River and connect with the make-up water well located adjacent to the river. See Table 2-17 for information on the size and types of pipe proposed for use. All pipelines would be buried at least 24 inches deep. Burying the pipelines would provide better protection from vandalism, eliminate the visible presence of the pipelines, and facilitate concurrent reclamation in the pipeline corridor along most of the route between the mill and the paste plant. The pipelines would be visible at the four above ground crossings of Rock Creek, West Fork of Rock Creek, and Engle Creek. All lines would be encased in a larger steel pipe at creek crossings adjacent to or near bridge crossings to guard against the unlikely event of a leak or rupture.

Powerlines. Sterling would construct 5.3 miles of 230 kV transmission line with 61-foot-high wooden utility poles, dark porcelain or polymer insulators, and nonspecular conductors to reduce contrast within a 100-foot right-of-way. The transmission line would parallel the new FDR No. 150 until it intersected existing FDR No. 150 and then continue to parallel the existing FDR No. 150 from a new switchyard on an existing 230 kV line near Montana Highway 200 to the mill as described for Alternatives III and IV. Sterling would construct the new switchyard adjacent to the existing Noxon/Libby 230 kV line near Montana Highway 200 in a dedicated power line right-of-way. Two new substations at the mill and in the tailings storage facility area would be constructed as for Alternatives II through IV:

- one substation would be constructed at the mill site to distribute electricity through lower voltage lines to equipment within the mill site, adit, and mine; and
- a second substation would be constructed near FDR No. 150 in the vicinity of the tailings paste facility for electrical distribution to that area. This would involve clearing a 100 by 100 foot area and fencing it.

The rail loadout facility would be supplied power from a local distribution line along Government Mountain Road. Sterling would be responsible for paying all construction costs for the substations and transmission line. Annual power consumption is estimated at 95,000,000 kW-hours, with a peak demand of 13,300 kW. No power provider has been selected for supplying the mine's estimated annual consumption of 95,000,000 kW-hours.

TABLE 2-17
Summary of Pipeline Information for Alternative V

Pipeline	Location	Size	Type
Tailings Slurry Pipeline	Mill to paste plant	16 to 24 inches(1)	Steel/polyethylene dual-wall pipe w/leak detection
Reclaim water return pipeline	Paste plant to mill	16 inches	Dual-wall pipe w/leak detection(2)
Mine water discharge pipeline/make-up water pipeline(3)	Mine to waste water treatment plant to Clark Fork river diffuser	12 to 14 inches	Single-walled pipe w/leak detection
Mine segregation water pipeline (option for later development)	Mine to waste water treatment plant	10 inches	Type undetermined at this time
Concentrate pipeline	Mill to rail loadout facility	3 inches	Dual-wall pipe w/leak detection(2)
Concentrate return water line	Rail siding to paste plant	2 inches	Dual-wall pipe w/leak detection(2)
Storm water return pipeline	Paste facility site storm water retention pond to paste plant	6 inches	Single-walled pipe w/leak detection

Source: Hydrometrics 1997a

Notes: (1) The final pipeline diameter will need to be determined based on tailings viscosity and topographic analysis of final pipeline corridor.
(2) The type of dual wall pipe has not been determined at this time.
(3) Mine water is estimated to meet mill make-up water requirements; however, a contingency make-up water well site has been identified near the Clark Fork River in the event that insufficient mine water is available. In this event, make-up water would utilize the discharge pipeline.

Utility corridor right-of-way clearing. Sterling would use the following measures to reduce right-of way clearing and help produce a feathered, more natural-appearing edge of timber along the utility and road corridor. These measures would be applied to appropriate segments of the corridor during the design phase:

- retaining non-hazardous trees and brush on the right-of-way;
- cutting trees at ground level to reduce visibility of stumps;
- disposing of felled material with the least possible impact on remaining vegetation; and
- selective clearing of timber adjacent to the corridor to soften the edge between cleared and uncleared areas.

Erosion and Sediment Control

Wind and water erosion control measures are described in detail throughout Sterling's permit application in operation and reclamation plans. These measures involve 1) mechanical practices to minimize fugitive dust, 2) grading to reduce erosion potential, 3) soil-handling techniques to enhance stability, 4) hydrologic systems to control runoff and sedimentation, and 5) revegetation practices to

provide a stabilizing cover. Sterling would follow Forest Service soil and water conservation practices. A storm water discharge permit may be required from DEQ. As part of this permit or the MPDES permit, Sterling would be required to submit a storm water management plan for DEQ approval. This plan would describe the methods to minimize and control runoff contamination.

Sterling would be required to implement all BMPs detailed in its permit application and described under Alternative II. In addition, a vegetation management plan would be developed by Sterling and approved by the Agencies to minimize disturbance during clearing and construction and to maximize revegetation success on all cut-and-fill slopes and reclaimed road segments. A field review would be required by agency hydrologists/soil scientists after facilities and roads have been staked in the field but before construction begins to identify any additional BMPs needed on a site-specific basis.

Sterling would mitigate for unavoidable fine sediment impacts to Rock Creek resulting from the construction of facilities and changes in the road system. Sediment mitigation measures would consist of stabilization, armoring and revegetation of existing sediment sources in the Rock Creek floodplain, and maintenance of these measures for the term of the project. Concurrent with project start-up, Sterling would mitigate an eroding cutbank where Engle Creek joins Rock Creek (site P1). Also beginning in year 1, Sterling would inventory the Orr Creek and Snort Creek basins to identify potential sediment mitigation opportunities and estimate the annual fine sediment production in tons/year for all identified floodplain sediment sources in the watershed. Sterling would submit a fine sediment mitigation plan to the Agencies for approval, and cumulatively reduce the annual fine sediment loading to Rock Creek by at least 400 tons by mitigating two or more sediment sources in the west fork basin and in the mainstem floodplain of Rock Creek prior to the end of the project construction period. Treated mitigation sites would be monitored in average to above-average snowpack years (as of April 15), or in the event of greater than bankfull discharge events. This monitoring would be needed to measure erosion of the treated sites and to quantify any need for further mitigation that would maintain the 400 ton fine sediment reduction and ensure effectiveness of the mitigation program for the life of the project.

Employment

The development schedule and employment levels during all phases of the project would be the same as described for Alternative IV. Development of the evaluation adit would take about a year. Work would start with 23 employees in the first quarter and increase to a maximum of 73 workers in the fourth quarter. Mine construction might immediately follow the adit work, or there could be a period of inactivity lasting months or even years between the two phases.

During the initial phase of mine construction, the entire workforce would consist of 73 Sterling employees, then 275 contract construction personnel would be brought onto the project for 18 months. Employment of Sterling and contract workers would peak at a total of 348 during mine construction, with the minimum employment of 180 mine workers following this peak at about year four of construction. Sterling would have no direct control over contract labor schedules. It is expected that the contractor would use a 7-day work week with more than one shift per day.

As contract construction ended, the Sterling workforce would be expanded to 180 workers, from where it would continue to increase to 340 permanent full time workers nearly 2 years later as the mine reached full production. The project would operate 24 hours per day, 7 days a week, 354 days a year. It would have an expected operating life of up to 30 years. At the end of production there would be a two-year shutdown and reclamation period employing 35 workers. Because the available labor force initially

would not have all the skills needed to develop and operate the mine, Sterling proposes to conduct an intensive training program.

Adit Closure

The adit closure plans for the air-intake ventilation and evaluation adits would be the same as described in Alternatives III and IV.

The evaluation adit would be plugged with reinforced concrete at mine closure. Since this adit would be a decline and the portal is above the water table, the purpose of the plug would be primarily to close off access and eliminate any potential for surface water inflow.

Closure of the main access adits would depend upon what impacts if any occur to the wilderness lakes above the mine and the potential for creation of springs and seeps down gradient of the mine workings. If the mine had an impact on the groundwater recharge of the wilderness lakes and the buffer zones at the ore outcrops was sufficient to prevent springs and seeps then the mine would be sealed and flooded. If despite the ore outcrop buffer zones, the potential for the creation of springs and seeps existed as determined by data collected during mine operation, then the mine adits would not be sealed but only closed to prevent access. In this case, the discharge would continue to be pumped in perpetuity down to the waste water treatment plant until it met the MPDES discharge limits without treatment and then would be discharged without treatment into the Clark Fork River.

If there were no impacts either to the lakes or the potential for creation of new springs and seeps was negligible, or if there were impacts to the wilderness lakes that needed to be reduced, then the main access adits would be sealed once mine water met ground water standards without treatment. Under these scenarios the service and conveyor adits would be plugged with reinforced concrete near the elevation of the orebody within the mine. This would prevent 1,150 feet of water pressure that would develop if adit seals or plugs were only placed at lower elevations in the adits. The adits would be closed at the portal with non-mineralized waste rock to prevent access. Drainage from the portal (inflow to the adits below the elevation of the plugs) would be treated and discharged to the Clark Fork River until it met applicable surface water quality standards without treatment at which time it would be allowed to infiltrate into the reclaimed mill pad and underlying alluvium. Monitoring data would be used to establish discharge requirements prior to the time of adit closure.

The wilderness air intake ventilation adit would be reclaimed. Sterling would develop a plan to restore the air intake ventilation adit within the CMW to its premining appearance and configuration following mine closure. The grate and fan would be removed internally and the adit would be sealed with a 12-inch-thick bulkhead. The bulkhead would be constructed from within the adit using reinforced concrete. Equipment removal and plugging would be conducted primarily from inside the adit. Rock from adjacent areas and/or waste rock treated with oxidating compounds would be used for the surface closure to replicate natural conditions and appearances. Sterling would investigate the potential for creating bat habitat at both the evaluation and air-intake ventilation adits. Depending upon the results of the study, agencies may require modification to adit closure plans to accommodate bats.

The adit closure plan would need to be finalized and submitted to the agencies for review and approval prior to mine closure.

Reclamation

Reclamation of the evaluation disturbances, adits, mill site and utility corridors would remain the same as described for Alternatives III and/or IV, depending upon the facility in question. The revegetation plan is summarized and seed mixes are described in Appendix J. An updated, detailed reclamation plan[16] that covered revegetation of all mine facilities would need to be submitted for Agency review and approval before mine construction. The plan would provide the means to ensure adequate reclamation and minimize visual impacts of the project. Plans for reclaiming any Forest System roads, if required, would be submitted to the Forest Service for review and approval.

Reclamation objectives remain the same as described under Alternative II. Short-term reclamation objectives are to stabilize disturbed areas and to prevent air and water pollution. The long-term reclamation objective is to establish a postoperational environment compatible with existing land uses and consistent with the Forest Plan. Specific reclamation objectives include the following:

- permanent protection for air, surface water, and ground water resources;
- protection of public health and safety by removing potential hazards;
- maintenance of public access through the project area;
- restoration of wildlife habitat;
- design of a land configuration compatible with the watershed;
- re-establishment of an aesthetic environment allowing for visual quality and recreational opportunity; and
- re-establishment of postoperational biological potential suitable for supporting vegetative cover appropriate to the area.

To accomplish these objectives, Sterling proposes to provide interim revegetation and stabilization of most disturbed areas, to follow measures described under Sediment and Erosion Control, and, after mining, to reclaim all disturbed areas by recontouring and redistributing soil, and revegetating.

Postmining Topography. All buildings and other structures at the evaluation adit support facilities site would be removed once the mill site was operational. It is estimated that the support facilities would be used through exploration and the first 3 to 4 years of mine construction and operation. This site would be either recontoured to approximate original contours or otherwise developed for facilities associated with the operation of the tailings paste facility.

Sterling would regrade the evaluation adit waste rock dump to approximate existing contours at the end of operations, eliminating any bench at the adit portal. Waste rock from the lower Revett Formation,[17] a rock formation with similar characteristics to surface rock, would be used for the surface layer of the dump, especially for the portion that would be left unvegetated. If necessary to meet visual quality objectives, waste rock surfaces that remained exposed after reclamation would be treated with oxidizing compounds to blend them with adjacent talus (Reynolds 1995). Where possible, existing trees

[16] This primarily entails incorporating the additional agency requirements into the revegetation plans for all mine facilities that are contained in Sterling's permit applications and submitting them to the Agencies to verify that all requirements have been added and to approve the plans if acceptable.

[17] This rock type would be the last waste rock removed from the evaluation adit. Due to variations in rock types within the formation, it may be necessary to stockpile quartzite material that closely resembles surface talus to blend the new rock dump with the existing talus as much as possible. This material would be stockpiled on the bench or stored in the adit until ready for deposition as the final layer on the rock dump.

at the outer edge of this talus slope and existing pockets of trees and shrubs within this talus slope would be retained and would not be damaged during dumping. Reclamation of the evaluation adit portal would be the same as described for Alternative II. If stockpiled ore at the evaluation adit proved uneconomical to process, Sterling would develop a plan, subject to review and approval by the Agencies, to dispose of the ore in conjunction with reclamation of the evaluation adit.

A channel would be constructed across the evaluation adit waste rock dump from the area of the backfilled lined pond to the access road cut to connect natural drainage areas above and below the evaluation adit dump. This channel would be lined with coarse rock to prevent erosion. Disturbances other than the evaluation adit waste rock dump (i.e., facilities area, diversion ditches, fuel storage area) would be graded to blend with adjacent undisturbed topography.

Sterling would be required to submit more detailed design and regrading plans for all mine facilities for Agencies' approval in conjunction with the final design of the paste facility. Landform design for the tailings paste facility would incorporate topographic templates from the surrounding area to help meet reclamation goals and Forest Service visual standards. These plans would result in reclaimed sites that decrease landform and vegetation differences between mine facilities and surrounding natural landscapes.

The diversion structures above the reclaimed tailings facility would remain as permanent stream channels to route runoff around the reclaimed tailings mass. All mechanical facilities associated with the tailings facility would be removed. The remaining surface disturbances (e.g., runoff control ditches, seepage capture and storm water ponds, facility pads, soil stockpile sites, emergency dump ponds, and internal and perimeter access roads) would be returned to approximate original contours.

After mining and ore processing were completed, all mill buildings and related equipment and infrastructure, the conveyor, and the power line would be dismantled and removed. Paving material would be buried on site or removed to a disposal facility. Inert waste such as steel, concrete, plastic, or wood would be buried in on-site waste disposal areas or sold to scrap dealers for recycling; some waste may be transported to an approved waste transfer station as authorized by the county solid waste district. Buried pipelines would remain in place except at stream crossings.

Once ground water quality beneath the tailings facility met ground water quality standards and MPDES limits without treatment, and Sterling was given permission to shut down the seepage collection system, all remaining tailings facility-related surface components would be removed, and the sites regraded according to approved plans. Wells would be decommissioned once monitoring was no longer required or the well was no longer required (i.e., a contingency pumpback well used to control seepage when control was no longer a need). When the waste water treatment facility would not be needed for treating tailings seepage and/or mine adit discharge, the buildings, related equipment, and surface discharge pipelines would be removed and the sites regraded to approximate original contours.

Final reclamation of portions of mine facilities, such as outer slopes of the mill site pad and completed portions of the tailings paste facility would be done as early as possible to assist in decreasing the visual impact of the project. Toe buttresses and paste layers creating the deposit surfaces for all options, and the compacted paste zone of the Bottom-Up option, would be designed to minimize straight horizontal crests, long linear contours and uniformly sloping surfaces; however, stability requirements would have precedence. Contours of reclaimed surfaces, including those on the top surface of the deposit, would mimic those of surrounding topography. Both regrading and selective placement of the

paste during deposition would be used to create topographic pockets, swales, ridges and surface water drainages. Rocky soils and possibly cement additive would be used in steepened drainageways to create naturalized swales and help break up the massiveness of the deposit.

Vegetation Removal and Disposition. The mining company must prepare a Vegetation Removal and Disposition Plan that deals with the potential uses of vegetation removed from areas to be disturbed. The plan must detail disposition and storage plans during mine life. The vegetation debris piles and surface lift soil piles containing large quantities of organic debris should be stored in carefully selected storage sites to prevent off-site impacts from the production of low quality organic acids as the materials begin to decay.

Where possible, slash from timber-clearing operations would be salvaged for soil protection. Large or whole pieces could be used as physical barriers and catchments and ground-up slash would be used as mulch or as an additive to stored topsoil. Large or whole pieces could also be used to enhance or create desirable fisheries habitat in Rock Creek according to aquatic/fisheries mitigation plans. All mulching materials would be certified weed-seed free.

Soil Salvage and Handling Plan. Direct haul soil salvage and replacement would be required as much as possible to enhance revegetation success of native unseeded species. Most soil would have to be stockpiled. Areas such as road cut-and-fill slopes, power line pole locations and access roads, and other disturbances that would remain postmine should be reclaimed as soon as final grades are achieved with direct haul soil or soil that has been stockpiled for less than one year. This would increase the chances of direct transplantation and propagation of many of the local ecotypes on the reclaimed surface.

Soil stockpiles would be constructed with a 2.5:1 side slope and 3:1 ramps. Soil stockpiles would be incrementally stabilized (rather than waiting until the design capacity was reached) to reduce erosion and maintain soil biological activity in the surface. Soil stockpiles would have organic matter added to help retain soil quality. Seeding would be done as soon after disturbance as possible rather than waiting until the next appropriate season. Fertilizer and mulch would be applied to the piles as necessary. Sediment traps would be used downslope where necessary to minimize soil movement.

In forested soils, it is advantageous to stockpile the surface organic and mineral horizons and store them separately from subsoil mineral horizons. Ideally, this would mean that the surface 6-12 inches of organic materials and soil would be separated from the subsurface 12-18 inches of soil in a 24 inch soil replacement profile. To pick up a uniform 6-12 inch organic and mineral layer in a forested setting is not practicable. Soil would be salvaged in a two-lift process with the first lift being the more suitable topsoil and the second lift being subsoils excavated up to 36 inches; average total salvage depth equaling 24 inches. Replaced soil depths would average 24 inches over the tailings paste facility, the mill site, and the waste water treatment facility site. If extra soil is available at the mill site, it should be stockpiled for use at the paste facility or other locations. DEQ requires salvage of rocky soil (less than 50 percent rock fragments) if it is characteristic of the area. Shallow and rocky soils would be salvaged at the evaluation adit and at the mine portal if present. Sterling would be required to submit a revised soil salvage and handling program that deals with two lift salvage and storage practices and concerns over water quality, and direct haul soil replacement on acreages reclaimed during mine life.

Soils salvaged from 7.7 acres at the evaluation adit site would be removed in two lifts where soil was available and where slopes were less than 2:1. The soil would be stockpiled northwest of the evaluation adit (see Figure 2-26). All of the first lift soil and half of the second lift soil would be

redistributed over 5.0 acres at the adit, waste rock dump top, and facilities to an average total depth of 12 inches. The remaining second lift soils would be redistributed over a portion of the slope face of the dump designated for revegetation at an average depth of 13 inches over 1.9 acres. Approximately 1.4 acres on the waste rock dump would be left as talus to achieve a mosaic appearance.

Because the paste would be deposited layer upon layer, soil would be stripped just ahead of the extent of the proposed disturbance for each layer. The first soil stripped for the first two or three layers would need to be stockpiled for reclaiming the final segment and outer slope. At times soil being salvaged may not be suitable for the portions of the facility that need to be reclaimed; this soil would also be stockpiled until needed for other purposes. The soils would be segregated according to rocky or non-rocky soils and first lift versus second lift and, if necessary, stockpiled adjacent to the deposit site (see Figure 2-26). Sufficient volumes of the colluvial and alluvial soils, including their rocky subsoils, within the tailings paste facility footprint would need to be salvaged and stored for use in reclaiming slopes 8 percent or greater and along reconstructed drainage ways to minimize erosion. Based on experience and preliminary research to control erosion at Golden Sunlight Mines, the lacustrine soils could be mixed with the rocky subsoils or crushed bedrock to produce a soil with 20% rocks greater than 1 inch in diameter. The mixed soil must also have less than 20% very fine sand in the fine soil matrix (Golden Sunlight Mines 1995). The lacustrine soils could be placed on all slopes less than 8 percent (approximately 12.5:1) without the addition of rock materials as long as the slope length is limited by armored drainageways or other erosion control features. Soil would be salvaged in a two-lift process with the first lift being the more suitable topsoil and the second lift being subsoils excavated up to 36 inches; average total salvage depth equaling 24 inches. Replaced soil depths would average 24 inches over the tailings paste facility. The final design of the paste facility would need to include a volume determination of soil types needed based on the slope breakdown of the paste facility.

Sterling would need to conduct a more detailed soil survey to more accurately determine the amounts and types of soils available for reclamation prior to construction of the paste facility and associated facilities. Since rocky materials are also needed for constructing the toe buttresses, the survey is especially important to ensure there is enough material available for both requirements or to identify the need to obtain more rocky material from other sources than has been estimated in Table 2-13.

The tailings paste could, if needed, have organic amendments or fertilizer added to the uppermost lift. This material, which would have no cement added, may need to be ripped prior to topsoil replacement to minimize the development of a root-barrier zone. Both regrading this material and selective placement of the paste during deposition would be used to create diverse topographic pockets, swales, ridges and surface water drainages constructed to a predetermined surveyed gradient in the final design. Overall outer slopes would range between 2H:1V and 5H:1V. These slopes would be protected against erosion using BMPs described in detail for Alternative II and in the Erosion and Sediment Control section above. The compacted slopes of the Bottom-Up or Combined option would have less potential for slope variability due to the method of construction and would have a general appearance similar to that of a conventional tailings impoundment. The flatter slopes of the Top-Down option appear to offer greater flexibility to develop a more natural appearing landform.

Disturbed areas, especially parking lots, roads, and building sites, would be ripped prior to soil replacement to reduce any root zone barriers due to compaction and to facilitate storm water infiltration after reclamation. Any disturbed area to be seeded would be scarified to a depth of 6 to 12 inches prior to seeding for best seed establishment. Where soil fertility may be low and tilth poor, organic matter (weed-free aged manure, compost) would be incorporated into respread soils before planting.

Revegetation. Sterling would develop a detailed final planting design[18] for all disturbed areas including the area between the impoundment footprint and the highway. Final designs would avoid uniform distributions of plants, with planting densities, species selection, and their distributions repeating natural patterns in the surrounding landscape. A combination of planting designs, natural mortality, and possible thinning of thick tree stands would achieve a natural-appearing mosaic of vegetation on reclaimed areas. Forest Service standards for revegetation would be required on NFS lands.

Sterling proposes to meet short- and long-term objectives stated in its revegetation plan. The plan specifically addresses species selection for final and interim seed mixtures and planting schemes, seeding and planting rates, seedbed preparation, seeding and planting methods, cultural treatments, and interim revegetation. The proposed seeding and planting mixes are presented in Appendix J of the final EIS and the applicant's proposed reclamation plan (ASARCO Incorporated 1987-1997). Weed seed-free seed mixes would be modified to include grass and forb species suited for quick stabilization as well as those needed for long-term wildlife habitat needs. Locally collected seeds and plants would be used whenever possible.

The proposed species selection and seeding/planting rates are based on preoperation vegetation types, environmental tolerance, species that exhibit hardiness on postoperational sites, and a variety of other factors. An understory seed mix consisting of grasses and forbs would be used on all disturbance areas. Shrubs would be seeded on most sites, but not on the evaluation adit site or the transportation and utility corridors.

Grass species proposed, including both native (preferred) and non-natives (where other options are not feasible), are typical of those used for reclaiming sites in similar settings. Forbs and shrubs proposed are native species that typically occur in one or more of the communities identified within the project area. No clovers would be planted on any disturbed areas during mine operation, as clover is a bear attractant. No cereal grains are to be added to the seed mixes. Seed mixtures may be modified due to limited species availability, poor initial performance, advances in reclamation technology, or a variety of other factors.

Seeding rates would average about 120 pure live seeds per square foot (13 to 16 pounds per acre) for drill seeding and roughly twice that for broadcast seeding. Drill seeding would occur on slopes of less than 3:1 (horizontal to vertical) that are not rocky as determined by the Agencies. Steeper slopes and rocky areas would be broadcast or hydroseeded (a technique where seed is mixed into a slurry and sprayed onto a slope). Seeding would occur in the first appropriate season following site preparation.

Sterling proposes a number of cultural treatments for seedbed preparation. Sites would be prepared for seeding by grading; ripping to prepare the surface for soil placement; respreading salvaged soil; and tilling soils on gentle slopes (3:1 or less) to break up clods and relieve compaction, as needed. Phosphorus fertilizer, important for seedling establishment, would be applied prior to seeding. Once seeding occurred, straw mulch would be applied and anchored according to slope steepness and seeding method. Nitrogen fertilizer would be applied early in the subsequent growing season to enhance growth.

[18] This primarily entails incorporating the additional agency requirements into the revegetation and reclamation plans for all mine facilities that are contained in Sterling's permit applications and submitting them to the Agencies to verify that all requirements have been added and to approve the plans if acceptable.

Successful establishment and growth of trees are necessary to obtain the greatest visual mitigating effects on and adjacent to mine facilities. Given the importance of mycorrizhal fungi for tree growth and establishment, Sterling would obtain locally grown tree seedlings from an appropriately inoculated soil medium. Legume species would be inoculated with appropriate nitrogen-fixing bacteria. Other methods such as transplanting native shrubs and/or very small trees could be proposed. Fertilizer requirements and planned fertilizer applications would be carefully calculated to minimize nutrient losses due to deep leaching.

Shade cards or other methods would be used to protect tree and shrub seedlings, especially on south- and west-facing slopes of the impoundment and mill site. New tree and shrub plantings would be protected from wildlife browsing by netting. Drip-irrigation would be used during April through early June for up to three years after planting trees and shrubs on the tailings paste facility face to help with plant establishment.

Trees would be planted on slopes that do not exceed 3:1 in the tailings impoundment area, the facilities area, the waste rock dump top, and the access road to the waste rock dump. Trees would be planted in 2-to-4-foot-wide strips alternating with 8-foot-wide strips that were drill seeded. Trees would be planted 6 feet apart to achieve an initial stocking rate of 663 trees/acre. Planting patterns would be modified as needed to better mimic natural vegetation patterns on adjacent undisturbed lands. Reforestation of the transportation corridor and the evaluation adit area would rely on natural regeneration. Shrubs would also be planted on the tailings facility face. Shrubs would be planted on the access road cuts, only if herbaceous vegetation was not providing adequate erosion control.

During mine life, Sterling would also reclaim all cut-and-fill slopes along the access roads, and the adit portal slopes to maximize native plant establishment and minimize erosion, weed invasion and visual impacts during mine life. Interim reclamation plans would be developed with agency reclamation specialists to reduce slopes if practicable to approximate postmine contours wherever possible. Slopes reclaimed during operations would be revegetated with the permanent seed mix and planted as per the approved plan. This aggressive reclamation program is designed to increase native plant establishment, increase sediment and erosion control, limit noxious weed invasion, and reduce visual impacts during mine life.

Throughout mine life, disturbances would be seeded as they occurred with the permanent seed mix. Final revegetation (seeding) would occur in some areas during the preoperational phase; others would be revegetated incrementally when possible, such as the tailings paste facility. Final revegetation of all other disturbances not previously reclaimed would be completed within 2 years after mining.

Sterling would finalize a detailed planting plan for the mill site. Final revegetation of pad faces would occur as soon as the pad was completed. It would be seeded with grasses and forbs and planted with containerized shrubs and trees. Plantings would mimic natural patterns of vegetation.

Reclamation of the tailings paste facility would be somewhat different from that of a traditional tailings impoundment. Concurrent topsoiling and reclamation would allow the portion of the top and outer slopes of the paste facility that had achieved final grade to be reclaimed while the next segment was constructed. However, the timing of final reclamation would vary somewhat depending upon which option is selected. Final reclamation of the Bottom-Up option would occur on an annual basis unless specified otherwise by the Agencies. Reclamation of a small portion of the Top-Down option could begin in year 7 of mine operation (see Table 2-14) and could only be done when the layers had reached

their maximum height as each succeeding paste layer would cover the preceding layer. The sides and top of the Top-Down option could still be reclaimed concurrently with the stripping of soil from the next area proposed for disturbance rather than waiting until the facility was completely constructed. Reclamation of the Combined option would depend upon which method was being used at the time.

Interim revegetation would occur on an on-going basis for all paste options. An interim seed mix would be added to the paste before its deposition to limit erosion off paste slopes during operations and to reduce aesthetic impacts. A color tackifier or hydroseeding would also be applied to deposit lifts as needed for interim reclamation and stabilization prior to initiation of final reclamation activities. Both toe buttresses and paste deposit slopes for any of the deposition options would be seeded annually with final revegetation mix on any portion that reaches final grade.

Trees would be planted on each segment as it was reclaimed and seeded with approved planting mixes of grasses, forbs, and shrubs. The applicant has planted trees for screening between the main powerline and Montana Highway 200; however, the planting would be inspected during evaluation activities and any dead, dying or missing trees would be replaced to achieve the required density.

Sludge would be removed from the aeration pond after the water treatment system was decommissioned and dismantled, dried, and enclosed in a geomembrane lined cell in the impoundment. The substrate would be buried in the impoundment under a graded compacted layer of at least 6 feet of tailings near the embankment face. Topography in the area of the sludge would be mounded to prevent excess water from potentially moving through the substrate.

Reclamation of the mounded tailings over the aeration pond slurry cell substrate would be completed by applying a minimum of 24 inches of soil, followed by revegetation. The pond would be backfilled with clean subsoils to a mounded configuration to produce an area which would limit infiltration through the old pond area. Then the mounded subsoil area would be covered with a surface lift of soil and revegetated. Bond would be calculated to cover this reclamation modification and would include the salvage and storage of the materials needed to complete the reclamation at mine closure.

At the end of mine life agency reclamation personnel would review the reclamation success on the slopes and decide if the successful portions with up to 20-30 years of vegetation growth could be left in the final reclamation plan. Portions with unsuccessful reclamation would be recontoured as per the reclamation plan and soiled or rocked accordingly.

Pipeline Corridor Reclamation. The pipeline would be built and installed and covered with at least 24 inches of soil that had been salvaged prior to construction. No trees or shrubs would be seeded along the pipeline corridor, but any trees or shrubs that volunteered would be left. Trees that encroached on powerline conductors or were in the way of maintenance vehicles would be removed. Maintenance or replacement of a pipeline liner would require some redisturbance of a small area that would be immediately reclaimed after the work was done. When the pipelines were no longer needed they would be removed for a distance of 15 to 20 feet from stream crossings and where the pipes surfaced at the mill, the paste plant, the waste water treatment facility, and the Clark Fork River. The pipes would be completely drained, capped, sealed, the ends reburied, and the redisturbed section regraded, stabilized if necessary, and revegetated. The remaining buried segments of the pipeline would remain in place.

Appendix B

TERRESTRIAL THREATENED and ENDANGERED SPECIES MITIGATION PLAN for the PROPOSED REVETT ROCK CREEK MINE

This mitigation plan displays the specific items identified that are required to reduce, eliminate, or compensate for environmental consequences to species federally listed as threatened or endangered. It covers implementing alternative five as displayed in the final environmental impact statement and Record of Decision (2003) for the Rock Creek Mine project and supports requirements from the U.S. Fish and Wildlife Service (here after FWS) Biological Opinion. This mitigation plan will be implemented by the Revett Mining Company and appropriate state and federal agencies. Timing of completion of this plan is tied to three phases of mine activity (evaluation adit, construction, and operation with each requiring a letter from the Forest Service prior to proceeding).

This plan includes requirements for Revett to provide funding for a number of conservation measures that are needed long-term. Should future projects be proposed, that have adverse effects on grizzly bear in the Cabinet-Yaak ecosystem, funding for some of these measures could be required of the proponents, thus potentially changing the proportional funding required by Revett. Those items are marked with an asterisk **(*)** at the end of the measure description.

A. To reduce mortality risk (avoid incidental take) to Threatened and Endangered species Revett Mining Company will comply with the following, under the direction of the Forest:

1. Develop a transportation plan designed to minimize mine related vehicular traffic, traveling between state highway 200 and the mill site, and minimize parking availability at the plant site. Busing employees to the mill site will be a part of the plan. Forest Service approval required. The plan will be in place prior to starting the evaluation adit.

2. NOT use salt when sanding during winter plowing operations to reduce attracting big game, which can result in vehicles killing them. That in turn could draw bald eagles, wolves and grizzly to the road corridor and increase mortality.

3. Daily remove vehicular killed deer and elk from road rights-of-way within the permit area and along roadways used for access or hauling ore (FDR 150, 150A and new roads built for the project). Road kills would be moved at least 50 feet beyond the right-of-way clearing or as far as necessary to be out of sight from the road. During construction and the first three years of full operation, the Revett Mining Company would monitor the number of big game animals killed on these roads and report findings annually. They would also monitor and report (within 24 hours) all grizzly bear, bald eagle, lynx, wolf and black bear mortalities within the permit area. If a T&E species mortality occurs, and the grizzly bear specialists or law enforcement officer feel it is necessary to avoid grizzly bear or other T&E species mortality, the Revett Mining Company would be required to haul the road kill to a dumping location approved by Montana Fish, Wildlife and Parks (MFWP).

4. Construct power lines following criteria outlined by Olendorff, Miller and Lehman (1981) to reduce potential for electrocution of bald eagles.

5. Fund a local MFWP grizzly bear management specialist (with focus on public information and education) position to aid in grizzly bear conservation for the life of the mine. Funding would be provided prior to starting the evaluation adit to cover the first 5 years. The position would be stationed in the lower Clark Fork valley. The purposes are to reduce mortality risk through (1) education of the public on the law and penalty for violation (illegal killing of T&E species); (2) education of hunters on bear identification to reduce accidental killing of grizzly and (3) educate the public on biological needs of the grizzly so that an understanding exists that reduces "social jeopardy" and 4) educates the public on storage of human and pet (animal) food in bear habitat to prevent and correct sanitation problems. The position description and an initial list of work items will be developed jointly by the agencies (including but not limited to Forest Service, FWS, MFWP) and Revett Mining Company representatives. The Forest Service will request review and advice from the FWS on the position description and list of work items. **(*)**

6. Fund a local MFWP law enforcement position for the life of the mine. Funding would be provided prior to starting the evaluation adit to cover the first 5 years. The position would be stationed in the lower Clark Fork valley. The position description and an initial list of work items will be developed by the agencies (Forest Service and Montana Fish, Wildlife and Parks) and Revett representatives. The Forest Service will request review and advice from the FWS on the position description and list of work items. **(*)**

7. Prior to construction of the evaluation adit Revett will:

   a) In order to proceed with the evaluation adit, agree to defer the construction phase of the mine until at least six female grizzly bears have been augmented into the Cabinet Mountains portion of the Recovery Zone (south of Highway 2). Female grizzly bears placed in the Cabinet Mountains on or after 10/01/2005 count toward this requirement. As of 9/19/2006 two female bears have been placed in the Cabinets.

   b) In coordination the Kootenai Forest and Montana Fish, Wildlife, and Parks (MFWP) fund and/or conduct an enhanced outreach and education program to build support and understanding for the conservation of the Cabinet-Yaak grizzly population. This would involve educational materials, public service announcements, newspaper ads, and billboards supporting grizzly conservation. Examples could be signs at entrance roads to all grizzly habitats on the national forest, education programs for schools and civic clubs, and offering a reward leading to arrest and conviction of people illegally killing grizzly bears in the Cabinet-Yaak ecosystem. **(*)**

   c) Coordinate with bear specialist to provide funding for bear resistant garbage containers for personal use, by all mine employees associated with the evaluation adit phase, who live in or near grizzly bear habitat.

8. Prior to starting the construction phase Revett will:

a) Provide funding for a second bear specialist in Libby for life of mine, similar to position described in #5 above. Initial funding to cover first 5 years of the position provided prior to construction start-up. **(*)**

b) Coordinate with bear specialists and provide funding for bear-resistant garbage containers for personal use by all mine employees associated with the construction and operation phases who live in or near grizzly bear habitat.

c) Provide funding for an additional 100 bear resistant garbage containers plus an additional 20 per year, after the first year of construction phase, for distribution to the community at large by the grizzly bear management specialists.

d) Coordinate with bear specialists, FWS, and the Counties to prioritize and provide funding for fencing and electrification of garbage transfer stations in grizzly habitat in the Cabinet Yaak ecosystem. Revett will provide funding for and work with the FWS and Sanders County to make the Noxon Rock Creek garbage collection site bear resistant prior to start of evaluation adit construction. **(*)**

e) Fund an initial 10 electric fencing kits for use at bear problem sites that can be installed by MFWP bear specialists, and then 2 replacements per year, for use as needed. **(*)**

f) Agree that all mortality reduction measures would be subject to modification based on adaptive management, where new information supports changes. Modifications would be reviewed and approved by the oversight committee.

The Forest shall ensure that the law enforcement and information and education positions (grizzly bear personnel) required in the revised mitigation plan comply with the following :

a. Positions shall be located in the Clark Fork River side of the ecosystem.

b. Grizzly bear personnel shall be new positions with Montana Fish Wildlife and Parks.

c. Funding intended for the grizzly bear personnel positions will not be used to support already existing positions with Montana Fish Wildlife and Parks.

d. Duties for the law enforcement position shall be designed at a State grade determined by MFWP (recommend at least a grade14) and will be primarily directed at wildlife issues in the southern Cabinet Mountains of the CYE.

e. Duties for the bear specialist positions shall be designed as a grizzly bear management specialist at a State grade determined by MFWP (recommend at least a grade 14) and will be specifically tied to bear activities in the southern Cabinet Mountains of the CYE.

f. Grizzly bear personnel shall be fully-funded for the life of the mine through the reclamation period and including shut-down periods to provide for long-term consistency, the establishment of relationships with the resident public, familiarity with issues and potential problems in the area, and to address the large number of people who may remain in the area even in the event of temporary mine shut-downs.

g. Grizzly bear personnel will be operational, with all supportive equipment, vehicles and gear, prior to the letter to proceed on the evaluation adit.

h. Establish and maintain (through coordination with the three grizzly bear personnel: 2 specialists and 1 LEO) a mandatory reporting system to ensure that the Revett Mining Company and U.S. Forest Service employees are required to immediately report any black bear or grizzly bear incidents, observations or mortalities to both grizzly bear personnel to ensure that pre-emptive management, hazing, or removal of food attractants would occur to avoid further risks of habituation, mortality or displacement of grizzly bears. The reporting system would also be coordinated with the MFWP grizzly bear management specialist in Libby and would provide a mechanism to collect reliable information from the public on such incidents, although such reporting could not be required.

7. Use bear-resistant containers to hold attractants at all Rock Creek facilities. Remove contents in a timely manner (weekly unless a problem develops or grizzly bear personnel recommend a more frequent schedule). Containers will be in place at each mine facility site prior to starting any work on each site.

8. Avoid the use of clovers or other plants attractive to black or grizzly bears in the seed mix used on open roadways or any facility associated with the Rock Creek Mine (except as rehabilitation on closed roads or mitigation habitat where attracting bears would be encouraged).

9. Prohibit employees from carrying firearms within the permit area, except for security officers and other designated personnel. Identify consequences for violations in the an employment contract so employees will be aware of consequences prior to beginning their employment.

10. Prohibit employees from feeding wildlife (including dropping food stuffs from lunches etc.) within the permit area to avoid attracting bears or other wildlife into conflicts with people and encouraging habituation. Identify consequences for violations in an employment contract so employees will be aware of consequences prior to beginning their employment.

11. Fund the acquisition of bear resistant garbage containers to be placed in all developed campgrounds within Bear Management Units 1, 2, 3, 4, 5, 6, 7, 8 and 9 (pack in/pack out sites will not require garbage containers). The Forest shall ensure that the Revett Mining Company provide bear resistant garbage receptacles for all U.S. Forest Service camp

grounds and sites where garbage facilities are normally provided within the Cabinet portion of the CYE recovery zone (in BMUs 1-9). This includes those in MS-3 habitat, which often serve as the greatest risk to habituate bears and increase risk of bear removal through defense of life or property incidents or management action.**(*)**

12. Require mine employees (including all management staff) to attend training related to living and working in grizzly bear habitat prior to starting work and on an annual basis thereafter or as scheduled by the grizzly bear management personnel.

B. To maintain habitat effectiveness for Threatened and Endangered species, the Revett Mining Company will, under the direction of the Forest:

1. Secure or protect (through conservation easement, including road closures, or acquisition in fee with conveyance of fee or perpetual conservation easement to the Forest Service) from development (including but not limited to housing, motorized access) and use (timber harvest, grazing, mining) replacement habitat to compensate for acres lost by physical alterations, or acres with reduced habitat availability due to disturbance. Replacement acres for Alternative Five are: 2350. The "in kind" replacement acres must provide 2.61 early (6133.5 total), 1.61 late (3783.5 total) for an overall 2.11 habitat unit value (4958.5 total overall HUs). Replacement habitat will be provided using the following schedule:

Activity Area	Replacement Acres	Timing
Evaluation Adit	53	Prior to Eval. Adit
Tailings & AF	806	Prior to Construction
Mill & AF	248	Prior to Construction
Ventilation Adit	10	Prior to Construction
New Roads	102	Prior to Construction
Existing Roads (Reconstruction)	565	Prior to Construction
Existing Roads (Increased Influence)	566	Prior to Operations
Total Alternative 5	2350	Prior to Operations

AF = Associated Features

This schedule will have all replacement habitat (except ventilation adit) in place prior to starting full operations (end of year 5). Replacement habitat for the ventilation adit will be in place prior to its construction, if the adit becomes necessary.

Either fee title or conservation easements are acceptable. Conservation easements will be in perpetuity and transferred to the Forest Service. If fee lands are retained in private (non-Forest Service ownership) a conservation easement protecting the land in perpetuity must be conveyed to the Forest Service. Fee title lands may be considered for donation or land exchange with the Forest Service. Costs of processing land exchanges, and preparing and accepting conservation easement by the Forest Service for these acres will be funded by the Revett Mining Company. Land exchanges would be for equal valued lands as determined by a federal land appraisal. Any exchange must be beneficial to the Forest Service. First choice

for replacement habitat is within the disturbed BMUs (4,5,6). If adequate replacement acres are not available in those BMUs then acres may be found in other BMUs (1, 2, 7 & 8) within the Cabinet Mountains. See the Replacement Habitat Assessment for acceptable lands to consider **(Not available to public until replacement habitat mitigation completed).**

The FWS will be consulted with and asked advice on the mitigation acres and associated conservation easements as they relate to the requirements included in the Biological Opinion on the Rock Creek Mine, at an early stage in the acquistion negotiations. Forest Service will have final approval of mitigation acres and associated conservation easements prior to closing and recording.

The Forest shall ensure that the 2350 acres of mitigation properties be managed for grizzly bear habitat in perpetuity. Properties acquired in fee by the Revett Mining Company must either be transferred to the U.S. Forest Service or must be protected by perpetual conservation easement transferred to the U.S. Forest Service. Easement properties acquired by the Revett Mining Company must be transferred to the U.S. Forest Service. The 2350 acres of mitigation properties must meet the following requirements:

a) The FWS shall be requested to advise the Forest Service if it believes the proposed mitigation properties meet one or more of the following:

i restores or improves bear security habitat (HE and core) in the Southern Cabinet Mountains, particularly in the constricted north-south grizzly bear movement corridor;

ii improves habitat conditions related to established access standards (open motorized route density, total motorized route density) in BMUs 4,5, and 6,

iii reduces existing threats of development, food attractants or mortality risks in the Southern Cabinets,

iv reduces potential threats of development, food attractants or mortality risks in the Southern Cabinets,

v protect seasonally important habitats, with an primary emphasis on spring, and secondary emphasis on fall habitats

vi would maintain or increase MS-1 habitat (including the potential of acquiring and converting MS-3 properties or lands adjacent to the CYE recovery zone that have high mortality risks to MS-1 if those risks could be eliminated under Federal ownership).

b) Fee-title properties or transfers (trades) of NFS lands must meet standards,

requirements and legal processes for Federal acquisition or trade, including, but not limited to:

i approval by the Office of General Counsel,

ii be a Warranty Deed conveyance

iii comply with Department of Justice standards,

iv be free of hazardous materials, or develop an agreement among MOU signers as to appropriate remedy prior to acquisition

v include all surface and sub-surface rights including rights-of-ways, mineral claims, and/or other easements, unless otherwise advised by the FWS

vi be acquired in priority order. Lower priority acquisitions may be allowed, after approval of the Forest Service and when consistent with advice from the FWS to ensure that such a property would contribute to meeting the requirements of the biological opinion.

vii meet fair market appraised value, according to U.S. Forest Service appraisal processes with the allowance that Revett Mining Company could contribute additional funds to facilitate unequal appraised value trades, as approved by the Management Plan. Advanced approval by the Forest Service, after consultation with the FWS regarding the ability of the proposed lands to meet the requirements of the biological opinion, is required.

viii be acquired and recorded prior to the letter to proceed on the associated phase of the mine, with total acquisitions completed prior to the letter to proceed on the construction phase of the mine.

c) Conservation easements must include language approved in the Management Plan and meet standards, requirements and legal processes for Federal acquisition or trade, including, but not limited to:

i approval by the Office of General Counsel,

ii have the conservation easement be attached to the Warranty Deed

iii comply with Department of Justice standards,

iv be free of hazardous materials, or develop an agreement among MOU signers as to appropriate remedy prior to acquisition

v Include all surface and sub-surface rights including rights-of-ways, mineral claims, and/or other easements, unless otherwise advised by the FWS

vi be acquired in priority order. Lower priority acquisitions may be allowed, when consistent with advice from the FWS to ensure that such a property would contribute to avoiding jeopardy.

vii meet fair market appraised value, according to U.S. Forest Service appraisal processes with the allowance that the Revett Mining Company could contribute additional funds to facilitate unequal appraised value trades, as approved by the Management Plan if the affected parcels are consistent with advice from the FWS as being important to avoid jeopardy

viii be acquired and recorded prior to the letter to proceed on the associated phase of the mine, with all mitigation habitat acquired and recorded prior to the letter to proceed on the construction phase of the mine, excepting the mitigation habitat that may be necessary in the event the ventilation adit is required. Mitigation habitat for the ventilation adit would be acquired prior to the letter to proceed on development of the ventilation adit, should it be necessary.

The Forest shall implement access management improvements on lands acquired in the revised mitigation plan. The FWS requires specific mitigation properties to be acquired to improve habitat security, core area, total motorized route density and open motorized route density and will assess other areas prior to acquisition to ensure these lands will be sufficient to avoid jeopardizing the CYE grizzly bear population. These specific areas will be withheld from public disclosure due to their sensitive nature until acquisitions have been finalized.

The FWS agrees to work with the Forest in determining how road management associated with that property can improve access standards, with the goal of managing BMU 4,5 and 6 above levels in the Access Ammendment FEIS (March 2002). The FWS believes that 35 years of 24 hour disturbances as expected with Rock Creek Mine necessitate access management at a conservative level while the disturbance is ongoing. The acquisition of mitigation habitat may provide opportunities to manage access management at these levels in BMU s 4,5, and/or 6. Should mitigation property be acquired that would enable access management at these levels, the FWS expects that the Forest will provide the bears using BMU's 4,5 and 6 the optimum level of access management to reduce displacement and mortality risks during the life of the mine.

2. Fund habitat enhancement, commensurate with loss of habitat effectiveness. Enhancements include, but are not limited to, prescribed fire to restore whitebark pine, road closures and obliterations. Enhancements are preferred in the affected BMUs, however if opportunities are not available, then work may be done in BMUs in the southern portion of the Cabinet Mountains. Generally enhancements would occur in relation to replacement habitat acres.

Enhancements associated with replacement acres will occur in a timely manner as agreed to by the agencies.

BMU	% H.E. Change	Acres H.E. Mitigation
4	+ 1.0	0
5	- 1.1	348
6	- 0.3	136

C. To reduce mortality risk, maintain habitat effectiveness, reduce incidental take and avoid jeopardy for Threatened and Endangered species the Kootenai National Forest, with Revett Mining Company funds, will:

1. Close the following roads prior to the start of construction phase (see maps):

Road Number	Road Name	Closure Miles	Closure Period	Closure Method
2285	Orr Creek	1.61	Yearlong	Barrier
2741X	unnamed	0.18	Yearlong	Barrier
2741A	unnamed	0.51	Yearlong	Barrier
150	Rock Creek	2.92	Yearlong	Gate *

* 2.5 miles gated (south end), 0.42 miles obliterated (north end) - see map

2. Implement a mandatory food storage order for Bear Management Units 4, 5 and 6 prior to allowing the Revett Mining Company to start the evaluation adit, and implement same order throughout the CYE within 5 years of evaluation adit construction.

3. Monitor use on the Rock Lake and St Paul Lake trails to assure use levels do not exceed "high use" as defined by the IGBC. Monitoring visitor use on these trails would begin within 3 years of ROD. Methods used to monitor will be determined by a technical team led by the Forest Service. A recreational use management plan will be developed to assure high use does not occur. The plan will be implemented when monitoring indicates high use has occurred during one bear season. The plan will be prepared within 3 years of the start of the evaluation adit and must be signed by the involved agencies (Forest Service, FWS).

4. In coordination with the FWS the Forest Service will prioritize lands for conservation easement or acquisition in key linkage areas identified by research and monitoring along Highway 2 between the Cabinets and the Yaak.

5. The Forest Service will coordinate with the FWS and MFWP on release sites for augmentation of grizzly bears on National Forest lands.

6. Prior to the start of the construction phase Revett will: Provide funding for bear monitoring in the area along Highway 2 between the Cabinets and the Yaak. The linkage identification work would involve 3 years of monitoring movements of grizzly and black bears along the highway to identify movement patterns and key movement sites. Funding would cover 10 GPS collars, collar rebuilds each year for 3 years, salary for one seasonal worker for 6 month per year for 3 years and salary for one GIS technician for 6 months per year for 3 years. **(*)**

D. To address habitat constriction that reduces the potential to achieve CYE grizzly bear recovery goals (by impacting individuals in the Cabinet Mountains) and to avoid Jeopardy, Revett Mining Company will:

1. Secure or protect (through conservation easement, including road closures) or acquisition in fee with conveyance of fee or perpetual conservation easement to the Forest Service from development (including but not limited to housing, motorized access) and use (timber harvest, grazing, mining) 100 acres of replacement habitat that will enhance the north to south habitat corridor in the Cabinet Mountains. These lands are in addition to those identified under mitigation item B-1. All acres of replacement habitat for the constriction impact will be secured prior to starting the evaluation adit. See the Corridor Replacement Habitat Assessment for acceptable lands to consider **(Not available to public until corridor replacement habitat mitigation completed)** Fee title lands within the corridor would be placed in public ownership either through donation or land exchange. Costs of processing land exchanges, and preparing and accepting conservation easement by the Forest Service for these acres will be funded by the Revett Mining Company. Land exchanges would be for equal valued lands as determined by a federal land appraisal. Any exchange must be beneficial to the Forest Service. All land interest conveyed to the Forest Service must be acceptable and approved by the Office of General Counsel. Fee title land must be conveyed by Warranty Deed in accordance with Department of Justice standards. All property, or interest in property, shall be inspected for hazardous substances in accordance with law, regulation and policy. If hazardous substance are found an agreement needs to be reached on removal and remedial action.

The Forest shall ensure that, the 100 acres of mitigation habitat required to enhance the north-south corridor in the Cabinet Mountains:

a. the fee title or perpetual conservation easement to the 100 acres of mitigation property, be acquired by or transferred to the U.S. Forest Service;

b. include the specific properties identified by the FWS to avoid jeopardy (which will be released to the public when acquisition has been completed and recorded);

c. the U.S. Forest Service will request that the FWS advise the agency as to whether the proposed acres meet the requirements of the biological opinion, and once confirmed, will be acquired and recorded prior to the letter to proceed on the evaluation adit;

d. be managed as grizzly bear security habitat (core) throughout the life of the mine, including the reclamation period and any temporary or extended shutdown periods, and thereafter managed in a manner consistent with grizzly bear conservation requirements;

e. maintain or improve existing baseline core requirements (or other goals affiliated with Alternative E of the FEIS for Access Amendment on the Forest, Lolo and Panhandle National Forests, USDA 2002b); and

f. have any habitat enhancement activities needed to improve the mitigation properties, such as road closures or restoration, be planned and funded prior to the letter to proceed on the associated phase of the mine. Implementation will occur as soon as feasible (e.g. upon completion of any required NEPA process).

E. To assure compliance with the T&E species mitigation plan, and effectiveness of the management plan the Forest Service or Revett Mining Company will:

1. Prior to the Evaluation adit,

a) Revett will establish a trust fund and/or post a bond, to cover the mitigation plan implementation costs. The amount in the fund or posted in a bond will be commensurate with projected work and associated required mitigation items. The oversight committee will determine the amount of trust fund deposits, to be made in five year increments over the life of the mine.

b) Forest Service will lead a stakeholders information annual meeting. Stakeholders may include, but not limited to state and federal agency, county commissioners, mining company, local citizen, and NGO group representatives. The objectives of the meetings are to review a) management objectives, b) implementation of mitigation measures and c) monitoring and research results.

c) Forest Service would agree to adopt management actions in response to new information from monitoring to assure that on going management meets the objectives for grizzly bears in the Cabinet-Yaak ecosystem.

2. Participate in the development of and be a signer on a Memorandum of Understanding (MOU) that

The Forest shall develop an M.O.U. with FWP, the Revett Mining Company and other parties deemed appropriate by the Forest. The MOU must be completed prior to the Forest issuing the Revett Mining Company the letter to proceed with the evaluation adit. The MOU shall establish roles, responsibilities and time lines of an Oversight Committee comprised of members of the Forest, Montana Department of Fish, Wildlife and Parks, and other parties deemed appropriate by the parties named. The FWS shall be an ex-officio, non-voting member of the Oversight Committee, with only advisory responsibilities.

The Oversight Committee shall be responsible for the development of a Comprehensive Grizzly Bear Management Plan and its implementation. The Comprehensive Grizzly Bear Management

Plan shall focus on the Cabinet portion of the CYE and would fully include all provisions of the Forest's mitigation plan for grizzly bears, except where superceded by the FWS's Biological Opinion. It would also include provisions for adaptive management. The plan would be developed in detail by the parties to assure that human access to grizzly bear habitat, grizzly bear habitat quality, grizzly bear mortality, and habitat fragmentation issues shall be addressed to the extent that jeopardy would be avoided. Advice and comments on the plan from the FWS shall be requested and fully considered, including advice on whether the plan would meet the requirements of the biological opinion.

The Oversight Committee, led by the Forest, shall over the 35-year life of the mine:

a) assume responsibility for coordinating various aspects of the Management Plan;

b) assume responsibility for maintaining effective communication among all Committee members, stake holders, and interested public;

c) integrate the principles of adaptive management; collect, disseminate where needed, and review new information on grizzly bears, the results of implementation of the Comprehensive Grizzly Bear Management Plan over time, and other information related to CYE grizzly bears. If information or relevant data indicate appropriate, ensure the needed analysis and development of recommendations for changes or additions to the mitigation plan over the 35 year life of the mine, if such action is needed to ensure the proposed action is not likely to jeopardize the CYE grizzly bear population. The FWS would be asked to review proposed revisions to the Comprehensive Grizzly Bear Management Plan under appropriate section 7 provisions, if required.

The FWS shall be an advisor in the development of the MOU and subsequent Comprehensive Grizzly Bear Management Plan, and the Forest Service will request that the FWS advise, in writing, that the plan would meet the requirements of the biological opinion.

The MOU shall be completed prior to the letter to proceed on the evaluation adit and require the Forest to:

1) Ensure the Management Plan is completed prior to the construction phase of the mine.

2) Establish time frames for mitigation and implementation of other management to occur prior to the letter to proceed on the phase of the mine associated with that mitigation or management activity.

3) Ensure adequate funding, from the Revett Mining Company, to implement the revised mitigation plan according to the time frames.

4) Comply with legal guidelines or processes in as timely manner as possible in order to meet the mitigation plan and/or Comprehensive Grizzly Bear Management Plan implementation schedule.

5) Ensure that the FWS is consulted on the mitigation properties and the Comprehensive Grizzly Bear Management Plan and the FWS is requested to advise the Forest Service if the properties and the Plan meet the requirements in the biological opinion. All mitigation properties not specifically mentioned shall have undergone all necessary procedures for procurement including recordation, prior to the letter to proceed on the associated phase of the mine.

6) Establish language and legal procedures to ensure that mitigation properties acquired through fee title, land transfer or conservation easement:

a. are perpetual;
b. meet federal policies and regulations regarding such realty actions;
c. have the FWS advise whether they would meet the biological opinion requirements;
d. would be implemented and recorded in advance of the phase of the mine with which they are associated;
e. would increase or at least maintain a no net loss of MS-1 CYE habitat;
f. would be adequately funded such that enforcement of easement terms is assured;
g. would be selected on a priority basis with biologically justifiable rationale and the FWS advice that they meet the requirements included in the biological opinion;
h. would ensure management in support of grizzly bear survival and recovery if in public ownership.

The Comprehensive Grizzly Bear Management Plan shall include the measures in the mitigation plan, except where the mitigation plan has been superceded by the FWS's Biological Opinion. In addition, processes shall be established to ensure that access management, prevention of habituation, educational opportunities, reporting and monitoring, enforcement of easements, and management actions are being adequately implemented. Further, the Comprehensive Grizzly Bear Management Plan will establish processes to revise management, access, education or habitat enhancement strategies as new research or policies, such as revised IGBC guidelines.

3. Contribute funding to support monitoring of bear movements and population status in the Southern Cabinet Mountains to confirm the effectiveness of mitigation measures implemented to provide a secure north to south movement corridor. The Forest shall ensure that adequate funding, provided by the Revett Mining Company, is available to monitor bear movements and use of the Southern Cabinet Mountains to confirm the effective implementation of mitigation measures. Information gained would be useful in determining whether the mitigation plan is working as intended. If not, the information would help in developing new management strategies that would be incorporated in the Biological Opinion through appropriate ammendments. Funding would supplement ongoing research and monitoring activities in the CYE, would be conducted or coordinated by the FWS's grizzly bear researcher in Libby or his equivalent and would focus on grizzly bears in the Cabinet Mountains. Funding would include money for the following (but not limited to): trapping, hair sampling and analysis, radio collars, flight time, monitoring native and augmented grizzly bears, and data analysis, including all equipment and support materials needed for such monitoring. The Forest shall ensure that funding, provided by the Revett Mining Company, is available on an annual basis, two months in advance of the fiscal year (October) of the year it is to be used for the

life of the mine. Details of the monitoring activities and budget would be outlined in the Management Plan. Funding would be provided prior to the letter to proceed on the evaluation adit and would continue throughout the life of the mine through the reclamation phase. **(*)**

APPENDIX C (data from Kasworm et al. in litt. 2006a)

Table 1. (**DRAFT** 10/4/06) Known grizzly bear mortality in or near the Cabinet-Yaak recovery zone and the Yahk grizzly bear population unit in British Columbia, 1949-05 (from Kasworm et al. in litt. 2006a).

YEAR	LOCATION	TOTAL	SEX / AGE	MORTALITY CAUSE
1949	COPPER CR, MT	1	ADULT FEMALE	HUMAN, HUNTER KILL
1950	SQUAW CR, MT	1	SUBADULT	UNKNOWN
1951	PETE CR, MT	1	ADULT MALE	HUMAN, MANAGEMENT REMOVAL
1951	PAPOOSE CR, MT	2	SUBADULTS	UNKNOWN
1951	GOAT CR, MT	1	SUBADULT MALE	UNKNOWN
1952	FELIX CR, MT	6	2 ADULT FEMALES, 4 YEARLINGS	HUMAN, MANAGEMENT REMOVAL
1953	OBRIEN CR, MT	1	SUBADULT MALE	HUMAN, HUNTER KILL
1953	KENELTY MT, MT	1	UNKNOWN	HUMAN, HUNTER KILL
1953	20-ODD MT, MT	1	UNKNOWN	HUMAN, HUNTER KILL
1953	BURNT CR, MT	1	UNKNOWN	HUMAN, HUNTER KILL
1953	17-MILE CR, MT	1	UNKNOWN	HUMAN, HUNTER KILL
1954	N F BULL R, MT	1	UNKNOWN	HUMAN, HUNTER KILL
1954	S F BULL R, MT	1	UNKNOWN	HUMAN, HUNTER KILL
1954	CEDAR LK, MT	1	UNKNOWN	HUMAN, HUNTER KILL
1954	CEDAR LK, MT	1	UNKNOWN	HUMAN, HUNTER KILL
1954	TAYLOR PK, MT	1	UNKNOWN	HUMAN, HUNTER KILL
1954	SILVERBUTTE CR, MT	1	UNKNOWN	HUMAN, HUNTER KILL
1954	SILVERBOW CR, MT	1	ADULT FEMALE	HUMAN, HUNTER KILL
1955	WOLF CR, MT	1	ADULT MALE	HUMAN, MANAGEMENT REMOVAL
1955	MT HEADLEY, MT	1	SUBADULT	HUMAN, MANAGEMENT REMOVAL
1955	BAREE LK, MT	1	ADULT MALE	UNKNOWN
1955	BAREE LK, MT	1	ADULT FEMALE	UNKNOWN
1955	BEAR CR, MT	1	SUBADULT MALE	HUMAN, HUNTER KILL
1958	SQUAW CR, MT	1	ADULT FEMALE	HUMAN, MANAGEMENT REMOVAL
1959	E F ROCK CR, MT	2	ADULT FEMALE, 1 CUB	HUMAN, HUNTER KILL
1959	W F THOMPSON R, MT	4	ADULT FEMALE, 3 CUBS	UNKNOWN
1959	CLIFF CR, MT	1	UNKNOWN	UNKNOWN
1960	PROSPECT CR, MT	2	ADULT FEMALE, 1 CUB	UNKNOWN
1964	GRAVES CR, MT	2	SUBADULTS	UNKNOWN
1964	WANLESS LK, MT	3	SUBADULTS (ADULT WOUNDED)	UNKNOWN
1965	SNOWSHOE CR, MT	2	SUBADULTS	UNKNOWN
1965	PINKHAM CR, MT	1	UNKNOWN	UNKNOWN
1967	SOPHIE LK, MT	1	UNKNOWN	UNKNOWN
1968	BEAR CR, MT	1	ADULT FEMALE	HUMAN, ILLEGAL KILL
1968	GRANITE CR, MT	1	SUBADULT MALE	HUMAN, MANAGEMENT REMOVAL
1969	PRISCILLA PK, MT	1	ADULT FEMALE	UNKNOWN
1970	THOMPSON R, MT	1	UNKNOWN	UNKNOWN
1970	CAMERON CR, MT	1	SUBADULT MALE	UNKNOWN
1970	SQUAW CR, MT	2	ADULT FEMALE, SUBADULT FEMALE	HUMAN, MANAGEMENT REMOVAL
1971	MURR CR, MT	1	ADULT FEMALE	UNKNOWN
1972	ROCK CR, MT	1	SUBADULT	HUMAN, MISTAKEN IDENTITY (Black Bear)
1974	SWAMP CR, MT	1	ADULT MALE	HUMAN, HUNTER KILL
1977	RABBIT CR, MT	1	ADULT MALE	HUMAN, DEFENSE OF LIFE BY HUNTER
1978	MOYIE LAKE, BC	1	SUBADULT MALE	HUMAN, MANAGEMENT
1982	GROUSE, ID	1	ADULT MALE	HUMAN, ILLEGAL KILL
1984	HARVEY CR, ID	1	UNKNOWN	HUMAN, MISTAKEN IDENTITY (Black Bear)
1985	LYONS CR, MT	1	ADULT MALE	HUMAN, DEFENSE OF LIFE BY HUNTER
1986	BURNT CR, MT	1	CUB	UNKNOWN (NATURAL)
1987	FLATTAIL CR, MT	1	FEMALE CUB	HUMAN, MISTAKEN IDENTITY (Elk)
1988	LEWISBY CR, BC	1	ADULT MALE	HUMAN, HUNTER KILL (BC)
1988	N F 17-MILE CR, MT	1	ADULT FEMALE	HUMAN, DEFENSE OF LIFE BY HUNTER
1989	BURNT CR, MT	1	SUBADULT FEMALE	HUMAN, RESEARCH TRAP (Predation)
1990	POVERTY CR, MT	1	SUBADULT MALE	HUMAN, ILLEGAL
1992	TRAIL CR, MT	1	ADULT FEMALE	UNKNOWN
1993	LIBBY CR, MT	2	ADULT FEMALE AND CUB	UNKNOWN (NATURAL)
1994	JIM CR, BC	1	SUBADULT MALE	HUMAN, MANAGEMENT
1994	SOUTHWEST CRANBROOK, BC	3	2 FEMALES AND 1 MALE	HUMAN, MANAGEMENT
1995	RYAN CR, BC	1	ADULT MALE	HUMAN, MANAGEMENT REMOVAL
1996	DODGE CR, MT	1	SUBADULT MALE	HUMAN, UNDER INVESTIGATION

YEAR	LOCATION	TOTAL	SEX / AGE	MORTALITY CAUSE
1996	GOLD CR. BC	1	ADULT MALE	HUMAN. UNDER INVESTIGATION
1997?	LIBBY CR. MT	1	ADULT MALE	HUMAN. ILLEGAL
1997	PLUMBOB CR. BC	1	MALE	HUMAN. MANAGEMENT
1997	WARDNER. BC	1	ADULT FEMALE	HUMAN. MANAGEMENT
1997	MAYOOK. CR.BC	1	SUBADULT MALE	HUMAN. ILLEGAL KILL
1999	17 MILE CR. MT	3	ADULT FEMALE. 2 CUBS	NATURAL MORTALITY (Predation)
1999	W FK YAHK R. BC	1	SUBADULT FEMALE	HUMAN. DEFENSE OF LIFE BY HUNTER
1999	E FK YAAK R. MT	1	ADULT MALE	HUMAN. MANAGEMENT REMOVAL
2000	HAWKINS CR. BC	2	2 CUBS	UNKNOWN (NATURAL)
2000	FOWLER CR. MT	1	1 CUB	UNKNOWN (NATURAL)
2000	PETE CR. MT	1	SUBADULT FEMALE	HUMAN. UNDER INVESTIGATION
2001	COLD CR. BC	2	2 CUBS	UNKNOWN (NATURAL)
2001	SPREAD CR. MT	1	SUBADULT FEMALE	HUMAN. MISTAKEN IDENTITY (Black Bear)
2001	ELK CR. MT	1	ADULT FEMALE	HUMAN. TRAIN COLLISION
2002	MARTEN CR. MT	1	SUBADULT FEMALE	NATURAL
2002	PORCUPINE CR. MT	1	SUBADULT FEMALE	HUMAN. UNDER INVESTIGATION (Illegal)
2002	YAAK R. MT	4	ADULT FEMALE. 3 CUBS	HUMAN. ILLEGAL
2002	BLOOM CR. BC	1	UNKNOWN	HUMAN. BLACK BEAR HOUND HUNTERS
2002	KOOTENAY R. BC	1	FEMALE	HUMAN. DEFENSE OF LIFE
2004	WEST FORT STEELE. BC	1	MALE	HUMAN. DEFENSE OF LIFE AT DUMP
2004	JIM CR. BC	1	ADULT MALE	HUMAN. MISTAKEN IDENTITY
2004	NEWGATE.BC	1	ADULT FEMALE	HUMAN. MANAGEMENT REMOVAL
2005	RUSSELL CR. BC	1	ADULT MALE	HUMAN. HUNTER KILL (BC)
2005	GOVERNMENT CR. MT	1	SUBADULT FEMALE	HUMAN. TRAIN COLLISION
2005	PIPE CR. MT	1	SUBADULT FEMALE	HUMAN. ILLEGAL
2005	YAAK R. MT	1	SUBADULT MALE	HUMAN. ILLEGAL

Table 2. (**DRAFT** 10/4/06) Credible grizzly bear sightings, credible female with young sightings, and known human caused mortality by bear management unit (BMU) or area, 2005 (from Kasworm et al. in litt. 2006a).

BMU or Area	2005 Credible Grizzly Bear Sightings	2005 Female with Cub sightings (Unduplicated)	2005 Sightings of Females with Yearlings or 2-year-olds[2]	2005 Human Caused Mortality
3	1	0	0	0
4	1	0	0	1
5	6	1	2	0
6	5	0	4	0
10	4	0	0	0
11	4	0	0	1
12	3	0	0	0
13	1	0	0	0
14	1	0	0	0
15	5	0	0	0
16	1	0	0	1
17	2	0	2	0
20	1	0	0	0
British Columbia[1]	2	0	1	0
Cabinet Face[1]	2	0	0	0
Tobacco[1]	8	0	2	0
West Kootenai[1]	3	0	0	0
2005 TOTAL	50	1	11	3

[1] Areas are outside of Cabinet-Yaak recovery zone.
[2] Sightings may duplicate the same animal in different locations

Table 3. (**DRAFT** 10/4/06) Annual Cabinet-Yaak recovery zone (excluding Canada) grizzly bear minimum unduplicated counts of females with cubs and known human-caused mortality, 1988-2005 (from Kasworm et al. in litt. 2006a).

YEAR	ANNUAL FWC'S	ANNUAL HUMAN CAUSED ADULT FEMALE MORTALITY	ANNUAL HUMAN CAUSED ALL FEMALE MORTALITY	ANNUAL HUMAN CAUSED TOTAL MORTALITY	4% TOTAL HUMAN CAUSED MORTALITY LIMIT[1]	30% ALL FEMALE HUMAN CAUSED MORTALITY LIMIT[1]	TOTAL HUMAN CAUSED MORTALITY 6 YEAR AVERAGE	FEMALE HUMAN CAUSED MORTALITY 6 YEAR AVERAGE
1988	1	1	1	1	0	0		
1989	0	0	1	1	0	0		
1990	1	0	0	1	0	0		
1991	1	0	0	0	0	0		
1992	1	0	0	0	0	0		
1993	2	0	0	0	0.9	0.3	0.5	0.3
1994	1	0	0	0	0.9	0.3	0.3	0.2
1995	1	0	0	0	0.9	0.3	0.2	0
1996	1	0	0	1	0.7	0.2	0.2	0
1997	3	0	0	1	1.2	0.4	0.3	0
1998	0	0	0	0	0.9	0.3	0.3	0
1999	0	0	0	1	0.7	0.2	0.5	0
2000	2	0	1	1	0.5	0.1	0.7	0.2
2001	1	1	2	2	0.5	0.1	1.0	0.5
2002	4	1	4	5	1.2	0.4	1.7	1.2
2003	2	0	0	0	1.2	0.4	1.5	1.2
2004	1	0	0	0	1.4	0.4	1.5	1.2
2005	1	0	2	3	0.9	0.3	1.8	1.5

[1] Presently grizzly bear numbers are so small in this ecosystem that the mortality goal shall be zero known human-caused mortalities.

Table 4. (**DRAFT** 10/4/06) Status of the Cabinet-Yaak recovery zone during 2000-2005 in relation to the demographic recovery targets from the grizzly bear recovery plan (USFWS 1993) (from Kasworm et al. in litt. 2006a).

Recovery Criteria	Target	2000-2005
Females w/cubs (6-yr avg)	6.0	1.8 (11/6)
Human Caused Mortality limit (4% of minimum estimate)	0.9	1.8 (6 yr avg)
Female Human Caused mortality limit (30% of total mortality)	0.3	1.5 (6 yr avg)
Distribution of females w/young	18 of 22	12 of 22

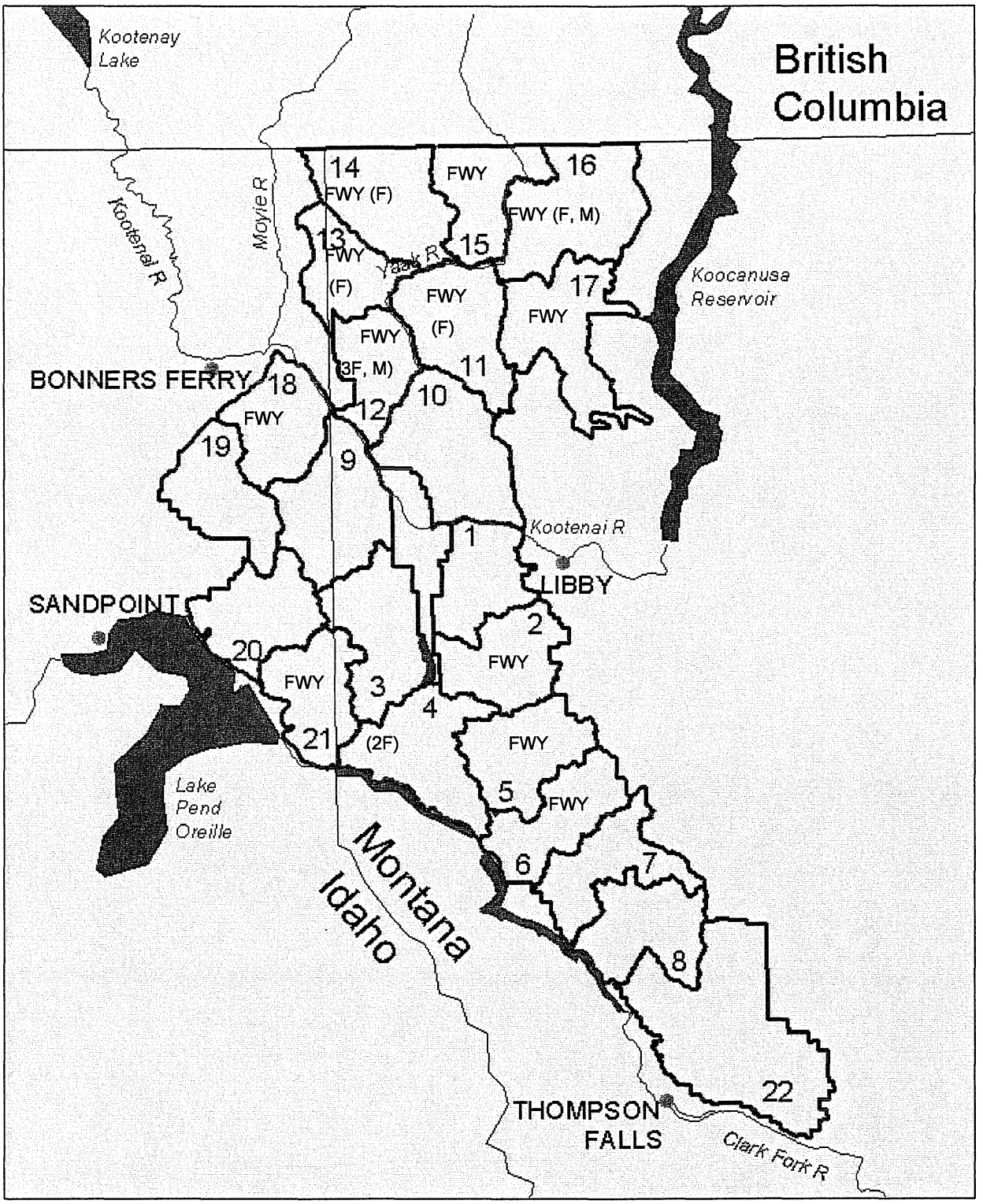


Figure 1. (**DRAFT** 10/4/06) Female with young occupancy and mortality by Bear Management Units (BMUs) within the Cabinet-Yaak recovery zone 2000-2005. (FWY indicates occupancy of a female with young and the sex of any mortality is indicated within parentheses).

Table 5. (**DRAFT** 10/4/06) Credible observations of females with young in or within 10 miles of the Cabinet-Yaak recovery zone, 1988-2005. Observations from Canada shown in parentheses (from Kasworm et al. in litt. 2006a).

Year	Total credible sightings females with young	Unduplicated females with cubs	Unduplicated females with yearlings or 2-year-olds	Minimum probable adult females
1988	3	1	1	2
1989	13	0	3	3
1990	9	1	2	3
1991	4	1	1	2
1992	8	1	5	6
1993	6	2	1	3
1994	5	1	2	3
1995	8	1	2	3
1996	5	1	1	2
1997	14 (1)	3	4	7
1998	6 (1)	0	2 (1)	2 (1)
1999	2	0	2	2
2000	6 (1)	2 (1)	1	3 (1)
2001	5 (2)	1 (1)	3	4 (1)
2002	10 (1)	4 (1)	1	5 (1)
2003	11	2	4	6
2004	11	1	4	5
2005	9 (1)	1	4 (1)	5 (1)

Table 6. (**DRAFT** 10/4/06) Occupancy of bear management units by grizzly bear females with young in the Cabinet-Yaak recovery zone 1988-2005 (from Kasworm et al. in litt. 2006a).

BMU	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
1 CEDAR	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
2 SNOWSHOE	No	No	Yes	No	No	No	No	No	No	Yes	No	No	No	No	Yes	Yes	Yes	No
3 SPAR	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
4 BULL	No	Yes	No	No	No	No	No	No	No	Yes	No	No	No	No	No	No	No	No
5 ST. PAUL	No	No	No	No	No	Yes	No	No	No	No	No	No	Yes	No	No	Yes	Yes	Yes
6 WANLESS	No	No	No	No	Yes	Yes	No	No	Yes	Yes	No	No	No	No	No	Yes	Yes	Yes
7 SILVER BUTTE	No	Yes	No	No	No	No	No	No	No	Yes	No	No	No	No	No	No	No	No
8 VERMILION	No	No	Yes	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
9 CALLAHAN	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
10 PULPIT	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
11 RODERICK	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	No	Yes	No
12 NEWTON	No	No	Yes	No	No	No	No	No	Yes	No	No	No	No	No	Yes	No	No	No
13 KENO	No	Yes	No	No	Yes	No	No	No	Yes	No	No	No	No	Yes	Yes	Yes	No	No
14 NORTHWEST PEAK	No	Yes	Yes	No	Yes	No	Yes	Yes	No	Yes	No	No	No	No	Yes	No	No	No
15 GARVER	No	Yes	Yes	No	No	No	Yes	Yes	No	Yes	Yes	Yes	No	No	Yes	No	No	No
16 EAST FORK YAAK	No	No	No	No	No	No	No	No	No	Yes	Yes	No	No	No	No	Yes	No	No
17 BIG CREEK	No	No	No	Yes	Yes	Yes	No	No	No	No	No	No	Yes	Yes	Yes	No	Yes	Yes
18 BOULDER	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	Yes	No	No
19 GROUSE	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
20 NORTH LIGHTNING	No	No	No	No	Yes	No	Yes	No	No	No	No	No	No	No	No	No	No	No
21 SCOTCHMAN	No	No	No	No	No	No	No	No	No	Yes	No	No	No	No	No	Yes	No	No
22 MT HEADLEY	No	No	Yes	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

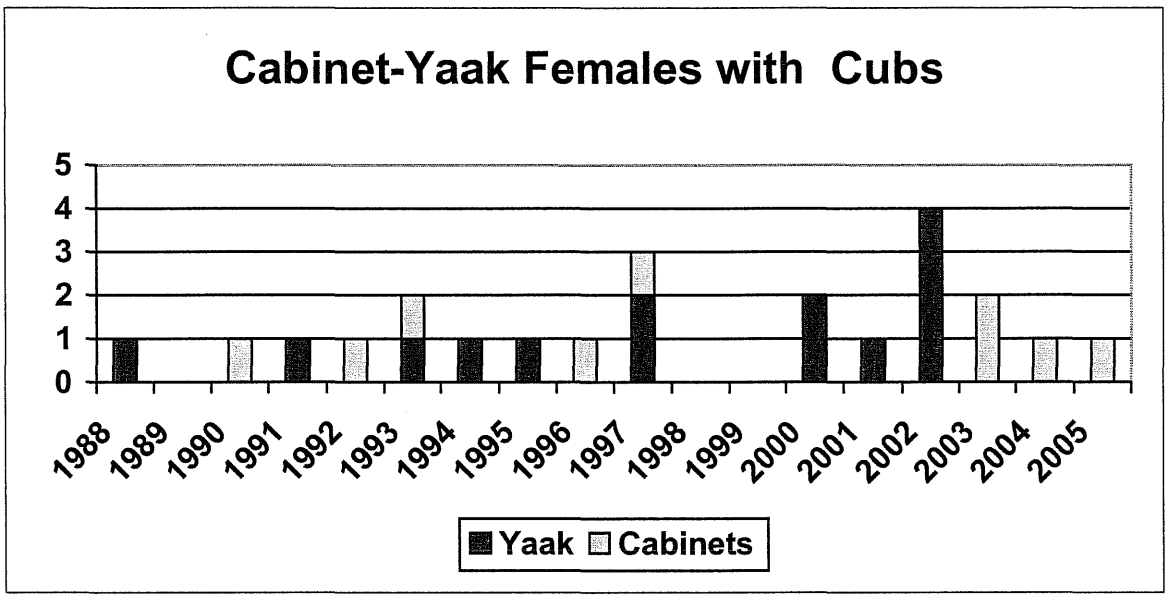


Figure 5. (DRAFT 10/4/06) Credible observations of females with cubs in or within 10 miles of the Cabinet-Yaak recovery zone (excluding Canada), 1988-05 (from Kasworm et al. in litt. 2006a.).

.

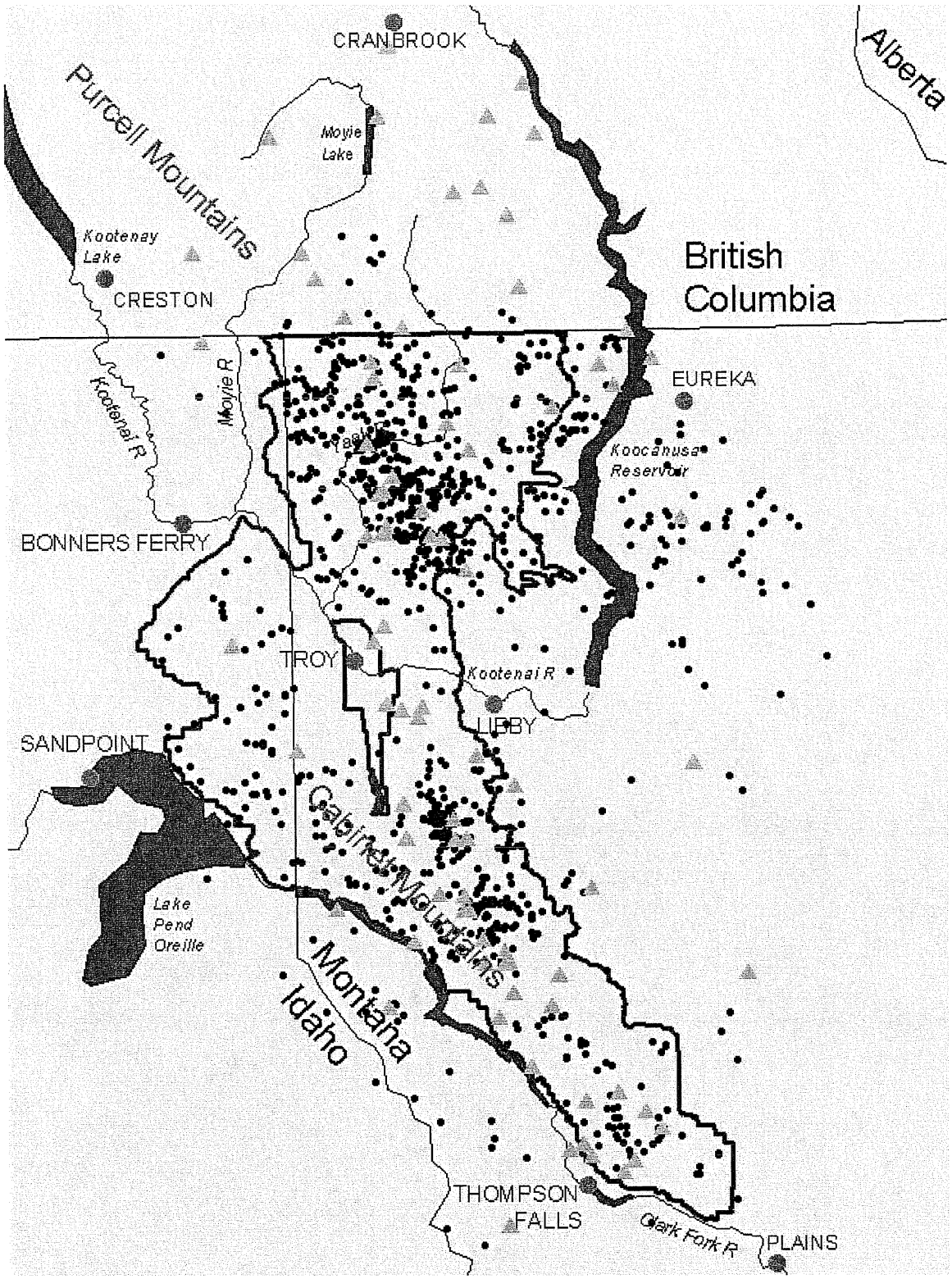


Figure 2. (**DRAFT** 10/4/06) Grizzly bear observations (1959-2005, circles) and mortality (1949-2005, triangles) in the Cabinet-Yaak recovery area. (from Kasworm et al. in litt. 2006).

Appendix C

APPENDIX C (data from Kasworm et al. in litt. 2006a)

Table 1. (**DRAFT** 10/4/06) Known grizzly bear mortality in or near the Cabinet-Yaak recovery zone and the Yahk grizzly bear population unit in British Columbia, 1949-05 (from Kasworm et al. in litt. 2006a).

YEAR	LOCATION	TOTAL	SEX / AGE	MORTALITY CAUSE
1949	COPPER CR, MT	1	ADULT FEMALE	HUMAN, HUNTER KILL
1950	SQUAW CR, MT	1	SUBADULT	UNKNOWN
1951	PETE CR, MT	1	ADULT MALE	HUMAN, MANAGEMENT REMOVAL
1951	PAPOOSE CR, MT	2	SUBADULTS	UNKNOWN
1951	GOAT CR, MT	1	SUBADULT MALE	UNKNOWN
1952	FELIX CR, MT	6	2 ADULT FEMALES, 4 YEARLINGS	HUMAN, MANAGEMENT REMOVAL
1953	OBRIEN CR, MT	1	SUBADULT MALE	HUMAN, HUNTER KILL
1953	KENELTY MT, MT	1	UNKNOWN	HUMAN, HUNTER KILL
1953	20-ODD MT, MT	1	UNKNOWN	HUMAN, HUNTER KILL
1953	BURNT CR, MT	1	UNKNOWN	HUMAN, HUNTER KILL
1953	17-MILE CR, MT	1	UNKNOWN	HUMAN, HUNTER KILL
1954	N F BULL R, MT	1	UNKNOWN	HUMAN, HUNTER KILL
1954	S F BULL R, MT	1	UNKNOWN	HUMAN, HUNTER KILL
1954	CEDAR LK, MT	1	UNKNOWN	HUMAN, HUNTER KILL
1954	CEDAR LK, MT	1	UNKNOWN	HUMAN, HUNTER KILL
1954	TAYLOR PK, MT	1	UNKNOWN	HUMAN, HUNTER KILL
1954	SILVERBUTTE CR, MT	1	UNKNOWN	HUMAN, HUNTER KILL
1954	SILVERBOW CR, MT	1	ADULT FEMALE	HUMAN, HUNTER KILL
1955	WOLF CR, MT	1	ADULT MALE	HUMAN, MANAGEMENT REMOVAL
1955	MT HEADLEY, MT	1	SUBADULT	HUMAN, MANAGEMENT REMOVAL
1955	BAREE LK, MT	1	ADULT MALE	UNKNOWN
1955	BAREE LK, MT	1	ADULT FEMALE	UNKNOWN
1955	BEAR CR, MT	1	SUBADULT MALE	HUMAN, HUNTER KILL
1958	SQUAW CR, MT	1	ADULT FEMALE	HUMAN, MANAGEMENT REMOVAL
1959	E F ROCK CR, MT	2	ADULT FEMALE, 1 CUB	HUMAN, HUNTER KILL
1959	W F THOMPSON R, MT	4	ADULT FEMALE, 3 CUBS	UNKNOWN
1959	CLIFF CR, MT	1	UNKNOWN	UNKNOWN
1960	PROSPECT CR, MT	2	ADULT FEMALE, 1 CUB	UNKNOWN
1964	GRAVES CR, MT	2	SUBADULTS	UNKNOWN
1964	WANLESS LK, MT	3	SUBADULTS (ADULT WOUNDED)	UNKNOWN
1965	SNOWSHOE CR, MT	2	SUBADULTS	UNKNOWN
1965	PINKHAM CR, MT	1	UNKNOWN	UNKNOWN
1967	SOPHIE LK, MT	1	UNKNOWN	UNKNOWN
1968	BEAR CR, MT	1	ADULT FEMALE	HUMAN, ILLEGAL KILL
1968	GRANITE CR, MT	1	SUBADULT MALE	HUMAN, MANAGEMENT REMOVAL
1969	PRISCILLA PK, MT	1	ADULT FEMALE	UNKNOWN
1970	THOMPSON R, MT	1	UNKNOWN	UNKNOWN
1970	CAMERON CR, MT	1	SUBADULT MALE	UNKNOWN
1970	SQUAW CR, MT	2	ADULT FEMALE, SUBADULT FEMALE	HUMAN, MANAGEMENT REMOVAL
1971	MURR CR, MT	1	ADULT FEMALE	UNKNOWN
1972	ROCK CR, MT	1	SUBADULT	HUMAN, MISTAKEN IDENTITY (Black Bear)
1974	SWAMP CR, MT	1	ADULT MALE	HUMAN, HUNTER KILL
1977	RABBIT CR, MT	1	ADULT MALE	HUMAN, DEFENSE OF LIFE BY HUNTER
1978	MOYIE LAKE, BC	1	SUBADULT MALE	HUMAN, MANAGEMENT
1982	GROUSE, ID	1	ADULT MALE	HUMAN, ILLEGAL KILL
1984	HARVEY CR, ID	1	UNKNOWN	HUMAN, MISTAKEN IDENTITY (Black Bear)
1985	LYONS CR, MT	1	ADULT MALE	HUMAN, DEFENSE OF LIFE BY HUNTER
1986	BURNT CR, MT	1	CUB	UNKNOWN (NATURAL)
1987	FLATTAIL CR, MT	1	FEMALE CUB	HUMAN, MISTAKEN IDENTITY (Elk)
1988	LEWISBY CR, BC	1	ADULT MALE	HUMAN, HUNTER KILL (BC)
1988	N F 17-MILE CR, MT	1	ADULT FEMALE	HUMAN, DEFENSE OF LIFE BY HUNTER
1989	BURNT CR, MT	1	SUBADULT FEMALE	HUMAN, RESEARCH TRAP (Predation)
1990	POVERTY CR, MT	1	SUBADULT MALE	HUMAN, ILLEGAL
1992	TRAIL CR, MT	1	ADULT FEMALE	UNKNOWN
1993	LIBBY CR, MT	2	ADULT FEMALE AND CUB	UNKNOWN (NATURAL)
1994	JIM CR, BC	1	SUBADULT MALE	HUMAN, MANAGEMENT
1994	SOUTHWEST CRANBROOK, BC	3	2 FEMALES AND 1 MALE	HUMAN, MANAGEMENT
1995	RYAN CR, BC	1	ADULT MALE	HUMAN, MANAGEMENT REMOVAL
1996	DODGE CR, MT	1	SUBADULT MALE	HUMAN, UNDER INVESTIGATION

YEAR	LOCATION	TOTAL	SEX / AGE	MORTALITY CAUSE
1996	GOLD CR. BC	1	ADULT MALE	HUMAN. UNDER INVESTIGATION
1997?	LIBBY CR. MT	1	ADULT MALE	HUMAN. ILLEGAL
1997	PLUMBOB CR. BC	1	MALE	HUMAN. MANAGEMENT
1997	WARDNER. BC	1	ADULT FEMALE	HUMAN. MANAGEMENT
1997	MAYOOK. CR.BC	1	SUBADULT MALE	HUMAN. ILLEGAL KILL
1999	17 MILE CR. MT	3	ADULT FEMALE. 2 CUBS	NATURAL MORTALITY (Predation)
1999	W FK YAHK R. BC	1	SUBADULT FEMALE	HUMAN. DEFENSE OF LIFE BY HUNTER
1999	E FK YAAK R. MT	1	ADULT MALE	HUMAN. MANAGEMENT REMOVAL
2000	HAWKINS CR. BC	2	2 CUBS	UNKNOWN (NATURAL)
2000	FOWLER CR. MT	1	1 CUB	UNKNOWN (NATURAL)
2000	PETE CR. MT	1	SUBADULT FEMALE	HUMAN. UNDER INVESTIGATION
2001	COLD CR. BC	2	2 CUBS	UNKNOWN (NATURAL)
2001	SPREAD CR. MT	1	SUBADULT FEMALE	HUMAN. MISTAKEN IDENTITY (Black Bear)
2001	ELK CR. MT	1	ADULT FEMALE	HUMAN. TRAIN COLLISION
2002	MARTEN CR. MT	1	SUBADULT FEMALE	NATURAL
2002	PORCUPINE CR. MT	1	SUBADULT FEMALE	HUMAN. UNDER INVESTIGATION (Illegal)
2002	YAAK R. MT	4	ADULT FEMALE. 3 CUBS	HUMAN. ILLEGAL
2002	BLOOM CR. BC	1	UNKNOWN	HUMAN. BLACK BEAR HOUND HUNTERS
2002	KOOTENAY R. BC	1	FEMALE	HUMAN. DEFENSE OF LIFE
2004	WEST FORT STEELE. BC	1	MALE	HUMAN. DEFENSE OF LIFE AT DUMP
2004	JIM CR. BC	1	ADULT MALE	HUMAN. MISTAKEN IDENTITY
2004	NEWGATE.BC	1	ADULT FEMALE	HUMAN. MANAGEMENT REMOVAL
2005	RUSSELL CR. BC	1	ADULT MALE	HUMAN. HUNTER KILL (BC)
2005	GOVERNMENT CR. MT	1	SUBADULT FEMALE	HUMAN. TRAIN COLLISION
2005	PIPE CR. MT	1	SUBADULT FEMALE	HUMAN. ILLEGAL
2005	YAAK R. MT	1	SUBADULT MALE	HUMAN. ILLEGAL

Table 2. (**DRAFT** 10/4/06) Credible grizzly bear sightings, credible female with young sightings, and known human caused mortality by bear management unit (BMU) or area, 2005 (from Kasworm et al. in litt. 2006a).

BMU or Area	2005 Credible Grizzly Bear Sightings	2005 Female with Cub sightings (Unduplicated)	2005 Sightings of Females with Yearlings or 2-year-olds[2]	2005 Human Caused Mortality
3	1	0	0	0
4	1	0	0	1
5	6	1	2	0
6	5	0	4	0
10	4	0	0	0
11	4	0	0	1
12	3	0	0	0
13	1	0	0	0
14	1	0	0	0
15	5	0	0	0
16	1	0	0	1
17	2	0	2	0
20	1	0	0	0
British Columbia[1]	2	0	1	0
Cabinet Face[1]	2	0	0	0
Tobacco[1]	8	0	2	0
West Kootenai[1]	3	0	0	0
2005 TOTAL	50	1	11	3

[1] Areas are outside of Cabinet-Yaak recovery zone.
[2] Sightings may duplicate the same animal in different locations

Table 3. (**DRAFT** 10/4/06) Annual Cabinet-Yaak recovery zone (excluding Canada) grizzly bear minimum unduplicated counts of females with cubs and known human-caused mortality, 1988-2005 (from Kasworm et al. in litt. 2006a).

YEAR	ANNUAL FWC'S	ANNUAL HUMAN CAUSED ADULT FEMALE MORTALITY	ANNUAL HUMAN CAUSED ALL FEMALE MORTALITY	ANNUAL HUMAN CAUSED TOTAL MORTALITY	4% TOTAL HUMAN CAUSED MORTALITY LIMIT[1]	30% ALL FEMALE HUMAN CAUSED MORTALITY LIMIT[1]	TOTAL HUMAN CAUSED MORTALITY 6 YEAR AVERAGE	FEMALE HUMAN CAUSED MORTALITY 6 YEAR AVERAGE
1988	1	1	1	1	0	0		
1989	0	0	1	1	0	0		
1990	1	0	0	1	0	0		
1991	1	0	0	0	0	0		
1992	1	0	0	0	0	0		
1993	2	0	0	0	0.9	0.3	0.5	0.3
1994	1	0	0	0	0.9	0.3	0.3	0.2
1995	1	0	0	0	0.9	0.3	0.2	0
1996	1	0	0	1	0.7	0.2	0.2	0
1997	3	0	0	1	1.2	0.4	0.3	0
1998	0	0	0	0	0.9	0.3	0.3	0
1999	0	0	0	1	0.7	0.2	0.5	0
2000	2	0	1	1	0.5	0.1	0.7	0.2
2001	1	1	2	2	0.5	0.1	1.0	0.5
2002	4	1	4	5	1.2	0.4	1.7	1.2
2003	2	0	0	0	1.2	0.4	1.5	1.2
2004	1	0	0	0	1.4	0.4	1.5	1.2
2005	1	0	2	3	0.9	0.3	1.8	1.5

[1] Presently grizzly bear numbers are so small in this ecosystem that the mortality goal shall be zero known human-caused mortalities.

Table 4. (**DRAFT** 10/4/06) Status of the Cabinet-Yaak recovery zone during 2000-2005 in relation to the demographic recovery targets from the grizzly bear recovery plan (USFWS 1993) (from Kasworm et al. in litt. 2006a).

Recovery Criteria	Target	2000-2005
Females w/cubs (6-yr avg)	6.0	1.8 (11/6)
Human Caused Mortality limit (4% of minimum estimate)	0.9	1.8 (6 yr avg)
Female Human Caused mortality limit (30% of total mortality)	0.3	1.5 (6 yr avg)
Distribution of females w/young	18 of 22	12 of 22

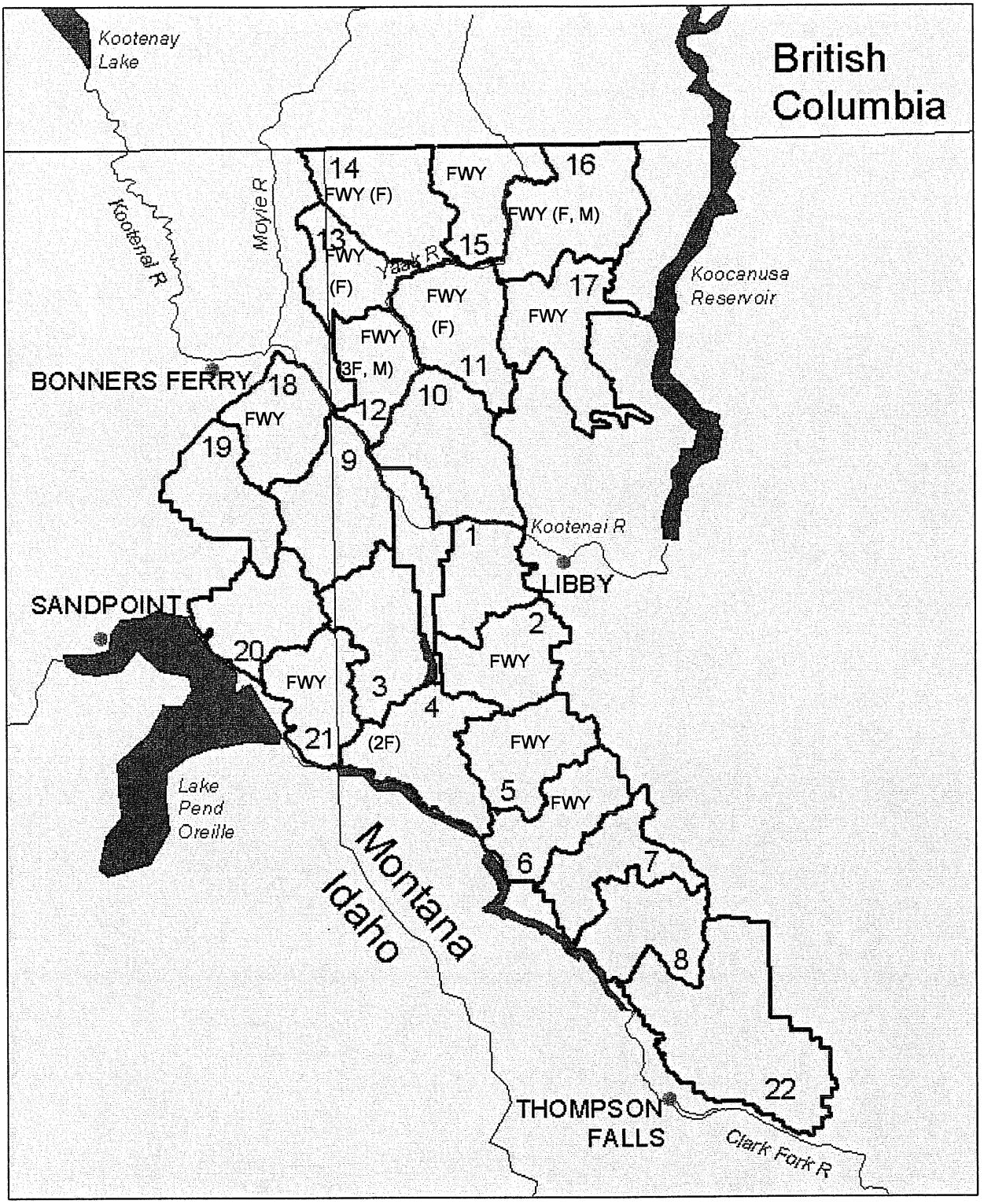


Figure 1. (**DRAFT** 10/4/06) Female with young occupancy and mortality by Bear Management Units (BMUs) within the Cabinet-Yaak recovery zone 2000-2005. (FWY indicates occupancy of a female with young and the sex of any mortality is indicated within parentheses).

Table 5. (**DRAFT** 10/4/06) Credible observations of females with young in or within 10 miles of the Cabinet-Yaak recovery zone, 1988-2005. Observations from Canada shown in parentheses (from Kasworm et al. in litt. 2006a).

Year	Total credible sightings females with young	Unduplicated females with cubs	Unduplicated females with yearlings or 2-year-olds	Minimum probable adult females
1988	3	1	1	2
1989	13	0	3	3
1990	9	1	2	3
1991	4	1	1	2
1992	8	1	5	6
1993	6	2	1	3
1994	5	1	2	3
1995	8	1	2	3
1996	5	1	1	2
1997	14 (1)	3	4	7
1998	6 (1)	0	2 (1)	2 (1)
1999	2	0	2	2
2000	6 (1)	2 (1)	1	3 (1)
2001	5 (2)	1 (1)	3	4 (1)
2002	10 (1)	4 (1)	1	5 (1)
2003	11	2	4	6
2004	11	1	4	5
2005	9 (1)	1	4 (1)	5 (1)

Table 6. (**DRAFT** 10/4/06) Occupancy of bear management units by grizzly bear females with young in the Cabinet-Yaak recovery zone 1988-2005 (from Kasworm et al. in litt. 2006a).

BMU	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
1 CEDAR	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
2 SNOWSHOE	No	No	Yes	No	No	No	No	No	No	Yes	No	No	No	No	Yes	Yes	Yes	No
3 SPAR	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
4 BULL	No	Yes	No	No	No	No	No	No	No	Yes	No	No	No	No	No	No	No	No
5 ST. PAUL	No	No	No	No	No	Yes	No	No	No	No	No	No	Yes	No	No	Yes	Yes	Yes
6 WANLESS	No	No	No	No	Yes	Yes	No	No	Yes	Yes	No	No	No	No	No	Yes	Yes	Yes
7 SILVER BUTTE	No	Yes	No	No	No	No	No	No	No	Yes	No	No	No	No	No	No	No	No
8 VERMILION	No	No	Yes	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
9 CALLAHAN	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
10 PULPIT	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
11 RODERICK	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	No	Yes	No
12 NEWTON	No	No	Yes	No	No	No	No	No	Yes	No	No	No	No	No	Yes	No	No	No
13 KENO	No	Yes	No	No	Yes	No	No	No	Yes	No	No	No	No	Yes	Yes	Yes	No	No
14 NORTHWEST PEAK	No	Yes	Yes	No	Yes	No	Yes	Yes	No	Yes	No	No	No	No	Yes	No	No	No
15 GARVER	No	Yes	Yes	No	No	No	Yes	Yes	No	Yes	Yes	Yes	No	No	Yes	No	No	No
16 EAST FORK YAAK	No	No	No	No	No	No	No	No	No	Yes	Yes	No	No	No	No	Yes	No	No
17 BIG CREEK	No	No	No	Yes	Yes	Yes	No	No	No	No	No	No	Yes	Yes	Yes	No	Yes	Yes
18 BOULDER	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	Yes	No	No
19 GROUSE	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
20 NORTH LIGHTNING	No	No	No	No	Yes	No	Yes	No	No	No	No	No	No	No	No	No	No	No
21 SCOTCHMAN	No	No	No	No	No	No	No	No	No	Yes	No	No	No	No	No	Yes	No	No
22 MT HEADLEY	No	No	Yes	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

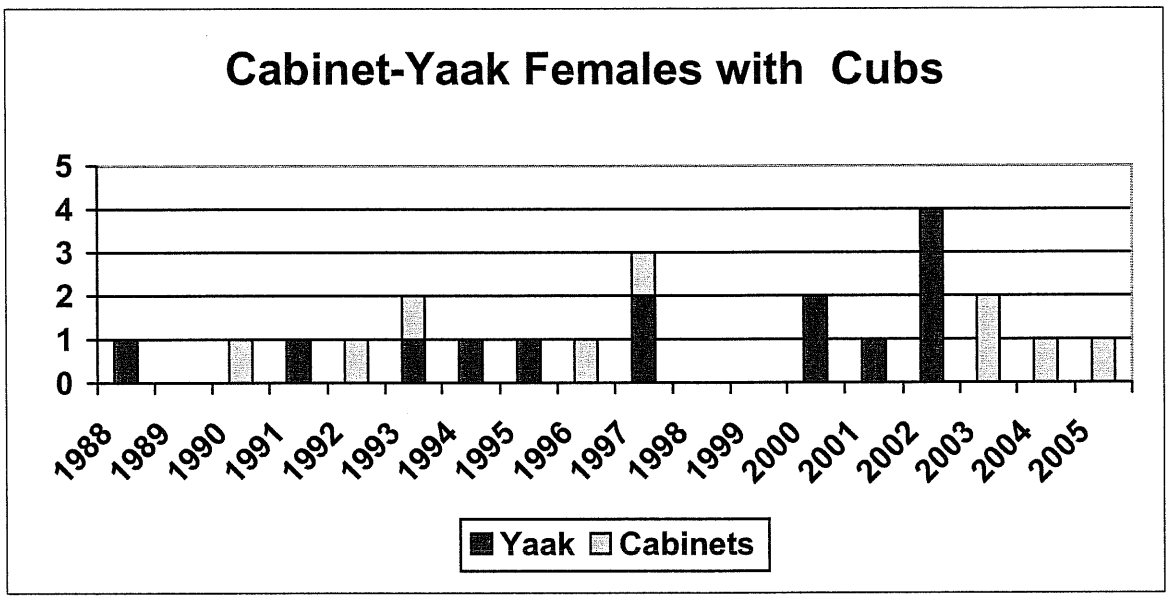


Figure 5. (DRAFT 10/4/06) Credible observations of females with cubs in or within 10 miles of the Cabinet-Yaak recovery zone (excluding Canada), 1988-05 (from Kasworm et al. in litt. 2006a.).

.

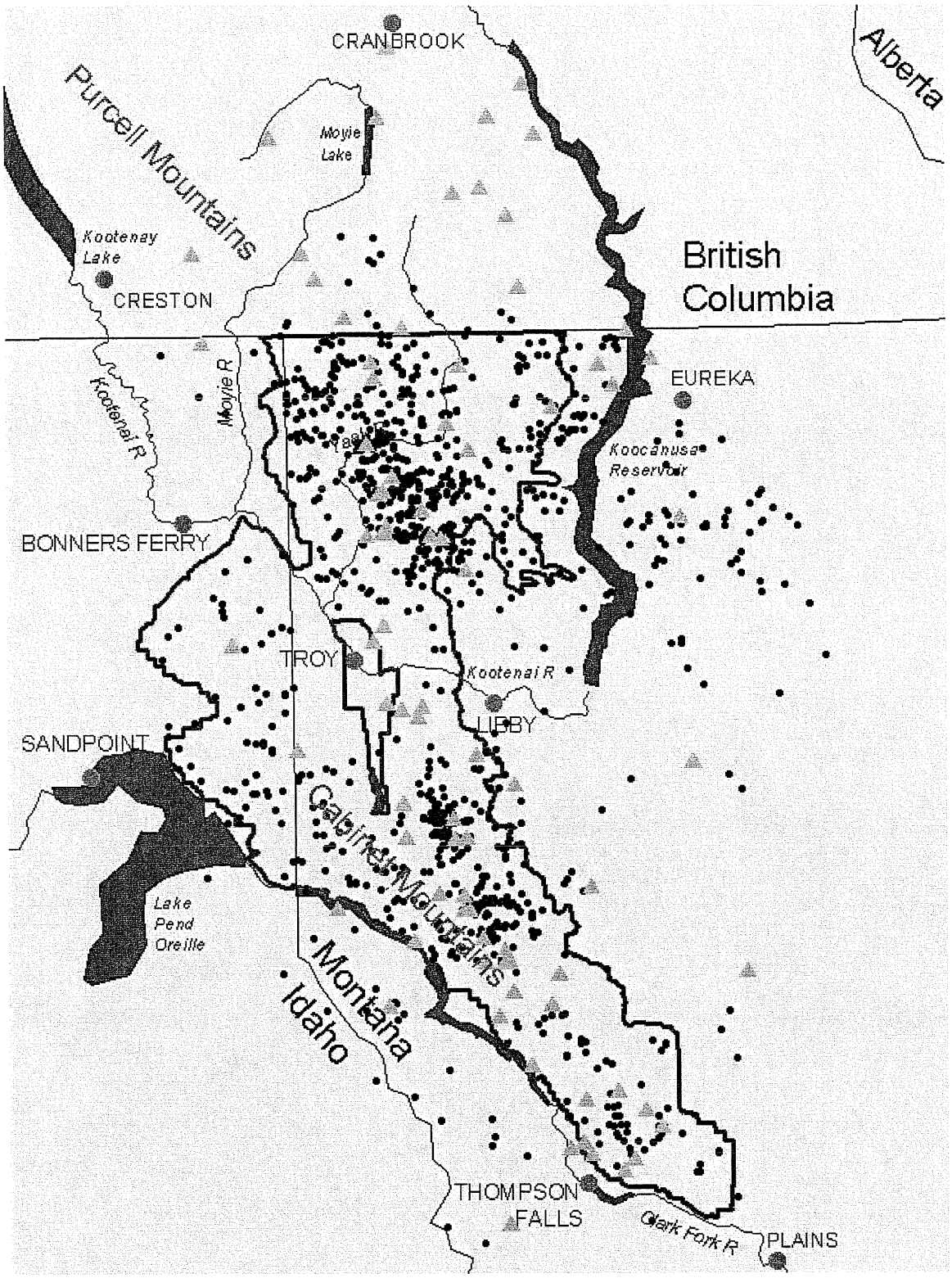


Figure 2. (**DRAFT** 10/4/06) Grizzly bear observations (1959-2005, circles) and mortality (1949-2005, triangles) in the Cabinet-Yaak recovery area. (from Kasworm et al. in litt. 2006).

Appendix D

APPENDIX D (from USDA in litt. 2006a

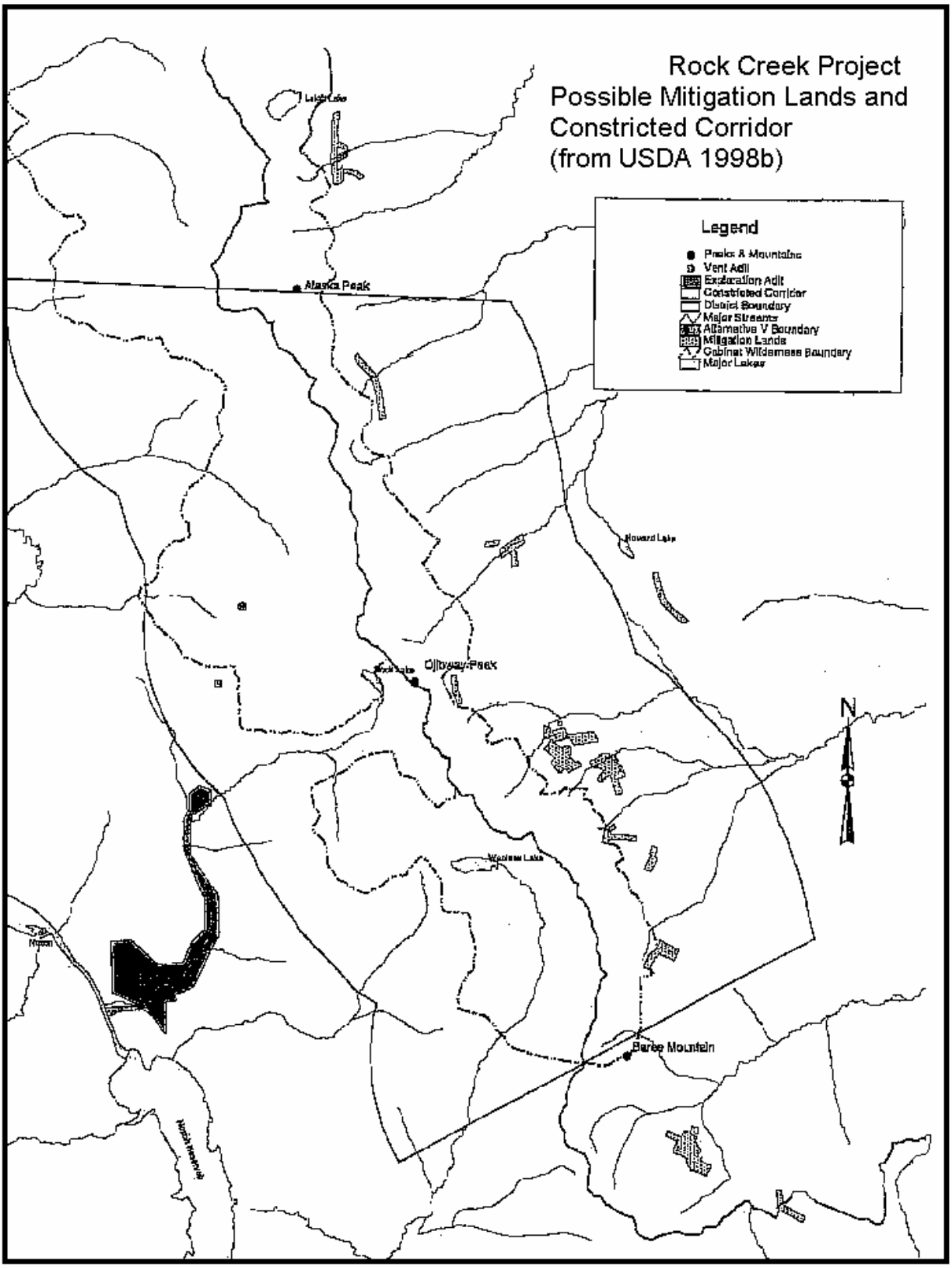
SELKIRK/CABINET/YAAK BEAR MANAGEMENT UNIT SUMMARY 2005 BEAR YEAR

BMU	Open Roads >1mi/sq.mi (%)	Total Roads >2 mi/sq.mi (%)	% Federal Land	% Core	Priority
1 (Cedar)	14 (15)	8 (15)	99	85 (80)	2
2 (Snowshoe)	19 (20)	14 (18)	94	77 (75)	2
3 (Spar)	26 (33)	24 (26)	95	63 (59)	3
4 (Bull)	37 (36)	26 (26)	84	63 (63)	2
5 (St. Paul)	27 (30)	24 (23)	97	59 (60)	1
6 (Wanless)	34 (34)	32 (32)	85	54 (55)	1
7 (Silver Butte)	24 (26)	20 (23)	92	67 (63)	2
8 (Vermilion)	32 (32)	23 (20)	93	56 (55)	3
9 (Calahan)	28 (33)	26 (26)	90	59 (55)	2
10 (Pulpit)	42 (44)	29 (34)	95	51 (52)	2
11 (Roderick)	28 (33)	29 (26)	96	53 (55)	1
12 (Newton)	42 (45)	31 (31)	92	56 (55)	1
13 (Keno)	34 (33)	24 (26)	99.5	61 (60)	1
14 (NW Peak)	28 (33)	26 (26)	99.9	56 (55)	1
15 (Garver)	33 (33)	34 (26)	94	46 (55)	1
16 (EF Yaak)	28 (33)	26 (26)	96	54 (55)	1
17 (Big Cr.)	29 (33)	25 (26)	99	49 (55)	2
18 (Boulder)	29 (33)	35 (29)	92	49 (55)	3
19 (Grouse) \1	61 (59)	59 (55)	54	32 (37)	3
20 (North Lightning)	39 (35)	21 (26)	94	61 (61)	1
21(Scotchman)	35 (35)	26 (26)	81	63 (62)	2
22 (Mt. Headley)	38 (33)	37 (35)	89	51 (55)	3
Blue Grass	28 (31)	28 (26)	96	51 (55)	1
Long-Smith	21 (25)	14 (15)	92	73 (67)	1
Kalispell-Granite	29 (33)	27 (26)	96	48 (55)	1
Salmo-Priest	30 (33)	25 (26)	99	66 (64)	2
Sullivan-Hughes	24 (23)	21 (18)	99	59 (61)	1
Myrtle	32 (33)	21 (22)	85	58 (56)	2
Ball-Trout	17 (20)	11 (13)	94	72 (69)	2
Le Clerc	38	58	64	27	3
Lakeshore	81 (82)	51 (56)	86	20 (20)	3

\1 Grouse BMU numbers assume no contribution to core or low road densities from private land.

( )—Represents the Standards that were agreed to in the Forest Plan Amendment for Motorized Access (3/23/2004) and the associated Biological Opinion (2/9/2004). These numbers are target levels, the specific agreements, including timing of achievement, are contained in the amendment and biological opinion.

Appendix E


Rock Creek Project
Possible Mitigation Lands and
Constricted Corridor
(from USDA 1998b)
Legend
Peaks & Mountains
Vent Adit
Exploration Adit
Constricted Corridor
District Boundary
Major Streams
Alternative V Boundary
Mitigation Lands
Cabinet Wilderness Boundary
Major Lakes
Alaska Peak
Howard Lake
Barbee Mountain
N

Endangered Species Act
Section 7 Consultation

BIOLOGICAL OPINION

on the

Part B: Effects to Bull Trout from the Implementation of

PROPOSED ACTIONS ASSOCIATED WITH PLAN OF OPERATION FOR THE

REVETT RC RESOURCES INCORPORATED ROCK CREEK COPPER/SILVER MINE

as proposed by the

U.S. Forest Service, Kootenai National Forest

U.S. Fish and Wildlife Service
Montana Ecological Services Field Office

October 11, 2006

TABLE OF CONTENTS

PART B. BULL TROUT

BACKGROUND B-1
Relationship Of Bull Trout Subpopulations, Core Areas, And Jeopardy Analyses B-2
Change In The Affected Core Area For The Rock Creek Mine Project B-8
Jeopardy Analysis for the Rock Creek Mine Project B-13
Designated Critical Habitat For Bull Trout B-16

DESCRIPTION OF THE PROPOSED ACTION B-18
Bull Trout Action Area B-18
Proposed Action B-18

STATUS OF THE SPECIES/CRITICAL HABITAT B-21
Listing History B-22
Species Description B-22
Life History B-23
Habitat Requirements B-23
Population Dynamics B-27
Status And Distribution B-31
Status Of Designated Critical Habitat B-50

ENVIRONMENTAL BASELINE B-52
Status Of The Species Within The Action Area B-52
Factors Affecting Species Environment Within The Action Area (Population And Habitat Factors) B-62
Environmental Baseline Of Designated Critical Habitat B-63

EFFECTS OF THE ACTION B-65
General Effects Of Mining Operations B-66
Specific Effects Of Mining Operations On Rock Creek B-69
Species Response To The Proposed Action B-79
Effects Of The Action To Designated Critical Habitat B-81

CUMULATIVE EFFECTS B-83
Cumulative Effects To Designated Critical Habitat B-84

CONCLUSION B-85
Jeopardy Analysis B-85
Conclusion For Designated Critical Habitat B-88

INCIDENTAL TAKE STATEMENT B-90
Proposed Mining Plan Of Operations In Lower Clark Fork River Basin-Rock Creek Mine B-91
Reasonable And Prudent Measures B-96
Conservation Recommendations B-102

REINITIATION NOTICE B-103
Heavy Metal Contamination B-103
Groundwater Influence B-104

REFERENCES B-105

APPENDICES B-120

LIST OF FIGURES

Figure B1. Map of the general location of the proposed Rock Creek Mine Facility in northwest Montana. Estimated surface disturbance within the mine claim area is 483 acres. B-3

Figure B2. Map of the three core areas in the lower Clark Fork River Basin. Outlined in blue are the four consolidated core areas that form the Lower Clark Fork Core Area. Estimated surface disturbance within the mine claim area is 483 acres. B-12

Figure B3. Map of the Action Area, Cabinet Gorge Reservoir and major bull trout tributaries – Bull River and Rock Creek. Estimated surface disturbance within the mine claim area is 483 acres. B-15

Figure B4. Map of Designated Bull Trout Critical Habitat in the Rock Creek Watershed (based on the September 26, 2005, Final Rule). Estimated surface disturbance within the mine claim area is 483 acres. B-17

Figure B5. Map of the Rock Creek mine facilities, bull trout redds, and radio-tracking locations. B-20

LIST OF TABLES

Table B1. Hierarchy of Units of Analysis for Bull Trout Jeopardy Analysis for the Rock Creek Mine Project B-7

Table B2. Estimated Annual Implementation Schedule for the Revett Silver Company Rock Creek Mine in Sanders County, Montana. B-19

Table B3. Proposed Surface Disturbance and Features Associated with Rock Creek Mine Project. B-21

Table B4. Baseline Indicators and Documentation for Rock Creek Bull Trout Rated as Functioning Appropriately (FA), Functioning at Risk (FAR), or Functioning at Unacceptable Risk (FUR) (USDA 2001)(Appendix G). B-56

BACKGROUND

In 1998, the U.S. Fish and Wildlife Service (Service) issued the *Biological Opinion for the Effects to Bull Trout from the Continued Implementation of Land and Resource Management Plans and Resource Management Plans as Amended by the Interim Strategies for Managing Fish Producing Watersheds in Eastern Oregon and Washington, Idaho, Western Montana and portions of Nevada (INFISH)* and the *Interim Strategy for Managing Anadromous Fish-producing Watersheds in Eastern Oregon and Washington, Idaho and portions of California (PACFISH*; UDSI 1998d). The 1987 Kootenai National Forest Plan (USDA 1987) was included in the plans addressed in that consultation.

Part B of this document represents the Service's biological opinion for the impacts of the Forest Service action to permit the Rock Creek mine on bull trout (*Salvelinus confluentus)* based on our review of the May 10, 1999, biological assessment and its potential effects on bull trout in the September 2001 Final Environmental Impact Statement (MDEQ and USDA Forest Service 2001) in accordance with section 7 of the Endangered Species Act (Act), as amended (16 USC 1531 et seq.). The Service issued a biological opinion on this federal action on May 9, 2003, which the U.S. District Court set aside and remanded to the Service in March 2005. For analyses in this biological opinion, the Service used new and updated technical information (to July 2006). Significant updates include, but are not limited to the following:

- Designation of critical habitat for bull trout on September 26, 2005;
- In 2004 and 2005, several adult adfluvial bull trout were radio-tracked into Rock Creek;
- Service adoption of new terminology (May, 2005) different from the original listing (1998);
- Service guidance on adverse modification determination of critical habitat, December 9, 2004;
- Service guidance on jeopardy determinations under section 7 of the Act for bull trout, September 26, 2005 (70 FR 56212) (April 20, 2006, guidance memorandum);
- Improved upstream passage of adult bull trout around Cabinet Gorge Dam since 2001;
- Consolidation of four core areas in the lower Clark Fork River into one (July 2006);
- Five-year Status Review, Bull Trout Core Area Conservation Status Assessment (USDI 2005b).

For a complete review of the consultation history for the proposed action, please refer to the Introduction (Part A), Consultation History – Rock Creek mine project, in this biological opinion.

Relationship Of Bull Trout Subpopulations, Core Areas, And Jeopardy Analyses

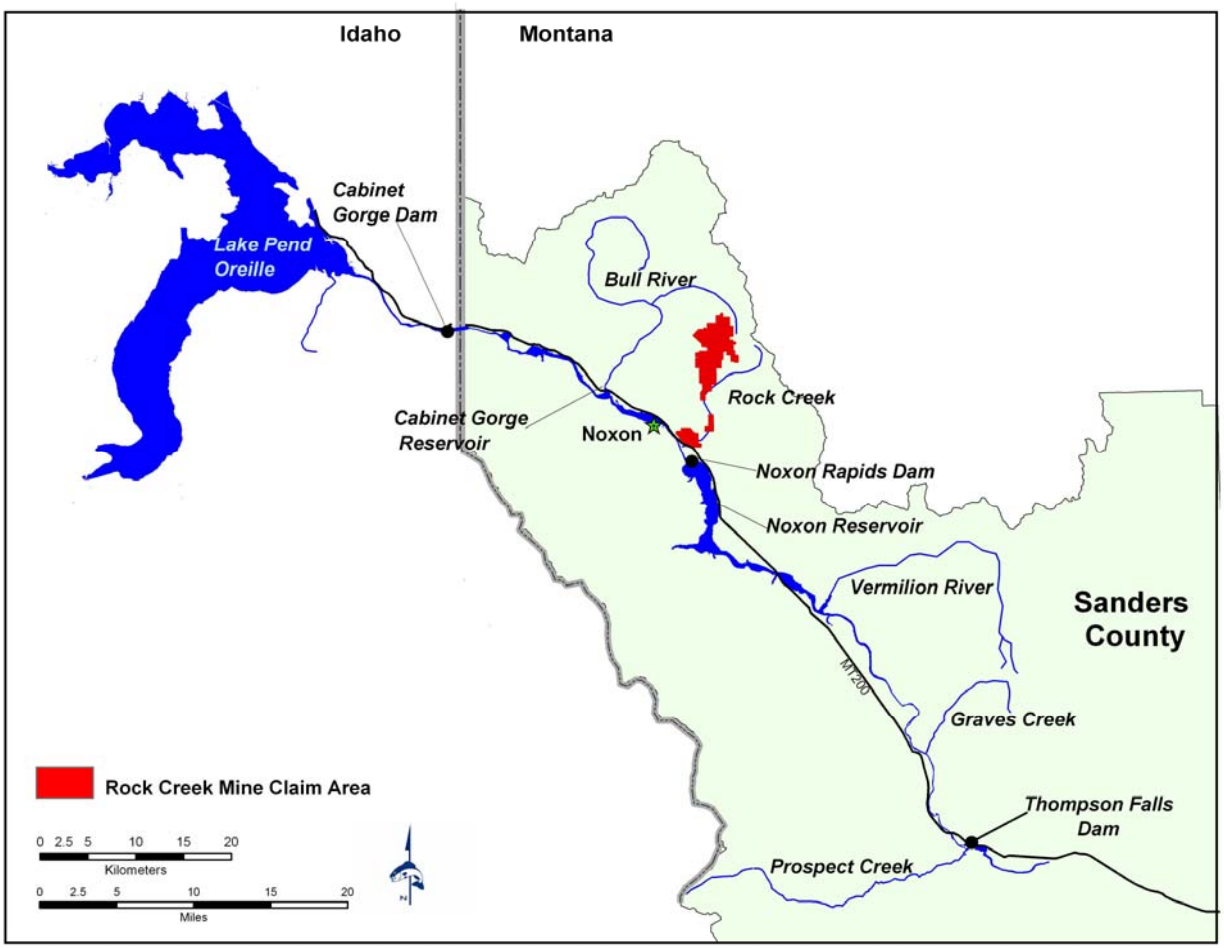
This section addresses the Court's concern regarding the Service's seeming contradiction of earlier findings related to language in previous biological opinions that suggested all bull trout subpopulations were critical to the Columbia River Distinct Population Segment (DPS). The Court indicated that the Service departed from this position (without explanation) when in 2003 the Service stated that extirpation of the Cabinet Gorge subpopulation was not likely to jeopardize the Columbia River DPS. The Service has since discontinued the use of the "subpopulation" terminology and adopted different terminology and units of analysis (i.e., core areas) for jeopardy analyses based on improved scientific information since the listing of bull trout and development of the Draft Bull Trout Recovery Plan. In this biological opinion, we describe the current status of the affected bull trout local population that occupies the Rock Creek watershed and the associated core area (an interacting group of local populations). Recent scientific information on the status of Rock Creek bull trout shows that the adfluvial component of bull trout has improved and has been partially restored due to the upstream and downstream fish passage that has recently been occurring around Cabinet Gorge Dam.

Subpopulations in the original listing of bull trout

Bull trout were listed as threatened in the Columbia and Klamath River Distinct Population Segments (DPS) on June 10, 1998 (50 CFR 17, Vol. 63(111):31647-31673). Concurrently, a proposed rule was published to list all remaining bull trout within three additional DPS's in the contiguous U.S. (Coastal – Puget Sound, Jarbidge River, and St. Mary – Belly Rivers). The initial listing rule for the Klamath and Columbia described 141 subpopulations of bull trout in the Columbia River DPS. A subpopulation was considered to be "a reproductively isolated group of bull trout that spawns within a particular area of a river system." For the action area (described below), the supporting documentation for the original 1998 listing rule (USDI 1998c) described Cabinet Gorge Reservoir as a subpopulation within the Clark Fork River Basin of the Columbia River DPS. A map of the general location of the proposed action in northwest Montana is shown in Figure B1.

In November, 1999, a final rule determined threatened status for "all populations of bull trout within the United States," thus making the original listing coterminous (50 CFR 17, Vol. 64(210):58910-58936, meaning the five DPSs were consolidated into one listed taxon. Furthermore this rule states that: "for the purposes of consultation and recovery, we recognize these five DPS's (Columbia River, Klamath River, Coastal-Puget Sound, Jarbridge River, and St Mary-Belly River) as interim recovery units" because of their uniqueness and significance. A discussion in the response to comments within that final rule (see Issue 3 in 64 FR 58918-58919) acknowledged the difficulty and some of the challenges in consistently applying subpopulation and metapopulation concepts to bull trout.

Figure B1. Map of the general location of the proposed Rock Creek Mine Facility in northwest Montana. Estimated surface disturbance within the mine claim area is 483 acres.



Conflict with the use of subpopulations for section 7 consultation

The Court pointed out that some previously issued biological opinions contained language that indicated the loss of a bull trout subpopulation would cause jeopardy to the DPS, and asked for further explanation of why the Service departed from this position in the 2003 Rock Creek biological opinion. In response to the Court's remand, our evaluation substantiated the Court's conclusion that some biological opinions were issued with this language while others were not. During preparation of the 2003 Rock Creek biological opinion, we were made aware through an email message from Region-1 of the Service that Region-1 had drafted an approach to jeopardy analyses which was intended to be used to address section 7 consultation until the Draft Recovery Plan was finalized (2/2/01 email from John Young, FWS, Portland Regional Office; see email attachment marked draft; Appendix A in this opinion is a copy of this email). The email message discussed the importance of a subpopulation to the DPS and the attachment was a document marked "Draft," that contained language that was proposed to be used in the Status of

the Species section of biological opinions addressing effects to bull trout (see Appendix A). This proposed draft language stated that loss of a subpopulation "constitutes an unacceptable risk to the DPS," which has been interpreted and incorporated into some biological opinions as meaning the "loss of a subpopulation would cause jeopardy to the DPS." Because this was "draft" language, we did not use this language in the 2003 biological opinion, and in fact, recognized that the language may not be applicable to circumstances for the Rock Creek mine project and other situations in Montana (see below). However, as the Court found, other offices did use this draft language in their biological opinions for actions affecting bull trout resulting in an apparent inconsistency among biological opinions. Consequently, we requested updated information in an email to Region-1 (email to John Young, Portland Regional Office, 5/20/05). The response from Region-1 stated *"In light of new information available since the 1998 listing that has been incorporated into the draft Recovery Plan, which has been provided for public and agency comment on two occasions, and subjected to two separate peer reviews, my position is that it is now inappropriate to base bull trout conservation status and conservation requirement conclusions on the subpopulations identified in 1998."* Additionally, the Service has since discontinued the use of "subpopulation" terminology as a unit of analysis for jeopardy determinations as explained below.

The Court also raised a concern whether bull trout were suffering from "death by a thousand pinpricks" as a result of incidental take authorized by the many biological opinions on bull trout. When preparing the 2003 Rock Creek biological opinion, we recognized that each previous biological opinion incorporated updated environmental baselines to take into account the effects of the federal actions including "incidental take" that had been authorized under previous biological opinions. Updating environmental baselines based on previously proposed actions and associated incidental take is a requirement in preparing a biological opinion (see the Service's Consultation Handbook, pg 4-1 and pg 4-22, March 1998). Updating the baseline conditions on bull trout (population and habitat) is a regular procedure. To assist the Service in that regard, the Service has required updated baseline conditions from action agencies, including consideration of impacts from previous actions, as a procedure in the guidance document for federal land management agencies to use when assessing the effects of their actions on bull trout (*A Framework to Assist in Making Endangered Species Act Determinations of Effect for Individual or Grouped Actions at the Bull Trout Subpopulation Watershed Scale)*(Framework)(USDI 1998). During consultation with the federal action agency, it is routine for the Service to ensure that it has incorporated an updated baseline as required by the Framework. Therefore, all previous biological opinions had been considered in the updated baseline before another biological opinion was issued for any individual action or project affecting a subpopulation.

At the time of preparing the 2003 Rock Creek biological opinion there were no biological opinions within the range of bull trout with other than a no-jeopardy determination. Further, these actions did not adversely affect bull trout populations to the extent of loss of a subpopulation (see Status of the Species section, Consulted-on Effects Analysis of Previous Biological Opinions, for more detailed explanation). By extension, because all previous biological opinions were to have updated baselines and were no-jeopardy determinations, we concluded that the continued long-term survival and existence of the species had not been appreciably reduced range-wide. Subsequently, a recent assessment of all of the biological opinions (explained in more detail below in the Status of the Species section) from the time of

listing until August 2003 (137 biological opinions) confirmed that no actions that have undergone section 7 consultation, considered either singly or cumulatively, will appreciably reduce the likelihood of survival and recovery of the bull trout or result in the loss of any subpopulations (USDI 2003) (Appendix B). We have also reviewed all biological opinions issued in the affected core area (Lower Clark Fork Core Area) since August 2003 and confirmed that no actions that have undergone section 7 consultation considered either singly or cumulatively, will appreciably reduce the likelihood of survival and recovery of the bull trout or result in the loss of any subpopulation. In fact, many of them will benefit bull trout.

Discontinued use of subpopulations to address section 7 consultation

Prior to 2005, certain aspects of the original subpopulation classification system were considered problematic in application. For example, in the Bitterroot River watershed the listing described 27 separate subpopulations of bull trout, which were essentially isolated headwater populations that developed as an artifact of human-caused fragmentation of the habitat. Under natural conditions, we believed those subpopulations formed a single interacting group. The Service continued to work on these classification challenges, and in 2002 released a draft recovery plan. The Draft Bull Trout Recovery Plan (USDI 2002b) describes an organizational hierarchy for bull trout at nested spatial levels that include *recovery units, core areas, and local populations* (the lowest rung in the hierarchical --organizational level). Twenty-seven major watersheds were referred to as recovery units; terminology that has since been revised and they are now referred to as management units. The following definitions are from the Draft Bull Trout Recovery Plan (USDI 2002b):

- Local population: A group of bull trout that spawn within a particular stream or portion of a stream system. Multiple local populations may exist within a core area. A local population is considered to be the smallest group of fish that is known to represent an interacting reproductive unit. In most areas a local population is represented by a single headwater tributary or complex of headwater tributaries where spawning occurs. Gene flow may occur between local populations (*e.g.*, those within a core population), but is assumed to be infrequent compared with that among individuals within a local population.

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

- Recovery unit / management unit: Management units are the major units for managing recovery efforts; management units were described (as recovery units) in separate chapters in the draft recovery plan (USDI 2002b). Most management units, as proposed, consisted of one or more major river basins. Several factors were considered in our identifying management units, for example, biological and genetic factors, political boundaries, and ongoing conservation efforts. In some instances, management unit boundaries were modified to maximize efficiency of established watershed groups, encompass areas of common threats, or accommodate other logistic concerns. Some proposed management units included portions of mainstem rivers (e.g., Columbia and Snake rivers) when biological evidence warranted such inclusion.

Within each management unit, there are one or more core areas, which are intended to reflect the metapopulation structure of bull trout. By definition, a core area contains all of the necessary constituent elements for the long-term security of bull trout. Each core area represents the closest approximation of a biologically functioning unit for bull trout and as described below constitutes the unit on which the Service is gauging the status of bull trout. The Draft Bull Trout Recovery Plan recognizes core areas as the population units that are necessary to provide for bull trout biological needs in relation to genetic and phenotypic diversity, and spreading the risk of extinction caused by stochastic events. Peer review of the Draft Bull Trout Recovery Plan supported this approach. A panel of scientists invited to participate in the bull trout 5-year review process concluded that core areas are appropriate units of analysis by which threats to the bull trout and recovery standards should be measured [September 26, 2005, Final Rule Designating Critical Habitat for Bull Trout (FR 70, No 185, 56211-56311); USFWS, staff memorandum, *in litt.* 5/20/2005). Furthermore, in a staff memorandum issued by the Assistant Regional Directors of Ecological Service for Regions 1 and 6 (USFWS, *in litt*. 5/20/2005) and in the September 26, 2005 Final Rule Designating Critical Habitat for Bull Trout (FR 70, No 185, 56211-56311), additional guidance was given on the appropriate use of terminology to promote consistency in carrying out Service consultation responsibilities with respect to bull trout.

At the time of publication of the Draft Bull Trout Recovery Plan (October 2002), there were 27 recovery units described. Almost immediately upon publication, the Service recognized that these units may not meet the Service standard for "recovery units" and decided to call them "management units." Consequently, "recovery units" as described in the Draft Bull Trout Recovery Plan are interchangeable with "management units" and these units are used throughout this biological opinion. To clarify further, as mentioned above the previously five DPSs described in the June 10, 1998, listing of bull trout (FR 63, No.111, 31647-31674) were subsequently recognized as "interim recovery units" in the November 1, 1999, final listing rule for bull trout (FR 64, No. 210, 58910-58936). Note that "recovery units" as described in the Draft Bull Trout Recovery Plan should not be confused with "interim recovery units" as described in the aforementioned guidance (USFWS, *in litt*. 5/20/2005) and in the September 26, 2005 Final Rule Designating Critical Habitat for Bull Trout (FR 70, No 185, 56211-56311). These unit designations (recovery units and interim recovery units) are not the same in that the designations reflect different geographic scales ("recovery units" are interchangeable with "management units" and "interim recovery units" are interchangeable with "DPSs").

In summary, until the Draft Bull Trout Recovery Plan is finalized, the Service has adopted the use of *local population, core area, management unit, and interim recovery unit* for purposes of consultation and recovery. Table B1 illustrates the language used by the Service for purposes of consultation for bull trout, including this biological opinion, as well as the hierarchal relationships between these geographical units of analysis (see below for further explanation).

Table B1. Hierarchy of Units of Analysis for Bull Trout Jeopardy Analysis for the Rock Creek Mine Project

Name	Hierarchal Relationship
Columbia River Interim Recovery Unit	One of 5 interim recovery units in the range of the species within the coterminous United States
Clark Fork River Management Unit	One of 23 management units in the Columbia River Interim Recovery Unit
Lower Clark Fork Core Area	One of 35 core areas in the Clark Fork River Management Unit (adjusted for 4 original core areas consolidated into one - Lower Clark Fork Core Area)
Rock Creek Local Population	One of 14 local populations in the Lower Clark Fork Core Area
East and West Fork Rock Creek	Tributaries to Rock Creek

Conducting jeopardy analyses for bull trout

Jeopardy determinations for bull trout are made at the scale of the listed entity, which is the coterminous United States population (64 FR 58910). This follows the April 20, 2006, analytical framework guidance described in the Service's memorandum to Ecological Services Project Leaders in Idaho, Oregon and Washington from the Assistant Regional Director – Ecological Services, Region 1 (Appendix C). The guidance indicates that if an action "impairs or precludes the capacity of a recovery unit from providing both the survival and recovery function assigned to it, that action may represent jeopardy to the species." The guidance provides an analytical framework with direction to consider the following: 1) in the status section concisely discuss the relationship between each of the interim recovery units and the survival recovery of the coterminous United States population of bull trout; 2) in the baseline section discuss the relationship between the action area and recovery function of the affected interim recovery unit(s), in addition to recognizing the importance of viable core areas within the interim recovery unit(s); 3) in the effects of the action and cumulative effects sections address the significance of adverse and beneficial effects in relation to the role of the action area in the conservation of the bull trout at the interim recovery unit scale; and 4) in the conclusion section discuss how all the effects of the proposed action are likely to influence the survival and recovery function assigned to the interim recovery unit(s) as the basis for the jeopardy determination (i.e., is the proposed action likely to appreciably reduce both survival and recovery of the coterminous United States population in the wild).

Within the context of the jeopardy analytical framework (Appendix C), the Service uses the hierarchal relationship between units of analysis (i.e., the geographical subdivisions of local populations, core areas, management units and interim recovery units) defined in the Draft Recovery Plan to characterize effects of the proposed action beginning at the lowest level or smallest scale (local population) and then progresses toward the highest level or largest scale (Interim Recovery Unit). The hierarchal relationship between units of analysis is used to determine whether the proposed action is likely to jeopardize the survival and recovery of bull trout. Should the adverse effects of the proposed action not rise to the level where it appreciably reduces both survival and recovery of the species at a lower scale, such as the local or the core population, by deduction the proposed action could not jeopardize bull trout at the higher scale of the coterminous United States (i.e., rangewide). Therefore, the determination would result in a no-jeopardy finding. However, should a proposed action produce adverse effects that are determined to appreciably reduce both survival and recovery of the species at a lower scale of analysis, then further analysis is warranted at the next higher scale.

Change In The Affected Core Area For The Rock Creek Mine Project

The Draft Bull Trout Recovery Plan (USFWS 2002) described the inherent complexity of designating bull trout core areas on the portions of the Clark Fork River in Montana in watersheds that were historically connected, but are now fragmented by dams: "For fluvial or anadromous populations, delineating core areas requires that some judgment calls be made in determining the extent of historical and current connectivity of migratory habitat, while considering natural and manmade barriers, survey and movement data, and genetic analysis." For resident populations, we must consider whether local populations are remnants from previously existing migratory bull trout and whether reconnecting fragmented habitat would restore a migratory core area since some local populations may not have a history of a migratory component and instead may have been isolated historically during the glacial retreat. At the time the draft recovery plan was written (circa 2000-2002) long-term bull trout trend monitoring data was unavailable for most local populations in the lower Clark Fork River basin (see USFWS 2002, Chapter 3, Table 1, page 27) and the fish passage projects at Cabinet Gorge and Noxon Dams were only in the initial stages. We also did not have extensive genetic information, and survey and movement data were generally not yet available. As a partial consequence of the limited data, in the Draft Bull Trout Recovery Plan (USFWS 2002) the Service took a relatively conservative approach in designating core areas within the Clark Fork drainage. Generally, we adopted a structure that reflected the existing fragmented status of bull trout populations as they were prior to 2002 (see USFWS 2002, Chapter 3, Table 2, pages 124-128).

With the further scrutiny mandated by the Court, and additional analysis presented in this biological opinion, we have reanalyzed whether connectivity provided at both Noxon and Cabinet Gorge dams in the Lower Clark Fork Core Area by the Avista fish passage program is now sufficient, in concert with other actions, to consider these fragmented core areas as no longer isolated genetically and in terms of population dynamics.

The Avista fish passage program originated as part of the 1999 Clark Fork Settlement Agreement for relicensing by the Federal Energy Regulatory Commission (FERC) of Cabinet and Noxon dams, which are owned and operated by Avista Corporation for hydropower. Under the FERC

re-licensing of the dam projects, Avista is required to mitigate for the impacts to native fish, including bull trout. The dams had completely blocked migrating adult bull trout from moving upstream in the lower Clark Fork River, which has resulted in significant losses and has been identified as the major threat to bull trout in this area (USDI 2002). Restoring connectivity in the system by providing timely fish passage at the dams is a major objective under Avista's Fish Passage/Native Salmonid Restoration Plan and a mandatory term and condition in the Service's biological opinion on the Avista projects to minimize effects to bull trout. The fish passage component of the program began in 2000 and consists of trapping juvenile bull trout from tributary streams in Montana and transporting a portion of them downstream of the dams to the Lake Pend Oreille system in Idaho where historically these fish would have reared in the lake for 1-3 years before attempting to return to their stream of origin in Montana to spawn. A second aspect of the fish passage program is to capture returning adult bull trout at Cabinet Gorge Dam, install radio transmitters, and transport them around the dams to a location where they can access their stream of origin for spawning. The release location is based on genetic analysis and assignment while in captivity (a bull trout's natal stream can be identified within 48 hours through genetic testing of a fish scale). The Avista fish passage program is well-funded with full-time dedicated staff to implement the trap and transport of bull trout for the entire 45-year licensing period. Currently, Avista is planning and designing a permanent fish passage facility for both dams.

The Recovery Criteria in the Draft Bull Trout Recovery Plan placed a strong emphasis on the restoration of biological connectivity for bull trout in the Clark Fork drainage. Elsewhere in this opinion we describe the trap and transport fish passage actions undertaken by the Avista program (see *Status of the local bull trout population in the Rock Creek watershed* below). It has documented successful passage of adult bull trout upstream (174 total in 2001 through 2005, between 29 and 42 annually) of Cabinet Gorge and Noxon dams. Furthermore, the Avista program has reported that in the last few years some radio-tagged adult bull trout passed upstream over the dams have successfully spawned in tributary streams. The refinement of genetic techniques now allow the accurate assignment of bull trout to certain tributaries where they were born and as adults are attempting to return in order to spawn. Adult bull trout that are captured and radio-tagged and then transported around the dams in trucks and then released, are verifying those genetic assignments through collection of telemetry data. In short, functional biological connectivity has been and continues to be progressing through successful fish passage efforts.

While the numbers of bull trout successfully passed upstream has not been large, due to their fecundity (i.e., each fish carrying several thousand eggs) each fish potentially makes a substantial genetic contribution to the reconnected population. Numbers of juvenile bull trout captured from Montana tributaries and either transported downstream (to the Clark Fork River downstream of Cabinet Gorge Dam) or tagged and allowed to volitionally migrate were 87 in 2001, 416 in 2002, 213 in 2003, 210 in 2004, and 323 in 2005 for a total of 1,249 fish in the first five years of implementation (LaDana Hintz, Avista, pers. comm., July 6, 2006). These numbers cannot be considered trend indicators, due to unequal trapping effort by year, but they do indicate substantial progress in providing downstream as well as upstream connectivity through the dams. In 2006, for the first time, a fish trapped and tagged as a juvenile in Montana (Bull River screw trap on 6/20/02 @ 7.5 inches total length) was captured as an adult at the base of Cabinet Gorge

Dam (LaDana Hintz, Avista, pers. comm., July 5, 2006). This is significant because it demonstrates that juvenile bull trout can pass through Cabinet Gorge Dam and survive to return as an adult and are doing so. This particular fish was not transported around the dam, instead it was released back into the Bull River, which is part of the protocol for this program – all captured fish are marked, but half are transported around the Cabinet Gorge Dam and half are released back into the river.

In the Recovery Measures Narrative portion of the Draft Bull Trout Recovery Plan (see USFWS 2002, Chapter 3, pages 162-168) there are a series of lists of *actions needed* to achieve recovery of bull trout. Two of these recovery tasks, both listed as priority one actions under subheading 1.4 – *Operate dams to minimize negative effects on bull trout.* - are as follows:

> 1.4.1 Evaluate and restore upstream fish passage at mainstem Clark Fork and Pend Oreille River dams. Investigate and implement upstream fish passage at Albeni Falls (USFWS Biological Opinion), Cabinet Gorge and Noxon Rapids (Avista fish passage protection, mitigation, and enhancement measures), and Thompson Falls Dams, as needed, to reconnect fragmented core habitat of bull trout with Lake Pend Oreille.
>
> 1.4.2 Provide safe passage downstream through dams and reservoirs. Provide safe downstream fish passage from Montana tributaries through Thompson Falls, Noxon Rapids, and Cabinet Gorge Dams and Reservoirs for juvenile and adult bull trout migrating to Lake Pend Oreille.

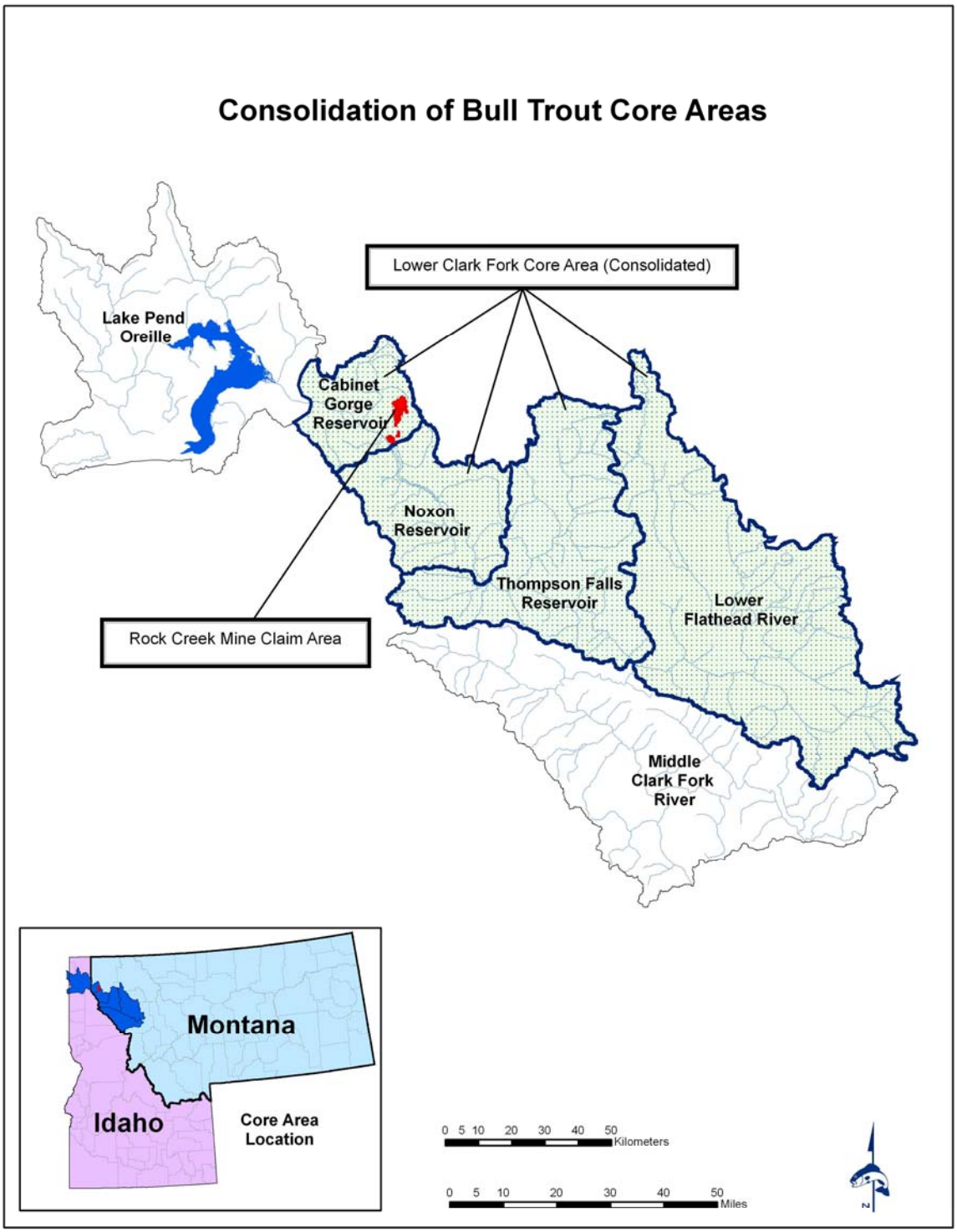
As described in the Draft Bull Trout Recovery Plan (see USFWS 2002, Chapter 3, Recovery Goals and Objectives, pages 129-140): "The specific goal of the bull trout recovery plan is to ensure the long-term persistence of self-sustaining, complex, interacting groups of bull trout distributed throughout the Clark Fork River basin so that the species can be delisted. Specifically, the recovery subunit teams for the four Clark Fork River subunits (Upper Clark Fork, Lower Clark Fork, Flathead, and Priest) adopted the goal of a sustained net increase in bull trout abundance, and increased distribution of some local populations, within existing core areas." Further, the Lower Clark Fork River was designated as a future primary core area under recovered conditions. As described in the draft Recovery Plan: "Lower Clark Fork River (includes four currently fragmented population segments: Lower Flathead River, Thompson Falls Reservoir, Noxon Reservoir, and Cabinet Gorge Reservoir; these segments are currently treated as separate core areas). Note that these core areas were historically connected and must be functionally rejoined under recovered conditions."

It is the judgment of the Service, that based on best available science as described above, Recovery Measures 1.4.1 and 1.4.2 are now being partially met. Successful upstream fish passage has been restored to a significant degree by the trap and transport program. The percentage of the total migrant fish that are seeking their natal spawning stream and that are passed is currently unquantifiable and the ultimate degree of effectiveness of this program under full implementation remains to be determined. However, many of the fish that have been passed appear to be contributing substantially to the production of juveniles in upstream tributaries. In combination with the downstream trap and transport program, it has been demonstrated that survival of a substantial (again unquantified) portion of the fish volitionally migrating through

the turbines or spill passage is also occurring. Not all fish passing through turbines are killed and depending on the type of turbine (e.g., modern Kaplan turbines with adjustable blades), survival of small fish can range from 87 to 100 percent (Kleinschmidt Associates 1996, RMC 1994, Oligher and Donaldson 1966). Future returns will dictate whether downstream trap and transport of juvenile bull trout from Montana tributaries is effective or necessary. In conclusion, it is now evident that a significant level of functional connectivity has been reestablished in the Lower Clark Fork. Neither the upstream nor the downstream passage programs have been fully developed, but it is anticipated that gains in efficiency will continue, given the documented successes thus far and the major commitments of resources already in place.

Based in part on the above record of scientific analysis, with the imperative to reanalyze the current status of bull trout presented by the recent Court actions, the Service has reconsidered the designation of core areas in the Lower Clark Fork. We have made the determination that the four previously designated core areas in Montana that had been fragmented from their natural connectivity by the dams at Cabinet Gorge, Noxon, and Thompson Falls (Lower Flathead River, Thompson Falls Reservoir, Noxon Reservoir, and Cabinet Gorge Reservoir) should be considered rejoined to form a single contiguous core area – the Lower Clark Fork core area (memorandum to the ARD, Ecological Services, Region 1, Portland, OR, from Field Supervisor, Montana Ecological Services, Helena, MT., July 14, 2006) (Appendix D) (Figure B2). Furthermore, Region 1 of the Service (lead Region for bull trout), supported the decision to consolidate the four core areas (email from Patrick Sousa, Program Manager, Endangered Species, Region 1, Portland, Oregon to Mike Stempel, ARD, Ecological Services, Region 6, Denver, Colorado; dated 8/23/06). This action by the Service should have no significant effect in changing the emphasis or priority of any of the prescribed recovery actions in the Lower Clark Fork. Rather, it is a significant acknowledgment that, due mostly to the fish passage efforts, the recovery of bull trout resources in the Lower Clark Fork have progressed to a measurable extent toward the specific recovery goal to: "ensure the long-term persistence of self-sustaining, complex, interacting groups of bull trout distributed throughout the Clark Fork River basin so that the species can be delisted." It is also a recognition that the four previously designated core areas did not, by themselves, constitute true core areas - that is, biologically functioning units that contained all of the necessary constituent elements for the long-term security of bull trout.

Figure B2. Map of the three core areas in the lower Clark Fork River Basin. Outlined in blue are the four consolidated core areas that form the Lower Clark Fork Core Area. Estimated surface disturbance within the mine claim area is 483 acres.



In the newly designated Lower Clark Fork Core Area, the collective number of local populations currently identified is 14 (7 in the lower Flathead in Mission and Jocko drainages; 2 in Thompson River; 3 in Noxon Reservoir; and 2 in Cabinet Gorge Reservoir in Rock Creek and the Bull River). The recovery criteria presented in the Draft Bull Trout Recovery Plan (see USFWS 2002, Chapter 3, Table 3, page 131) already treated this area as a consolidated primary core area, because restored connectivity was considered by the Recovery Team to be necessary for long-term maintenance. The numeric standards that are necessary to achieve recovered abundance (Table 3 in the Draft Recovery Plan) call for a total of 1,000 adult bull trout in the consolidated Lower Clark Fork Core Area, with at least five local populations each supporting over 100 adult fish. Current population levels remain well below those standards. Current levels are estimated to be around 300 adults and no local populations with 100 adults occur in the core area (USDI 2002).

In summarizing this section, the Cabinet Gorge population of bull trout had been artificially isolated since the mid-1950s, by Cabinet Gorge Dam (downstream) and Noxon Rapids Dam (upstream). Under natural conditions (pre-dam), migratory fish found in the waters of the lower Clark Fork River were part of the Lake Pend Oreille Core Area and the two spawning streams, the Bull River and Rock Creek, represented two of many local populations of the Lake Pend Oreille Core Area (Figure B2). Currently, the long-term isolation and lack of upstream fish passage at the dams has been addressed and the functional connectivity over the three dams of the lower Clark Fork through trap and transport and eventual permanent artificial fish passage is in the process of being restored amongst the waters of Lake Pend Oreille, Cabinet Gorge Reservoir, Noxon Reservoir, Thompson Falls Reservoir, and the lower Flathead River (including the Jocko watershed and all waters downstream of Kerr Dam on Flathead lake). According to the Draft Bull Trout Recovery plan this is necessary to restore genetic connectivity and ensure the long-term persistence of the bull trout population in the Lower Clark Fork River Basin.

Jeopardy Analysis for the Rock Creek Mine Project

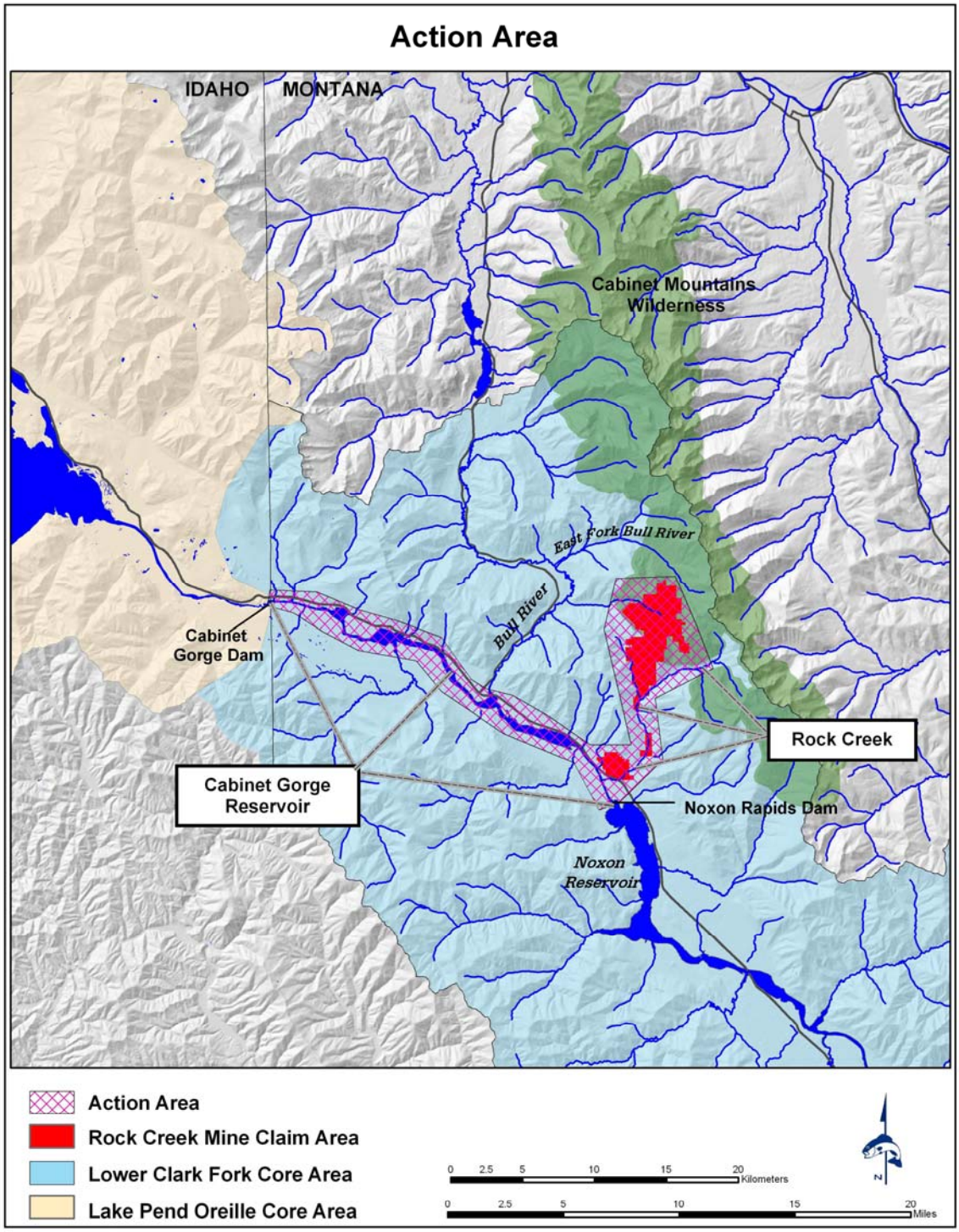
We have relied heavily on the importance of the core area population as described in the current Draft Bull Trout Recovery Plan because core areas are the classification units that relate functionally to the survival and recovery of the bull trout, as described below. The analysis not only focuses on the Lower Clark Fork Core Area population but also on the habitat conditions necessary to support it. The September 26, 2005, Final Rule Designating Critical Habitat for Bull Trout (FR 70, No 185, 56211-56311) provides guidance that indicates when a proposed action is "incompatible with the viability of the affected core area population(s), inclusive of associated habitat conditions, a jeopardy finding is considered to be warranted."

The Clark Fork River Management Unit is amongst the largest and most diverse across the species range and contains the highest number of core areas of any management unit, due in large part to the preponderance of isolated headwater lakes in the system. In the Clark Fork River Management Unit (USDI 2002d), which includes all of the Clark Fork River Basin from Albeni Falls Dam (outlet of Lake Pend Oreille) upstream to Montana headwaters, the Service described 38 core areas for bull trout. However, the recent consolidation of the aforementioned four core areas changes the total number of core areas to 35, three of which are in the Lower Clark Fork

River Basin (see Figure B2). Bull trout within the larger and more diverse core areas are typically characterized by having relatively small amounts of genetic diversity within a local population but high levels of divergence between them (see for example Spruell *et al.* 1999, Kanda and Allendorf 2001, Neraas and Spruell 2001). At the lowest rung in the hierarchical organizational level, the Draft Bull Trout Recovery Plan (USDI 2002c) describes groups of bull trout that spawn together in tributaries as local populations. There are approximately 150 local populations of bull trout currently described in the Clark Fork River Management Unit (USDI 2002d).

The jeopardy analysis in this biological opinion follows the organizational hierarchy depicted in Table B1, which identifies Rock Creek as one of the 14 local populations in the affected core area. The Lower Clark Fork Core Area (see Figure B2) is identified as the only core area potentially affected by the proposed action, and is one of 35 core areas in the Clark Fork River Management Unit. The potential effects of the proposed action are addressed in detail progressively at each higher scale as warranted. Should the detailed analysis of a particular scale result in a finding of no significant adverse effect (i.e., no-jeopardy), no further detailed analysis at the next higher scale is necessary. For the jeopardy analysis in this biological opinion, we evaluated the potential impacts from the proposed action to bull trout and bull trout habitat in the action area (Figure B3) beginning at the lowest level or scale in the hierarchy – East and West Fork Rock Creek. We found that adverse impacts to habitat and bull trout inhabiting these two tributaries are likely to occur. Consequently, we assessed the impacts at the next higher level, which includes all of the Rock Creek watershed (including all tributaries to the mainstem) and the associated Rock Creek local population occupying the mainstem and its tributaries. This assessment suggested that adverse impacts may occur at the watershed scale and have an adverse impact on the local population and its habitat. However, at this level our detailed analysis of impacts showed that the severity of the adverse effect(s) would not make the local population of bull trout highly vulnerable to loss. In addition, existing baseline habitat conditions in the watershed would not be degraded enough to cause significant impairment of essential functions of feeding, breeding, and sheltering for the Rock Creek bull trout population throughout the entire watershed. Habitat impacts were limited in terms of duration and extent - only portions of the watershed would be affected and only certain habitat parameters, primarily sediment deposition in spawning areas, and that impairment of this sediment function would be moderate and confined largely to the 5-year construction period (see Effects of the Action section below). Subsequent to this assessment in the jeopardy analysis, we determined that no further analysis at the core area scale was needed because the risk of loss of the local bull trout population was found to be small. However, we did address why at the core area scale, the impacts from the proposed action are even less consequential than at the local population scale and even less likely to appreciably reduce the likelihood of survival and recovery of bull trout.

Figure B3. Map of the Action Area, Cabinet Gorge Reservoir and major bull trout tributaries – Bull River and Rock Creek. Estimated surface disturbance within the mine claim area is 483 acres.



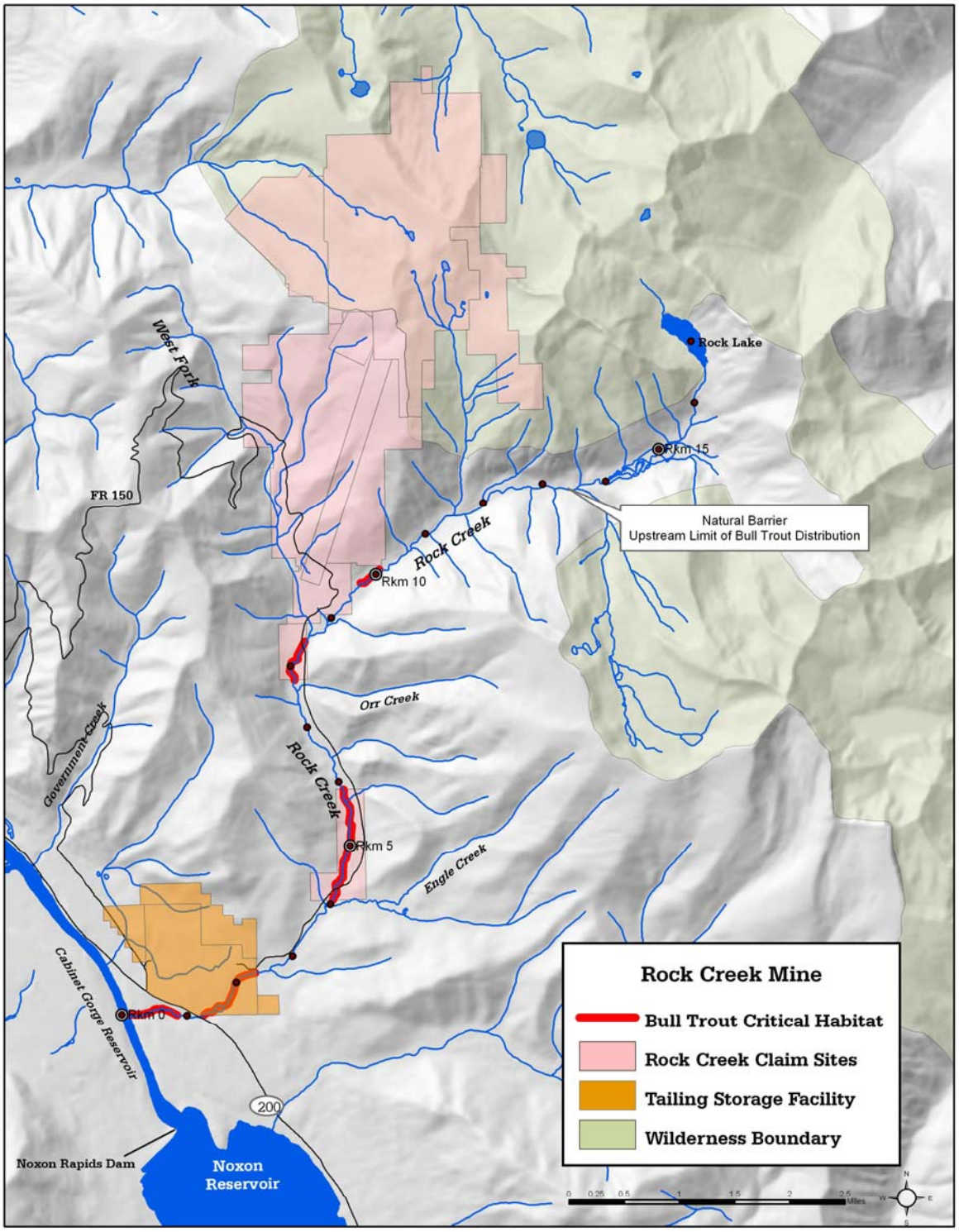
Designated Critical Habitat For Bull Trout

On September 26, 2005, the Service published the final rule designating critical habitat for bull trout for the Klamath River, Columbia River, Jarbridge River, Coastal-Puget Sound, and Saint Mary-Belly River populations of bull trout (FR 70, No 185, 56211-56311). Guidance for analysis of designated critical habitat for bull trout was provided in the final rule and in the Director's December 9, 2004, memorandum, which is in response to litigation on the regulatory standard for determining whether proposed Federal agency actions are likely to result in the "destruction or adverse modification" of designated critical habitat under Section 7(a)(2) of the Act (Appendix E). This memorandum outlines interim measures for conducting Section 7 consultations pending the adoption of any new regulatory definition of "destruction or adverse modification." Consequently, this biological opinion does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 CFR 402.02. Instead, we have relied upon the statutory provisions of the Act to complete the following analysis with respect to critical habitat.

The key factor related to adverse modification determination of designated critical habitat is whether, with implementation of the proposed Federal action, the affected critical habitat would remain functional (i.e. or retain the current ability for the primary constituent elements to be functionally established) to serve the intended conservation role for the species. In general, conservation of critical habitat units supports a viable core area.

The lower Clark Fork River basin contains 355.28 stream miles and 24,065 acres of lakes/reservoirs designated as critical habitat for bull trout. Within the Lower Clark Fork Core Area there are 135 stream miles of critical habitat and of this total, 2.88 stream miles occur in five specific stream segments of Rock Creek within the action area as indicated in Figure B4. As described in the final rule, critical habitat applies only to the stream channel as defined by its ordinary high-water line according to the U.S. Army Corps of Engineers in 33 CFR 329.11. If not defined, the width of the stream channel based on the bank-full elevation will be used. Critical habitat does not extend into the floodplain or into adjacent land.

Figure B4. Map of Designated Bull Trout Critical Habitat in the Rock Creek Watershed (based on the September 26, 2005, Final Rule). Estimated surface disturbance within the mine claim area is 483 acres.



DESCRIPTION OF THE PROPOSED ACTION

Bull Trout Action Area

The action area for Part B of this biological opinion includes the Rock Creek drainage and all of Cabinet Gorge Reservoir. The Rock Creek drainage would contain all of the proposed mine activity. The Bull River drainage, which is a major tributary to Cabinet Gorge Reservoir, is excluded from the action area because no impacts are anticipated in that drainage as a result of the proposed action. Cabinet Gorge Dam is reasoned to be the downstream extent of the action area as the dam would likely block downstream transport of bedload and sediment produced by the proposed action. In other words, under normal operations, the anticipated biological effects of the proposed action would be limited to those bull trout that inhabit Rock Creek and Cabinet Gorge Reservoir downstream to the dam.

The Draft Bull Trout Recovery Plan for the Clark Fork River Management Unit (USDI 2002c) identifies one bull trout core area (Cabinet Gorge Reservoir) and two local populations (Rock Creek and Bull River) within the action area. Noxon Rapids and Cabinet Gorge dams form the upper and lower bounds, respectively. The action area is considered to be the Cabinet Gorge Reservoir and the Rock Creek drainage, which occur within the recently consolidated Lower Clark Fork Core Area (Appendix D).

Proposed Action

The proposed Rock Creek Mine would be a 10,000-ton per day underground copper and silver mine in northwestern Montana. The mine, mill, and other facilities would occur in Sanders County about 13 miles northeast of the town of Noxon (see Figure B1). The mine originally was proposed by ASARCO Incorporated, but was sold to the Sterling Mining Company in 1999. In October of 2003 the Company changed its name from the Sterling Mining Company to Revett Silver Company, a Montana Company, followed by the incorporation of its wholly owned subsidiary RC Resources, Inc (Revett), also a Montana Company and the new project proponent.

The proposed action is Alternative V, the Forest's preferred alternative to Revett's proposed mine plan. The complete description of Alternative V is provided in the FEIS (MDEQ and USDA Forest Service 2001). Here we summarize only major features of the proposed action. The proposed action for the mine includes the development of an evaluation adit, a 5.5- year construction period, a 27.5-year operation/production period, and a 2-year reclamation period, for a total period of approximately 35 years (Table B2).

Table B2. Estimated Annual Implementation Schedule for the Revett Silver Company Rock Creek Mine in Sanders County, Montana.

PROJECT YEAR	ACTIVITY
1 - 3	Evaluation adit construction
2 - 3	Mine development[1]
4 - 5.5	Mine development[1]/surface facilities construction[2]
5.5 - 6	Start-up/limited production
7 - 33	Production
34 - 35	Reclamation

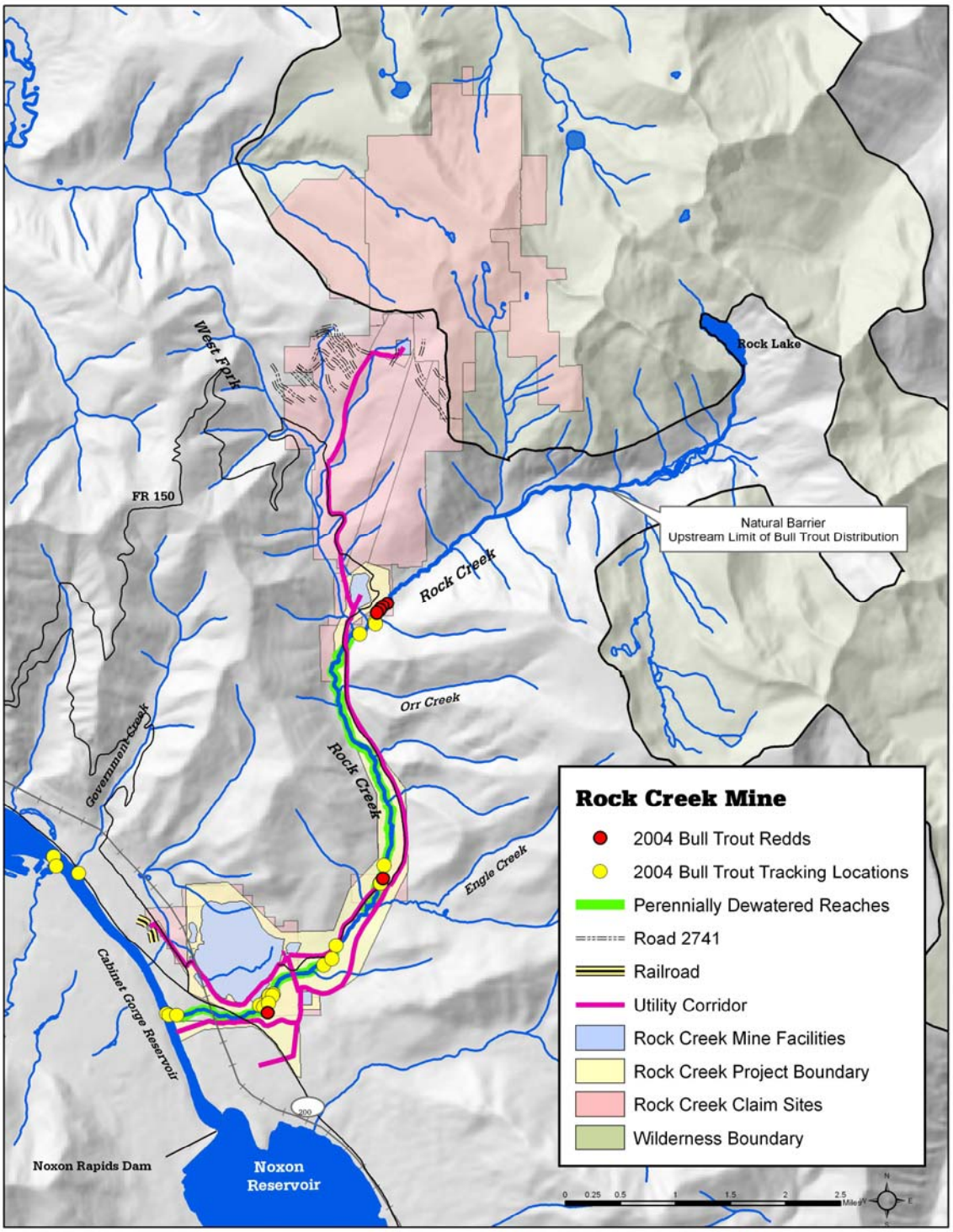
[1] Waste rock will be hauled mid-August through May during mine development period.

[2] Includes construction of the mill site, waste water treatment plant, paste plant, and utilities corridor.

The proposed action would result in construction of an evaluation adit, mine, mill, tailings paste facility, rail loadout, reverse osmosis and passive biotreatment facility, and various pipelines and access roads. A "bottom-up" construction option for the paste facility would be used and final design would incorporate measures to meet visual impact mitigation and reclamation goals. Some mine water would be stored in underground workings during mine operation, but most excess water would be treated and discharged to the Clark Fork River.

Several check points are built into the development of the mine to address specific conditions as they develop. For example, initial exploration involves developing an evaluation adit to further investigate and define the underground ore body. Results of the evaluation adit may result in various scenarios described in Alternative V. For example, should acid-forming rock be located, certain constraints would be required that would not be necessary if no acid-forming rock is encountered. Several similar check points and contingency plans occur throughout the life of the mine and will not be specifically addressed here [see FEIS, Alternative V (MDEQ and USDA 2001)].

Figure B5. Map of the Rock Creek mine facilities, bull trout redds, and radio-tracking locations.



The Rock Creek Mine's proposed permit boundary would encompass approximately 1,560 acres; 483 acres would directly impacted by mining activity and 1,078 would remain undisturbed (Table B3). Land encompassed by the proposed permit boundary is 48 percent private land The analysis area includes approximately 3.54 miles of road construction and 5.43 miles of road reconstruction. Land encompassed by the proposed permit boundary is 48% private land and 52% national forest lands (Table B3). As shown in Figure B3, the project area is located near the southern boundary of the Cabinet-Yaak Ecosystem (CYE), south and west of the Cabinet Mountains Wilderness area. Except for a possible ventilation adit that would disturb about 800 square feet, all ground disturbances would occur outside the wilderness. Of the total 483 acres disturbed, 342 acres (71 percent) are privately owned by Revett and 141 acres (29 percent) are on public lands administered by the Forest. The project area contains existing roads providing public access to the wilderness area and nonwilderness Forest lands for recreation and to areas logged in the past.

Table B3. Proposed Surface Disturbance and Features Associated with Rock Creek Mine Project.

PROJECT FEATURE	AREA IN ACRES
Analysis area	198,394
Hard rock mine permit area	1,561**
Total area of surface disturbance	483
Tailings impoundment	368
Mill site	41
Exploration adit and support facilities	10
Roads	64
Road construction	3.54 miles
Road reconstruction	5.43 miles
Total road construction/reconstruction	8.97 miles

* Estimated surface disturbance includes all the features associated with the tailings impoundment and mill site.

** Corrected permit area acres from MDEQ, December 2000. From Appendix A, Alternative V description.

The initial analysis for the proposed Rock Creek Mine project predicted construction of the mine would commence in 2000. Therefore, the calendar years identified during the analysis no longer correspond with the actual implementation of the project. The life of the mine may be shorter or longer than predicted, depending on the quality, quantity and accessibility of the ore body, market values of the minerals recovered and other factors that cannot be predicted at this time.

STATUS OF THE SPECIES/CRITICAL HABITAT

In response to the Court's concern regarding the consideration of relevant information in the last six years since the listing for updating the current status of the species, we address this matter in this section of the biological opinion. We provide current information on the status of bull trout range-wide and within the Clark Fork River Management Unit, Lower Clark Fork Core Area,

and the Rock Creek local population. In addition, we address the Court's determination that the Service "failed to adequately explain" the aggregate effect to the status of the species of issuing over 100 biological opinions range-wide.

Listing History

In September 1985, bull trout in the coterminous United States were designated as a category 2 candidate for listing, in the Annual Notice of Review (USDI 1997). Category 2 candidates show some evidence of vulnerability but not enough information is available to support a listing of the species (USDI 1997). Bull trout status changed in May 1993 when the Service placed bull trout in category 1 of the candidate species list (USDI 1997). The listing of category 1 species was justified, but precluded due to other higher priority listing actions (USDI 1997).

In June 1998, the Service published the final rule listing the Klamath River and Columbia River distinct population segments (DPS) as threatened (USDI 1998a), with an effective date of July 10, 1998. In November 1999 the Service published a rule listing all populations of bull trout as threatened throughout its entire range in the coterminous United States (USDI 1999), with an effective date of December 1, 1999 (see additional discussion of listing history and evolution of terminology in the Introduction and Consultation Background section of this biological opinion). This coterminous listing effectively eliminated the separate DPS designations within the United States. However, the rule states that: "for the purposes of consultation and recovery, we recognize these five distinct population segments as interim recovery units." For the remainder of this analysis, we will refer to the species, and not the DPS, as the listed entity. We will also use the core area and local population structure as the basis for our analysis, and not the original subpopulation terminology, for reasons previously described.

Species Description

Bull trout have an elongated body, somewhat rounded and slightly compressed laterally, and covered with cycloid scales numbering 190-240 along the lateral line. The mouth is large with the maxilla extending beyond the eye and with well-developed teeth on both jaws and head of the vomer bone (none on the shaft). Bull trout have 11 dorsal fin rays, 9 anal fin rays, and the caudal fin is slightly forked. Although they are often olive green to brown with paler sides, color is variable with locality and habitat. Their spotting pattern is easily recognizable, showing pale yellow spots on the back, and pale yellow, orange, pink, or red spots on the sides. Bull trout fins are often tinged with yellow or orange, while the pelvic, pectoral, and anal fins have white leading margins. Bull trout have no black markings on the dorsal fin and no halos around their spots, which is useful in distinguishing them from brook trout (*S. fontinalis*).

Prior to 1980, bull trout and Dolly Varden (*S. malma* Girard) were considered a single species, the Dolly Varden (*S. malma* Walbaum). In 1980, the American Fisheries Society recognized bull trout (*S.* confluentus) and Dolly Varden as distinct species (see Cavender 1978). Bull trout are found mostly inland and Dolly Varden are found primarily in coastal drainages. Though separation of the two species based on phenotypic characteristics may be difficult (i.e., similarity of appearance), in recent years results of genetic analysis have supported the distinctiveness of these species.

Current known range in the United States and Canada

Bull trout are found throughout the northwestern United States and in British Columbia and Alberta in western Canada (Rieman and McIntyre 1993; USDI 2002a). Within Montana and Alberta, Canada bull trout also exist in the headwaters of the South Saskatchewan River basin and further north in drainages along the east side of the Continental Divide. In the Klamath River basin, only isolated, resident bull trout are found in higher elevation headwater streams of the Upper Klamath Lake, Sprague River, and Sycan River watersheds (Goetz 1989; Light et al. 1996). In the state of Washington, bull trout are found in coastal drainages of the Olympic Peninsula and in streams surrounding Puget Sound (USDI 2004a). In Montana, bull trout occur in the headwaters of the Columbia River basin in the Clark Fork and the Kootenai subbasins. Within the Clark Fork subbasin of western Montana and northern Idaho, the Draft Bull Trout Recovery Plan describes 38 bull trout core areas (now 35 core areas, memorandum to the ARD, Ecological Services, Region 1, Portland, OR, from Field Supervisor, Montana Ecological Services, Helena, MT., July 14, 2006) and at least 152 local populations (USDI 2002c). Within the Kootenai subbasin, four core areas and ten local populations are described (USDI 2002d).

Life History

Life history forms

Two distinct life-history types, migratory and resident, occur throughout the range of bull trout (Pratt 1992; Rieman and McIntyre 1993). Migratory bull trout live in natal tributaries for several years before moving to larger rivers (fluvial form), lakes (adfluvial form), or the ocean (amphidromous) to mature (USDI 2002b). Migratory forms return to natal tributaries to spawn (USDI 2002b). Migratory bull trout may use a wide range of habitats ranging from first to sixth order streams and varying by season and life stage. Resident populations often live in small headwater streams where they spend their entire lives (Thurow 1987; Goetz 1989).

Most bull trout spawning occurs between late August and early November (Pratt 1992; USDI 2002b). They may spawn each year or in alternate years (Fraley and Shepard 1989). Hatching occurs in winter or early spring, and alevins may stay in the gravel for extended periods, typically emerging from the gravel in April. Growth is variable with different environments, but first spawning is usually noted after age 4, and the fish may live 10 or more years (Pratt 1992; Rieman and McIntyre 1993). Although spawning typically occurs in second to fifth order streams, juveniles may move upstream or downstream of reaches used by adults for spawning, presumably to forage in other accessible waters (Fraley and Shepard 1989; Ratliff 1992). Seasonal movements by adult bull trout may range up to 186 miles (300 kilometers) as migratory fish move from spawning and rearing areas into over-winter habitat in large lakes or rivers in the downstream reaches of large basins (Bjornn and Mallet 1964; Fraley and Shepard 1989).

Habitat Requirements

Common predators and competitors of juvenile bull trout are larger bull trout and introduced fish species of the same genus, namely lake trout (Fredenberg 2002a) and brook trout (Pratt and

Huston 1993; Rieman and McIntyre 1993). Other piscivorous species such as brown trout, northern pike, and walleye are also considered potential threats in some core areas (USDI 2002a, 2002b, 2002c and 2005a). Disease is not believed to be a major factor in the long-term health and survival of bull trout populations (USDI 1999), although whirling disease has been detected in wild bull trout (USDI 2005a) and may have unpredictable effects on species complexes.

Hybridization with brook trout poses a threat to the persistence of isolated or remnant populations. These hybrids are likely to be sterile and may experience developmental problems, but could play a role in eliminating local populations of bull trout (Leary et al. 1993; Rieman and McIntyre 1993; USDI 2005a). The degree of hybridization, other interactions, and distribution of the two species is likely influenced by habitat condition (Rieman and McIntyre 1993). Bull trout are rare, if present at all, in many streams supporting large numbers of brook trout (Buckman et al. 1992; Ziller 1992; Rich 1996). Rich (1996) found brook trout occupied more degraded stream reaches than bull trout. Leary et al. (1993) documented a shift in community dominance from bull trout to brook trout in Lolo Creek, Montana, and expected the trend to continue until bull trout are displaced from the stream. Habitat degradation appears to give brook trout a competitive advantage over bull trout in streams where water temperature and/or sediment levels increase.

Bull trout are sensitive to environmental disturbance at all life stages, and have very specific habitat requirements. Bull trout growth, survival, and long-term population persistence appear to be dependent upon five habitat characteristics: water temperature, substrate composition, migratory corridors, channel stability and cover (Rieman and McIntyre 1993). Cover includes undercut banks, large woody debris, boulders, and pools that are used as rearing, foraging and resting habitat, and protection from predators (Fraley and Shepard 1989; Watson and Hillman 1997). Deep pools also help moderate stream temperatures, offering refuge from warmer water temperatures during summer low-flow conditions. Stream temperatures and substrate types are especially important to bull trout.

Temperature

Bull trout are relatively intolerant of warm water and are typically associated with the coldest stream reaches within basins they inhabit (Craig 2001; Selong et al. 2001). The most heavily populated reaches in several Oregon streams seldom exceed 59^0 F (15^0 C) (Buckman et al. 1992; Ratliff 1992; Ziller 1992). Cold-water temperatures are required for successful bull trout spawning. Many studies report water temperatures near 50^0 F (10^0 C) during the onset of spawning (Riehle et. al.1997; Chandler et al. 2001). Bull trout spawning typically occurs in areas influenced by groundwater (Allan 1980; Shepard et al. 1982; Fraley and Shepard 1989; Ratliff 1992). In Montana's Swan River drainage, bull trout spawning site selection occurred primarily in stream reaches directly influenced by groundwater upwelling or directly downstream from upwelling reaches (Baxter et al. 1999; Baxter and Hauer 2000). Cold water upwellings may moderate warmer summer stream temperatures (Bonneau and Scarnecchia 1996; Adams and Bjornn 1997) and extreme winter cold temperatures, which can result in anchor ice.

Cold water temperature also influences the development of embryos and the distribution of juveniles (Fraley and Shepard 1989; Saffel and Scarnecchia 1995; Dunham and Chandler 2001).

Selong et al. (2001) report the predicted ultimate upper incipient lethal temperature for age-0 bull trout during 60-day lab trials to be 69.6^0 F (20.9^0 C) and peak growth to occur at 55.8^0 F (13.2^0 C). Goetz (1994) reports juvenile bull trout in the Cascade Mountains were not found in water temperatures above 53.6^0 F (12^0 C).

Substrate composition

Bull trout are more strongly oriented to the stream bottom and substrate than most other salmonids (Pratt 1992). Substrate composition has been repeatedly correlated with bull trout occurrence and abundance (Rieman and McIntyre 1993; Watson and Hillman 1997; Earle and McKenzie 2001) as well as selection of spawning sites (Graham et al. 1981; Boag and Hvenegaard 1997). Bull trout are more often found in areas with boulder and cobble substrate rather than areas of finer bed material (Watson and Hillman 1997).

Preferred spawning habitat includes low gradient reaches of mountain valley streams with loose, clean gravel and cobble substrate (Fraley and Shepard 1989; Reiser et al. 1997; MBTSG 1998; USDI 2002b). Fine sediments fill spaces between the gravel needed by incubating eggs and fry, lowering incubation survival and emergence success (Everest et al. 1987, USDI 2002a). If fine sediment is deposited into interstitial spaces during incubation, it can impede the movement of water through the gravel, lowering the levels of dissolved oxygen as well as inhibiting the removal of metabolic waste (MBTSG 1998). Because bull trout eggs incubate about 7 months (e.g., mid-September to mid-April) in the gravel, they are especially vulnerable to fine sediment accumulation and water quality degradation (Fraley and Shepard 1989). Some embryos can incubate and develop successfully but emerging fry can be trapped by fine sediment and entombed (MBTSG 1998).

Juveniles are similarly affected, as they also live on or within the streambed cobble (Pratt 1984). The accumulation of sediment leads to a reduction in pool depth and interstitial spaces, as well as causing channel braiding or dewatering (Shepard et al. 1984; Everest et al. 1987). Substrate interstices also provide important over wintering cover (Goetz 1994; Jakober 1995). Sub adults and adults tend to occupy deep pools with boulder-rubble substrate and abundant cover (MBTSG 1998).

Migratory corridors

Migratory bull trout ensure regular interchange of genetic material between local populations within core areas (USDI 2002a), and sometimes facilitate genetic interchange among core areas on an evolutionary time scale (Whitesel et al. 2004), thereby promoting genetic variability. Intact migratory corridors also allow for the potential reestablishment of extirpated local populations (USDI 2002b). Unfortunately, many populations of migratory bull trout have been restricted or eliminated due to 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 foraging, migrating and overwintering habitat (USDI 2002a, 2002b) to spawning and rearing habitat (USDI 2002a, 2002b) for anadromous, adfluvial, and fluvial forms. Such corridors could potentially allow for dispersal of resident forms for recolonization of recovering habitats (Rieman and McIntyre

1993), though evidence indicates that resident fish are naturally less likely to disperse (Nelson et al. 2002). Dam and reservoir construction and operation have altered major portions of migratory bull trout habitat throughout the Columbia River Basin (USDI 2002a, 2002b, 2002c, 2002d, 2005a). 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 (USDI 1999). In addition, reservoirs sometimes do not contain suitable bull trout habitat during certain portions of the year when temperature or other factors may be limiting (USDI 2002b, 2002c, 2005a).

Channel stability and stream flow

Bull trout are exceptionally sensitive to activities that directly or indirectly affect stream channel integrity. Juvenile and adult bull trout frequently inhabit areas of reduced water velocity, such as side channels, stream margins, and pools. These areas can be eliminated or degraded by management activities (Rieman and McIntyre 1993). Bull trout also are sensitive to activities that alter stream flow. Incubation to emergence may take up to 200 days during winter and early spring. The fall spawning period and strong association of juvenile fish with stream channel substrates make bull trout vulnerable to flow pattern changes and associated channel instability (Fraley and Shepard 1989; Pratt 1992; Pratt and Huston 1993; Rieman and McIntyre 1993).

Patterns of stream flow and the frequency of extreme flow events that influence substrate are important factors in population dynamics (Rieman and McIntyre 1993). Embryo and juvenile bull trout, closely associated with the substrate, may be particularly vulnerable to flooding and channel scour associated with rain-on-snow events common in some parts of the range (Rieman and McIntyre 1993). Channel dewatering and bed aggradation also can block access for spawning fish.

Cover

All life history stages of bull trout are associated with complex forms of cover, including large woody debris, undercut banks, boulders and pools (Fraley and Shepard 1989; Goetz 1989; USDI 2002a). Young-of-the-year bull trout tend to use areas of low velocity such as side channels, staying close to substrate and submerged debris (Rieman and McIntyre 1993). Juveniles live close to undercut banks, coarse rock substrate and woody debris in the channel (Pratt 1984; Goetz 1991; Pratt 1992). Adult fish use deep pools with boulder-rubble substrate, undercut banks and areas with large woody debris (Pratt 1984, 1985; MBTSG 1998; USDI 2002a and 2002b). Cover also plays an important role to spawning bull trout by protecting the adults from disturbance or predation as well as providing security (MBTSG 1998). Large migratory bull trout typically spawn in small streams during low flow periods, the combination making them exceptionally vulnerable to humans and other predators. Jakober (1998) observed bull trout over wintering in deep beaver ponds and pools containing large woody debris in the Bitterroot River drainage, and suggested that suitable winter habitat may be more restrictive than summer habitat.

Population Dynamics

Population size

Bull trout have declined in overall range and numbers of fish. Though still widespread, there have been numerous local extirpations reported throughout the Columbia River basin (Thomas 1992; Goetz 1994; USDI 2002b). The Service recognized 121 bull trout core areas; with consolidation of four core areas, this number is now 118 within the coterminous U.S. range (USDI 2002b). Due to the high concentration of isolated lakes in the headwaters a significant portion of those (35) are located in a single subbasin in western Montana and northern Idaho. The ensuing baseline and effects analysis uses the core area and its component local populations as the unit of biological organization (USDI 2002b) to demonstrate the influences of land management activities on population persistence at several scales.

The concept of establishing core areas "that contain bull trout populations with the demographic characteristics needed to ensure their persistence and with the habitat needed to sustain those characteristics" (Rieman and McIntyre 1993) for the purposes of bull trout conservation is reflected in the scientific literature (e.g., Rieman and McIntyre (1993); MBTSG (1998); Morita and Yamamoto (2002); Frissel et al. 1993). Further, quite a bit of specific information on bull trout presence, population status, migratory behavior, spawning behavior, and habitat relationships has been developed since the 1998 listing action (USDI 2002b, Whitesel et al. 2004, USDI 2005a). This scientific literature suggests that core areas do not contribute equally to the regional persistence of bull trout due to the wide differences between local populations that result from the variability of habitat quality and population conditions found in individual watersheds that comprise the core areas. Core areas that have large, stable bull trout populations and high quality habitat are the primary sources for re-colonization if other areas fail and are the mainstay to ensure a high probability of persistence despite deterministic and stochastic threats. In terms of management, it is these “stronghold” core areas where conservation should be emphasized (Rieman and McIntyre 1993). In other core areas, the likelihood of persistence is not as strong and the probability of persistence is less than desired. These core areas may require more intensive management and monitoring to ensure that desirable demographic and habitat characteristics are protected, enhanced, or restored (Rieman and McIntyre 1993). The Lower Clark Fork Core Area falls into this later category of needing intensive management to reach recovery goals as evidenced by the major threat to connectivity caused by dams and the extensive efforts to provide artificial fish passage at all three dams (Thompson Falls, Noxon Rapids, and Cabinet Gorge) in the lower Clark Fork River.

As a result of the availability of new information, as well as a reconsideration of the scientific literature, the Draft Bull Trout Recovery Plan (USDI 2002b) defined core areas and their local populations as the population units more appropriate for the purposes of assessing the current status of bull trout and tracking progress towards recovery.

Public comment on the Draft Bull Trout Recovery Plan for the Klamath River and Columbia River populations (USDI 2002b) was closed on February 27, 2003. Public comment for the Jarbidge and Coastal-Puget Sound populations closed on October 29, 2004. Peer review was also conducted on all of the draft Recovery Plan documents in approximately the same respective

time periods. Although suggestions to more accurately identify the delineation of specific local populations and their relationships to identified core areas were received, no issues were raised relative to the general concept of the local population/core area definitions or relationships. There were, however, substantial concerns with the definition of "recovery unit". As a result, the Service's current draft of the recovery plan for all populations of bull trout has substituted the term "management unit" for "recovery unit" (i.e., because "recovery unit" is a unique term relative to Section 7 consultation and listing programs).

The Service recognizes that the existing management units have no consistent biological significance across the range, but they do provide an orderly avenue for management and coordination with other stakeholders. The final resolution of how management units will be described has not been fully completed. Pending completion of the ongoing bull trout five-year review that was initiated in March 2005 and decisions forthcoming from that process, additional resolution of the recovery unit structure is anticipated. Regardless, we do not anticipate that the basic structure of major genetic groupings, core areas and local populations will be modified, except in response to new biological information that causes refinement within individual core areas, such as the recent consolidation of four core areas in the lower Clark Fork River (memorandum to the ARD, Ecological Services, Region 1, Portland, OR, from Field Supervisor, Montana Ecological Services, Helena, MT., July 14, 2006). As previously mentioned, Region 1 of the Service (lead Region for bull trout), supported the decision to consolidate the four core areas (email from Patrick Sousa, Program Manager, Endangered Species, Region 1, Portland, Oregon to Mike Stempel, ARD, Ecological Services, Region 6, Denver, Colorado; dated 8/23/06).

To evaluate the current status of bull trout distribution and abundance for the five-year review, the Service analyzed the most recent information on bull trout relative to core areas and local populations (USDI 2005a).

Some core areas are considered at inherently higher risk of extirpation from naturally occurring or human-caused events, especially where the core areas are:

1. Unlikely to be reestablished by individuals from another core area (i.e., functionally or geographically isolated from other core areas);

2. Limited to a single spawning area (i.e., spatially restricted); and either

3. Characterized by low individual or spawning numbers; or

4. Primarily of a single life-history form.

For example, a core area that is isolated in a small watershed upstream of an impassable waterfall (e.g., several of those found in Glacier National Park) would be considered at elevated risk of extirpation from naturally occurring events, especially if the core area had low numbers of fish that spawn in a restricted area. In such cases, an event such as a fire or flood affecting the spawning area could eliminate bull trout from the core area, and the impassable waterfall would prevent reestablishment from fish downstream. However, a core area residing downstream of

the waterfall might not be considered at the same level of risk of extirpation from naturally occurring events because there would be potential for immigration of fish from adjacent core areas either upstream or downstream.

In the process of reviewing information relative to the bull trout listing process, the status of core areas (previously called subpopulations in the listing process) was based on modified criteria of Rieman et al. (1997), including the abundance, trends in abundance, and the presence of life history forms of bull trout. In the listing, the Service considered a "core area" (i.e., subpopulation) "strong" if 5,000 individuals or 500 spawners likely occurred in the subpopulation, abundance appeared stable or increasing, and life-history forms were likely to persist. The Service considered a subpopulation "depressed" if less than 5,000 individuals or 500 spawners likely occurred in the subpopulation, abundance appeared to be declining, or a life-history form historically present had been lost. The complete review of this evaluation is found in a status summary compiled by the Service (USDI 1998c).

Based on abundance, trends in abundance, and the presence of life-history forms, bull trout were considered strong in 13% of the occupied range in the interior Columbia River basin (Quigley and Arbelbide 1997). Using various estimates of bull trout range, Rieman et al. (1997) estimated that bull trout populations were strong in 6% of the subwatersheds in the Columbia River basin. Bull trout declines have been attributed to the effects of land and water management activities, including forest management and road building, mining, agricultural practices, livestock grazing (Meehan 1991; Frissell 1993), isolation and habitat fragmentation from dams and agricultural diversions (Rode 1990; Jakober 1995), fisheries management practices, poaching and the introduction of non-native species (Rode 1990; Bond 1992; Donald and Alger 1993; Leary et al. 1993; Pratt and Huston 1993; Rieman and McIntyre 1993; MBTSG 1998; USDI 2002b and 2002c; Fredenberg 2002a).

Population variability

Distribution of existing bull trout populations is often patchy even where numbers are still strong and habitat is in good condition (Rieman and McIntyre 1993, 1995). It is unlikely bull trout occupied all of the accessible streams within the range at any one time. The number of bull trout within a population can vary dramatically both spatially and temporally. Redd (a covered gravel nest constructed by adult spawning bull trout where eggs are deposited) counts are commonly used to assess population trends. Existing long-term redd count data indicate a high degree of variability within and between populations (Rieman and McIntyre 1996, USDI 2002b, USDI 2005a). Habitat preferences or selection is likely important (Rieman and McIntyre 1995; Dambacher and Jones 1997; Baxter and Hauer 2000), but more stochastic extirpation and colonization processes may influence distribution even within suitable habitats (Rieman and McIntyre 1995).

Population stability

The best available information indicates that bull trout are in widespread decline across their historic range (USDI 1998b) and are characterized by numerous, often reproductively isolated core areas in the Columbia River basin with evidence of recent local extirpations (Rieman et al.

1997; USDI 2002b). The largest contiguous areas supporting bull trout are in central Idaho and western Montana. Many bull trout core areas are characterized by declining trends, but a few are increasing and in most the status is unknown (USDI 2005a).

The viability of functioning core areas for bull trout depend on the habitat quality and population characteristics of the multiple local populations that comprise the core area. Rieman and McIntyre (1993) reported that the extinction rate of small local populations was high when testing hypothetical populations during a 30 year timeframe and increased fivefold when migrating bull trout were restricted to low numbers. It appeared the more isolated and independent the local population, the higher the risk of extinction. In contrast, even with moderate amounts of immigration (i.e., connectivity) to the local population, the risk of extinction was one-fourth as high in these connected environments. Some populations will be stable and more robust than and may act as "sources" while other less stable and less robust populations may act as "sinks." Further, these roles may switch at different times (Rieman and McIntyre 1993).

Some local populations will persist in habitat conditions that are less than optimal. In these cases, Rieman and McIntyre (1993) propose that managers create core areas so that any seriously degraded local population could be re-colonized from other core areas (i.e., opportunities should exist within larger river basins that allow some natural connection whenever possible). The Lower Clark Fork Core Area is such a case, where recolonization is highly possible from the healthy bull trout population in the Lake Pend Oreille Core Area as a result of re-establishing connectivity by artificial fish passage pass the dams in the lower Clark Fork River.

What is evident is that the stability of a rangewide population of bull trout depends on the maintenance of protecting those habitats in the best condition with the strongest populations. Fragmentation and disruption of bull trout habitat will increasingly isolate local populations and life history forms, thus reducing survival, growth, and resilience of individual local populations. As long as there are multiple, robust local populations to support several widely distributed healthy functioning core areas within the range of bull trout, the higher the likehood bull trout will be able to survive catastrophic events, normal environmental variation, and the effects of human activities (Rieman and McIntyre 1993), including fragmentation and disruption.

Population structure

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

They were characterized as:

- "Coastal", including the Deschutes River and all of the Columbia River drainage downstream, as well as most coastal streams in Washington, Oregon, and British Columbia. A compelling case also exists that the Klamath Basin represents a unique evolutionary lineage within the coastal group.

- "Snake River", which also included the John Day, Umatilla, and Walla Walla Rivers. Despite close proximity of the John Day and Deschutes Rivers, a striking level of divergence between bull trout in these two systems was observed.

- "Upper Columbia River" which includes the entire basin in Montana and northern Idaho. A tentative assignment was made by Spruell et al. (2003) of the Saskatchewan River drainage populations (east of the continental divide), grouping them with the upper Columbia River group.

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

Status And Distribution

Historic and current distribution

The historic range of bull trout was restricted to North America (Cavender 1978; Haas and McPhail 1991). Bull trout were historically recorded from the McCloud River in northern California, the Klamath River basin in Oregon and throughout the Columbia River basin in much of interior Oregon, Washington, Idaho, northern Nevada, and western Montana. They also occurred in coastal and interior Canada in much of British Columbia, with populations extending along the east slopes of the Rockies in Alberta and including a small area in northern Montana (Rieman et al. 1997).

Bull trout distribution has probably contracted and expanded periodically with natural climate change (Williams et al. 1997). Genetic variation (presence of unique alleles) suggests an extended and evolutionarily important isolation between populations in the Klamath basin and those in the Columbia River basin (Leary et al.1993). Populations within the Columbia River basin are more closely allied and are thought to have expanded from at least two common glacial refugias in recent geologic time (Williams et al. 1997; Haas and McPhail 2001; Whitesel et al. 2004).

Despite bull trout occurring widely across a major portion of the historic potential range, many areas support only remnant populations of bull trout. Bull trout were reported present in 36% and unknown or unclassified in 28% of the subwatersheds within the potential historic range. Strong populations were estimated to occur in only 6% of the potential historic range (Rieman et al. 1997). Bull trout are now extirpated in California and only remnant populations are found in portions of Oregon (Ratliff and Howell 1992). A small population still exists in the headwaters of the Jarbidge River, Nevada, which represents the present southern limit of the species' range.

Though bull trout may move throughout entire river basins seasonally, spawning and juvenile rearing appear to be restricted to the coldest streams or stream reaches. The downstream limits of habitat used by bull trout are strongly associated with gradients in elevation, longitude, and latitude, which likely approximate a gradient in climate across the basin (Goetz 1994). The patterns indicate that spatial and temporal variation in climate may strongly influence habitat occupancy by bull trout. While temperatures are probably suitable throughout much of the northern and mountainous portions of the range, predicted spawning and rearing habitat are restricted to increasingly isolated high elevation or headwater "islands" toward the south (Goetz 1994; Rieman and McIntyre 1995).

Status of bull trout in the Columbia River Basin

Range-wide, local populations of bull trout within their respective core areas are often isolated and remnant. Migratory life histories have been lost or limited throughout major portions of the range (Ratliff and Howell 1992; Pratt and Huston 1993; Rieman and McIntyre 1993, 1995; Goetz 1994; Jakober 1995; MBTSG 1998; USDI 2002b; USDI 2005a) and fluvial bull trout populations in portions of the upper Columbia River basin appear to be nearly extirpated (USDI 2002b, 2005a).

At this time, the Service recognizes 118 bull trout core areas range-wide in Idaho, Montana, Oregon, Nevada and Washington (USDI 2002b). This represents a partial consolidation of some of the 188 subpopulations originally described in the various bull trout listing documents (USDI 1999), and is based on the use of more consistent and updated terminology as well as specific information regarding connectivity and consolidation between some populations previously considered autonomous. For example, radio telemetry information from some recent studies has been particularly useful in further describing the movements of bull trout. Core areas were previously defined as approximating interacting biological units for bull trout. Hence, as more information is obtained and recovery proceeds, we would anticipate the number of core areas and the boundaries that describe them will continue to be somewhat fluid.

Within the Columbia River basin, a total of 95 core areas are described (USDI 2002b). Generally, where status is known and population data exists, bull trout populations throughout the Columbia River basin are at best stable and more often declining (Thomas 1992; Schill 1992; Pratt and Huston 1993; USDI 2005a). In the Lower Clark Fork Core Area, the status and trend is still largely unknown, but ongoing monitoring of local populations may help determine the status as more information becomes available in the next few years. Bull trout in the Columbia basin have been estimated to occupy about 45% of their historic range (Quigley and Arbelbide 1997). Many of the bull trout core areas occur as isolated watersheds in headwater tributaries, or in

tributaries where the migratory corridors have been lost or restricted. Few bull trout core areas are considered strong in terms of relative abundance and core area stability (USDI 1998c; USDI 2005a). Strong core areas are generally associated with large areas of contiguous habitat.

Aggregate effects of previous range-wide section 7 consultations

In response to the Court's concern about the Service's alleged disregard of the aggregate effects on bull trout throughout the Columbia River basin from over 100 biological opinions (completed from 1998-2001) on Federal actions that may adversely affect bull trout, we offer the following.

In this section we explain why all biological opinions do not result in permanent adverse effects to the species. In fact, many are intended to allow some short-term adverse effects in order to achieve a permanent benefit that supports recovery of the species. Consequently, all adverse effects are not additive, and therefore, the species is not subject to "death by a thousand pinpricks" because many of these individual projects are explicitly recovery activities for bull trout, or at worst de minimis effects because of the small scale or very short duration of the action. Further, we discuss the requirement that a section 7 consultation must consider previous biological opinions in determining the environmental baseline conditions of an affected population of bull trout. Also, we note that each biological opinion should have mandatory requirements to reduce impacts if the federal action is anticipated to result in incidental take. We clarify the analyses and information used to support our determination that the addition of the proposed Rock Creek mine would not have an appreciable effect on survival and recovery of the species range-wide. The significant sources of information that we have utilized to arrive at this determination include, but are not limited to the following: 1) Analysis of Actions that have Undergone Section 7 Consultations; 2) Five-year status review (April 2005)(including core area assessments); 3) Draft Recovery Plan for Bull Trout; 4) Science team report – Bull Trout Recovery Planning: A review of the science associated with population structure and size (Whitesel et al. 2004); and 5) relevant technical reports prepared by Avista regarding the local Rock Creek bull trout population. Finally, we explain the Service's ongoing efforts to develop a data based mechanism designed to track effects of authorized incidental take.

The Service conducted a rigorous analysis of the effects of projects that have been analyzed through section 7 consultations in biological opinions on bull trout from the time of listing until August 2003 (137 total)(Appendix B). Also, we examined all the additional biological opinions (total 30) that have been issued in the Clark Fork River Management Unit since August 2003 through July 2006 (Appendix F). This brings the total number of biological opinions issued in the Clark Fork River Management Unit in Montana since the time of listing to 67. Of the 67 biological opinions issued in the Clark Fork River Management Unit, 14 biological opinions were issued within the Lower Clark Fork Core Area. The result of examining all the biological opinions issued within the Lower Clark Fork Core Area and the Clark Fork River Management Unit (i.e., recovery unit) since the time of listing is central to objectively characterizing and evaluating the effects of previous biological opinions range-wide. The analysis of biological opinions issued within the affected core area is especially noteworthy because the analysis of effects of a proposed Federal action on the core area population is the first indication of whether a proposed action may jeopardize bull trout. The next level to evaluate a jeopardy determination is the management unit.

Other relevant information to characterize the overall status of the species range-wide is the five-year status review on bull trout, which considered all available population information over the entire range of the species in order to determine whether the status of the species has changed, including whether it should continue to be federally listed under the ACT. The five-year status review conducted from February 2005 through April 2005 was an intensive evaluation conducted individually at the core area population level as well as comprehensively at the scale of the listed entity. We relied on this information as well to help support our finding that previous opinions were not adding to a perceived downfall of the bull trout range-wide.

Consulted-on effects analysis of previous biological opinions issued range-wide from the time of listing to August 2003

To assess the effects of previous actions/projects on bull trout for this biological opinion the Service reviewed all of the biological opinions received by the Service from the time of listing in June 1998 until August 2003; this summed to 137 biological opinions (USDI 2003)(Appendix B contains this analysis). Of these, 124 biological opinions (91%) applied to activities affecting bull trout in the Columbia River population, 12 biological opinions (9%) applied to activities affecting bull trout in the Coastal-Puget Sound population, 7 biological opinions (5%) applied to activities affecting bull trout in the Klamath River population, and 1 biological opinion (<1%) applied to activities affecting the Jarbidge and St. Mary Belly populations (Note: these percentages do not add to 100, because several biological opinions applied to more than one population). The geographic scale of these consultations varied from individual actions (e.g., construction of a bridge or pipeline) within one basin to multiple-project actions occurring across several basins.

The 137 actions were categorized into 24 different activity types (e.g., grazing, road maintenance, habitat restoration, timber sales, hydropower, etc…). Twenty actions involved multiple projects, including some of which are restorative actions for bull trout. Within each river basin, the number of actions, type of actions, and a brief description of the action was provided. Furthermore, each individual action was identified as to the cause of the effect and the anticipated effect on a spawning stream and/or migratory corridor if known (in most cases this effect was known). An attempt was made to further define the anticipated effect by duration (e.g., "short-term effects" varied from hours to several months) and a determination was made, when possible, to identify those projects with long-term benefits. Actions whose effects were "unquantifiable" numbered 55 in migratory corridors and 55 in spawning streams.

An example of the above analysis summarized here and presented in more detail in the report (Appendix B) is the evaluation of the Clark Fork River basin from the time of listing to August 2003, which includes the affected core area (Lower Clark Fork Core Area) of the Rock Creek mine project. Of the 37 actions in this river basin during this period, the majority (35) involved habitat disturbance with unquantifiable effects. Sixteen actions are ongoing and 21 actions have been completed and effects are no longer occurring. Hydropower actions had unquantifiable effects, but likely cause entrainment and possible detrimental effects; however, it is known that bull trout do get entrained in the Avista projects and survive to later return to the dams. Research and management actions can have detrimental effects to bull trout at times, but these

effects are anticipated to be low in magnitude and ultimately result in long-term benefits to the population. Six resource and land management plans were anticipated to have largely short-term degradation effects from sediment increases associated with 280 miles of stream reach. The single water diversion project identified probably entrains fish, but whether it would impact bull trout was unquantifiable. Below, under "Biological Opinions with Beneficial Actions and Unquantifiable Effects," we explain why so many actions that may affect bull trout result in unquantifiable effects.

Consulted-on effects analysis of all previous biological opinions issued in the Clark Fork River Management Unit and Lower Clark Fork Core Area from listing to July 2006

The total number of biological opinions issued for the Clark Fork River Management Unit since listing to July 2006 is 67 (37 from listing to August 2003 and 30 from August 2003 to July 2006). Thirty-nine indicated that long-term benefits for bull trout were anticipated and 28 showed no benefits (see Appendix F). Fourteen (21.5 percent) of the 67 biological opinions were issued for the Lower Clark Fork Core Area during this period and 11 showed long-term benefits to bull trout while three were not beneficial. None of the 14 biological opinions were for activities found to adversely affect the local population of bull trout in Rock Creek. As clarified below, the analysis of the 67 biological opinions revealed some actions are ongoing (e.g., forest management), some re-occur each year on a seasonal basis (e.g., recreational suction dredging in July-August), which is about 10-15 days each summer; others occur all season long (90 days or more)(e.g., on-going research such as weir trapping, electro-fishing, radio-tagging); others are continuous for several consecutive years (e.g., Milltown dam removal), and some actions have been completed (e.g., Essex bridge replacement). Of the total 67 Federal actions that have occurred in the Clark Fork River Management Unit since listing, 23 actions have been completed and their effects are no longer occurring. Forty-four actions are ongoing and effects of the action may be presently occurring (e.g., cattle grazing), or effects are indeterminate because minimization measures have not yet been employed (e.g., fish screens being designed but not yet installed in an irrigation diversion). Thirty-eight actions were identified as having long-term beneficial effects such as dam removal, streambank stabilization, and habitat restoration.

Of the 14 biological opinions issued for the Lower Clark Fork Core Area since listing, 11or 79.1 percent, were expected to have long-term benefits mainly through improvements from road decommissioning, culvert removals, streambank stabilization, improved fish passage, increased water quality, and riparian vegetation restoration. For example, under the Avista program, in the Lower Clark Fork Core Area 27 habitat restoration projects have been completed from 1999-2004 and three are currently in progress (2005 to present). The Forest Service's White Pine Creek Project, a 10-year activity (2002-2012) involves primarily timber management, but in conjunction with 32 miles of road decommissioning, 12 culvert removals, and potentially approximately 8.5 miles of fisheries habitat improvement on White Pine Creek. The Plum Creek Native Fish Habitat Conservation Plan, a 30-year agreement on private timberland, includes five miles of riparian vegetation restoration in the Thompson River and ongoing planning for fisheries habitat improvement activities in lower Fishtrap Creek. The ongoing Jocko River watershed restoration project is a Confederated Salish and Kootenai Tribe comprehensive phased-action plan that involves habitat acquisition and restorative actions over a 20 year period

and currently has completed over 2,000 acres of riparian habitat acquisition and 13.5 miles of stream restoration and protection. These are three examples of the 11 projects in the Lower Clark Fork Core Area that required biological opinions because of the effects to bull trout and, in general, provide mitigation which results in long-term benefits to the species primarily through improved habitat conditions.

As stated in the previous subsection, the 137 biological opinions issued rangewide were considered in the most recent technical and status information, taking into account all of the previously issued biological opinions to update baseline conditions for bull trout. Updating environmental baselines based on previously proposed actions and associated incidental take is a requirement in preparing a biological opinion (see the Service's Consultation Handbook, pg 4-1 and pg 4-22, March 1998), and as previously mentioned, routinely done when a federal agency is preparing a biological assessment. The Service regularly checks to make sure the environmental baseline is updated when preparing a biological opinion. The Service has provided this guidance to federal land management agencies (Forest Service and Bureau of Land Management in particular because of the extensive area over which these agencies have jurisdiction within the range of bull trout) to help document baseline conditions and effects of actions when assessing the affects of their activities on bull trout (*A Framework to Assist in Making Endangered Species Act Determinations of Effect for Individual or Grouped Actions at the Bull Trout Subpopulation Watershed Scale)*(Framework)(USDI 1998)(Appendix G). It is clearly required in the Framework that these agencies use when preparing biological assessments. Nevertheless, when assessing potential impacts at the local population scale the Framework impact assessment approach evaluates 19 specific habitat parameters and four population parameters for bull trout. Quite often, the determination of risk to each of these parameters from a proposed action rests on the professional judgment of the action agency's project fish biologist because technical site data is generally lacking for most bull trout. However, the Service should agree with the action agency on baseline conditions as part of the section 7 consultation process prior to this information being used in a biological opinion.

As expected, each biological opinion had incorporated mandatory terms and conditions to reduce the impact of any anticipated incidental take. Terms and conditions were designed to minimize impacts from the effects of the anticipated incidental take and were binding on the action agency. Even though incidental take was anticipated in all these opinions, the Service reasonably concluded that the viability of a core area population (or subpopulation) would not be significantly affected by the level of anticipated take, and that the terms and conditions issued to reduce the anticipated incidental take would adequately lessen the potential to affect the core area population.

In summary, the Service's analyses of biological opinions (range-wide assessment from listing to August 2003 and the analysis of biological opinions in the Clark Fork River Management Unit from August 2003 to July 2006) showed that we consulted on a wide array of actions, which had varying level of effects with various timeframes for completion, or that continue to be ongoing either seasonally or continuously at some level throughout the entire year. Even when accounting for previous actions that have been subject to consultation, the analyses revealed that no actions that have undergone consultation were found to appreciably reduce the likelihood of

survival and recovery of the bull trout in any core area, including the Lower Clark Fork Core Area, or result in the loss of any subpopulations (USDI 2003)(Appendix A and F).

At the time of preparing this Rock Creek biological opinion we are not aware of any existing biological opinion within the range of bull trout with other than a no-jeopardy determination. As a consequence, we conclude that these actions do not adversely affect any bull trout populations to the extent of loss of a core area. Our recent review of the range-wide assessment from listing to August 2003 and the analysis from the Clark Fork River Management Unit biological opinions from August 2003 to July 2006 have demonstrated that the conclusions reached in the May 9, 2003, biological opinion were correct and should be used as a basis for this analysis in this biological opinion.

Biological opinions with beneficial actions and unquantifiable effects

Some biological opinions are prepared for projects that result in significant potential gains for bull trout. However, usually these projects have a short-term or temporary harmful effect on existing habitat conditions during construction, and therefore, require formal consultation to address the temporary change in habitat conditions. In many of these cases there could be permanent substantial benefits to the species and that result in restoring habitat to historical level or near-historical conditions. A typical example would be the removal of a culvert that has blocked fish from several miles of historic spawning and rearing habitat. During the removal of the culvert from the streambed, the sediment produced in the stream channel travels downstream a certain distance depending on the amount of sediment delivered and site conditions. These conditions may temporarily impede feeding behavior or displace bull trout immediately in the affected downstream reaches. Because there is much scientific evidence that total sediment and suspended sediment can have negative impacts to fish and fish habitat, we can anticipate some adverse effect. However, it is much more difficult to determine the extent or to quantify this effect because it depends on many interacting site variables. To name a few: 1) presence of fish and particular life stage [(eggs, juveniles, subadults, adults (migratory or resident)]; 2) proximity, type, and habitat quality downstream (spawning and/or rearing habitat); 3) amount and type of fill being removed (shallow fill or deep fill; coarse or fine materials); 4) stream gradient and channel type; 5) erodibility of the fill and associated native soils; 6) steepness of the hillslope or incised stream channel; 7) effectiveness of sediment abatement measures; 8) duration and timing of the construction; 9) size and type of the culvert removed; 10) weather conditions; and 11) professional experience of the contractor conducting the work. The risk of a minimal amount of incidental take is high enough to warrant an incidental take statement in a biological opinion and to ensure that measures will be in place to reduce the amount of sediment potentially delivered to the stream. Clearly however, the substantial gains for the species far outweigh the relatively minor and temporary harmful effect to the species or its habitat.

An example of a beneficial project is the Jocko River restoration project (programmatic biological opinion issued in 1998, revised in 1999), which is a long-term phased project that has resulted in 13.5 miles of stream channel restoration for bull trout, more than 2,000 acres of riparian and upland habitat acquisition, and greater than 30 miles of road upgrades and decommissioning. Similarly, since the listing of bull trout, Montana Fish, Wildlife, and Parks (MFWP) has conducted numerous projects through their department's management and

monitoring activities that have benefited bull trout through activities conducted under section 6 of the Act. The effects to bull trout from these annual activities are addressed in a programmatic biological opinion (revised section 7 programmatic consultation on issuance of section 10(a)(1)(A) scientific take permits and section 6(c)(1) exemption from take for bull trout, *Salvelinus confluentus*, June 29, 1999). The activities addressed are actions like habitat restoration and enhancement, population surveys, capture and handling, tagging and marking, tissue sampling (genetic and disease research), outreach and education, and other activities necessary to conduct various ecological studies aimed at the recovery and conservation of bull trout. For example, in one year (2003) MFWP completed 49 habitat improvement projects, 92 electrofishing projects,72 redd surveys, seven trapping and tagging activities, and four telemetry studies to benefit the conservation and recovery of bull trout (MFWP letter to the Service on the State's Bull Trout Assessment, 1/3/2005). The vast majority of these actions occur in the Clark Fork River Management Unit. A list of these annual section 6 activities is on file with the Service.

Under section 6 of the Act (and its associated conservation plan and programmatic biological opinion), the Service has closely cooperated with MFWP to monitor and evaluate three populations of bull trout (Swan Lake, Hungry Horse, and Lake Kookanusa) where state regulations allow a restricted recreational fishery in western Montana. At present, the bull trout populations in these subbasins are strong enough to support a limited angler harvest. Western Montana is currently the only region within the entire range of bull trout that can support three recreational fisheries on bull trout, two of which occur within the Clark Fork Management Unit.

Biological opinions on adverse actions with mitigation having beneficial actions

As previously mentioned, within the Lower Clark Fork Core Area there were 14 biological opinions issued since bull trout were listed. Eleven federal actions have mitigation activities that provide some degree of offsetting beneficial actions. Many of the mitigation activities have already been completed since the biological opinion for a specific federal action was issued. For example, the biological opinion for the re-licensing of the Avista hydroelectric dams, issued in 1999, addresses habitat restoration projects that are proposed and funded annually throughout the 45-year license period. From 1999-2004, 27 fish restoration habitat projects have been completed and their short-term adverse impacts have past while fish benefits from habitat improvements are accruing. Three habitat restoration projects are currently ongoing. Under the Avista program each year new habitat restoration projects are proposed and are implemented as funding allows. As a result of the completed habitat restoration under the Avista program, at minimum, 2.4 stream miles have been restored in 14 different watersheds, and conservatively, 8.5 miles of additional stream have been opened to fish migration through culvert removals, and greater than 2,000 riparian trees and shrubs have been planted for revegetation and bank stabilization along several important bull trout streams

Another example is the 30-year native fish habitat conservation plan (NFHCP) agreement with the largest private landowner in western Montana (biological opinion issued in 2000). As a commitment in this agreement, Plum Creek Timber Company is undergoing an intensive multi-year effort to restore native riparian vegetation along five miles of an important bull trout stream habitat in the core area, the Thompson River. The relative success of the various riparian

planting treatments is intended to guide restoration projects in the streams and rivers within the 1.4 million acre NFHCP area. The actual improvement to the species from all the completed habitat restoration projects are not yet quantified, but it is expected that redd counts and electro-fishing surveys will document the likely increase in bull trout use of these sites.

In summary, the analysis of the 11 bull trout biological opinions that occurred in the Lower Clark Fork Core Area, revealed a total of 30 habitat restoration projects that were completed and that resulted in 10 miles of improved habitat conditions for bull trout.

Stream channel restoration, streambank stabilization, installation of fish passage/fish screens, and research projects are other examples of federal actions with biological opinions where potential gains to the species are significant, but require formal consultation. Intuitively, a bull trout present in the affected stream reach could be temporarily subjected to a minor harmful effect, but the long-term benefits of permanently improved habitat conditions is likely to increase its survival significantly, thus outweighing the short-term risk. Some would argue there may not be a harmful effect at all because these fish have adapted and evolved intrinsic mechanisms to deal with naturally occurring small events of sediment-laden water and that it is *excessive* sediment generated as anthropogenic waste that often damages biological components of a stream (Waters 1995). Most often it is difficult to know positively whether an adverse effect will occur, and therefore it becomes somewhat subjective to determine the risk of take and the associated effect to the species or its habitat. For projects where risk of incidental take is uncertain, but would clearly result in benefits to a species, the Service errs on the side of the species (U.S. Fish and Wildlife Service 2004; see Box 3, providing the benefit of the doubt to listed resources).

Five-year status review

In 2005, the Service assessed the conservation status of bull trout and the vulnerability for each of 121 bull trout core areas (now 118 core areas)(USDI 2005b). We reviewed the Bull Trout Core Area Conservation Assessment (Appendix H) and concluded that that the original threats to bull trout still existed for the most part in all core areas, but no substantial new and widespread threats were discovered during this review or in the review of previous biological opinions on bull trout. This finding indicates the baseline conditions overall range-wide had not changed substantially in the last five years and that the trend and magnitude of the range-wide population had not worsened nor did it improve measurably.

The risk assessment or ranking portion of the status review was modeled (see Appendix H) to assess the relative status of each of the 121 core areas. The model used to rank the relative risk to bull trout was based on the Natural Heritage Programs' NatureServe Conservation Status Assessment Criteria, which had been applied in previous assessments of fish status, including bull trout (Master *et al.* 2003; MNHP 2004). The model integrated four factors: population abundance, distribution, population trend, and threats. For a complete understanding of the ranking process, a more thorough review of the report which describes the model and the output (USDI 2005b) is required (Appendix H). Results of the 2005 Status Assessment indicated that each of the four core areas in the Lower Clark Fork, because they existed in isolation from one another by Cabinet Gorge, Noxon, and Thompson Falls dams (i.e, Lower Flathead River, Clark

Fork River Section 3, Noxon Reservoir, and Cabinet Gorge Reservoir) were considered to be at "High Risk" of extirpation.

Following consolidation of the four fragmented core areas into a single Lower Clark Fork Core Area (see Figure B2), as described elsewhere in this biological opinion (see previous section and Appendix D), we then applied the same Nature Serve model. The score for the combined Lower Clark Fork Core Area resulted in an "At Risk" ranking, which is one step reduced from the "High Risk" rankings of the status the core areas achieved under the previously fragmented condition. The action of rejoining the core areas through restored connectivity of bull trout migratory corridors, as called for in the Draft Bull Trout Recovery Plan, demonstrated an incremental improvement to the vulnerability status for the Lower Clark Fork Core Area. Full and complete connectivity over all three dams remains the longer term objective.

Development of range-wide tracking system of effects of consulted-on activities

As previously mentioned, the Service recognizes the importance of tracking the effects of consulted-on activities on bull trout and its critical habitat in order to assess conservation and regulatory efforts for the species. To that end, in 2005 the Service formed a "Bull Trout Consultation Coordination Team" charged with developing and implementing a system to accomplish this task. This coordinated effort is on-going and in 2006 the team developed and formalized a team charter with clearly defined duties and tasks as well as obligated funds specifically allocated to the process and development of work products (Memorandum dated June 14, 2006, from ARDs in R-1 and R-6 and Assistant Manager, California-Nevada operations to all R-1 and R-6 Field Offices within the range of bull trout).

The Coordination Team is currently working on a model that will help the Service more accurately track the effects of take, which in turn would help us better estimate the impacts of projects on local populations and core area populations (i.e., status of bull trout). As currently proposed, the model is an integrated and interactive database that comprehensively addresses tracking consulted-on effects of various actions with baseline conditions, extent of take at appropriate scales, and status of the species. The process is well underway and model development in the design and testing phase. The process should be completed in summer 2007. If this model suggests our current analyses are flawed, we would use this as new information and that may trigger reinitiation of consultation. However, we have confidence that at this point in time, the best available information is being used in this biological opinion and will produce conclusions that are consistent with the outputs from the effect-of-take tracking model when it is available.

Status of bull trout populations at the local and core area level

Having discussed the broader aspects of the overall status of bull trout at the range-wide and Columbia River basin scale in the preceding sections, we now analyze the status of bull trout at the finer hierarchical levels of core areas and local populations. First, we describe the status of bull trout in the Rock Creek local population. Rock Creek is one of 14 local populations in the Lower Clark Fork River Core Area. However, as we have indicated, artificial fish passage is being enhanced at the three dams in this core area and the natural connectivity within the Clark

Fork River basin is being restored. Rejoining the Lower Clark Fork Core Area into a single functioning entity with the Lake Pend Oreille Core Area greatly reduces the reliance on single or multiple local populations in the network of artificially fragmented core areas as had occurred in the past half-century. Even partial functional connectivity has greatly enhanced the overall welfare of bull trout in the entire lower Clark Fork River system. Because bull trout, unlike terrestrial or avian species, are constrained in their movements to connected watersheds, it is the ongoing restoration of this connectivity which is fundamental to the long-term survival and status of the species in this portion of the Clark Fork River system. A reconnected system will have a measure of resiliency and redundancy beyond that which is achievable in any single core area under an artificially fragmented condition.

Status of the local population of bull trout in the Rock Creek Watershed (HUC 170102131101)

In the Rock Creek watershed two bull trout life history forms are known to occur – stream resident and migratory forms. In 1996, the Montana Bull Trout Scientific Group (1996) reported that "large fish have been observed (presumably migratory)" and that "smaller redds, presumably from the resident population" were found in the Rock Creek watershed. Since then, through implementation of tasks associated with the Avista fishery program, much has been learned about the bull trout population inhabiting this drainage; however, there is still insufficient data to reveal any trend indication (USFWS 2005a). Information on this local population has been collected in recent years from trapping, electrofishing, redd counts, and radio-telemetry work (USFWS 2005b).

Information gathered from radio-tracked fish in 2003 and 2004 (see Figure B5) has shown that Rock Creek, despite its chronically dewatered condition, supports migratory bull trout in at least some years (Lockard, Carlson, and Hintz 2004). In 2003, four migratory-sized adult bull trout were captured or radio-tagged in the Rock Creek drainage (Lockard et al. 2004), and during 2004 that number increased to ten (Lockard and Hintz 2005). This information strengthens the hypothesis that the Rock Creek drainage is utilized by large, migratory adult bull trout during the spawning season. Further, six of the migratory bull trout tracked in Rock Creek in 2004 were believed to have spawned there (Lockard and Hintz 2005). Two of the six moved upstream to the confluence of the West Fork Rock Creek and the remaining four were located further downstream in the Canyon reach section. We note that 2004 was the first year that the Avista program documented bull trout entering Rock Creek and reported observed spawning in this stream.

Lockard and Hintz (2005) observed that the presence of the ten migratory adult bull trout observed in Rock Creek in 2004 was dependent on stream flow conditions. To enter Rock Creek from Cabinet Gorge Reservoir, these large pre-spawning fish must migrate before spring stream flows drop too low or after rains increase streamflow in the fall. Upstream passage in Rock Creek was facilitated with nearly ideal stream flow conditions during 2004, which do not occur in most years. Thus, spawning activity of migratory fish may be reduced or absent in most years because of unsuitable stream flows. The stream was seasonally de-watered prior to spawning season in 2001 through 2003, when presence of large fish was not typically noted (Lockard et al. 2005). Lockard and Hintz (2005) surmised five of the six radio-tagged adult bull trout that

spawned in Rock Creek in 2004 did so because they could not pass Noxon Rapids Dam to get upstream to their stream of origin. This was based on genetic assignment tests which assigned these fish to tributaries upstream of Noxon Rapids Dam, which suggested to the authors that bull trout may spawn in nonnatal tributary streams near to where upstream movement encounters a passage barrier or obstruction.

Native salmonid abundance monitoring through electrofishing methods provides an indicator of relative bull trout density estimates for certain sections of the Rock Creek drainage (Liermann and Tholl 2005). In 2003, electrofishing depletion estimates were completed in two sections of Rock Creek. At site two, 20 bull trout were sampled and at site four, 21 bull trout were sampled. Based on these samples, densities of bull trout were estimated at 15.1 fish per 328 feet (100 m) at site two and 20.4 bull trout per 328 feet at site four. Both sites were located in the East Fork Rock Creek. Lengths of these fish ranged from 2 to 14 inches. Four sites were monitored in Rock Creek in 2001 and three sites in 2002. Both years combined, density estimates ranged from a low of 7.0 fish per 328 feet (site two) to a high of 28.4 bull trout per 328 feet (site three)(Liermann et al. 2003). Bull trout densities showed considerable annual variation at the same sampling sites, but no distinguishable trend between years (Liermann et al. 2003).

Annual redd count surveys have been conducted in the Rock Creek drainage for the past 5 years. In some years the surveys were incomplete. While informative, the surveys have low confidence as a trend indicator because positively identifying clean gravel in under-scour areas as bull trout redds is difficult (Moran 2004). For example, in the West Fork Rock Creek Moran (2005) reported that no definitive migratory bull trout redds were observed during redd counts conducted in 2001 and 2002. Therefore, this method for determining spawning use of this tributary was ineffective and was discontinued in 2003. Because of the discovery of two radio-tags, apparently from radio-tagged fish that were in the area in fall of 2004, redd counts were re-instated. Further, redd count surveys were expanded in 2004 to cover lower areas of the Rock Creek drainage, where definitive redds were located. Moran (2005) concluded that these newly discovered redds in the lower section of the drainage should require future surveys to encompass larger areas of the channel, especially during years of favorable stream flow.

- Total 2005 count: 1 bull trout redd.
- Total 2004 count: 6 bull trout redds.
- Total 2003 count (not surveyed).
- Total 2002 count: 1 (possible) bull trout redd (low confidence).
- Total 2001 count: no bull trout redds (low confidence).

In general, it is known that the Avista trap and transport program has enhanced the number of bull trout spawning in the Lower Clark Fork Core Area, particularly in the Bull River. The 2004 and 2005 (Moran 2006) results indicate enhanced spawning specific to the Rock Creek drainage.

The Avista Downstream Juvenile Bull Trout Transport Program began in 2001 and is intended to study survival of downstream migrating juvenile bull trout leaving Montana tributary streams for Lake Pend Oreille, Idaho. Juvenile bull trout are trapped annually in Montana tributaries, including Rock Creek, and then transported directly to Lake Pend Oreille, thus avoiding the vulnerability of increased predation in the reservoirs and the Clark Fork River or entrainment

through the turbines. For the past five years a portion of the total juvenile bull trout migrating downstream in Rock Creek have been trapped before reaching Cabinet Gorge Reservoir and then transported to Idaho where they are released. In order to prevent depletion of certain size/age classes and to be conservative due to the possibility of high trapping efficiency, not all trapped fish are transported. It is anticipated that the "trap and haul" program will eventually become a permanent component of the overall Avista fish passage program (Lockard et al. 2002b).

In 2001, 87 juvenile bull trout were captured in Montana tributaries in the Lower Clark Fork Core Area. Thirty of these fish came from Rock Creek and 23 of those were transported while seven were released on site (Lockard et al. 2002b). In 2002, a total of 416 juvenile bull trout were captured in fish traps while migrating downstream in Rock Creek, Bull River, Graves Creek and the Vermilion River. Only 11 juvenile bull trout came from Rock Creek in 2002 and 9 were transported and 2 released (Lockard et al. 2003). In 2003, a total of 221 juvenile bull trout were captured and 24 came from Rock Creek, with 10 being transported and 14 being released (Lockard et al. 2004).

In 2004, the trapping conditions occurred during a year when the mainstem of Rock Creek had perennial stream flow conditions, which resulted in significant capture rates. A total of 56 bull trout were captured in upstream and downstream trapping efforts in Rock Creek, 55 juveniles and one adult (Lockard et al. 2005). The number of juvenile bull trout captured (19 upstream and 36 downstream) was the highest in Rock Creek since trapping began in 2001 and was probably due to the increased trapping efficiency from the favorable flow conditions throughout the trapping season. In summary, cumulative numbers of juvenile bull trout captured in Rock Creek (upstream and downstream trapping) in 2001, 2002, 2003, and 2004, were 30, 17, 35, and 55, respectively (Lockard et al. 2005).

The month of August showed the greatest downstream movement of juvenile bull trout in Rock Creek in 2003 and 2004, followed by the month of July (Lockard et al. 2005, Lockard et al. 2004). For all Montana tributaries, in 2004, downstream movement occurred from April through December, with a noticeable peak in late August and tapering off from September through November. Lockard et al. (2005) noted that peak juvenile migration in these tributaries might occur in the spring or at other times during high flows when trapping efficiency drops off.

Resident bull trout are more abundant in the East Fork Rock Creek and West Fork Rock Creek than in the mainstem (MDEQ and USDA Forest Service 2001). Overall, the local population of resident bull trout inhabiting the Rock Creek drainage appears to exist at relatively low densities, but has been persistent under current habitat and population conditions (see B3 below). However, most of the 19 habitat variables that are important indicators of watershed conditions for bull trout are functioning at risk in Rock Creek. Of these, three are functioning appropriately and the two at most risk – streamflows and refugia – are related to the chronic dewatering in the mainstem (MDEQ and USDA Forest Service 2001) (Table B3). The limiting factor for fish in this drainage may be the two lengthy reaches of the stream that dewater in most years during summer or fall. Consequently, the threat to the population of resident bull trout inhabiting Rock Creek is relatively high due to these current habitat conditions and relative isolation in most years. Recent summer drought years (2001 – 2003) have caused the dewatered sections of the mainstem to expand significantly in length, which has further limited habitat availability during

the critical low flow summer season. Another threat whose impacts are uncertain is hybridization from brook trout.

At present, brook trout are found in low numbers and only in the very lower reaches of the mainstem of Rock Creek and not in the upper watershed where most of the resident bull trout reside. Ironically, the chronic dewatering of the mainstem is probably limiting brook trout distribution to primarily the lower sections of the mainstem (Larry Lockard, pers. comm., U.S. Fish and Wildlife Service, 2005). Nevertheless, this threat exists because of this species presence in the watershed and its known adverse effects on small resident populations of bull trout elsewhere.

As described, the migratory component of the bull trout population utilizing Rock Creek is small and current use of Rock Creek by migratory spawners is sporadic. However, use may increase in the future as fish passage around Cabinet Gorge Dam continues under the Avista program. Genetic evidence suggests that there is a component of returning adult bull trout that migrate to Cabinet Gorge Dam from Lake Pend Oreille that has a strong genetic association with Rock Creek as their stream of origin. If the downstream Avista juvenile transport program is successful in terms of increasing juvenile survival, and more juvenile bull trout are transported to Lake Pend Oreille in the future, this may increase the possibility of additional adult migratory bull trout returning to the Rock Creek drainage in the future.

However, despite the future likelihood for migratory bull trout to return to the Rock Creek drainage, the risk to the migratory component of the Rock Creek bull trout population currently remains high due to the small annual number of these returning fish and the uncertainty in most years of adequate streamflows allowing access to spawning areas.

Status of bull trout in bull trout core areas in the Lower Clark Fork River Subbasin (see Figure B2):

Lake Pend Oreille Core Area: The Lake Pend Oreille watershed is one of the largest, most complex, and best-documented bull trout core areas in the upper Columbia River watershed, encompassing 95,000-acre Lake Pend Oreille (the largest and deepest natural lake in Idaho). An extensive redd count monitoring program was devised by Idaho Department of Fish and Game and has been in place since 1983 (USDI 2005a). These redd counts accurately reflect the population trend. Data is collected from six index tributary streams: two in the lower Clark Fork River (downstream of Cabinet Gorge Dam) and four other tributaries to the lake. Index counts average about two-thirds to three-fourths of the known spawning in the contiguous Pend Oreille basin. Bull trout index redd counts have ranged from about 300-700 throughout the 22-year period of record (averaging 505). In 8 years post-listing (1998-2006), index redd counts have ranged between 462 and 691, averaging 581, and the most recent (2005) count was 580. There is some indication that numbers have been more robust since 1998 than they were in the prior years.

The status and trend of bull trout in this core area was considered “depressed” and “declining” based on information available at the time of listing (USFWS 1998). However, based on recent analysis, there are as many as 5,000 adult bull trout in this core area and the recent trend is

considered stable or increasing. In fact, the Lake Pend Oreille Core Area may have reached the Service's recovery objectives outlined in the Draft Bull Trout Recovery Plan (USFWS 2002) since it was considered very close to that level in 2004 (Downs and Jakubowski 2004). These findings reflect improved monitoring and expanded knowledge about population demographics in this core area. There is potential for increased bull trout recruitment to this core area from the Clark Fork River watershed as a result of artificial upstream passage of spawning bull trout over the dams (Lockard et al. 2003). The range of this core area has also been expanded to include the lower portions of the Priest River watershed, based on results of bull trout radio telemetry studies. The precarious status of kokanee (the primary forage fish) and apparent expansion of the lake trout population, which may currently exceed bull trout abundance in Lake Pend Oreille, are the biggest threats to recovery; and therefore, the magnitude and imminence of the nonnative species threat remains high.

Possible Consolidation of the Lake Pend Oreille Core Area with the Lower Clark Fork Core Area: The potential consequences (see Draft Bull Trout Recovery Plan) of increasing connectivity and bull trout migration through the Lower Clark Fork Core Area include returning the Clark Fork River to a state closer to its natural configuration prior to the dams and expanding important aspects of population size, replication, and distribution, thus improving the overall viability of a consolidated Lower Clark Fork /Lake Pend Oreille consolidated core area. In such a consolidated core area configuration, Rock Creek is one of 20 local populations. The importance of Rock Creek to bull trout is neither increased nor diminished as a result, but the resiliency and stability of the reconnected core area(s) exceeds the sum of its individual parts as discussed below and in the Draft Bull Trout Recovery Plan. The Draft Bull Trout Recovery Plan (USDI 2002c) places strong emphasis on reconnecting the Lake Pend Oreille Core Area with the Lower Clark Fork Core Area in order to achieve bull trout recovery in the lower Clark Fork River system.

The foregoing discussion in the Introduction and Consultation Background section of this biological opinion clearly emphasizes that the Lower Clark Fork Core Area is part of a larger entity with the Lake Pend Oreille Core Area. Unlike some headwater core areas that function with complete independence from migration of bull trout from upstream or downstream waters, the future status of bull trout in the Lower Clark Fork Core Area is integrally linked to Lake Pend Oreille. The current status, with successful upstream fish passage since 2003, and tracking of fish from Lake Pend Oreille to spawning tributaries through the efforts of the Avista project, in the near future Lake Pend Oreille Core Area should be combined with the Lower Clark Fork Core Area. The basic definition of a core area (given under Population Dynamics heading in this document) includes that it: "represents the closest approximation of a biologically functioning unit for bull trout. Local populations within a core area have the potential to interact because of connected aquatic habitat." Given the existing levels of biological function and connectivity established through the trap and transport program, any future revision to the core area map should seriously consider treating the Lower Clark Fork Core Area as part of the Lake Pend Oreille Core Area (Wade Fredenberg, pers. comm., U.S. Fish and Wildlife Service, 2006).

Lower Clark Fork Core Area (formerly the Cabinet Gorge Reservoir, Noxon Reservoir Thompson Falls Reservoir and Lower Flathead River): The action area falls within this core area (See Figures B2, B3, and B5). Following consolidation of the four fragmented core areas

into a single Lower Clark Fork Core Area (See figure B2), as described elsewhere in this biological opinion (see previous section and Appendix D), we then scored the newly combined Lower Clark Fork Core Area following the assessment criteria applied in previous assessments of fish status (Master et al. 2003; MNHP 2004). This resulted in an "At Risk" ranking, which is one step improved from the "High Risk" rankings of the status the core areas achieved under the previously fragmented condition. The action of rejoining the core areas through restored connectivity of bull trout migratory corridors, as called for in the Draft Bull Trout Recovery Plan, is an incremental improvement to the risk of extirpation for the Lower Clark Fork Core Area population. Full and complete connectivity over all three dams remains the longer term objective.

A large amount of recent data has been collected, characterizing both bull trout abundance and demographics in this core area, since the Avista Native Salmonid Restoration Program began conducting surveys in 2000 (USDI 2005a). Prior to that there was only limited and partial monitoring of bull trout in this core area. Results of redd counts since 2000 indicate approximately 10-50 redds per year have been constructed in portions of the Bull River drainage (Lockard, Carlson and Hintz 2004, Moran 2004, MFWP 2004a). Per our previous discussion, additional limited spawning has been confirmed in Rock Creek (Lockard and Hintz 2005). Passage of radio-tagged fish over Cabinet Gorge Dam has contributed to the annual spawning total since 2003. Extensive radio tracking of fish has led to many important observations of timing and movement patterns related to spawning. Preliminary conclusions are that the abundance of adult bull trout in Cabinet Gorge Reservoir is around 100 fish. The determination is complicated by movement patterns over two dams (Cabinet Gorge and Noxon Rapids) and the influx and egress of adult bull trout that has been documented to occur in this core area. There is insufficient data to reveal any trend indication, though it is known that the trap and transport program has enhanced the number of bull trout spawning in the core area.

Spruell et al. (2000) reported on the findings of a scientific panel that investigated the genetic structure of bull trout in the Lake Pend Oreille – Lower Clark Fork system, with particular attention to strategies for retaining genetic connectivity of bull trout in Lake Pend Oreille with upstream portions of the Clark Fork River drainage in Montana, including local populations isolated in Cabinet Gorge Reservoir. The panel endorsed strategies, which would restore connectivity (including trap and transfer of migratory bull trout over dams) to allow the full expression of bull trout life histories and maximize the potential for natural gene flow. Genetic data supported the hypothesis that bull trout migrating to the base of Cabinet Gorge Dam were individuals that hatched in upstream tributaries, reared in Lake Pend Oreille, and were blocked by the dams from returning to their natal tributaries to spawn (Neraas and Spruell 2001). More recent work has lent credibility to the use of genetic markers as an accurate indicator of which source populations fish are derived from, allowing managers to transport individual trapped fish to the general vicinity of their stream of origin (Ardren and Campton 2003). It is important to note that the findings to date support previous conclusions that upstream and downstream connectivity to this core area should continue at, or preferably above, existing levels and so that under recovered conditions it should function as part of a larger core area with Lake Pend Oreille (USFWS 2002c).

Many of the actions conducted under the Avista Fish Passage and Native Salmonid Restoration Program of the Clark Fork FERC Settlement Agreement have been directed at transporting bull trout upstream and downstream over Cabinet Gorge and Noxon Rapids dams, with a goal of establishing functional connectivity for migratory bull trout between Lake Pend Oreille and upstream watersheds blocked by the dams. In 2002, a total of 416 juvenile bull trout were captured in fish traps while migrating downstream in Rock Creek, Bull River, Graves Creek and the Vermilion River (Lockard et al. 2003). Of that total, about 40% (167 fish) were transported to Idaho and released in the Clark Fork River below Cabinet Gorge Dam. All were marked for future identification. In 2003, 221 juvenile bull trout were captured migrating downstream and 88 were successfully transported below Cabinet Gorge Dam (Lockard et al. 2004).

A second phase of the Avista Native Salmonid Restoration Program involves capture and transfer of adult bull trout migrating upstream to the base of Cabinet Gorge Dam. In 2003, a total of 42 adult bull trout were captured and transported from the Clark Fork River around Cabinet Gorge Dam and released into Cabinet Gorge Reservoir (Lockard et al. 2004). Seven of those were fish that had been captured and transported over the dam in previous years (2001 or 2002). Of 36 bull trout that were implanted with transmitters and radio tracked in 2003, upstream movements of 20 were detected in the Bull River drainage, two were detected in the Rock Creek drainage, and 14 staged below Noxon Rapids Dam, the next upstream barrier on the Clark Fork River (Lockard et al. 2004). Tracking of bull trout to the spawning areas, combined with redd counts, led to the conclusion that most (73-89%) of the potential bull trout egg deposition in the Bull River drainage in 2003 was from migratory fish transported over Cabinet Gorge Dam. Additional information gathered from radio tracked fish in 2003 and 2004 (see Figure B5) has also shown that Rock Creek, despite it's chronically dewatered condition, continues to support migratory bull trout (Lockard, Carlson, and Hintz 2004).

Extensive information is being collected on the overlap with and potential superimposition of brown trout redds in important bull trout drainages (Moran 2004). Studies that are ongoing relate to concerns that northern pike negatively interact with bull trout and predate on juvenile bull trout in Cabinet Gorge Reservoir (Bernall and Moran 2004). There are also concerns about negative interactions with high densities of brook trout in many watersheds and the potential for an increasing population of recently illegally introduced walleye that are reproducing in Noxon Reservoir. To date, control actions on these species have not been initiated, pending further analysis.

In 1997 and 1998 a total of 780 fish were collected among nine sites in Montana above Cabinet Gorge Dam and 384 fish from four sites in Idaho below the dam for pathogen surveys. Only one fish was a bull trout, but the study was conducted in response to concerns that transport of bull trout over the dam might introduce new fish pathogens upstream. The soluble antigen of *R. salmoninarum*, the causative agent for bacterial kidney disease, was detected in fish from all sample sites across the study area, though no clinical cases of the disease were found. *F. psychrophilum*, the bacterium that causes cold water disease, was isolated from samples below the dam, but not above. However, the pathogen is generally regarded as a widely distributed organism and because it's ubiquitous it was not determined to be an agent of concern for the fish transport program. IPN virus was also isolated from brook trout in the Mosquito Creek drainage, but previous cases had already occurred in the drainage and this pathogen was also known from

upstream waters in Montana. No evidence of *M. cerebralis*, the parasite that causes whirling disease, was detected in any of the samples. With these findings, the fish transport program moved forward.

The potential for increased bull trout recruitment beyond the existing levels to this core area from Lake Pend Oreille as a result of artificial upstream passage of spawning bull trout over the dams is promising given the current fish passage that is occurring through the trap and transport program and the planning for permanent fish passage facilities at all three dams. Suitability of Cabinet Gorge Reservoir habitat for adult bull trout remains limiting, thus the emphasis on connectivity to restore this core area as a functioning portion of a larger core area. The current approach of restoring functional connectivity to allow upstream and downstream migration will benefit the entire Lake Pend Oreille / Lower Clark Fork ecosystem. Some obstacles remain to achieving that goal, though a long-term funding and implementing mechanism (Avista FERC settlement) is in place and has been successful so far.

Similar to the conservation efforts directed at Cabinet Gorge Reservoir bull trout as described above, intensively focused monitoring and research efforts have occurred for Noxon Reservoir as part of the Avista Native Salmonid Restoration Program (USDI 2005a). Based on recent analysis, we conclude that the abundance of adult bull trout in Noxon Reservoir is greater than 100 fish. The determination is complicated by movement patterns over the two dams (Noxon Rapids and Thompson Falls) and the influx and egress of adult bull trout that has been documented to occur in this area. There is insufficient data to reveal any trend indication, though it is anticipated that expansion of the trap and transport program will further enhance the number of bull trout spawning in the Noxon Reservoir area. Suitability of Noxon Rapids Reservoir habitat for adult bull trout remains somewhat limiting though it is better than for Cabinet Gorge. The establishment of a reproducing walleye population in Noxon Reservoir is one element that elevates the magnitude and imminence of the nonnative species threat. Currently, MFWP is studying the growth of the walleye population and in the future could address control measures through specific management actions.

The determination of approximately 100 adult fish in the Thompson Falls Reservoir reach is complicated by losses that may occur over Thompson Falls Dam, which forms the lower bound of this reach. Additionally, if efforts to restore bull trout populations in the Jocko River watershed on the Flathead Reservation (upstream of this reach) are successful, some of those fish will use a portion of this reach as overwintering and migratory habitat. Influx and egress patterns of adult bull trout in this area are not documented. There is insufficient data to reveal any trend indication, though it is anticipated that the trap and transport program currently occurring at Cabinet Gorge and Noxon dams will be expanded to Thompson Falls Dam, further enhancing the number of bull trout spawning in this area. The potential for increased bull trout recruitment to this area from the Clark Fork River watershed as a result of artificial upstream passage of spawning bull trout over the dams is promising, but untested. Suitability of the Clark Fork River habitat for adult bull trout is partially limiting, due to thermal and water quality concerns. Similarly, portions of the Thompson River watershed experience warm summer water temperatures. Thus, the emphasis has been placed on connectivity to restore this core area as a functioning portion of a larger complex of core areas.

Kerr Dam blocks fish passage between the lower Flathead and Clark Fork rivers and Flathead Lake. As a consequence, with the exception of occasional downstream migrants from these systems, it is unlikely that the status of the Flathead Lake Core Area and upstream waters bears much relevance to the future of the bull trout populations in the Lower Clark Fork Core Area. Additionally, dams constructed to create irrigation reservoirs isolate tributaries of the Jocko River drainage from the lower Flathead River. The lower Flathead River is almost entirely on the Flathead Reservation of the Confederated Salish and Kootenai Tribes (CSKT). Data from Tribal monitoring programs is typically not available as public information, but to our knowledge redd counts are not being routinely conducted in this area (USDI 2005a). Extensive bull trout restoration activities are occurring in the Jocko River watershed, which is where most of the bull trout habitat exists in the upper portion of this core area (CSKT 2000). Information from informal discussion with Tribal representatives indicates that numbers of adult bull trout in the area are generally low, on the order of 100 adult fish or fewer in the entire migratory population. There is no available information on the population trend. With fish passage now provided over lower Clark Fork dams and additional habitat restoration efforts, the past fragmentation in the upper portion of this core area is being improved. However, significant habitat limitations remain (e.g. dewatering, thermal enrichment, nonnative species, impacts of whirling disease, expanding recreational use) before reconnection to the Lake Pend Oreille Core Area is a likely prospect. Full recovery of bull trout in the lower Flathead River is at best an uncertain prospect. Potentially, this area should be able to support at least several hundred migratory adult bull trout. Thus, the emphasis has been placed on connectivity to restore this upper portion of the Lower Clark Fork Core Area as a functioning portion of the Lake Pend Oreille Core Area.

Middle Clark Fork River (Section 2 – Flathead River to Milltown Dam) Core Area: More intensive bull trout surveys have been conducted in recent years in this core area, which is just upstream of the Lower Clark Fork Core Area, primarily by MFWP in the portion of the Clark Fork River drainage from the Flathead River to Milltown Dam. (Figure B2). Local spawning populations in Cedar Creek, Fish Creek, Rattlesnake Creek, and the Saint Regis River have been monitored sporadically (MFWP 2004a). The surveys have identified up to 17 redds in Cedar Creek (2002), 20 redds in Fish Creek (2003), 33 redds in Rattlesnake Creek (2003), and 18 redds in the Saint Regis River (2003). These results indicate adult bull trout numbers in this core area range from roughly 100-200 fish, although there's uncertainty in that estimate. No trend is indicated by the short period of record. Most local populations are well below historical levels of natural abundance and inadequate to maintain long-term genetic viability.

Milltown Dam, which has blocked fish passage at the upper boundary of this core area since 1908 (Schmetterling and McEvoy 2000), is slated for complete removal as early as 2006 (Missoulian *in litt.* 12/21/04). While benefits are more likely to accrue to the next core area upstream by allowing fluvial bull trout to return to natal headwaters, tangible benefits to this core area will accrue as well. Benefits of restoring fish passage throughout the system over four major dams, as a result of both the Avista and Thompson Falls projects as well as the Milltown Dam removal, cannot be fully anticipated nor fully realized for several bull trout generations.

Status of bull trout in the Clark Fork River Management Unit

Bull trout are found in 35 core areas (following consolidation as previously stated in the Status of the Species section of this biological opinion) within the Clark Fork River drainage (USDI 2002c). The Lower Clark Fork Core Area is currently considered to be one of those 35. At least 152 local populations of bull trout have been identified associated within these core areas (USDI 2002c). Rock Creek is one of those 152 local populations.

The Service considers many of the core areas in the Clark Fork River drainage to be at risk of extirpation due in part to natural isolation, single life-history form, and low abundance. Expansion of nonnative lake trout into headwater lakes is the single largest human-caused threat in most of the 25 primarily adfluvial core areas, and dams and degraded habitat have contributed significantly to bull trout declines in the four core areas centered primarily in fluvial habitat in the Clark Fork subbasin.

Reconnection of fragmented core areas within the Clark Fork River Management Unit is a high priority identified in the draft Recovery Plan (USDI 2002c). The progress made in reconnecting the lower mainstem corridor is a direct measure of the recovery of bull trout in the Clark Fork River Management Unit. Due to its location, the health and stability of bull trout in the Lower Clark Fork Core Area is important. Perhaps more importantly the passage of bull trout both upstream and downstream through this area is an essential component of recovery.

Status Of Designated Critical Habitat

In November 2002, the Service proposed designation of critical habitat for the Klamath River and Columbia River, pursuant to the Endangered Species Act of 1973, as amended. For the Columbia River basin the proposed critical habitat designation totaled approximately 29,251 km (18,175 mi) of streams and 201,850 ha (498,782 ac) of lakes and reservoirs, which included--approximately 14,416 km (8,958 mi) of streams and 83,219 ha (205,639 ac) of lakes and reservoirs in the State of Idaho; 5,341 km (3,319 mi) of streams and 88,051 ha (217,577 ac) of lakes and reservoirs in the State of Montana; 5,460 km (3,391 mi) of streams and 18,077 ha (44,670 ac) of lakes and reservoirs in the State of Oregon; and 4,034 km (2,507 mi) of streams and 12,503 ha (30,897 ac) of lakes and reservoirs in the State of Washington (USDI 2002a).

In October, 2004, the Service published a final rule designating approximately 1,748 miles of streams and 61,235 acres of lakes and reservoirs in the Columbia and Klamath River basins of Oregon, Washington, and Idaho as critical habitat for bull trout under the Act (USDI 2004c). All 3,319 miles of proposed streams and 217,577 acres of proposed lakes in Montana were excluded from the final designation, based primarily on the existence and presumed adequacy of the State of Montana's Bull Trout Restoration Plan. Lake Pend Oreille, the Clark Fork River, and Priest Lakes were also excluded, but portions of thirteen tributaries to Lake Pend Oreille or the Clark Fork River in Idaho, as well as 14 tributaries to Priest Lake and Priest River were included in the final designation. The final critical habitat designation amounted to less than 10% of that originally proposed range-wide and on December 14, 2004, a lawsuit was filed by a Montana environmental group challenging the final designation.

On May 24, 2005, the Service published notice in the Federal register that it would accept further public comment for a period of 30 days, through June 24, 2005, on the adequacy of the exclusions in the October, 2004 final rule. On June 27, 2005, District Judge Redden of Oregon granted the Service request to voluntarily remand the October, 2004 final rule for a new decision. As a result, a voluntary remand went into effect which reinstated the November 29, 2002, proposed rule and the Service engaged in preparing a new analysis by September 15, 2005.

On September 26, 2005, the Service published notice in the Federal Register the final rule designating critical habitat for bull trout for the Klamath River, Columbia River, Jarbridge River, Coastal-Puget Sound, and Saint Mary-Belly River populations of bull trout (FR 70, No 185, 56211-56311). This final designation totals approximately 3,828 miles (6,161 kilometers) of streams, 143,218 acres (57,958 hectares) of lakes in Idaho, Montana, Oregon, and Washington, and 985 miles of shoreline paralleling marine habitat in Washington. There are three critical habitat units located in Montana: 1) Clark Fork River Basin with 1,136 miles of streams and 31,916 acres of lakes/reservoirs; 2) Kootenai River Basin with 56 miles of streams and 1,384 acres of lakes/reservoirs; and the Saint Mary-Belly River Basins with 37 miles of streams and 4,107 acres of lakes/reservoirs (note that a portion of the Clark Fork River Basin is in northern Idaho, so the numbers do not add up to the totals previously listed for Montana).

Guidance for analysis of designated critical habitat for bull trout was provided in the final rule and previously in the Director's December 9, 2004, memorandum, which is in response to litigation on the regulatory standard for determining whether proposed Federal agency actions are likely to result in the "destruction or adverse modification" of designated critical habitat under Section 7(a)(2) of the Act (Appendix E). This memorandum outlines interim measures for conducting Section 7 consultations pending the adoption of any new regulatory definition of "destruction or adverse modification." Consequently, this biological opinion does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 CFR 402.02. Instead, we have relied upon the statutory provisions of the Act to complete the following analysis with respect to critical habitat.

Summary of analysis of bull trout critical habitat likely to be affected

The proposed action would occur in Cabinet Gorge Reservoir in a portion of the lower Clark Fork River watershed (USDI 2002c), portions of which are designated as critical habitat. Designation of bull trout critical habitat was identified in the Rock Creek watershed and published in the September 26, 2005, final rule (FR 70, No 185, 56211-56311). Bull trout critical habitat in the Rock Creek drainage is designated at five individual locations and totals 2.88 miles. This biological opinion analyses the potential effect the proposed action would have on designated critical habitat for bull trout in the Rock Creek watershed and the Lower Clark Fork Core Area.

Pursuant to our regulations, the Service is required to identify the known physical and biological features (primary constituent elements or PCEs) essential to the conservation of the bull trout. All areas designated as critical habitat for bull trout are occupied, within the species historic range, and contain sufficient PCEs to support at least one life history function. Watson and Hillman (1997) concluded that bull trout watersheds must have specific physical characteristics

to support spawning and rearing, but that these characteristics are not necessarily present everywhere throughout the drainage.

Based on the current life history, biology, and ecology information of bull trout, the Service has identified the bull trout's PCEs (FR (FR 70, No 185, 56211-56311). The following are the PCEs for bull trout: 1) stream temperatures from 32 to 72^0 F; 2) complex stream channels influenced by large woody debris, pools, and undercut banks that result in various depths, velocities, and instream habitat structures; 3) substrates of sufficient size, amount, and composition for juvenile and egg survival; 4) natural stream flows or artificial flows that are regulated in order to support bull trout; 5) springs, seeps, and groundwater sources, and subsurface flow that contributes to the water quantity and quality as a cold water source; 6) migratory corridors that support unimpeded movement between spawning, rearing, foraging, and over-wintering areas; 7) adequate food base of terrestrial and aquatic insects and forage fish; and 8) permanent water sufficient to provide the quality and quantity for normal reproduction, growth, and survival.

ENVIRONMENTAL BASELINE

Regulations implementing the Act (50 CFR 402.02) define the environmental baseline as the past and present impacts of all Federal, State, or private actions and other human activities leading to the current status of the species, its habitat (including designated critical habitat), and ecosystem in the action area. Also included in the environmental baseline are the anticipated impacts of all proposed Federal projects in the action area which have already undergone section 7 consultations and the impacts of State and private actions which are contemporaneous with the consultations in progress.

Status Of The Species Within The Action Area

Lower Clark Fork Core Area Population

The action area (areas potentially affected directly or indirectly) for this biological opinion includes the Rock Creek drainage (local population) where the most direct effects may occur and Cabinet Gorge Reservoir, which functions as rearing and over-wintering habitat for migratory fish and part of the larger Lower Clark Fork Core Area population of bull trout (see Figure B3). The local population of bull trout that spawns and rears in Rock Creek is the smaller of two local populations that are found in tributaries to Cabinet Gorge Reservoir; the other being in the Bull River drainage. Prior to Cabinet Gorge Dam the downstream extent of the action area would have historically extended further in the riverine environment, most likely down the Clark Fork River to Lake Pend Oreille. However, we conclude that potential direct and indirect effects of this project are not likely to extend downstream of Cabinet Gorge Dam, due to the storage capacity of Cabinet Gorge Reservoir. The water impounded by Cabinet Gorge Dam (i.e., Cabinet Gorge Reservoir) is held significantly longer than the fast-flowing water in the Rock Creek drainage. The storage time of water in the reservoir may vary from hours, to days, to weeks, but this period of storage will, to a large degree, modify temperature, dissolved gases, and suspended solids in the reservoir. An immediate result of Rock Creek inflows into the reservoir is the reduction in velocity of water. As the inflowing water meets the more quiescent water of

the reservoir, it loses some of its capacity to carry suspended solids, and these solids are deposited in the reservoir (e.g., suspended sediment from Rock Creek). Thus the longer residence time of the slow-moving water of the reservoir caused by the impoundment would not convey effects beyond Cabinet Gorge Dam.

Pre-impoundment population estimates for migratory adult bull trout range between 2,000 and 10,000 for the lower Clark Fork River (Pratt and Huston 1993). This would have included primarily adfluvial fish from Lake Pend Oreille, but perhaps some fluvial fish as well. There has been a decrease in the relative abundance of bull trout upstream of Cabinet Gorge Dam. Since the Pratt and Houston (1993) investigations, other studies (WWP 1995a, 1995b, 1996) have confirmed the limited abundance and tenuous nature of bull trout associated with Cabinet Gorge Reservoir (Neraas and Spruell 2001, Lockard et al. 2004). Bull trout numbers within the project area "are small enough to prompt concern about both available genetic diversity and population persistence" (MDEQ and USDA Forest Service 2001). In Cabinet Gorge Reservoir tributary reaches accessible to migratory fish, bull trout were the least abundant trout species sampled.

Until recently, fluvial and adfluvial fish were blocked from freely and extensively migrating in the lower Clark Fork River (if not further upstream) by the three dams (Cabinet Gorge, Noxon Rapids, and Thompson Falls) that are positioned in sequence immediately upstream of Lake Pend Oreille (see Figure B3). In the absence of the dams, it is likely the Lower Clark Fork Core Area population would have comprised a single Lake Pend Oreille Core Area population with local populations located in each of the watersheds. Despite these limitations, the lower Clark Fork watershed continues to support bull trout that exhibit both resident and migratory life history forms. Most of the drainages occupied by bull trout in this watershed are believed to be dependent on migratory individuals to ensure long-term bull trout persistence.

Fragmentation of the migratory corridor by mainstem dams is a major factor affecting the survival and recovery of bull trout in the lower Clark Fork River drainage (MBTSG 1996b). However, in the last five years this threat has been addressed to a large degree at the Avista dams through current fish passage programs (see previous discussions in this biological opinion, Introduction and Consultation). Fish passage planning and development is currently underway by Montana PP&L at Thompson Falls Dam. Prior to the Avista fish passage program, past fragmentation resulted in smaller, isolated groups of bull trout with decreased tributary accessibility. The migratory component of these smaller units was at a higher threat of extirpation due to their limited abundance and available range as well as the inability of fish migrating downstream over or through dams to return to natal waters. Rearing capacity in the reservoirs was greatly reduced compared to Lake Pend Oreille due to the size differential. Furthermore, the quality of available habitat for bull trout in the reservoirs was lower due to water level fluctuation, higher turnover rate of nutrients cycling through the system, and especially the much warmer water temperatures and lack of deep-water thermal refugia.

Some self-sustaining bull trout currently persist and reach adulthood in Noxon Rapids or Cabinet Gorge reservoirs. Bull trout in these two reservoirs are isolated from freely migrating to upstream and downstream reaches. As a partial result of habitat limitations, the reservoirs support relatively few adult bull trout, and populations were viewed as being at high risk of

extirpation (USDI 1998c). Migratory bull trout tend to use larger tributaries to the lower Clark Fork River for spawning and rearing. Primary spawning tributaries in the system are Prospect Creek, and the Bull, Thompson, and Vermilion rivers. Movement of fish (and resulting gene flow) between the reservoirs has been previously limited to a downstream direction, although the magnitude of bull trout movement out of either reservoir is unknown. With the initiation of the Avista trap and transport program about five years ago, that situation has changed.

The Bull River supports more spawning bull trout than other tributaries in the Lower Clark Fork Core Area, with 9-32 bull trout redds located in the East Fork Bull River in 2001-2006, 1-10 bull trout redds in the South Fork Bull River, and occasional redds in the upper mainstem (Moran 2004, MFWP unpublished data 2006, Moran 2005). The bull trout redd counts in Rock Creek indicate inconsistent spawning, likely due in part to intermittent access as a result of a reach in the midsection of the lower mainstem that is perennially dewatered (see Figure B5). In 2004, the highest number of redds were recorded since surveys began in 2001, with two redds in the mainstem below the dewatered reach and four redds just upstream of the confluence of the West Fork (see Figure B5). At least a portion of those redds were known to be constructed by fish that had been passed upstream over Cabinet Gorge Dam (Lockard et al. 2004).

Neither Cabinet Gorge, Noxon, or Thompson Falls reservoirs provide an adequate surrogate for Lake Pend Oreille. Cool water habitat conditions are limited in the reservoirs. Reservoir habitat conditions are largely unsuitable for bull trout (WWP 1995a) and are considered degraded by State of Montana standards as they pertain to supporting a cold water fishery. Bull trout growth and survival rates are likely decreased from predevelopment conditions. This shift in habitat suitability is evidenced by the highly successful bass fishery and dominance by generalist fishes in these reservoirs (WWP 1995b).

The small, isolated nature of the original four core areas, limited bull trout abundance, suboptimal habitat, and low re-founding potential from other core areas led to the listing characterization of the core areas as depressed (USDI 1998c). That, in part is why the Bull Trout Recovery Team for the Clark Fork determined that functional connectivity of the core areas in the lower Clark Fork River subbasin to upstream (and downstream) areas past the dams was important to help ensure the long-term persistence of bull trout (USDI 2002c). It noted that the core areas were an artificial designation due to the dams and that functionally for bull trout the historical core area (pre-dam development) is significantly much larger as explained above. It is believed that the relative contribution of bull trout of the Lower Clark Fork Core Area population to the overall function of the larger historical Lake Pend Oreille system is currently very small, less than 5% of known spawners, assuming 100 percent of adults returning to the three reservoirs could pass Cabinet Gorge Dam and successfully spawn (an unlikely circumstance due to natural variation in addition to man-caused obstacles). At the very best, the Lower Clark Fork Core Area may presently support 200-300 adult bull trout as compared to 5,000 in the Lake Pend Oreille Core Area. Under current circumstances, the rate of recovery of bull trout in the Lower Clark Fork Core Area has improved slightly with the Avista fish passage program. However, it is anticipated that with the development of permanent fish passage facilities and operations within the next 10 years, this rate should improve significantly.

In summary, due largely to the artificial isolation caused by the dams and the habitat unsuitability of the three reservoirs in the Lower Clark Fork Core Area, bull trout distribution and numbers have been relatively small between 1952 and present. This is evident when this core area is compared to other core areas in the Clark Fork River Management Unit and some other portions of the Columbia River basin (USDI 2005a). Local populations of bull trout in the Bull River (35.3 miles) and Rock Creek (7.1 miles) form a very small percentage (1.3%) of the 3,372 miles of important occupied bull trout habitat in the Clark Fork River watershed (USDI 2002a). With improved fish passage in the core area in the next few years, it is likely that some local populations could be strengthened and that bull trout distribution could expand.

Status of the Rock Creek local population of bull trout

The baseline conditions for the Rock Creek local bull trout population parameters and its associated important habitat indicators are summarized in Table B4 and are based largely on the biological assessment conducted by the Forest (MDEQ and USDA Forest Service 2001). Although the baseline assessment was conducted in 2001, based on discussions with the Forest Service and considering habitat and population information since 2001, the Service has determined that the baseline conditions in Table B4 have not changed for any individual indicator, and therefore, the risk ratings are current. Risk ratings for each category provide a good indication of the status of the population and of how well the habitat components function to support the existing population. Most of the habitat parameters are functioning at-risk for bull trout, which suggests that the existing habitat conditions are able to provide for persistence of the current population level of resident bull trout. Although the population level of the adfluvial component of Rock Creek bull trout is unknown, the current habitat conditions do provide for spawning and rearing adfluvial bull trout based on the adult adfluvial fish that were found in Rock Creek in 2004 (total 10 adult bull trout) and the trapping of juvenile fish migrating downstream in the spring and summer in recent years.

The level of information available on bull trout in Rock Creek has been minimal in the past, but with recent more intensive investigation additional information on fish presence, absence, migration and demographic characteristics have been generated. Bull trout in the Rock Creek drainage had been thought to be primarily of the resident life history form (MDEQ and USDA Forest Service 2001). Pratt and Huston (1993) suggested Rock Creek bull trout historically did not have a strong migratory component. Within the Rock Creek drainage, bull trout occur in the mainstem Rock Creek, West Fork Rock Creek, and East Fork Rock Creek (see Figure B5; MDEQ and USDA Forest Service 2001). Watershed Consulting (1997) reported 79% of the bull trout captured were sampled in the East Fork. Several attempts to determine the number of Rock Creek bull trout were made between 1986 and 1996. Watershed Consulting (1997) and WWP (1996) reported similar bull trout densities in East Fork Rock Creek. The WWP(currently known as Avista) (1996) population estimates extrapolated to the drainage scale from density data collected at the reach scale yielded approximately 1,900 total bull trout in Rock Creek and 743 total bull trout in West Fork Rock Creek. However, such extrapolations were viewed cautiously.

Table B4. Baseline Indicators and Documentation for Rock Creek Bull Trout Rated as Functioning Appropriately (FA), Functioning at Risk (FAR), or Functioning at Unacceptable Risk (FUR) (USDA 2001)(Appendix G).

Indicator	Rock Creek Values	Rating
Core Area Size	Greater than 2000 individuals, low habitat complexity, largely isolated system.	FAR
Growth and survival	Growth rates are low and not expected to improve within the next life cycle of bull trout. Instantaneous survival rate for bull trout was lower than for other salmonids in Rock Creek.	FUR
Life history and diversity	Absence or rarity of the adfluvial component.	FUR
Persistence and genetic integrity	Presence and threat of brook trout hybridization in the drainage.	FUR
Temperature	12°C summer, 9°C spring/fall, 5°C winter.	FA
Sediment	Range from 10% to 24%.	FAR
Nutrients and contaminants	Nutrient levels are low in the Rock Creek drainage. Productivity in the stream is phosphorus limited. Background contaminants include arsenic, cadmium, copper, lead, and zinc which are all naturally present below current detection limits with the exception of zinc at 0.5 µg/l (MDEQ and USDA Forest Service 2001).	FA
Physical barriers	Intermittent flow, culvert barrier during some flows.	FAR
Substrate embeddedness	No data specific to embeddedness however, core sampling data range from 15.4% to 43.1%.	FA
Large woody debris	Mean 6.8 pieces/100 m below the confluence of the East and West Forks (WWP 1996). Upper East Fork has high levels of LWD (MDEQ and USDA Forest Service 2001. Mean of 4.6 pieces/100 m greater than 10 ft in length in the West Fork (WWP 1996). Low numbers in mainstem Rock Creek.	FAR
Pool frequency and quality	Reduction in pool volume due to sediment loading.	FAR
Large pools	Existing pools are shallow and wide.	FAR
Off-channel habitat	Naturally limited.	FAR
Refugia	Currently not adequate.	FUR
Wetted width/ depth ratio	Ratio <10.	FAR
Streambank condition	Alluvial terraces are being undermined.	FAR
Floodplain connectivity	Has not been altered.	FAR
Change in peak/base flows	Intermittent flow during some times of the year.	FUR
Drainage network increase	Roads lack BMP standards.	FAR
Road density and location	Densities 1.5 to 3.0 mi/mi^2, riparian roads.	FAR
Disturbance history	Equivalent Clearcut Area = 15%	FAR
Riparian conservation areas	Roads and sediment are issues within the RHCA	FAR
Disturbance regime	Data inadequate	FAR
Integration of species and habitat conditions	**Minimal migratory component, low habitat complexity and low pool frequency.**	**FUR**

There have been documented occurrences of larger migratory bull trout in the Rock Creek drainage (MDEQ and USDA Forest Service 2001). Two radio-tagged bull trout transported from the Clark Fork River below Cabinet Gorge Dam to Cabinet Gorge Reservoir were relocated near the mouth of Rock Creek in 2001. This suggested these fish were attempting to enter Rock Creek to spawn (Lockard et al. 2002a). In 2002, tracking of 19 radio tagged bull trout in the Cabinet Gorge Reservoir (fish that were either captured there initially or transported over the dam from downstream) showed substantial migratory movement occurred into the Bull River drainage, particularly the East Fork Bull River, during the period surrounding the spawning season (Lockard et al. 2003).

In 2003, a total of 22 individual bull trout with radio tags were documented entering spawning streams in portions of the Cabinet Gorge Reservoir (Lockard et al. 2004). Most were located in the East Fork Bull River, with lesser numbers in the South Fork and mainstem Bull River. However, for the first time migratory bull trout from the reservoir were tracked into Rock Creek upstream of the reservoir (Lockard et al. 2004). Both fish (a 25 inch male and 26 inch female) were known to be alive in the upper end of Cabinet Gorge Reservoir in June or July 2003 and then disappeared from tracking surveys. Both tags were located outside the fish and lying in the substrate or buried in debris, approximately 1.9 miles up Rock Creek, in July 2004. The fish had presumably expired at or upstream of those locations due to unknown causes. The location where the tags were found was upstream of a perennially dewatered reach. It was unknown whether the fish were present or spawned in Rock Creek in 2003 (Lockard et al. 2004).

In 2003, weir traps located on the mainstem of Rock Creek, 164 feet downstream from the West Fork of Rock Creek confluence, operated from July 24 through August 30, at which time operations ceased due to a lack of flowing water (Lockard et al. 2004). The trap was reinstalled on October 28 and operated intermittently during a period of unseasonably high flows until November 24. In 2004, this weir trap captured a single migratory-sized adult male bull trout 18 inches in length (Lockard et al. 2004). This was the first migratory-sized bull trout to be captured since this weir trap began operating in 2001, and considered the first documented occurrence in Rock Creek since 1986. Another migratory-sized bull trout (14 inches in length) was captured in 2003 during electrofishing operations upstream of the weir site in Rock Creek (Liermann 2004). Even though few large bull trout have been captured in the drainage, the four migratory-sized adults captured or detected in 2003 suggested the persistence of a migratory form of bull trout in the Rock Creek drainage.

In 2004, radio tracking documented six radio-tagged bull trout, all of which had been transported around Cabinet Gorge Dam, in the Rock Creek drainage during the spawning season (Lockard and Hintz 2005). This was the first year the Avista project had documented migratory bull trout both entering and spawning in Rock Creek. Figure B5 shows the pattern of radio relocations and redd observations in the system. Two of the six fish moved upstream of the confluence of the West Fork Rock Creek. The other four remained in the lower 2.5-mile reach, known locally as the canyon reach. Five of the six fish were first detected in Rock Creek between September 2 and September 18, 2004, and the sixth was found on July 16. Immigration of most fish apparently followed a late August high rainfall event. Perhaps not coincidentally, the first fish to enter was located the furthest upstream, approximately 8.3 miles up the drainage. Lengths of these fish were 22.8 – 28.9 inches. Four were females and the two largest were thought to be

males. Two of the fish were observed paired in the vicinity where a redd was later found and several others were also believed to have spawned (Lockard and Hintz 2005). In total ten adult sized migratory bull trout, including the six with transmitters, were located in the Rock Creek drainage in 2004. It appears that the migratory form of bull trout persists (or has rebounded) in this drainage to a greater extent than believed at the time of listing (USDI 1998c). The spawning capability of migratory bull trout in this drainage and their access to Rock Creek appears to be directly linked to two factors. First, is the availability of higher than average flows, particularly during the late summer or early Fall. Second is the availability of adult fish, which apparently could be greatly enhanced by the Avista trap and transport program. The latter circumstance directly supports the premise of the Draft Bull Trout Recovery Plan that Lake Pend Oreille Core Area and the Lower Clark Fork Core Area described in the lower Clark Fork River system must be reconnected for full recovery of bull trout to occur in this region.

Extensive effort has been expended since 2000 to capture juvenile bull trout in streams entering Cabinet Gorge Reservoir, using weirs, rotary screw traps, and electrofishing. Fish are PIT tagged, with unique individual codes, and a portion is transported downstream around Cabinet Gorge Dam while the remainder is allowed to volitionally migrate. The effort is designed to track juvenile fish through the system as well as evaluate returns as adults, in order to more efficiently manage the program. To date, one PIT tagged juvenile has been recaptured as an adult; apparently this fish survived passing Cabinet Gorge Dam and Reservoir, because it was released into Bull River and not transported around the dam. Effort and success of the juvenile capture program has been variable, with frequent high water events affecting the integrity of the traps on a seasonal basis (Lockard et al. 2005). Site suitability, streamflow, and other factors greatly affect the efficiency of the various collector systems. In 2004, a total of 211 downstream moving juvenile bull trout were captured in tributaries to Cabinet Gorge Reservoir (Bull River and Rock Creek) and Noxon Rapids Reservoir (Vermilion River and Graves Creek).

Results, though not absolutely comparable, do provide some indication of the numbers and distribution of juvenile bull trout that core area streams are contributing. Approximately 20 juvenile bull trout were captured in the upper mainstem Bull River over a four year period (2001-2004). In the East Fork Bull River between 24 and 101 juvenile bull trout were captured annually between 2000 and 2004, with a total of 327. In Rock Creek, between 17 and 55 bull trout were collected annually between 2001 and 2004, with a total of 137 over the four-year period (Lockard et al. 2005). These data support the contention that Rock Creek is secondary to the Bull River in terms of recruitment of juvenile bull trout to the Cabinet Gorge Reservoir, though Rock Creek has steadily contributed.

In addition to bull trout, the primary species captured in traps in Rock Creek is westslope cutthroat trout. A total of 462 juvenile westslope cutthroat trout were captured in Rock Creek traps in 2004 (Lockard et al. 2005). The 2004 trap catch represents the highest numbers of both bull trout and westslope cutthroat since trapping began.

Resident bull trout remain the most significant component of the bull trout population in Rock Creek. However, the Avista studies have focused on migratory fish and so have not extensively evaluated the resident portion of the population (Larry Lockard, pers. comm.,, U.S. Fish and Wildlife Service, 2005). Brook trout are present in Rock Creek and may compete or hybridize

with bull trout. Brook trout are especially prevalent in the lower reaches downstream of the canyon section (see Figure B5). Risk of hybridization between brook trout and bull trout remains relatively high, though it has not been evaluated in this system.

The investigations conducted since 2000, primarily by the Avista program, have greatly advanced our understanding of the importance of migratory bull trout in Rock Creek and Cabinet Gorge Reservoir. Contrary to earlier beliefs, evidence is mounting that may show that migratory bull trout are an important component of the Rock Creek local population and appear to play a role in maintaining the persistence of the core area population. That role is apparently being enhanced and may be enhanced further by the trap and transport program and/or any eventual fish passage around Cabinet Gorge and Noxon Rapids dams. Perhaps these results are not surprising, given the known previously depressed status of the bull trout population in this core area.

Status of Habitat Conditions for Bull Trout in Rock Creek

Rock Creek is classified as a fourth order drainage (see Figure B4). The headwaters are in the southwestern end of the Cabinet Mountains. This watershed drains approximately 21,162 acres. Peak flow for Rock Creek is estimated to be between 200 and 300 cubic-feet-second (cfs). Base flow is approximately 2 cfs with a 7-day, 10-year low of 0 cfs (MDEQ and USDA Forest Service 2001). The mainstem Rock Creek consists of C and D Rosgen channel types through much of its lower reaches. The lower section is typified by low gradient, approximately 2%, through much of its length. The watershed contains several areas of sensitive landtypes, which are presently chronic sediment sources. This has resulted in a large volume of bedload and reduced transport efficiency. The trophic condition of the watershed is characterized by low overall primary and secondary productivity (USDA 2000).

The East and West Forks of Rock Creek have gradients of 10.4 and 7.3%, respectively (MDEQ and USDA Forest Service 2001). Rubble and gravel are the co-dominant substrate in the lower reaches associated with large boulders and cobble (WWP 1996; MDEQ and USDA Forest Service 2001). Steeper sections of the mainstem and the East and West Forks are dominated by cobbles (WWP 1996). Spawning habitat is limited in some reaches to isolated pockets of gravel behind stable debris or boulders.

In general, habitat conditions in the Rock Creek watershed are degraded with relatively high levels of sediments present in the spawning gravels and periods of stream flow intermittence occurring in many years (MDEQ and USDA Forest Service 2001). The past occurrences such as climate change, riparian logging, road building, geologic events, and the 1910 fire have likely degraded habitat and contributed to Rock Creek's limited habitat conditions for bull trout (MDEQ and USDA Forest Service 2001).

Riparian harvest, roads, and other management activity affect lower sections of the stream. The upper sections of the East and West Forks are less impacted. The riparian areas of mainstem Rock Creek have been harvested on much of the private land. The drainage network in Rock Creek has been altered by past road construction. Road 150 runs adjacent to Rock Creek for much of its length. There are 46.1 miles of road within the Rock Creek drainage. This is a road

density of 1.5 mi/mi^2 in the Rock Creek drainage. The road density on sensitive land types is 2.2 mi/mi^2. Impacts to the riparian area in Engle Creek also are extensive.

Engle Creek has been impacted by fire and past riparian harvest throughout much of its length. There has been extensive riparian harvest in the lower reaches of Rock Creek as well. The whole watershed was affected by the fires of 1889 and 1910, and although forest vegetation has recovered to a large extent, latent effects from these fires may still be occurring in the watershed. There have been 2,484 acres of regeneration harvest on the Forest since 1970. Equivalent clearcut acres (ECA) for the drainage are approximately 12.7%.

Typically, intermittent stream flow seasonally isolates Rock Creek from the reservoir. The cause of the dewatering of segments of Rock Creek is uncertain, and therefore, it is unknown whether it is a natural or man-caused condition. Mainstem Rock Creek lacks surface flow during periods of base flow for the majority of its lower 3.4 miles. West Fork Rock Creek flows perennially from the falls, approximately 1.6 miles upstream from the confluence of the East Fork Rock Creek, downstream to about 0.2 mile upstream from the confluence. East Fork Rock Creek flows perennially, but loses water near the confluence (Watershed Consulting 1997).

The culvert under State Highway 200 has been identified as a potential barrier at some flows (see Table B3). Natural barriers have been identified including the ephemeral lower reaches of Rock Creek downstream of the canyon and a waterfall limiting upstream movement on the East Fork (see Figure B5).

Watershed Consulting (1997) identified the stream banks as a major source of sediment in their surveys. Watershed surveys have consistently identified three areas contributing sediment to the Rock Creek system. They include Engle Creek, a slump in the West Fork Rock Creek and the stream banks in the mainstem Rock Creek. Sampling done by Watershed Consulting (1997) measured mean percent surface fines at 10%, 6.8%, and 1.0% in Rock Creek, the West Fork and the East Fork, respectively. Washington Water Power measured similar levels of fines in Rock Creek with a mean of 10% (see Table B3; WWP 1996). Mean percent fines in the West Fork were higher at 24% (WWP 1996).

Off-channel habitat is naturally limited in the Rock Creek drainage. The stream has access to its floodplain but there is limited complexity and potential for backwater areas particularly in the areas of steeper gradient. Connectivity with the Rock Creek floodplain has not been altered by past management activity.

Pool frequency is low in the Rock Creek drainage (see Table B3). Most of the available fish habitat is in the form of runs and riffles (WWP 1996). This condition holds true in the low gradient portions of the mainstem Rock Creek. Given the overall low frequency of pools, pool quality also is very low. Stream surveys have consistently identified low pool frequency as a potential aspect for habitat improvement. Width/depth data for pools has not been collected. Width/depth data has been collected for riffles in the mainstem, East Fork and West Fork by Watershed Consulting (1997). The mean ratios are 29, 37, and 19 respectively. Since the dominant habitat type in the Rock Creek system is riffle and glide habitat types this is an accurate description of available habitat.

The mainstem of Rock Creek contains a relatively low amount of large woody debris (LWD) relative to other watersheds in the lower Clark Fork River drainage (see Table B3; WWP 1996). The potential for future recruitment of LWD is greatly reduced due to past riparian timber harvest and the location of existing roads. Little of the large woody material that enters the active channel is retained. Despite the low abundance of LWD, the thermal regime appears to be functioning appropriately. Low water temperatures ranged from 32 °F (0.3 °C) in November up to 54 °F (12.1 °C) in August in 1994 (see Table B3; WWP 1996).

In summary, the inherent difficulties faced by migratory bull trout persisting in a watershed such as Rock Creek, is in part a result of intermittent flow conditions, which may have been exacerbated by man-caused impacts to the habitat. Reduced complexity and quality of the instream and riparian habitat and low frequency and quality of pools are problematic for the maintenance of spawning runs of large migratory adult bull trout that are uniquely vulnerable during the low flow period in the early fall. These issues are exacerbated by competition from non-native species and increased human use (including angling, poaching, and harassment). Much of the available habitat in Rock Creek is marginally suitable for large, migratory fish. Most habitat components in the Rock Creek drainage are functioning at-risk for bull trout; however, a few important habitat attributes such as stream temperature and substrate embeddedness are functioning appropriately (see Table B4). Another reason for concern is the frequency with which the stream goes dry at low flow. As the record from 2000 through 2005 indicates, access to upper reaches of Rock Creek is likely denied for migratory bull trout in many years. This is due primarily to intermittent flows in the lowermost reach and much of the midsection in most years. In addition, loss of juvenile bull trout migrating downstream (entrainment, etc.) and blocked upstream passage for adults over Cabinet Gorge Dam, further limits productivity. Both of these issues are currently being partly overcome by the Avista trap and transport program, but the level of efficiency is unknown.

Marginal rearing conditions in Cabinet Gorge Reservoir are an additional constraint (WWP 1995a). The combined conditions support an integrated rating of species and habitat conditions of functioning at unacceptable risk (see Table B4). Though the situation may be viewed as improving, the low habitat complexity, limited suitable spawning and rearing habitat, stream intermittence, and the rarity of the migratory life history form indicate bull trout in the Cabinet Gorge Reservoir and the Rock Creek local population are still largely isolated and at high risk of extirpation due to random events (MDEQ and USDA Forest Service 2001).

Finally, fine sediment levels in Rock Creek are functioning at-risk for bull trout. It ranges from 10 to 49 percent in areas of bull trout spawning and incubation, which are limited in the watershed, particularly for adfluvial-sized adult fish. The high levels are likely due to past logging activities; however, background levels are unknown prior to intensive forest management and associated road construction. Under current baseline conditions, fine sediment levels deposited in spawning areas could be limiting reproduction. Nevertheless, it is difficult to determine if this is a limiting factor given several other habitat parameters are functioning at-risk, especially the nearly annual intermittent flows in the lowermost reach and much of the midsection in most years.

Factors Affecting Species Environment Within The Action Area (Population And Habitat Factors)

The Montana Bull Trout Scientific Group (1996b) documented the risks to bull trout in the lower Clark Fork River. That documentation was expanded in the Draft Bull Trout Recovery Plan (USFWS 2002c) and updated in the core area status assessment (USFWS 2005a). Fragmentation of the historic migratory populations in the lower Clark Fork River was considered the highest risk, but this threat has been addressed with consolidation of four core areas into one (Lower Clark Fork Core Area) as a result of the success of the Avista fish passage program. Past fragmentation has reduced potential genetic interchange and accessibility to tributary systems. The migratory component of these smaller, isolated units was at a higher risk of extirpation due to their limited abundance and available range. Other risks to restoration include environmental instability from landslides and rain-on-snow events, thermal problems related to increased summer water temperatures, rural and residential development, and illegal bull trout harvest. The MBTSG (1996b) concluded adfluvial bull trout in Cabinet Gorge Reservoir were at risk because of fragmented habitat, migration barriers, small available habitat areas, degraded habitat conditions, low predicted survival to emergence, threats of hybridization with brook trout, competition and predation from other introduce fishes, and low bull trout abundance. Subsequent analyses reinforced that conclusion (USFWS 2005b).

The Cabinet Gorge Reservoir habitat is suitable for nonnative species such as walleye (*Stizostedion vitreum*) and northern pike (*Esox lucius*). These predatory species likely compete with adult bull trout and prey on juvenile bull trout. Brown trout are another nonnative species with potential impacts on bull trout. Since bull trout and brown trout spawning areas overlap in the Bull River and brown trout spawn later than bull trout, bull trout redd disturbance may be a factor (Pratt and Huston 1993).

The FERC BA (FERC 1999) concluded, based on the licensee's studies (WWP 1995a, 1995b, 1996), "it is now highly likely that many of the adfluvial bull trout populations that historically existed in the reservoir's tributary streams, and were presumed to be maintaining a remnant population, in fact no longer exist." In other words, the bull trout observed in the tributary streams were either small resident fish or juvenile fish remaining from very few spawning adfluvial fish from the reservoir. The restoration plan for bull trout in the Clark Fork River basin in Montana (MBTRT 2000) and the conservation plan for bull trout in Lake Pend Oreille (LPOBTWAG 1999) identify the need to reconnect the Lake Pend Oreille and lower Clark Fork River areas to accomplish restoration goals. Threats and limiting factors identified in the reports included Cabinet Gorge Dam as a barrier to migratory fish movement.

Ongoing mitigation tied to the relicensing of the Avista (formerly known as WWP) Clark Fork FERC Project number 2058 includes the Native Salmonid Restoration Plan. The Native Salmonid Restoration Plan strives to address issues related to fish passage and restoration efforts for native salmonids on the lower Clark Fork River. There are two primary objectives relative to fish passage. One objective is to determine whether passage at Cabinet Gorge Dam would effectively increase the viability of bull and westslope cutthroat trout populations in the lower Clark Fork River, its tributaries, and Lake Pend Oreille. The other objective is to re-establish connectivity for migratory native salmonids. Both are essential components to restoration of

native salmonids. As described in the preceding sections of this biological opinion, Avista investigations conducted since 2000 have proven that the migratory life history component of bull trout in Rock Creek and the Bull River is still viable and the trap and transport program is currently enhancing the status of migratory fish in the Lower Clark Fork Core Area (Lockard and Hintz 2005). Additional mitigation measures are being used to support the Rock Creek Watershed council and implement watershed research to describe Rock Creek bull trout and available habitat and restoration to benefit bull trout.

Cooperative efforts between Avista, MFWP, and local watershed groups are providing long-term habitat protection through land acquisition, conservation easements, and watershed restoration. Bull trout occurrence in the Lower Clark Fork Core Area could increase as a result of such activities. These efforts are highly important to the eventual recovery of bull trout in the lower Clark Fork River system once fish passage at Cabinet Gorge, Noxon, and Thompson Falls dams is attained permanently. The primary restoration actions needed to restore the original migratory life history functions of bull trout in the lower Clark Fork River system is habitat improvement and fish passage at the dams. Once this is accomplished, it will help define the biological contribution of Rock Creek bull trout to the historically larger bull trout Lake Pend Oreille Core Area.

Environmental Baseline Of Designated Critical Habitat

On September 26, 2005, the Service published notice in the Federal Register the final rule designating critical habitat for bull trout for the Klamath River, Columbia River, Jarbridge River, Coastal-Puget Sound, and Saint Mary-Belly River populations of bull trout (FR 70, No 185, 56211-56311). This final designation totals approximately 3,828 miles (6,161 kilometers) of streams, 143,218 acres (57,958 hectares) of lakes in Idaho, Montana, Oregon, and Washington, and 985 miles of shoreline paralleling marine habitat in Washington. There are 3 critical habitat units located in Montana: 1) Clark Fork River Basin with 1,136 miles of streams and 31,916 acres of lakes/reservoirs; 2) Kootenai River Basin with 56 miles of streams and 1,384 acres of lakes/reservoirs; and the Saint Mary-Belly River Basins with 37 miles of streams and 4,107 acres of lakes/reservoirs (note that a portion of the Clark Fork River Basin is in northern Idaho, so the numbers do not add up to the totals previously listed for Montana). Note that the final rule designating critical habitat for bull trout adopts the use of *local population, core area, and major genetic group* (as defined in the memorandum consistent with the draft recovery plan) (page 36258 in FR 70, No.185, 56211-56311).

Based on the current life history, biology, and ecology information of bull trout, the Service has identified the bull trout's PCEs (FR (FR 70, No 185, 56211-56311). The following are the PCEs for bull trout: 1) stream temperatures from 32 to 72^0 F; 2) complex stream channels influenced by large woody debris, pools, and undercut banks that result in various depths, velocities, and instream habitat structures; 3) substrates of sufficient size, amount, and composition for juvenile and egg survival; 4) natural stream flows or artificial flows that are regulated in order to support bull trout; 5) springs, seeps, and groundwater sources, and subsurface flow that contributes to the water quantity and quality as a cold water source; 6) migratory corridors that support unimpeded movement between spawning, rearing, foraging, and over-wintering areas; 7) adequate food base

of terrestrial and aquatic insects and forage fish; and 8) permanent water sufficient to provide the quality and quantity for normal reproduction, growth, and survival.

Action agencies authorizing activities within lands occupied by bull trout are mandated by the Endangered Species Act of 1973, as amended, to consider the environmental baseline in the action area and effects to bull trout that would likely occur as a result of management actions. To that end, agency biologists use the four biological/population indicators and the 19 physical habitat indicators in the Framework for bull trout to assess the environmental baseline conditions and determine the likelihood of take per interagency guidance and agreement on section 7 consultations on the effects of actions to bull trout (USDA and USDI 1998a, 1998b). Analysis of the 19 matrix habitat indicators provides a very thorough analysis of the existing habitat condition and potential impacts to bull trout habitat.

While assessing the environmental baseline and potential effects to bull trout as a species, agency biologists have concurrently provided a companion analysis of effects to the PCEs for proposed bull trout critical habitat and related habitat indicators (Appendix I). This companion analysis shows that the matrix analysis for environmental baseline conditions thoroughly addresses the PCEs for baseline conditions of designated critical habitat for bull trout.

The proposed action would occur in a portion of the Lower Clark Fork Core Area that contains 135 stream miles and 735 lake acres of designated critical habitat for bull trout and of that total Rock Creek contains 2.88 miles.

Only the Rock Creek watershed has designated critical habitat that lies within the action area. Cabinet Gorge Reservoir, for which Rock Creek is a tributary and which provides foraging, migratory, and over-wintering habitat for Rock Creek bull trout (Pratt and Huston 1993), does not contain critical habitat. Bull River, which is a tributary to Cabinet Gorge Reservoir and which is the most important bull trout stream in the lower Clark Fork River, does contain critical habitat, but is not within the action area.

Rock Creek from its confluence with Cabinet Gorge Reservoir upstream 7.1 river miles (rmi) to a natural barrier provides spawning and rearing habitat for Rock Creek bull trout. Designated bull trout critical habitat was identified in the Rock Creek watershed and published in the final rule (FR 70, No 185, 56211-56311). Bull trout critical habitat in the Rock Creek drainage is designated at five separate locations. Four sections are located on the mainstem and one section is located on the East Fork (above the confluence with the West Fork). The total amount of designated critical habitat is 2.88 miles (see Figure B4 and below).

Designated Critical Habitat Stream Miles (2.88 miles):

	Length	**Location**
Section 1	45 rmi	0 - .46 rmi
Section 2	66 rmi	.8 - 1.45 rmi
Section 3	1.11 rmi	2.53 - 3.64 rmi
Section 4	43 rmi	4.81 - 5.25 rmi
Section 5	.23 rmi	6.05 - 6.28 rmi

All five sections listed above identified as critical habitat in Rock Creek contain some, or all, of the PCEs that support bull trout. However, the two seasonally dewatered segments of the mainstem of Rock Creek encompass all or portions of critical habitat sections 1, 2, 3 and 4. The extent of critical habitat area that is affected annually depends on year-round stream flow conditions. In most years all PCEs are negatively impacted to some degree due to the seasonal lack of connectivity preventing upstream movement of adult migratory bull trout. Annual sub-surface stream flow conditions in summer and early fall severely impact the ability of these fish to find suitable spawning areas. Consequently, it is likely that reproduction in most years is significantly limited. As expected, the functioning at-risk environmental baseline conditions for the bull trout habitat indicators in the matrix analysis (see Table B4) confirm the deficient environmental baseline conditions for designated critical habitat in Rock Creek.

Of interest, in 2004 when adult migratory bull trout were radio-tracked in Rock Creek, several relocations throughout the stream channel were documented. Of 17 relocations, 11 occurred in designated critical habitat areas and of the six bull trout redds counted in 2004, two were located in critical habitat, one in section 1 and one in section 2. The four remaining redds were located in close proximity in a non-designated reach higher in the watershed between sections 4 and 5 in the East Fork Rock Creek tributary.

Summary of environmental baseline for designated critical habitat

Based on the site specific environmental baseline habitat conditions of bull trout (see Table B4) and linkage to the PCEs considering those habitat indicators described in Appendix I and other factors as necessary, all PCEs are in less than optimal condition for all five sections designated as critical habitat for bull trout. Furthermore, not all the stream area designated as critical habitat in the Rock Creek mainstem contain all the PCEs as indicated by the overlap of critical habitat sections and the annually dewatered areas. Only in those years where stream flows in the mainstem exist year-round do PCEs (albeit degraded) function to provide for one or more of the two life history functions (resident and migratory) of bull trout. Since the listing of bull trout in 1998, only the year 2004 had year-round flows in the mainstem and this was the first year since 1986 that migratory bull trout were confirmed in Rock Creek.

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 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.

General Effects Of Mining Operations

The U.S. Congress passed the Mining Laws Act of 1872, granting top land-use priority to mineral extraction on all public lands not specifically withdrawn from mineral development. As a result, some 741 million acres (68% of all public land) are open to mining (Sheridan 1977 in Nelson et al. 1991). Extraction of minerals in the United States has frequently deleteriously affected fishery resources in the western United States, and continues to degrade salmonid habitat in many areas (Nelson et al. 1991).

Underground mining and the associated above ground development can potentially have negative effects on bull trout should water quality and quantity be altered. The five specific habitat factors that could be affected are the following:1) stream temperature and dissolved oxygen, 2) stream flow, 3) sediment, 4) large woody debris, and 5) water chemistry. Several studies have shown that underground mining operations and their facilities can increase stream temperatures, create acid discharge, and mobilize toxic heavy metals, produce sediment, create barriers to fish movement, alter stream channel morphology, and alter stream flow (Nelson et al. 1991; Lee et al.1997; Harvey and Lisle1998).

Stream temperature/dissolved oxygen and stream flow

Water quality (e.g., water temperature and dissolved oxygen) can be altered by activities associated with mining. Stream temperature is affected by eliminating stream-side shading, disrupted subsurface flows, reduced stream flows, and morphological shifts toward wider and shallower channels with fewer deep pools. Loss of streamside vegetation reduces the input of material to the stream that would become or create cover for fish in the future as well as result in changes in water temperature regulation (Lee et al. 1997). Dissolved oxygen can be reduced by low stream flows, elevated temperatures, and increased fine inorganic and organic materials that have infiltrated into stream gravels retarding intergravel flows (Chamberlain et al. 1991). Water quantity can be affected by direct removal of water during offstream operations (Martin and Platts 1981).

Sediment

Soil and site disturbance inevitably occurring during mill construction and use and other underground mining activities are often responsible for increased rates of erosion and sedimentation to streams (Martin and Platts 1981; Lee et al. 1997). The site disturbance is associated with many activities including vegetation removal from the site, vehicular access to the site, installation of stream crossing structures, removal of overburden from the site, re-routing or diversion of streams, construction of settling ponds, and removal and processing of valuable minerals. The amount of sediment actually delivered to streams will depend on site specific factors. The deposition of fine sediments in salmonid spawning and rearing habitat increases mortality of bull trout embryos, alevins, and fry (Shepard et al. 1984; Pratt 1984; Fraley and Shepard 1989; Rieman and McIntyre 1993). Sedimentation effects on salmonids can vary significantly depending on salmonid species, stream channel morphology, and stream flows (Harvey and Lisle 1998). For a substrate oriented salmonid like juvenile bull trout, deposition of fine sediments filling spaces between rubble could have a very negative effect on survival,

especially overwinter survival. This could reduce the amount of rearing habitat available to juvenile and subadult bull trout as well as adult bull trout. Suspended sediment also can have both acute and sublethal effects on salmonids (Sigler et al. 1984). Suspended sediment levels have to be very high to cause lethal effects, so sublethal effects such as reduced growth are much more likely to occur. Reduction in growth in various salmonid species has been found to occur at suspended sediment concentrations of 100 to 300 mg/l (Sigler et al. 1984; McLeay et al. 1987).

Many mining projects involve road construction, re-construction and use, which results in further adverse effects. Roads built in forested watersheds can cause mass soil movement and surface erosion, resulting in soil creep, slumping, earthflows, and debris avalanches (Meehan 1991).

Roads are recognized as a long-term source of sediment for extended periods even after erosion control measures have been implemented (Furniss et al. 1991; Belt et al. 1992). Ground disturbance from road blading, particularly where the road is immediately adjacent to streams and at both intermittent and perennial stream crossings can result in elevated levels of sediment introduction. Ditch maintenance is another source of sediment delivery to streams. Increased erosion occurs within the ditch as a function of cleaning, pulling, or heeling, increased rate of slides in the cutslope (if the cutslope is undercut), and long-term risk of increased sedimentation from vegetation or ditch rock removal within the ditch. Delivery of available sediment to streams can vary substantially depending on the level of best management practices in effect on a given road (Belt et al. 1992). Installation of cross drainage structures and maintenance of buffers between the roads and the streams reduce sediment delivery to streams.

Other activities associated with road activities such as ditch maintenance, culvert cleaning, riprapping, crossing structure activities also may increase sediment delivery to streams. Snowplowing can result in increased erosion of the road surface and fill slopes as thawing occurs in the spring. Water flowing down ruts in plowed roads and water flowing off the road onto fill slopes are the primary cause of increased sediment delivery. Installation of new cross drainage features as well as cleaning existing ones can result in some short term increases in sediment delivery, but will help reduce long-term sediment delivery to streams during road maintenance activities.

Large woody debris

Because the supply of large woody debris to stream channels is typically a function of the size and number of trees in riparian areas, it can be profoundly altered by mining activities that remove vegetation in preparation for mining activities. Removal of streamside trees can greatly alter the amount of woody debris in streams over time (Sedell et al. 1988). Shifts in the composition and size of trees within the riparian area affect the recruitment potential and longevity of large woody debris within the stream channel. Large woody debris influences channel morphology, especially in forming pools and instream cover, retention of nutrients, and storage and buffering of sediment. Any reduction in the amount of large woody debris within streams, or within the distance equal to one site-potential tree height from the stream, can reduce instream complexity (Ralph et al. 1994). Large woody debris increases the quality of pools and provides hiding cover, slow water refuges, shade, and deep water areas (Hauer et al. 1999).

Ralph et al. (1994) found instream wood to be significantly smaller and pool depths significantly shallower in intensively logged watersheds. The size of woody debris in a watershed subjected to streamside tree removal in Idaho was smaller than that found in a relatively undisturbed watershed (Overton et al. 1993).

Water chemistry and contamination

Exposing rock strata to weathering and erosion through removal of vegetation and overburden can result in higher levels of metals in streams (Martin and Platts 1981). Metals such as arsenic, cadmium, zinc, copper, and mercury all pose risks for aquatic organisms depending on site-specific water chemistry. Combinations of several metals may pose greater risks despite concentrations for each being below its own toxicity threshold (Wels and Wels 1991). Generally, severe metal contamination is more associated with erosion from milled tailings and waste rock, or acid mine discharge associated with either open pit or underground mines.

Laboratory studies have shown that trout and salmon can detect low levels of metals and actively select lower metals concentrations when given the choice. Woodward et al. (1997) documented that Snake River cutthroat trout will avoid mixtures of cadmium, lead, and zinc. Additional tests documented avoidance behavior in cutthroat trout for copper (6 μg/l) and zinc (28 μg/l). Woodward et al. (1995) showed that brown trout avoided mixtures where copper and zinc were present in concentrations as low as 6.5 and 32 μg/l, respectively. Further, fish acclimated for 90 days to zinc at 55 μg/l, preferred lower concentrations (28 μg/l), when given the choice.

Field studies also have documented the avoidance of metal concentrations by wild fish. Spawning Atlantic salmon in New Brunswick displayed avoidance behavior of metals (primarily copper and zinc) at thresholds of 17-21 μg/l for copper mixed with 210-258 μg/l zinc originating from hardrock mining activities (Sprague et al. 1965; Saunders and Sprague 1967 both in Henry and Atchison 1991).

There may be effects to bull trout related to the various petroleum products commonly used in mining operations. Petroleum can cause environmental harm by toxic action, physical contact, chemical and physical changes within the soil or water medium, and habitat alteration. Oil spills have caused major changes in local plant and invertebrate populations lasting from several weeks to many years. Effects of oil spills on fish have been difficult to determine beyond the immediate losses in local populations. Drilling fluids, sometimes used in great quantities at mining sites, were found to be toxic to rainbow trout at concentrations less than 100 mg/L (Sprague and Logan 1979 in Nelson et al. 1991). Chemicals used in processing and recovery of metalliferous deposits may be toxic. Webb et al. (1976) reported the flotation reagents sodium ethyl and potassium amyl xanthate were highly toxic to rainbow trout.

While it is unlikely large numbers of fish inhabiting large, deep bodies of water would be killed by the toxic effects of spilled petroleum, fish kills may be caused by large amounts of oil moving rapidly in shallow waters such as shallow streams. Oil and petroleum products vary considerably in their toxicity, and the sensitivity of fish to petroleum varies among species. The sublethal effects of oil on fish include changes in heart and respiratory rates, gill hyperplasia, enlarged liver, reduced growth, fin erosion, impaired endocrine system, and a variety of

biochemical, blood, and cellular changes, and behavioral responses (Weber et al. 1981). Therefore, a fuel spill into the stream related to a mining operation could directly poison bull trout or indirectly affect bull trout by poisoning invertebrate or vertebrate prey species.

Specific Effects Of Mining Operations On Rock Creek

Impacts related to water quality and quantity in the Rock Creek watershed because of the construction and operation of the Rock Creek mine, potentially, may adversely affect macro-invertebrates, and aquatic plants at some time during, or possibly, for some period of time following, the overall implementation of the project. Expected impacts to the aquatic community, should they occur, could include a reduction in numbers of individuals, changes in species composition, and a reduction in species diversity, primarily through alteration of the existing habitat conditions in Rock Creek.

Habitat fragmentation and isolation because of Cabinet Gorge and Noxon dams are the greatest risk to the persistence of the migratory form bull trout in the Lower Clark Fork Core Area (MBTSG 1996b), although this threat is being addressed through the Avista fish passage program (Appendix D). Currently, Rock Creek bull trout are dominated by the resident life history form and are considered at high risk of extirpation from localized catastrophic events due to the limited area inhabited by bull trout and the relatively low availability of high quality habitat in Rock Creek (MDEQ and USDA Forest Service 2001). If direct loss of individuals or indirect adverse effects from additional habitat modifications occurs, this could reduce the likelihood of persistence of both forms of Rock Creek bull trout. Such effects increase the risk of extirpation of Rock Creek bull trout; however, the effect on the Lower Clark Fork Core Area population would be minor because Rock Creek's contribution to the core area population is relatively small. Some of the more important local populations that contribute to the Lower Clark Fork Core Area population are Bull and West Fork Thompson rivers and Graves, Vermillion, Prospect, and Fishtrap creeks.

Additional risks related to the mine could further compromise the continued existence of Rock Creek bull trout. For example, changes in habitat conditions due to implementation of the mine may favor non-native brook trout. In the western United States, where brook trout have been introduced into bull trout habitat, habitat degradation generally favors brook trout, thus yielding a competitive edge over bull trout (Rieman and McIntyre 1993). When brook trout interbreed with bull trout, offspring are most often sterile; however, there has been some evidence of F2 hybrids in other drainages, an indication of successful breeding of hybrid offspring (Hansen 2001). At present, brook trout are found in small numbers only in the lower reaches of Rock Creek.

Predicting specific effects due to habitat changes that influence the stability, growth, and survival of a bull trout population is challenging. Determining what habitat factors may be limiting in a system and at what threshold is difficult when considering the influence of other variables like productivity in the watershed, climate, geology, geomorphology, dominant-life history form, competition, and predation. Rieman and McIntyre (1993) indicated it is improbable to identify a minimum habitat condition that will maintain a population, neither is it possible to identify precise tolerance limits for habitat characteristics that can be set to clearly maintain bull trout

populations. Moreover, they use fine sediment as an example of a habitat characteristic that is often negative, but indicate that it's not possible to define precise tolerance thresholds in a watershed that are known to affect population levels.

Given the difficulty of predicting specific effects to a bull trout population, we have attempted to use the best information in the scientific literature and site specific technical information to set reasonable bounds or limits on fine sediment that may be delivered to Rock Creek during implementation of the proposed action. The scientific literature provides information of the negative influence of fine sediment, which causes increasing fish egg mortality as more and more fine sediment accumulates and covers the eggs. It stands to reason that efforts should be made to limit the amount of sediment delivered to the stream in order to avoid potential egg mortality. The thresholds we considered seem reasonable to us and provide initial starting points that should be verified, refined, or changed as more information on fine sediment becomes available through site-specific monitoring or through other scientific studies pertaining to this subject. Consequently, this can be viewed as an adaptive approach that measures effects through time and adjusts bull trout minimization measures accordingly in order to be more effective at minimizing potential effects.

Stream temperature and groundwater influence

As part of this project, right-of-way clearing within the riparian area is expected to facilitate road, powerline and pipeline construction and maintenance (see Figure B5). Previous logging activities have already reduced existing shading to the stream, and these activities are expected to add to that cumulative loss (USDA Forest Service 1999, MDEQ and USDA Forest Service 2001). Additional loss of riparian vegetation may affect stream temperatures within Rock Creek, which are currently functioning appropriately for bull trout. However, an unaltered vegetation zone would be left between Rock Creek and the road and utility corridors where possible to protect bull trout habitat. Further, the amount of clearing in the riparian zone is relatively minor (<1.5 acres) and related primarily to construction or re-construction of bridges and pipeline crossings. Therefore, the small incremental loss of associated shade would not cause a dramatic temperature change or even a slight change that could be measurable. In other words, stream temperature is expected to be maintained as functioning appropriately for bull trout after clearing of vegetation in the right-of-way utility corridor.

The loss of groundwater to interception by the mining activities may influence stream temperatures in Rock Creek (USDA Forest Service 1999, MDEQ and USDA Forest Service 2001). If impacts to seeps and wetlands in the area occur, it can be expected to alter groundwater flows, which may affect stream temperature. Groundwater provides a cooling effect and is important to maintaining colder stream temperatures essential for high quality spawning and rearing habitat. The loss of groundwater recharge and upwellings resulting from the removal and discharge of between 1,700 and 2,046 gallons-per-minute (gpm) during mining operations is expected to occur for the life of the mining operations and possibly after mine closure. Groundwater upwelling has been shown to be important to the success of spawning and successful incubation of eggs to larval stage (Baxter and Hauer 2000). The loss of groundwater and resulting effect on stream temperature, if any, is difficult to predict. Therefore, close stream temperature monitoring will be needed and has been proposed as a project component in order to

detect any mining induced changes in the groundwater system in terms of water quantity, water temperature, and water chemistry budgets in Rock Creek.

The threat to overlying lakes and streams is associated with groundwater drainage stress. Cliff Lake and Moran Basin receive much of their inflow from groundwater and subsequently recharge the groundwater system down gradient (Gurrieri 2001). To reduce risk of groundwater drainage stress to low, a buffer zone of 1,000 feet around Cliff Lake would be maintained. In addition, monitoring subsurface hydraulic conditions would allow early detection of potential mining impacts and grouting of groundwater inflows to the mine. The Corrective Action Plan would identify measures to be taken should monitoring identify potential water resources issues. Hydrogeologic information collected during evaluation adit construction would be used to develop these measures and evaluate their effectiveness (MDEQ and USDA Forest Service 2001).

Buffer zones are assumed effective in reducing the impact to overlying lakes and down gradient streams, but mine related effects to groundwater flow and chemistry are very difficult to predict reliably. The case studies of other mines presented by Gurrieri (2001) provide evidence of the unpredictable nature of groundwater flow in fractured rocks. In this instance, the Troy mine serves as a close analog to predict impacts from mining because of its similar location, climate, geology, and structure (Gurrieri 2001). Disruptions of surrounding surface water bodies has not been documented, but lakes or perennial streams do not directly overly the Troy mine and intensive monitoring has not been conducted. Gurrieri (2001) concludes the likelihood of impact would be reduced to low for both lakes given the proposed mitigation.

An additional risk to down gradient streams is post-closure leakage of groundwater containing dissolved metals from the mine to the surface. After mine closure, groundwater from the mine could leak through rock fractures down gradient to the surface and into streams. Because of high risk of impact to North Basin and South Basin Creeks, 1,000-foot buffer zones near ore outcrops and post-closure mine dewatering would be maintained to reduce risk to these down gradient streams. Such mitigation would reduce the likelihood of impact to low risk (Gurrieri 2001).

The Forest Service also recently completed a geotechnical assessment analyzing the effectiveness of the proposed mitigation, including buffer zones, for the Rock Creek Project. Final Geotechnical Assessment Report Sinkhole Development at the Troy Mine and Implications for the Proposed Rock Creek Mine, Lincoln and Sanders Counties, Montana (USDA Forest Service 2006). This study reports that the Rock Creek Project buffer zones were "designed to protect the hydrologic integrity of the potentiometric surface near Cliff Lake (1,000-foot-buffer zone), and to prevent hydro-fracturing of bedrock in near surface (shallower than 450 feet) and near outcrop areas (nearer than 1,000 feet laterally) in order to prevent the formation of new surface seeps and springs during flooding of the mine workings at closure." (USDA Forest Service 2006, pg 18). The study also reports that "Buffer zones under lakes and near faults and outcrop zones area expected to be the most effective mitigations for reducing impacts to surface water bodies." (USDA Forest Service 2006, pg 18-19).

The only certain mitigation to avoid post-closure leakage of dissolved metals to the surface is mine dewatering after closure. However, this would have to be done in perpetuity, and mine

dewatering after closure would maintain the groundwater drainage stress on overlying lakes and streams since dewatering and adit plugging are mutually exclusive. If the mine is left to passively drain from the adit, the mine would flood to the level of the adit and possibly discharge to the North Basin and Copper Gulch, tributaries to the Bull River system. Again, 1,000-foot buffer zones near ore outcrops and post-closure mine dewatering would be maintained for these down gradient streams. Such mitigation would reduce the likelihood of impact to low (Gurrieri 2001). Based on this information, the Service does not anticipate adverse impacts to bull trout in the Bull River drainage. Indeed, at the nearby Troy Mine, Revett has an excess of 20 years of water quality data showing no change in aquatic life in Lake Creek.

Sedimentation

The most obvious direct impact of the construction and operation of the Rock Creek Mine to bull trout is the potential for an increased level of fine sediment entering the stream during the 5-year construction phase. Activities associated with the development of the mine include road construction, road reconstruction, bridge and culvert replacement, alteration of existing roads to conform to Best Management Practices Standards (BMPs), and construction and development of tailings ponds, adit and mill sites, powerlines, and pipelines.

The highest levels of sediment loading are expected to occur during the 5-year construction period with significantly decreasing levels of additional sediment entering the stream over the 35-year operating life of the mine. The increase in sediment loading is estimated to be 46% in the West Fork of Rock Creek, 20% in the East Fork of Rock Creek, and 38% overall for the entire Rock Creek watershed (USDA Forest Service 1999, MDEQ and USDA Forest Service 2001). These values are probably over estimates and likely present a worse-case scenario because of the parameters used in the modeling evaluation and because the evaluation did not include the proposed sediment abatement mitigation activities, which would occur before, during, and after construction. Further, sediment loading during this period would likely happen in pulses of short duration and be mainly localized to certain segments of particular reaches. The overall area affected would be confined to the mainstem Rock Creek and West Fork Rock Creek nearest the mine facilities and utility corridors. Areas upstream, such as the above mill site, which includes most of East Fork Rock Creek, would be largely unaffected. Only a few hundred yards of East Fork Rock Creek are potentially downgradient from the mill site.

All roads used during mine operation between the mill, the mine, the paste plant, the water treatment facility, the highway, and the rail loadout facility would be upgraded and either paved or graveled. This would greatly reduce the chances of sediment delivery to Rock Creek due to the increased traffic on FDR No. 150. A portion of FDR No. 150 and the parking lot of the waste water treatment facility will be re-located away from Rock Creek in year two of the construction in order to keep mine traffic away from Rock Creek. In addition, access restrictions would be in place along FDR No. 150B to mine-related traffic only. Under-sized culverts would be replaced as needed, which should aid fish passage. A vegetation management plan and all BMPs would be detailed and would have to be approved in the permit application. A field review would be required by agency hydrologists/soil scientists to identify additional site-specific BMPs after facilities and roads have been staked in the field but prior to construction.

To mitigate for unavoidable sediment impacts, there is a requirement for 114 acres of sediment reduction work to be accomplished (MDEQ and USDA Forest Service 2001).

Sampling of sediment composition was conducted by Washington Water Power (WWP 1996) in the Rock Creek watershed and is the best available information and applicable as an indicator of potential impacts to bull trout. Fine sediment levels were sampled using McNeil hollow core samplers (McNeil and Ahnell 1964) at identified spawning sites and embryo survival to fry emergence for bull trout was estimated based on equations from Weaver and Fraley (1991). Sampling of mainstem Rock Creek was limited to one reach (reach 2) because it was not possible to follow sampling protocol as spawning gravels were restricted to small depositional areas behind boulders and stream obstructions. The East Fork was not sampled due to these same protocol requirements; however, two reaches were sampled in the West Fork Rock Creek (WWP 1996).

Results from the WWP sediment surveys in the Rock Creek watershed indicated the median percent fine sediment for spawning substrate in the mainstem was 43 percent (WWP 1996). Predicted embryo survival to emergence for bull trout was 18 percent, a relatively low value when compared to the lower Clark Fork River drainage average value of 33 percent. The West Fork Rock Creek median percent fine sediment for spawning substrate averaged 27 percent (range 24-28 percent) and predicted bull trout embryo to emergence survival averaged 40 percent, which was higher than the lower Clark Fork River average (WWP 1996).

At present, fine sediment levels in mainstem Rock Creek, West Fork Rock Creek, and East Fork Rock Creek are functioning at-risk for bull trout spawning (MDEQ and USDA Forest Service 2001), signifying that the present amount of fine sediment in spawning substrate allows the current Rock Creek bull trout population to persist under these conditions, but the population may not improve unless the levels of fine sediment decrease to a point where survival of bull trout eggs would increase. Furthermore, very little spawning habitat is available in Rock Creek; and therefore, any incremental increases in levels of fine sediment may negatively impact spawning success because high levels of fine sediment in spawning gravels are known to lower the survival of salmonid eggs to the emergence stage (Weaver and Fraley 1993). High levels of fine sediment at or above certain thresholds (more than 30% of materials less than 6.4 mm) result in embeddedness associated with sharp declines in juvenile bull trout densities (Shepard et al 1984). The mainstem Rock Creek predicted bull trout embryo to emergence survival of 18 percent is low. Very little spawning area is available in the mainstem and, at present, most bull trout redds (nests made in gravel where eggs are deposited) of the few migratory fish that have entered Rock Creek spawned in the area of the confluence with the West Fork Rock Creek, which is just downstream of the mine site. Evidence of some spawning does occur in the lower mainstem in an area known locally as the Canyon Reach (see Figure B5).

The expected increase in sediment loading during construction is estimated to be 46% in the West Fork of Rock Creek, 20% in the East Fork of Rock Creek, and 38% overall for the entire Rock Creek watershed based on the Forest's R-1 WATSED modeling outputs (USDA Forest Service 1999, MDEQ and USDA Forest Service 2001). A portion of this sediment will be fine sediment that will be deposited in these spawning areas. How much fine sediment that is deposited in these areas will be difficult to predict because some substrates are more likely to

accumulate fines than others. Furthermore, the precise effect on the local bull trout population is difficult to predict because some populations are more sensitive than others. However, any significant increase in fine sediment levels in bull trout spawning areas will most likely have negative effects on productivity of bull trout (Reiman and McIntyre 1993). In order to determine the extent of increase in fine sediment due to project-related activities, annual monitoring of substrate composition will be necessary during and after the five year construction period.

Sedimentation can increase substrate embeddedness and result in decreased aquatic insect production and diversity. Juvenile bull trout feed primarily on aquatic macroinvertebrates and the distribution of aquatic macroinvertebrates inhabiting running water environments is highly dependent on substrate particle size (Cummins and Lauf 1969). Increased levels of deposited sediment reduce the quantity of the food base for bull trout resulting in slower growth rates, higher mortality, and reduced fecundity.

An indirect effect of the proposed action relates to impacts of increased levels of sediment on physical features of stream habitat and the resulting effects of those impacts on prey availability and ultimately on bull trout fitness and survival. Such indirect effects may include changes in stream channel morphology and decreased availability and quality of interstitial spaces affecting rearing habitat, which could lower juvenile survival. Any habitat changes may be aggravated by a decreased availability of water supply to the stream caused by disruption of ground water and surface drainage patterns as well as direct withdrawal of water.

The actual sediment loading that would occur is difficult to determine because of the variability in travel distances to the creeks, unpredictable amounts of sediment generated by various activities, erosivity of the soil, the timing of sediment movement which relates to precipitation and weather, severity of soil and site disturbance, and the effectiveness of the sediment abatement measures. As a result of this uncertainty, the mine plan includes measures to address sedimentation. These measures include road construction BMPs, road paving, reconstruction and resurfacing, riparian vegetation buffers along roads and around the mill site, slash filter windrows on cut-banks and around culvert openings, downslope sediment traps, immediate hydro-seeding after soil disturbance, and other measures as appropriate (see Table 1, Forest Service BA, MDEQ and USDA Forest Service 2001 for a list of sediment mitigation components). Although these measures will not prevent sediment delivery to Rock Creek entirely, they can reduce sediment loading to a large degree, which would likely reduce the percentage of sediment generated (from those derived from the modeling outputs) from reaching the creeks. Further, the sediment mitigation plan is required to reduce annual fine sediment loading to Rock Creek by 400 tons prior to the end of the project construction period by mitigating two or more fine sediment sources in the drainage (mainstem Rock Creek and West Fork Rock Creek).

It is likely habitat impacts caused by an increase in sediment loading in the Rock Creek watershed would occur sometime during the first five years when site disturbance is greatest due to construction of roads and facility development. After this 5–year period, sediment levels would probably stabilize, most likely within two years, and gradually return to near pre-project conditions over some unknown period of time. The impact to bull trout spawning and rearing would likely be highest during these first five years of construction and then decrease as

conditions stabilize. Monitoring of sediment levels combined with fish population monitoring would allow an approximation of the degree of impact. The Aquatics and Fisheries Monitoring Plan should require annual substrate sampling and evaluation, as well as long-term monitoring (minimum 10 years) of fine sediment levels to determine if BMPs and other mitigation measures are effective, or if higher than expected impacts to aquatic resources are occurring cumulatively. Corrective actions would be required to address known and potential sources of sediment delivery discovered during monitoring.

Large woody debris (LWD)

Although LWD is currently functioning appropriately for bull trout in Rock Creek, it is limited on the mainstem and future recruitment in the near-term is reduced presumably because riparian stands are comprised of younger aged trees due to past riparian harvest. On the other hand, the upper reaches of the East Fork Rock Creek have high levels of LWD and the West Fork Rock Creek has average instream loading of LWD.

The biological assessment (MDEQ and USDA Forest Service 2001) determined that LWD would not be affected by the project, and therefore, the current function of LWD would be maintained. This assessment is based, in part, on the joining and location of the utility and pipelines within the same corridor away from the riparian zone whenever possible. Also, a 300-foot vegetative buffer zone would be maintained around the mill site. Further, INFISH standards and guidelines (Standard MM-2) will be met with relocation of some activities and sediment mitigation measures. This standard is designed to avoid or minimize locating facilities in RHCAs where adverse impacts could occur to streams supporting inland native fish. Given the small amount of RHCA area that would be affected by the proposed project, it is very unlikely there would be a measurable effect on instream LWD and on future recruitment of LWD. It is more likely that in the mainstem Rock Creek LWD function would improve over the term of the project as younger-aged riparian stands of trees mature and increase the probability of instream LWD recruitment.

Water quality and chemical contamination

Mining activity may release available metals and add to baseline conditions. Increasing the concentration of dissolved heavy metals in soft water environments, such as Rock Creek (Rock Creek = 10 mg/l), can result in a corresponding increase in toxicity to fish. Fish are much more susceptible to metals toxicity in soft water environments (Nelson et al. 1991), and therefore, bull trout in Rock Creek would be more susceptible to toxicity if heavy metal concentrations should increase.

Groundwater infiltration of metals contamination to Rock Creek also may result from this project. Impacts to groundwater quality from waste rock seepage, tailings seepage, tailings impoundment structures and underground mine pool, during operations and upon closure of the mine, are expected. If the metals concentrations are elevated in the groundwater and then flow to Rock Creek, aquatic organisms may be adversely impacted.

The mine water treatment system would remove suspended solids, heavy metals, and ammonia

nitrogen and nitrate/nitrite nitrogen in order to meet the requirements of the Montana Pollution Discharge Elimination System (MPDES) permit. Two nitrate removal systems would be installed, a biotreatment and reverse osmosis system according to the MPDES permit. Treated mine water would discharge to the Clark Fork River (i.e., Cabinet Gorge Reservoir) through a submerged outfall located downstream of Noxon Rapids Dam. As part of the outfall system, an engineered in-stream diffuser located in the river would distribute treated water through a perforated steel pipe to allow more mixing with river water.

Discharge of treated mine water at the effluent outfall may deter upstream migration of bull trout, although this is unlikely as the diffuser pipe will be located upstream of Rock Creek. Treated effluent would be discharged into the Clark Fork River about 750 feet upstream from the mouth of Rock Creek (see Figure B5). Elevated metals levels may cause bull trout to avoid use of Rock Creek as a spawning or rearing area. The metal concentrations in the mixing zones are not expected to be detrimental to fish homing behavior. However, metal concentrations could increase near the mouth of Rock Creek as a result of groundwater seepage and surface erosion of metals from the paste storage facility. If Rock Creek metal concentrations increase to the point they exceed those in the Clark Fork River, then avoidance may be exhibited by fish wanting to reside in the cold-water refugia at the mouth of Rock Creek.

Because bull trout have not been tested for dissolved metal concentration avoidance behavior, it is uncertain how they might react to increased concentrations of copper and zinc in Rock Creek. However, the above listed criteria are considered conservative estimates for avoidance behavior associated with copper and zinc concentrations. The MPDES currently allows concentrations less than estimated avoidance thresholds, thus compliance with the MPDES standards would prevent reaching avoidance behavior thresholds for copper and zinc. Consequently, adverse effects to bull trout are not anticipated from dissolved metal concentrations.

The mine is expected to operate within guidelines established by the Clean Water Act and all applicable State of Montana water /environmental quality laws. Those guidelines are established, administered and enforced by EPA and MDEQ and consider potential impacts to cold water fisheries. Under Alternative V, mine water would continue to be treated until it met MPDES effluent limits. The Water Resources Monitoring Plan would require water quality monitoring to quantify any measurable environmental impacts due to the flow rate and water quality discharged to the Clark Fork River. The Aquatics and Fisheries Monitoring Plan would require aquatic macroinvertebrate, periphyton, and fish tissue monitoring to determine if water quality related impacts are occurring. If monitoring of water quality indicates that adverse impacts to bull trout are anticipated, reinitiation of consultation would be warranted and the Service would request it.

Catastrophic failure

Catastrophic failure of the contingency tailings impoundment or paste facility could have significant and long term impacts to aquatic organisms downstream of the project (MDEQ and USDA Forest Service 2001). Tailings impoundments and stormwater retention ponds can be exceeded and cause failure of the facilities located near the lower portion of Rock Creek (MDEQ and USDA Forest Service 2001, Figure BA-2, page 8,). This could result in release of tailings

slurry, paste material, or untreated storm water runoff from the tailings paste facility and potential delivery to lower Rock Creek and the Clark Fork River downstream to Cabinet Gorge Dam. It is difficult to estimate or predict the probability, magnitude, or long term effects of such events; however, the impacts, should they occur, would likely be significant to bull trout.

To minimize the probability of a catastrophic failure, the agencies would institute a process to review, evaluate, and condition Revett's final tailings facility design to ensure long-term stability. The proposed Alternative V paste facility eliminates the type of catastrophic failure potential associated with tailings ponds. In addition, environmental consequences due to transport of material as a result of damage to the facility is essentially negligible due to the dewatered state of the paste. Inherent in the design of the placement of dewatered paste is the tendency for the material to be contained and able to be graded or re-worked if slumping or fracturing occurred. Even if there was a mass failure of the paste facility, the relatively high viscosity of the paste would be sufficient to retard flow over any appreciable distance. Conditions which could change the character, and hence the behavior of the paste tailings include a change in moisture content of the paste. However, there would need to be a significant increase in moisture content throughout the entire paste deposit before overall stability would be compromised. This increase in moisture would not be expected with the strict quality control program that would be implemented by the agencies (MDEQ and USDA Forest Service 2001).

The Failure Modes and Effects Analysis (FMEA) looked at a complete failure of the paste facility nonetheless. The likelihood of failure of the paste pile with underdrains under seismic loading for the Bottom-Up design was assigned a likelihood of occurrence of 1 in 10,000 to 1 in 1,000,000; the likelihood of occurrence for the Top-Down approach was estimated at a 1 in a 100 chance to 1 in 10,000 chance of occurrence. The consequences associated with a failure in both instances were designated as "high" to "extreme," which are defined as "short-term irreversible impact, long-term excursion of water quality," and "catastrophic event, long term impact," respectively (MDEQ and USDA Forest Service 2001).

Despite the estimated consequences associated with such an occurrence, there are several mitigating measures, which could be implemented to reduce this risk of a failure. These include– employ the Bottom-Up construction sequence; install blanket and finger drains beneath the paste facility; continually model and monitor the moisture content of the paste pile during operations to better understand saturation levels; and generate a detailed design of the paste plant operations and disposal system to ensure quality assurance and quality control during operation and post-closure. With these compensating factors fully employed, the FMEA analysis estimated the likelihood of failure under the Bottom-Up option as "negligible" (< 1 in 1,000,000 chance of occurring), and the confidence associated with this estimate was considered "high" (MDEQ and USDA Forest Service 2001).

Direct and indirect effects are likely to occur if a pipeline rupture or vehicle accident results in slurry or hazardous substances entering Rock Creek (USDA Forest Service 1999, MDEQ and USDA Forest Service 2001). The slurry pipeline, water reclaim line, or discharge pipeline could leak or break, potentially spilling its contents to Rock Creek and possibly the Clark Fork River depending on Rock Creek flow levels. Trucks carrying reagents or concentrate also are at risk of accidents and spill to bull trout waters. Pipeline ruptures or vehicle accidents could occur

anywhere from the uppermost portion of West Fork Rock Creek downstream to the mouth of Rock Creek, but less likely, if at all, in the East Fork Rock Creek portion of the drainage (see Figure B5). Although time, location, and extent of these events are unpredictable, such events have occurred at the nearby Troy Mine in 1984 when the Troy Mine was operated by ARSARCO, and could occur during the life of the Rock Creek mine (MDEQ and USDA Forest Service 2001). Factors adding to the risks associated with spills include frequency and number of trucks hauling, weather, proximity of the road to live water, effectiveness of spill response equipment, and frequency and thoroughness of maintenance of facilities. In addition to direct effects on fish, such events may result in chronic and long-term effects on the habitat's ability to support bull trout. Monitoring and mitigation plans are expected to address the necessary requirements to minimize impacts in the event of a spill.

Emergency Action Plans would be required prior to mine operation to facilitate monitoring and mitigation in the event of accidental discharge of toxic or hazardous materials or sediments, which could adversely impact the environment. The Acid Rock Drainage and Metals Leaching and Water Resources Monitoring Plans would require testing and monitoring of the paste tailings to determine tailings and tailings impoundment facilities impacts to surface and ground water. If testing and monitoring of the paste tailings indicates that adverse impacts to bull trout are anticipated, reinitiation of consultation would be warranted and the Service would request it.

Monitoring and mitigation plans

The proposed action includes the future refinement and approval of monitoring and mitigation plans for bull trout by Revett, in cooperation with the MDEQ, the Forest, and the Service. Appendix K of the FEIS contains a complete description of the conceptual monitoring and mitigation plans for Alternatives III through V developed by MDEQ and the Forest.

Revett would be required to develop final monitoring and mitigation plans prior to project startup. The regulatory agencies have agreed to review and refine the plans as an interagency team. To minimize impacts to bull trout, the plans potentially directly affecting the fishery would be reviewed from a fisheries perspective. The Service will participate as an advisor as needed on issues related to water use, fishery monitoring plans, sediment abatement plans and monitoring, and groundwater monitoring. The Service will have approval authority for these plans and evaluations as described in the incidental take statement in this biological opinion. All plans are to identify trigger or alert levels, which would require Revett to implement a corrective action plan. Corrective action plans for the most likely scenarios would need to be developed and approved prior to project startup.

All monitoring would require an annual report unless otherwise specified. The reporting format and requirements would be reviewed and finalized by MDEQ, the Forest, and the Service. Reports would be submitted to other review agencies as identified by the Forest and MDEQ. After submittal of a monitoring report, the regulatory agencies and all other relevant agencies would review the monitoring plan and results, and evaluate possible modifications to the plan or permitted operations.

Monitoring and mitigation plans to be refined, approved and ultimately included in the plan of operations include:

- Air Quality Monitoring
- Rock Mechanics Monitoring
- Acid Rock Drainage and Metals Leaching Plan
- Evaluation Adit Data Evaluation Plan
- Tailings Paste Facility and Tailings Surry Line Construction Monitoring Plan
- Soils and Erosion Control Plan
- Reclamation Monitoring Plan
- Water Resources Monitoring Plan
- Influent and Effluent Monitoring Plan
- Monitoring of Biological Oxygen Demand Plan
- Wildlife Mitigation an Monitoring Plan
- Threatened and Endangered Species Mitigation Plan
- Aquatics and Fisheries Monitoring and Mitigation Plan
- Hard Rock Mining Impact Plan
- Wetlands Mitigation Plan

Species Response to the Proposed Action

The expected bull trout population response to the proposed mining operations is associated with impacts to the aquatic habitat and the resulting impacts to individual bull trout that inhabit the Rock Creek watershed and Cabinet Gorge Reservoir. Increased sediment from the proposed mining activities has potential to impact several life stages of bull trout within the action area during the proposed project. Increases in sedimentation affect incubation, emergence, and survival rates of eggs, fry, and juveniles. Fine sediment fills spaces between the gravel needed by incubating eggs and fry. Because bull trout eggs incubate about seven months in the gravel, they are especially vulnerable to fine sediment and water quality degradation (Fraley and Shepard 1989). Juveniles are similarly affected, as they also live on or within the streambed cobble (Pratt 1984).

Given that several important population and habitat parameters are currently functioning at risk for bull trout, including fine sediment (see Table B4), increases in sediment, decreases in base flow, and changes in habitat complexity and water chemistry due to the proposed mining operations could adversely affect production and survival of bull trout in the Rock Creek drainage, particularly in mainstem Rock Creek and West Fork Rock Creek. Increases in sediment and reduction in habitat complexity could be more than insignificant or inconsequential, especially during the period of construction. Those activities would affect aquatic habitat as well as the associated life stages of bull trout in the Rock Creek watershed. Long-term impacts associated with groundwater development, metals contamination, and catastrophic events also are inherent to a proposal of this magnitude and considered risks to bull trout.

Rock Creek bull trout are mainly resident fish and contribute relatively little to the Lower Clark Fork Core Area population because they are functionally isolated from the Lake Pend Oreille

system (i.e., non-migratory) and have low reproductive potential. Reproductive potential is limited because fecundity is size-dependent and smaller resident fish produce significantly lower numbers of eggs on the order of 400-3,000 eggs per female. On the other hand, adfluvial adult female fish are considerably larger and therefore more fecund producing around 8,000 – 12,000 eggs per adult female (Fraley and Shepard 1989, Martin 1992, McPhail and Murray 1979). Even though the larger adfluvial fish have much greater reproductive potential, and are therefore, more important from a recovery perspective, resident life forms are considered to be essential in highly variable environments because they are thought to stabilize populations due to their refounding capability, especially when migrant survival is low or varies (Rieman and McIntyre 1993) as is the case with the Rock Creek local population.

With the recent onset of passing migratory bull trout from Lake Pend Oreille over Cabinet Gorge Dam, a small number of adfluvial bull trout have been observed in Rock Creek (two in 2003 and ten in 2004) during the spawning season. If the adverse effects from the proposed action were enough to suppress this use altogether and eliminate this recruitment potential, the overall effect to the Lower Clark Fork Core Area population would be negligible because of the relatively small contribution from the Rock Creek local population (less than 4 percent and this assumes adfluvial fish can access Rock Creek annually, which is unlikely due to flow conditions that typically occur each year as explained above). In addition, Rock Creek is only one of 14 local populations contributing to the core area population. At most, the rate of recovery of the core area population may slow slightly, if at all, assuming fish passage at the dams and habitat restoration continues and is successful. Furthermore, at present the Bull River system is the primary source (about 80-90 percent) of the Cabinet Gorge Reservoir migratory bull trout population (Moran 2005). Also, when considering the thousands of migratory bull trout that occupy the Lake Pend Oreille Core Area (Downs and Jakubowski 2004), the overall effect of losing the adfluvial component of the Rock Creek bull trout population at this scale would be inconsequential - much less than 1 percent, and conservatively estimated at about 0.2 percent.

No impacts related to this project are anticipated in the Bull River drainage which is considered to be the principal contributor of the core area because it supports relatively strong numbers of adfluvial, fluvial, and resident bull trout. Impacts of this project are anticipated to only affect the local population of bull trout in Rock Creek, and these impacts are expected to result from sediment delivery during the construction period and two years following. The effect of sediment intrusion into the stream channel should be minimized by the proposed sediment abatement measures and vegetation buffer zones. Monitoring will be essential to determine if anticipated sediment levels are exceeded. Risks to bull trout could increase if the mining operations cause water quality and water quantity changes that affect stream flows in Rock Creek. However, at this juncture it is difficult to determine with any certainty whether a risk to bull trout would exist under project implementation because of the lack of data or pertinent scientific information on the relationship of underground mining effects on aquatic species. The potential changes of water quality and quantity are unpredictable and the only way to determine this risk is to monitor the appropriate streamflow parameters and if new information reveals that the risk to Rock Creek bull trout is anticipated, re-initiation of consultation would be warranted, and the Service would request it. In the unforeseen event of a catastrophic failure of the tailings impoundment, bull trout in Rock Creek and Cabinet Gorge Reservoir may be at risk. However, the chances (1 in 1,000,000) of this happening are very rare; nevertheless, monitoring of the

integrity of the tailings impoundment should be adequately conducted to ensure the risk to bull trout is not elevated. Should monitoring reveal an elevated risk, re-initiation of consultation would be warranted and the Service would request it. Remedial actions would likely be developed and implemented as soon as practicable to reduce the risk to bull trout.

Rock Creek is one of 14 occupied drainages in the Lower Clark Fork Core Area and if the Rock Creek local population were adversely affected by the project as anticipated, the risk to the function of the core area population would not change since the effect would be at most minimal. The functioning of the core area population would continue to be maintained and the risk from stochastic change in the environmental would be unaffected. This is largely because of the strength and stability of the remaining local populations, the relatively small contribution of Rock Creek bull trout to the core area population, and the recovery efforts now underway with fish passage and habitat restoration activities addressing the main threats to the core area population. However, there may be a slight slowing in the rate of recovery for the core area population because of the slight loss in recruitment potential, but if current efforts to recover the adfluvial component under the Avista program continue to be successful and overshadow the potential loss, the recovery rate of the core area may not be affected.

Effects of the Action to Designated Critical Habitat

Critical habitat is defined in section 3 of the Act "as the specific areas within the geographical area occupied by the species, at the time it is listed in accordance with the Act, on which are found those physical and biological features essential to the conservation of the species and that may require special management considerations or protection; and specific areas outside the geographical area occupied by a species at the time it is listed, upon a determination that such areas are essential for the conservation of the species." To be included in a critical habitat designation, "the habitat within the area occupied by the species must first have features that are essential to the conservation of the species. Critical habitat designations identify, to the extent known using the best scientific and commercial data available, habitat areas that provide essential life cycle needs of the species (i.e.; areas on which are found the primary constituent elements as defined at 50 CFR 424.12 (b))."

Designated bull trout critical habitat in the Rock Creek watershed was published in the September 26, 2005, final rule (FR 70, No 185, 56211-56311) and shown at five separate locations. Four sections are located on the mainstem and one section is located on the East Fork above the confluence with the West Fork (see Figure B4). The total amount of designated critical habitat is 2.88 stream miles in the Rock Creek watershed.

Action agencies authorizing activities within lands occupied by bull trout are mandated by the Endangered Species Act of 1973, as amended, to consider the environmental baseline in the action area and effects to bull trout that would likely occur as a result of management actions. To that end, agency biologists use the four biological indicators and the 19 physical habitat indicators in the bull trout matrix to assess the environmental baseline conditions and determine the likelihood of incidental take per interagency guidance and agreement on section 7 consultation on the effects of actions to bull trout (USDA and USDI 1998a, 1998b). Analysis of the 19 Framework habitat indicators provides a very thorough analysis of the existing habitat

condition and potential impacts to bull trout habitat. While assessing the environmental baseline and potential effects to bull trout as a species, agency biologists have concurrently provided a companion analysis of effects to the primary constituent elements (PCEs) for designated bull trout critical habitat and related habitat indicators (Appendix I).

Summary of effects of mining operations on Rock Creek designated critical habitat

There is a strong relationship between PCEs and the "associated habitat indicators" for bull trout, which the Service uses to analyze site-specific impacts to the species at the project level. The Service examines the effects to individual PCEs based on the linkage between the PCEs and associated habitat indicators described in Appendix I and any other factors pertinent to the project analysis.

The Service anticipates activities associated with the proposed mining operation could potentially negatively impact some of the primary constituent elements of bull trout critical habitat in the Rock Creek drainage. It is anticipated that affected PCEs would not be destroyed or adversely modified so as not to function for bull trout, but instead the level of function would be diminished below baseline conditions to some degree and would be temporary; the duration of effects restricted to the 5-7 year construction period. Increases in sedimentation could cause degradation of water quality and changes in channel and habitat complexity, which in turn could degrade spawning habitat, rearing habitat, food supply, migratory corridors, and overwintering habitat. However, the increase in sedimentation is anticipated to be during the 5-7 years construction period and then subside thereafter returning to or near baseline conditions. The effects on other PCEs as a result of increased sedimentation are difficult to discern; however; long-term monitoring of habitat conditions and water quality parameters are likely to reveal any significant changes to these PCEs.

The Forest anticipates that effects from some proposed mining activities could continue for approximately 35 years, the life of the plan of operations (MDEQ and USDA Forest Service 2001). However, mine operation could exceed that time frame and long-term effects of mining operations would likely continue indefinitely after mine closure. Impacts associated with groundwater development, metals contamination, and catastrophic events also are inherent to a proposal of this magnitude and considered risks to proposed bull trout critical habitat. Such impacts are difficult to predict, but are not anticipated by the Service. These actions contribute to the overall risk to designated bull trout critical habitat in the lower Clark Fork River basin and reasonable and prudent measures must be taken to minimize anticipated adverse impacts.

Specific effects of mining operations and habitat response on Rock Creek designated critical habitat to the proposed action

The specific effects of mining operations on designated critical habitat are virtually the same as those described in the preceding section, *Specific Effects of Mining Operations on Rock Creek,* because the PCEs considered under designated critical habitat involve the same habitat parameters such as sediment, large woody debris, stream temperature, water quality and chemical contamination. Consequently, those discussions and analysis of effects apply here; and therefore, will not be repeated. Impacts, should they occur, related to water quality and quantity

because of the construction and operation of Rock Creek mine are primarily expected to adversely affect fish, aquatic macroinvertebrates, aquatic habitat, and plants by reducing habitat quality and diversity and changing aquatic species composition.

The expected designated bull trout critical habitat response to the ongoing mining operations is associated with impacts to the aquatic habitat and the resulting impacts to individual bull trout. Increased sediment from the proposed mining activities, especially in the first five years, has potential to impact the habitat's ability (and PCEs) to support several life stages of bull trout within the action area during the proposed project. Increases in sedimentation affect incubation, emergence, and survival rates of eggs, fry, and juveniles. Fine sediment fills spaces between the gravel needed by incubating eggs and fry. Because bull trout eggs incubate about seven months in the gravel, they are especially vulnerable to fine sediment and water quality degradation (Fraley and Shepard 1989). Rearing habitat is similarly affected, as juveniles also live on or within the streambed cobble (Pratt 1984). To avoid these effects, the Rock Creek Mine development plan includes extensive sediment reduction mitigation.

Given the existing degraded conditions of the watershed, an increase in sedimentation could adversely affect all five sections of designated bull trout critical habitat in Rock Creek because they are located downstream of the proposed mine site. Increases in sediment that result in changes in habitat complexity could be considered more than insignificant or inconsequential to critical habitat in the watershed. Those changes would affect aquatic habitat as well as the associated life stages of bull trout in the Rock Creek watershed. Long-term impacts associated with groundwater development, metals contamination, and catastrophic events also are inherent to a proposal of this magnitude and can be considered risks to bull trout and critical habitat should they occur. In the event that new information found through monitoring that the risks to bull trout critical habitat have changed, it may warrant re-initiation of consultation.

CUMULATIVE EFFECTS

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

Past private forestry practices and mining activities in the Lower Clark Fork Core Area have degraded existing habitat; however, habitat conditions are improving and these practices now consider potential impacts to aquatic habitat and incorporate best management practices (BMPs) and other mitigation measures to avoid harmful effects. Other risks include environmental instability from landslides and rain on snow events, illegal harvest, introduced species, thermal barriers, and rural and residential development (MBTSG 1996b).

Residential development is anticipated to increase as more areas in the Lower Clark Fork Core Area become populated, including the action area. Both commercial and residential development on private lands often occur along stream corridors, which could lead to stream channel alterations exacerbating water temperature, nutrient, and bank stability problems. Private and Montana Department of Natural Resources and Conservation (MDNRC) salvage harvest and

associated road construction may increase in the future and could lead to potential woody debris contributions, increase sediment, and increase summer stream temperatures within the action area. However, preparation of a Habitat Conservation Plan (HCP) is currently under development with MDNRC to protect native fish relative to forest management and associated actions (completion of the HCP is expected in mid 2008), which should improve habitat value for bull trout on state school trust lands located in the action area.

Angler harvest and poaching has been identified as one reason for bull trout decline (USDI 2002b). It is likely that recreational fishing in and adjacent to the Rock Creek drainage will increase as the work force at the mine increases to its full level and as the general residential population of the area increases. Access to the creek from highway 200 and from Road 150 is relatively easy especially at stream crossings and where the creek runs adjacent to the road. Opportunities may also increase for poaching of large adfluvial bull trout, which are vulnerable in the fall when fish are easily observed holding in small pools or on spawning areas. Recreational fishing is known to occur in Rock Creek and poaching of bull trout has occurred in other streams in the area (Pratt and Houston 1993). In addition, misidentification of bull trout has been a concern because of the similarity of appearance with brook trout, which occur in lower reaches of Rock Creek. Although harvest of bull trout is illegal, incidental catch does occur and the fate of the released bull trout is unknown, but some level of hooking mortality is likely due to the associated stress and handling of the release (Long 1997).

The harvest of bull trout, either unintentionally or illegally, could have a direct effect on the local resident bull trout population and possibly the migratory adfluvial component of bull trout attempting to spawn in Rock Creek in the fall. The extent of the effect would be dependent on the amount of increased recreational fishing pressure, which is a function of the increased number of fishermen utilizing the fish resources each season. Illegal poaching is difficult to quantify, but generally increases in likelihood as the human population in the vicinity grows (Ross 1997). Depending on the severity of the direct losses due to fishing pressure, the Rock Creek bull trout population is likely to withstand some impact; however, over time it may show some evidence of weakening when combined with other impacts on habitat conditions.

Cumulative Effects to Designated Critical Habitat

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

Private forestry practices and some private mining activities that occur on private lands currently and are expected to continue in the foreseeable future may degrade some designated critical habitat. Other risks to critical habitat include environmental instability from landslides and rain on snow events, illegal harvest, thermal barriers, and rural and residential development in the Lower Clark Fork Core Area (MBTSG 1996b).

Residential development in the lower Clark Fork River valley is growing at a steady pace in Sanders County. Development along stream and river corridors is highly sought after by

developers and if development occurs along stream corridors that contain critical habitat for bull trout this could lead to stream channel alterations that exacerbate water temperature increases, nutrient inputs, and bank stability problems. Private and MDNRC salvage harvest and associated road construction could reduce potential woody debris contributions, increase sediment, and increase summer stream temperatures. However, the MDNRC HCP is currently under development and should protect native fish habitat, including designated critical habitat, relative to forest management and associated actions on state school trust lands located in the action area. These efforts should positively affect the habitat values associated with the primary constituent elements of designated bull trout critical habitat.

CONCLUSION

Jeopardy Analysis

Jeopardy determinations for bull trout are made at the scale of the listed entity, which is the coterminous United States population (64 FR 58910). This follows the April 20, 2006, analytical framework guidance described in the Service's memorandum to Ecological Services Project Leaders in Idaho, Oregon and Washington from the Assistant Regional Director – Ecological Services, Region 1 (Appendix C). The guidance indicates that a biological opinion should concisely discuss all the effects and take into account how those effects are likely to influence the survival and recovery functions of the affected interim recovery unit(s), which should be the basis for determining if the proposed action is "likely to appreciably reduce both survival and recovery of the coterminous United States population of bull trout in the wild."

As discussed earlier in this biological opinion in the Introduction section, the approach to the jeopardy analysis in relation to the proposed action follows a hierarchal relationship between units of analysis (i.e., geographical subdivisions) that characterize effects at the lowest level or smallest scale (local population) toward the highest level or largest scale (Columbia River Interim Recovery Unit) of unit of analysis. Table B1 shows the hierarchal relationship between units of analysis that was used to determine whether the proposed action, the Rock Creek mine, is likely to jeopardize the survival and recovery of bull trout. As mentioned previously, should the adverse effects of the proposed action not rise to the level where it appreciably reduces both survival and recovery of the species at a lower scale, such as the local or core population, the proposed action could not jeopardize bull trout in the coterminous United States (i.e., range-wide). Therefore, the determination would result in a no-jeopardy finding. However, should a proposed action cause adverse effects that are determined to appreciably reduce both survival and recovery of the species at a lower scale of analysis, then further analysis is warranted at the next higher scale.

As proposed, implementation of the Rock Creek mine is anticipated to adversely impact the majority of occupied habitat in the West Fork and mainstem of Rock Creek and to a lesser extent habitat in the lower section of the East Fork Rock Creek (only a few hundred yards of the East Fork are partially downgradient from the mill site). Activities in the action area associated with the proposed mining operation would likely result in some mortality related to expected degradation caused by sediment input of aquatic habitat including spawning habitat, rearing habitat, and food supply and the related risk to all bull trout life history stages. Sediment levels

are likely to increase over the five year construction period and could reach a level to cause morphological channel changes (e.g., filling of pools, substrate embeddedness) that reduce the quality of rearing and foraging habitat for bull trout. During this same period, degradation in the quality of spawning habitat is likely due to deposits of fine sediment in spawning gravels. Increases in sedimentation (total and fine sediment), water quality degradation, and changes in channel and habitat complexity related to mining activities are anticipated to result in reduced egg, larval, and juvenile life history stages by impairing feeding, breeding and sheltering patterns of adult and juvenile bull trout. Implementation of the proposed action is likely to reduce the reproduction, numbers, or distribution of bull trout within Rock Creek for five to seven years resulting in the local population of bull trout decreasing compared to existing levels.

Following the Service's Draft Bull Trout Recovery Plan direction and the recent Service memorandum (Appendix D) regarding consolidation of the four fragmented core areas in the lower Clark River Basin into a single contiguous core area – the Lower Clark Fork Core Area - the local population of Rock Creek is one of 14 local populations contributing to the function of the core area. At present, the contribution of Rock Creek bull trout to the Lower Clark Fork Core Area is relatively minor. A very small portion of the core area bull trout population (< 4 percent) would be negatively impacted by proposed project actions. Anticipated impacts to bull trout are unlikely outside of the Rock Creek drainage and no activity is proposed in the Bull River drainage, the principal and most productive local population in the core area. Even in the unanticipated and unlikely event of extirpation of Rock Creek bull trout, Bull River fish and other local populations would remain unimpaired and would maintain the viability and functionality of the core area population. In fact, bull trout may have the opportunity to re-colonize Rock Creek because it is highly possible that migratory bull trout may spawn in a non-natal tributary stream near to where upstream movement encounters a passage barrier as was the case in 2004 when five of the six radio-tagged adult bull trout that could not pass Noxon Dam to access their "genetically-assigned" stream of origin eventually spawned in Rock Creek (Lockard and Hintz 2005). With the current success and anticipated attainment of permanent fish passage under the Avista fish passage program, there is reason to believe that recolonization of Rock Creek by migratory fish is likely especially in years where perennial stream flow takes place. Furthermore, the loss of the Rock Creek local population would only reduce core area resiliency a small degree, if at all. However, to ensure the function of the core area for migrating adfluvial bull trout, the Lower Clark Fork Core Area is largely dependent on continued success of artificial passage of adult bull trout over Cabinet Gorge and Noxon dams in order to restore and maintain, at least partially, the historical connectivity that allowed adfluvial migrating adults from Lake Pend Oreille to reach spawning areas in their stream of origin.

As indicated in the previous section, the relative contribution of Rock Creek bull trout to the lower Clark Fork River bull trout population is small and limited in distribution – one of 14 tributaries. In turn, the overall contribution of Rock Creek bull trout to the genetic and phenotypic diversity of the overall Lower Clark Fork River Core Area population is minor. Further, Lake Pend Oreille, which is the primary core area of the lower Clark Fork River basin system, currently contains large numbers of bull trout and several healthy local populations (approximately 5,000 adult bull trout), and are now re-connected with the Lower Clark Fork Core Area through fish passage programs, which would help offset the low resiliency to stochastic events of the Lower Clark Fork River Core Area population. Also, it is reasonable to

assume that connectivity will be improved significantly and permanently between the two core areas (see Figure B2) in the lower Clark Fork River system and Lake Pend Oreille Core Area because fish are now being captured at all three dams (Cabinet Gorge, Noxon, and Thompson Falls dams) and planning efforts to establish permanent fish passage facilities at all three dams are now underway.

The connectivity to Lake Pend Oreille should be emphasized because a portion of the adfluvial bull trout rearing in this lake return to the Lower Clark Fork Core Area. Consequently, the probability of persistence of the species would not be appreciably affected even if the Rock Creek local population were lost when considering this re-connected system especially since empirical evidence shows that the Lake Pend Oreille Core Area is at or near the established recovery goal and the population is either stabilized or increasing.

The information and analysis presented in this biological opinion indicates that adverse impacts to the local Rock Creek population of bull trout are likely, but these effects on the core area population are minor. As a result, the Service concludes that implementation of this project is not likely to jeopardize the continued existence of bull trout at the scale of the Lower Clark Fork Core Area, and by extension not likely to jeopardize at the Clark Fork River Management Unit and the larger scale of the Columbia River Interim Recovery Unit. Therefore, the Service concludes that this project will not appreciably reduce both the survival and recovery of the coterminous United States population of the bull trout in the wild (64 FR 58910; April 20, 2006. memorandum to Ecological Services Project Leaders from Assistant Regional Director – Region 1, subject line, Jeopardy Determinations under Section 7 of the Endangered Species Act for the Bull Trout).

This conclusion is further supported by the following:

- The Clark Fork River basin consists of major river drainages including the Blackfoot, Clark Fork, Swan, Flathead, and Bitterroot rivers.

- Bull trout populations are considered strong in the South Fork Flathead, Blackfoot, and Swan rivers (USDI 1998c) and trends in abundance of bull trout are apparently stable in these rivers.

- The Lower Clark Fork Core Area contains 308 of approximately 3,369 miles of key bull trout recovery habitat in the Clark Fork River basin upstream of Albenai Falls Dam (USDI 2005b). As such, this core area contains a relatively minor portion (about 9 percent) of the important distribution in the Clark Fork River basin.

- The probability of persistence of bull trout in the lower Clark Fork River basin would not be significantly reduced even if the local population of Rock Creek bull trout core area was lost because the Lower Clark Fork Core Area would be largely unaffected.

- The Clark Fork River watershed is only 1 of at least 20 major watersheds forming the Columbia River basin, though it is amongst the largest (USDI 2002b). This demonstrates the small fraction of bull trout abundance, reproduction, and distribution of the Columbia

River basin bull trout represented by this core area.

- The probability of persistence of bull trout in the Columbia River basin would not be significantly reduced even if the Rock Creek local population were extirpated due to the remaining unaffected 13 local populations in the Lower Clark Fork Core Area.

- Significant progress has been made in fish passage over the lower Clark Fork River Avista dams and several habitat restoration projects in the Lower Clark Fork Core Area have been implemented and more are likely in the near future.

- Bull trout conservation is being implemented through Habitat Conservation Plans (HCP) in place on private land (Plum Creek Timber Company Native Fish HCP) and more plans are being developed on non-Federal ownership within the lower Clark Fork River basin (under development is the Montana Department of Natural Resources HCP, which currently identifies lands covered under the HCP in the lower Clark Fork River area).

- Lake Pend Oreille Core Area of the lower Clark Fork River system is at, or near, recovery goals of the Service's Draft Bull Trout Recovery Plan and the population is stabilized or increasing.

- Extensive mitigation to reduce sediment input and ensure water quality is included with the Rock Creek Project.

After reviewing the current status of bull trout, the environmental baseline (including effects of Federal actions covered by previous biological opinions) for the action area, the effects of the proposed mining operations, and the cumulative effects, it is the Service's biological opinion that the actions as proposed, are not likely to jeopardize the continued existence of bull trout. This conclusion is based on the magnitude of the project effects (to reproduction, distribution, and abundance) in relation to the listed population. Implementing regulations for section 7 (50 CFR 402) defines "jeopardize the continued existence of" as "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."

Conclusion for Designated Critical Habitat

<u>Adverse modification of designated bull trout critical habitat analysis</u>

After reviewing the current status of bull trout, the environmental baseline for the action area, the effects of the proposed mining operations, and the cumulative effects, it is the Service's biological opinion that the actions as proposed, are not likely to destroy or adversely modify bull trout critical habitat. This conclusion is based on the magnitude of the project effects in relation to the designated critical habitat at the Columbia River basin scale. Guidance for analysis of designated critical habitat for bull trout was provided in the final rule (FR 70, No 185, 56211-56311) and in the Director's December 9, 2004, memorandum and was promulgated in response to litigation on the regulatory standard for determining whether proposed Federal agency actions

are likely to result in the "destruction or adverse modification" of designated critical habitat under Section 7(a)(2) of the Act (Appendix E). The Director's December 9, 2004, memorandum outlines interim measures for conducting Section 7 consultations pending the adoption of any new regulatory definition of "destruction or adverse modification." Consequently, we have relied upon the statutory provisions of the Act to complete the following analysis with respect to critical habitat. Critical habitat is defined in section 3 of the Act "as the specific areas within the geographical area occupied by the species, at the time it is listed in accordance with the Act, on which are found those physical and biological features essential to the conservation of the species and that may require special management considerations or protection; and specific areas outside the geographical area occupied by a species at the time it is listed, upon a determination that such areas are essential for the conservation of the species."

As proposed, implementation of the Rock Creek mine is anticipated to negatively impact designated critical habitat in Rock Creek by diminishing the function of some of the PCEs due to increases in sedimentation in the West Fork and mainstem of Rock Creek and to a lesser extent critical habitat in the East Fork Rock Creek. Activities in the action area associated with the proposed mining operation would likely degrade aquatic habitat including spawning habitat, rearing habitat, and food supply and impact all bull trout life history stages during the 5-year construction period and likely for two years after construction is completed. Thereafter, the effects from sedimentation should subside and levels of sedimentation are expected to return to those observed before construction. Increases in sedimentation, water quality degradation, and changes in channel and habitat complexity related to mining activities are anticipated to reduce the functional ability of critical habitat to a small degree below baseline conditions temporarily, for about five to seven years associated with the construction period. The areas of critical habitat mostly affected in Rock Creek would be small localized stream segments in close proximity to the project area. All the primary constituent elements in Rock Creek are expected to remain functional, albeit at a lower level.

Anticipated impacts would be confined to the 2.88 miles of designated bull trout critical habitat in the Rock Creek drainage, and only to localized segments within the five sections identified as critical habitat (see Figure B4). Therefore, by extension the overall impact on the abundance and quality of designated critical habitat in the Lower Clark Fork Core Area and the Clark Fork River Management Unit would be diminutive, and therefore, not likely to be appreciably affected. The following reasons are the basis for our conclusion:

- The function of designated critical habitat in the Clark Fork River basin would not be significantly reduced because none of the PCEs in Rock Creek would be eliminated. It is anticipated that at most, affected PCEs would be diminished functionally only a small degree.

- Clark Fork River basin consists of major river drainages occupied by bull trout and with hundreds of miles of designated critical habitat including the Blackfoot, Clark Fork, Swan, Flathead, and Bitterroot rivers.

- The Lower Clark Fork Core Area contains 308 of approximately 3,369 miles of key bull trout recovery habitat in the Clark Fork River basin upstream of Albenai Falls Dam

(USDI 2005b). As such, this core area contains a relatively minor portion (about 9 percent) of the important distribution in the Clark Fork River basin.

- The Lower Clark Fork Core Area contains 135 miles of stream and 735 acres of lake surface area of designated critical habitat for bull trout. As such, the value of designated critical habitat within the action area (Rock Creek) is relatively small (about 2 percent) compared to the designated critical habitat distribution in the core area.

- The Clark Fork River watershed is only 1 of at least 20 major watersheds forming the Columbia River basin, though it is amongst the largest (USDI 2002b).

- Critical habitat in the Lower Clark Fork Core Area comprises 4 percent (135 stream miles) of the total Columbia River basin (3,096 stream miles) stream miles of critical habitat, and comprises only 0.1 percent of the total Columbia River basin stream miles when considering critical habitat in Rock Creek (2.88 miles). For critical habitat of lakes and reservoirs in the core area (735 acres), critical habitat comprises .8 percent of the total for the Columbia River basin (89,466 acres).

- Significant progress has been made in passing adult bull trout over the lower Clark Fork River Avista dams, as well as several successful habitat restoration projects in the lower Clark Fork River basin have been implemented and more are likely in the near future.

- Bull trout conservation is being implemented through Habitat Conservation Planning and more plans are being developed on non-Federal ownership within the lower Clark Fork Core Area.

This demonstrates the relatively small amount of designated critical habitat distribution located in the Rock Creek watershed in comparison to the Lower Clark Fork Core Area, and even smaller fraction when compared to the entire Columbia River basin. Based on the small amount of designated critical habitat exposed to potential project effects in the Rock Creek watershed in relation to the Lower Clark Fork Core Area and the fact that the impacted area will still support the PCE's, it is the Service's conclusion that the proposed action is not likely to destroy or adversely modify designated critical habitat of the Columbia River basin.

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 not discretionary, and must be undertaken by the Forest so that they become binding conditions of any contract or permit issued to any party, as appropriate, for the exemption in section 7(o)(2) to apply. The Forest has a continuing duty to regulate the activity covered by this incidental take statement. If the Forest (1) fails to assume and implement the terms and conditions or (2) fails to require any party 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 Forest must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement [50 CFR 402.14(I)(3)].

The biological assessment (MDEQ and USDA Forest Service 2001) describes actions anticipated to occur during implementation of the proposed Mining Plan of Operations of the Rock Creek Mine and proposes actions that, when implemented, are likely to adversely affect bull trout. The Service anticipates that implementation of the proposed Mining Plan of Operations of the Rock Creek Mine as described in the biological assessment would likely impart a level of adverse effect to individual bull trout to the extent that incidental take occurs.

Proposed Mining Plan of Operations in Lower Clark Fork River Basin-Rock Creek Mine

The proposed action includes the future refinement and approval of monitoring and mitigation plans for bull trout by Revett in cooperation with the MDEQ, the Forest, and the Service. Appendix K of the FEIS contains a complete description of the conceptual monitoring and mitigation plans for Alternatives III through V developed by MDEQ and the Forest.

Revett would develop final monitoring and mitigation plans prior to project startup. The regulatory agencies would review and approve the plans as an interagency team. To minimize impacts to bull trout, the plans potentially directly affecting the fishery would be reviewed from a fisheries perspective. The Service will participate as needed on issues related to water use, fishery monitoring plans, sediment abatement plans and monitoring, and groundwater monitoring. The Service will have approval authority of these plans and evaluations as described in the incidental take statement in this biological opinion. All plans would need to identify trigger or alert levels, which would require Revett to implement a corrective action plan. Corrective action plans with appropriate triggers for the most likely scenarios need to be developed and approved by the interagency team prior to project startup.

All monitoring would require an annual report unless otherwise specified. The reporting format and requirements would be reviewed and finalized by MDEQ, the Forest, and the Service. Reports would be submitted to other review agencies as identified by the Forest and MDEQ. After submittal of a monitoring report, the regulatory agencies and all other relevant agencies would review the monitoring plan and results, and evaluate possible modifications to the plan or permitted operations.

Monitoring and mitigation plans to be refined, approved and ultimately included in the plan of operations include:

- Air Quality Monitoring
- Rock Mechanics Monitoring
- Acid Rock Drainage and Metals Leaching Plan
- Evaluation Adit Data Evaluation Plan
- Tailings Paste Facility and Tailings Surry Line Construction Monitoring Plan
- Soils and Erosion Control Plan
- Reclamation Monitoring Plan
- Water Resources Monitoring Plan
- Influent and Effluent Monitoring Plan
- Monitoring of Biological Oxygen Demand Plan
- Wildlife Mitigation and Monitoring Plan
- Threatened and Endangered Species Mitigation Plan
- Aquatics and Fisheries Monitoring and Mitigation Plan
- Hard Rock Mining Impact Plan
- Wetlands Mitigation Plan

Amount or extent of take anticipated

The Service anticipates certain activities associated with the proposed mining operation would result in some incidental take of bull trout in the form of harm, harassment or mortality related to expected degradation of aquatic habitat conditions including spawning habitat, rearing habitat and food supply and the related risk to bull trout life history stages. Increases in sedimentation, degradation of water quality, and changes in channel and habitat complexity related to mining activities are anticipated to adversely affect and likely result in a take of the egg, larval and juvenile life history stages by harming or impairing feeding, breeding and sheltering patterns of adult and juvenile bull trout.

The Forest anticipates that adverse impacts could last for the life of the plan of operations, approximately 35 years (USDA Forest Service 1999, MDEQ and USDA Forest Service 2001). Further, it is possible long term effects of mining operations would continue indefinitely after mine closure. Impacts associated with groundwater development, metals contamination, and catastrophic events also are inherent to a proposal of this magnitude and considered risks to bull trout. Although these impacts are not expected, such impacts are difficult to predict. These actions, should they occur, could contribute to the overall risk to bull trout in the Lower Clark Fork Core Area and Reasonable and Prudent Measures must be taken to minimize take.

The amount of take expected in the Rock Creek watershed is difficult to quantify because of the wide ranging distribution of bull trout, identification and detection of dead or impaired species at the egg and larval stages is unlikely, losses may be masked by seasonal fluctuations in numbers and aquatic habitat modifications are difficult to ascribe to particular sources, especially in already degraded watersheds. In addition, the effects of management actions associated with some mining operations are largely unquantifiable in the short term and may only be measurable

in the long-term effects to the species or population levels. However, where the effects can be measured and the amount of take quantified, the Service has identified particular approaches and metrics to measure those effects.

The amount of take that may result from implementation of the proposed action is difficult to quantify for the following reasons:

- The duration and magnitude of sediment delivery is a function of weather conditions and the effectiveness of the mitigation measures.

- The amount and location of sediment deposition depends on numerous factors (flow regime, size of stream, channel roughness).

- Losses to bull trout in any life stage may be masked by wide seasonal fluctuations in numbers of individuals present and increases in natural sediment.

- The measures proposed by the Forest to minimize the delivery of additional sediment to bull trout habitat would likely be effective to varying degrees.

- Brook trout distribution in the action area appears to be limited to the lower portions of the drainage. If a change in brook trout/bull trout species composition does occur, impacts of increased competition and or hybridization would be difficult to quantify with the current levels of information.

- Chemical contamination of groundwater may undiscernibly adversely affect surface water in Rock Creek and not reach lethal levels for bull trout for some time, but continue to gradually increase and eventually affect long-term survival.

- The natural hydrograph of stream flow in Rock Creek may be changed or shifted imperceptibly over time through interruption of groundwater flow that supports or contributes to natural peak and base flow duration, timing and magnitude.

<u>Anticipated Take Due to Sediment Loading</u>

As mentioned above, the Service can use surrogates to measure the amount or extent of incidental take. In this biological opinion, the amount of sediment loading to the stream and the amount of fine sediment in spawning substrate will be used as a surrogate to determine the level of anticipated take that may result from sediment impacts. Baseline information does exist to compare pre-project levels of both parameters with post-construction project levels; however, the baseline should be updated prior to construction. The amount of sediment delivered to the stream and the amount of fine sediment levels in spawning areas are reasonable biological predictors of project impacts. Habitat for bull trout degrades when a change in the amount and composition of sediment delivered to the stream results in such changes as reducing pool depth, filling of interstitial space, and causing channels to braid. When this happens, cover, food supply, reproduction, and security for bull trout are diminished. Levels of fine sediment deposited in spawning areas during sediment loading reflect the quality of spawning habitat since

increasing fine sediment deposits reduces survival of bull trout embryos and fry, and therefore, negatively impacts productivity (Weaver and Fraley 1991, Weaver and White 1985, Furniss et al.1991, Bjornn and Reiser 1991, Tappel and Bjornn 1983, Bjornn et al. 1977, Bjornn et al.1974).

The amount of total sediment delivered to the stream from proposed project activities is expected to increase and peak during the five year construction period, and the percentage of this total that constitutes fine sediment (less than 6.35 mm or .25 inches) is expected to increase as well. Both sediment parameters (total sediment and percent fines in spawning gravel) can be measured and changes detected by conventional substrate sampling methods during this period. Moreover, it is reasonable to expect to observe a measurable reduction in total sediment delivered to the stream and a reduction in fine sediment levels in spawning gravel within two years following project construction, assuming implementation of the proposed sediment abatement measures and BMPs continue throughout this period and are effective (Ketcheson and Megahan 1996). As a result, the duration of anticipated incidental take from sediment impacts is seven years. Consequently, intensive post-construction annual sediment monitoring will be necessary for at least seven consecutive years, and preferably ten years, to assure the magnitude in fine sediment levels is declining and trend toward pre-project conditions.

The anticipated take level for total sediment delivered to the affected areas of the Rock Creek watershed will be limited to a numeric threshold. The numeric threshold is based on modeled outputs generated from the Forest's R-1 WATSED modeling as described in the Forest's biological assessment (MDEQ and USDA Forest Service 2001). Outputs of the modeled sediment loading are the predicted percent increase above baseline sediment levels at the height of the construction period. The "incidental take" thresholds for total sediment delivered are based on these outputs and are as follows: 1) 46 percent in the West Fork Rock Creek; 2) 20 percent in the East Fork Rock Creek; and 3) 38 percent overall for the entire Rock Creek watershed. To determine the extent of incidental take, actual measurements of sediment loading will be compared annually to the established pre-construction baseline level each year during the five year construction period and for two consecutive years immediately following the construction period. If the actual (as measured annually) percent increase above the pre-construction baseline level exceeds the modeled outputs (i.e., thresholds) in any one year during this seven year period, then anticipated take has been exceeded and the Service should be consulted per the terms and conditions in the Incidental Take Statement and Re-initiation Clause of this biological opinion.

In addition to the above, a second numeric threshold will be evaluated annually to determine project-related impacts to spawning areas. This metric is the average median percent fine sediment as measured in bull trout spawning substrate and is based on values measured from sediment core sampling conducted by Washington Water Power (1996) and as described in the Forest's biological assessment (MDEQ and USDA Forest Service 2001). Note that this value is not a percent increase over baseline conditions, but a fixed numeric value that is derived as a percent of substrate composition found in spawning areas that can be compared to those levels before the project is constructed. In this biological opinion, the values for the metric "average median percent fine sediment" were adjusted conservatively upward from the values found in the Washington Water Power study in order to account for anticipated project-related increases in

fine sediment. The increases are 13 percent (increased from 27 to 40 percent) for West Fork Rock Creek, (anticipated to be the most heavily impacted spawning areas) and 7 percent (increased from 43 to 50 percent) for mainstem Rock Creek. Fine sediment in spawning areas was not measured in the East Fork Rock Creek because the predominant substrate material was boulders and large cobble and what little spawning area existed was limited to isolated pockets of gravel behind stable debris or boulders (Washington Water Power 1996).

The Service anticipates that fine sediment in spawning gravels will likely increase during the construction period and have an adverse impact on embryo survival. The threshold limit for anticipated take will be preset based on a level of tolerance for embryo survival and the expected duration of this impact. As measured annually by the metric "average median percent fine sediment," the threshold limit is 40 percent fine sediment in spawning areas in the West Fork Rock Creek and 50 percent fine sediment in spawning areas in the mainstem Rock Creek below the confluence of the East Fork and above the confluence of Engle Creek. Each year during the five year construction period and for two years immediately following the construction period these data will be collected and compared to the pre-construction baseline values to determine the extent of incidental take. If annual monitoring of fine sediment levels shows that the increase in percent fines has surpassed these pre-set values in any one year during this seven year period, then the amount of anticipated take has been exceeded and the Service should be consulted per the terms and conditions in the Incidental Take Statement and Re-initiation Clause of this biological opinion.

The amount of anticipated take due to changes in sediment loading is based on the modeling estimates of the WATSED outputs (USDA Forest Service 1999, MDEQ and USDA Forest Service 2001) and the likelihood that increasing amounts of sediment loading during the construction period will increase the probability of habitat changes detrimental to bull trout. Consequently, monitoring of a suite of habitat variables will be required (e.g., pool depth, channel width/depth ratio, substrate embeddedness, channel braiding, etc.) to determine the actual effects of stream channel changes due to the sediment loading and to determine which habitat parameters may change in function to a higher risk level for bull trout. Pre-construction monitoring of these habitat parameters for at least three years would yield the most accurate baseline information for comparison to future habitat change attributable to the project. The Service will require that the Aquatic and Fisheries Mitigation Plan provide for sampling of pre-project habitat parameters to more accurately measure baseline conditions for a period of three years, including measurements of fine sediment in bull trout spawning gravel.

Should the amount of fine sediment deposited in bull trout spawning areas progressively increase up to 40 percent, embryo survival could progressively decrease to 20 percent in the West Fork Rock Creek. Fine sediment is not expected to reach this level during the seven year period; however, it is expected to increase to some extent. If monitoring shows that this level has been reached or exceeded, immediate corrective measures will be necessary. If percent fines in bull trout spawning areas in the mainstem Rock Creek progressively increase up to 50 percent, embryo survival could progressively decrease to 10 percent during this seven year period. However, this level is not expected to be reached, but if monitoring shows it has been reached or exceeded, immediate corrective measures will be necessary.

Mitigation measures are expected to be effective to reduce sediment loading; however, it is difficult to predict how effective the measures will be and how much change in substrate composition will affect survival for bull trout or any salmonid (Weaver and Fraley 1991, Chapman 1988). Consequently, collecting accurate baseline information before construction of the project is essential for comparison purposes and will be required as part of the Aquatic and Fisheries Mitigation Plan.

The development and approval of the Aquatic and Fisheries Mitigation Plan will incorporate appropriate sediment/substrate metrics to measure, detect, and evaluate each year project-related changes in habitat conditions that can be related to changing population parameters. In turn, this information can be used to assess impacts and gage whether the amount of incidental take is being minimized as anticipated and whether corrective actions are needed to address incidental take concerns. In this biological opinion, incidental take from potential sediment impacts has been assessed based on the best technical information available; however, through the development of the Aquatic and Fisheries Mitigation Plan, there may emerge a better means to calculate this incidental take or to refine this approach to better reflect the potential impacts. Because the Service will participate in the development and approval of this Plan, the Service may re-evaluate this assessment in this incidental take statement based on new technical information to help better refine its incidental take assessment and to ensure that sediment impacts are being minimized accordingly.

To ensure protection for a species assigned take due to mining related activities, re-initiation is required if the Terms and Conditions are not adhered to or the magnitude of the mining activities exceed the scope of this opinion.

Effect of the take

In the accompanying biological opinion, the Service determined that this level of anticipated take is not likely to result in jeopardy to bull trout or destruction or adverse modification of critical habitat.

Reasonable And Prudent Measures

The Service believes the following reasonable and prudent measure(s) are necessary and appropriate to minimize impacts of incidental take of bull trout:

1. To better assess and quantify incidental take of bull trout, Revett shall complete a pre-project watershed assessment of the Rock Creek watershed which characterizes the Rock Creek bull trout population, habitat conditions, and existing sediment sources in the basin. This is to be done in consultation with the Rock Creek Watershed Council, the Forest, and the Service. Incorporate, as appropriate, any additional findings into monitoring and mitigation plans.

    a. Implement a fish monitoring program to document the current status of Rock Creek bull trout and the effect of mitigation activities on Rock Creek bull trout.

Define bull trout distribution, densities, age class structures, genetics, growth rates, fecundity, and status of life history forms.

b. Implement a fish monitoring program to document the current status of brook and brown trout distribution and the effect of project activities on Rock Creek brook and brown trout. Determine feasibility of reducing risk of hybridization and interspecific competition by removing brook and brown trout from the Rock Creek drainage using accepted methodology.

c. Implement an assessment of existing instream habitat conditions for bull trout. Include assessment of spawning, rearing and overwintering conditions for resident and adfluvial bull trout. Also include temperature and sediment monitoring to establish baseline conditions for bull trout.

d. Implement a stream habitat enhancement program that improves the ability of bull trout to move throughout the year in Rock Creek and increases habitat availability and diversity for migratory and resident bull trout. Include an assessment of alternatives and designs for stream diversion to be constructed around the paste facility.

e. Identify sediment sources currently impacting Rock Creek and plan, design, and implement sediment abatement measures to reduce sediment input to the stream prior to initiation of any ground disturbing activities not related to adit exploration and development. This plan should identify existing sediment sources such as culverts, road impacts, bridges, past bank stabilization efforts and utility right of way impacts. Complete a road systems analysis to define existing and future road uses and closures.

f. Implement a sediment monitoring program to document the ongoing condition of Rock Creek and the effect of mitigation activities on sediment levels, and the actual effect of project activities and proposed mitigation actions on sediment levels in the drainage.

2. Evaluate all possible operations of the existing effluent location or relocating the effluent outfall discharge pipe to a location eliminating any potential impacts to bull trout related to project effects on migrating or holding fish moving into Rock Creek from the Clark Fork River.

3. Implement a metals monitoring program that includes monitoring levels of metal concentrations in groundwater, surface water, sediments, macroinvertebrates, and fish tissues. This could be incorporated in several conceptual monitoring plans including, but not limited to, the Aquatics and Fisheries Monitoring and Mitigation Plan.

4. Identify key spawning areas and implement a monitoring program of changes in groundwater influence for spawning and rearing bull trout. This would be incorporated into the groundwater monitoring program.

5. Complete a risk assessment of road failure related to haul routes and mine related vehicle traffic. Incorporate any additional measures identified to minimize the risk of road failures and the associated impacts to bull trout.

6. Incorporate any additional measures identified to minimize the risk of failure of the paste pile or facility and the associated impacts to bull trout.

7. Implement reporting and consultation requirements as outlined in the following terms and conditions.

Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the Act, the Forest 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.

1. The following terms and conditions are established to implement reasonable and prudent measure No. 1:

   Upon the of issuance of the letter of approval for the Rock Creek mine, the Forest would require the applicant to initiate baseline studies for use in a complete watershed assessment of Rock Creek. The Forest would require the applicant to complete and submit a comprehensive watershed assessment to the Forest and Service prior to surface disturbance activity *not* related to the evaluation adit stage of the project.

   The comprehensive watershed assessment would include information to characterize the Rock Creek bull trout population, instream and riparian habitat conditions and existing sediment sources in the basin and would address the following issues for bull trout:

   a. A monitoring plan to document the prevalence of Rock Creek bull trout. That monitoring plan would include studies to define bull trout distribution, densities, age class structures, genetics, and status of resident and migratory (adfluvial) bull trout.

   b. An assessment and subsequent monitoring to define the prevalence and distribution of brook and brown trout. In conjunction with Montana Fish, Wildlife and Parks, determine the feasibility of removing brook and brown trout from Rock Creek using accepted methodology. Evaluate the potential reduction of hybridization and competition risk by non native species and benefit to bull trout. If determined feasible and needed, subject to agreement with Montana Fish, Wildlife and Parks, remove brook and brown trout from the Rock Creek drainage using accepted methodology.

c. An assessment of current instream and riparian habitat conditions for bull trout. The assessment would include information on quantity and quality of spawning, rearing and overwintering conditions for resident and adfluvial bull trout. It would include a pre-and post-project assessment of riparian conditions including floodplain and channel migration zone areas, and fish passage barriers (natural and man-made).

d. An assessment of possible sediment mitigation and reduction projects within the Rock Creek watershed as outlined in the proposed action. Recommendations of stream enhancement projects should be included in that assessment.

e. A feasibility assessment (including engineering options, conceptual designs, estimated costs and expected sediment load effects) for sediment abatement measures that would reduce sediment levels in the Rock Creek drainage. This assessment would include any designs for the proposed stream diversion around the proposed paste facility and a complete roads analysis and recommendations associated with mine activities and proposed mitigation projects. This assessment will identify all potential sources of sediment (natural and man-caused) such as mass wasting areas and drainage from road surfaces.

(1) The sediment abatement program shall implement sediment mitigation actions designed to reduce sediment levels in Rock Creek by 38% (the projected increase in sediment levels attributable to development of the mine as described in the BA) <u>prior to</u> surface disturbance activity not related to the evaluation adit stage of the project.

(2) Upon completion of the feasibility assessment (1. d., above), the Forest would require the applicant to complete design and permitting requirements, in consultation with MDEQ, the Forest, and the Service, and begin construction of such sediment abatement measures as agreed to by the Forest and the Service.

f. Upon the issuance of the letter of approval for the Rock Creek Project, the Forest would require the applicant to complete and submit to the Forest and the Service a sediment monitoring plan that would adequately assess the current (i.e., baseline) and long-term status of sediment levels in Rock Creek. The sediment monitoring plan would be developed in consultation with MDEQ, the Forest and the Service and would address the entire Forest permit time period. This also would include a complete assessment of the effectiveness of the sediment abatement program in the Rock Creek drainage. If the assessment concludes, and the Service agrees, that the sediment abatement program failed to substantially reduce sediment levels in Rock Creek, then the applicant would prepare an assessment of other measures that could be implemented in the Rock Creek drainage and would be completed in a time frame agreed to by the Service.

g. Establish and document the natural hydrograph conditions prior to the mine becoming fully operational. Install a system of stream gages, as necessary, in order to record various stream flow conditions throughout the Rock Creek drainage before, during, and after mine operations. Consult a hydrologist to help establish the stream gage locations.

2. The following terms and conditions are established to implement reasonable and prudent measure # 2:

   a. Prior to surface disturbance activity not related to the evaluation adit stage of the project, the Forest would require the applicant to complete, and submit to the Forest and the Service, an evaluation of operational options with existing diffuser location and alternative locations for siting the diffuser entering the Clark Fork River below Noxon Dam. The evaluation would be prepared in consultation with the Forest, MDEQ, and the Service and would focus on recommendations that would minimize potential effects on migrating or resident bull trout utilizing the Clark Fork River habitats adjacent to the mouth of Rock Creek and the spring area immediately upstream. The Service would have the authority to ultimately approve the evaluation.

   b. If the evaluation identifies a more appropriate operation or location for the diffuser (2. a., above), the Forest would require the applicant to modify the plan of operations, as agreeable to the Service, to incorporate the alternative most likely to minimize impacts to bull trout.

3. The following terms and conditions are established to implement reasonable and prudent measure #3:

   a. Prior to surface disturbance activity not related to the evaluation adit stage of the project, the applicant shall submit a plan to the Forest and the Service for metals monitoring as it relates to bull trout habitat requirements that includes monitoring in water samples, sediment samples, and fish samples. This monitoring would start prior to mine development to establish the baseline, and continue during operations and post operations as determined necessary by the Forest and the Service. The Service would have the authority to ultimately approve the plan.

4. The following terms and conditions are established to implement reasonable and prudent measure #4:

   a. Prior to surface disturbance activity not related to the evaluation adit stage of the project, the Forest shall require the applicant to submit a plan to the Forest and the Service for monitoring of groundwater effects as they relate to bull trout habitat requirements. This monitoring would start prior to mine development to assess the baseline, and continue during operations and post operations as determined necessary by the Forest and the Service. The Service would have the authority to ultimately approve the plan.

5. The following terms and conditions are established to implement reasonable and prudent measure #5:

   a. Prior to surface disturbance activity not related to the evaluation adit stage of the project, the Forest shall require the applicant to submit a risk assessment of accidents related to haul routes for mine related vehicle traffic to the Forest and the Service for evaluation. The assessment would determine areas most at risk for bull trout and make recommendations for additional measures and responses to minimize risk. If any additional measures can be incorporated to minimize the risk of catastrophic failures, the Forest, MDEQ, and the Service would determine the timeline and mechanism for implementation of those identified measures.

6. The following terms and conditions are established to implement reasonable and prudent measure # 6:

   a. Minimization of paste pile or facility failures includes: employing the Bottom-Up construction sequence, installing blanket and finger drains beneath the paste facility; continually modeling and monitoring the moisture content of the paste pile during operations to better understand saturation levels, generating a detailed design of the paste plant operations and disposal system to ensure quality assurance and quality control during operation and post-closure. If any additional measures can be incorporated to minimize the risk of catastrophic paste pile or facility failures, the Forest, MDEQ, and the Service would determine the timeline and mechanism for implementation of those identified measures.

7. The following terms and conditions are established to implement reasonable and prudent measure # 7:

   a. The Forest would require the applicant to annually prepare and submit to the Service a report of the mining year activities as well as the next year's proposed activities.

   b. Upon locating dead or injured bull trout or upon observing destruction of redds, notification by the Forest or applicant must be made within 24 hours to the Montana Field Office at 406-449-5225. Record information relative to the date, time, and location of dead or injured bull trout when found, and possible cause of injury or death of each fish and provide this information to the Service.

   c. During project development and operation the Forest or applicant shall notify the Service within 24 hours of any emergency or unanticipated situations arising that may be detrimental for bull trout relative to the proposed activity.

   d. Within 90 days of the end of each year, the Forest or applicant would provide a written report or letter to the Service indicating the actual number of bull trout

taken, if any, as well as any relevant biological/habitat data or other pertinent information on bull trout that was collected.

e. The Forest shall assure consistent implementation of measures and standards specified in the Aquatic Conservation strategies as indicated in the 1998 Biological Opinion for the Effects to Bull Trout from the Continued Implementation of Land and Resource Management Plans and Resource Management Plans as Amended by the Interim Strategies for Managing Fish-producing Watersheds in Eastern Oregon and Washington, Idaho, Western Montana, and portions of Nevada (INFISH), and the Interim Strategy for Managing Anadromous Fish-producing Watershed in Eastern Oregon and Washington, Idaho and portions of California (PACFISH).

f. To better monitor mitigation measures identified, the Forest would provide summaries to the Service of all INFISH compliance, water quality and fish population monitoring conducted in conjunction with these mining operations.

The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. With implementation of these measures, the Service expects that incidental take of bull trout would result from changes stream channel characteristics associated with increases in sediment, modifications in water quality, and modifications of instream habitat features (e.g. pool depths, channel width, substrate embeddedness) for the life of the mining operations and reclamation activities. Some long term effects of mining operations would likely continue indefinitely after mine closure. If, during the course of the action, the proposed project design and operations are not adhered to, the level of incidental take anticipated in the biological opinion may be exceeded. Such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. The Service retains the discretion to determine whether non-compliance with terms and conditions results in take exceeding that considered here, and whether consultation should be re-initiated. This may require suspension of mining operations. The Federal agency must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the reasonable and prudent measures.

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. The Service recognizes the impacts of past mining, roading and logging actions on watersheds on the Forest. For the benefit of the watershed and listed bull trout, the Service encourages the Forest to seek appropriate levels of funding to reclaim and restore

impacts from previous actions and to have in reserve contingency funds for offsetting environmental damage to public lands caused by mining accidents.

2. The Service recognizes and appreciates the Forest and Revett's involvement with the Rock Creek Watershed Council. We encourage continued participation and development of actions to further restore native fish populations in the Rock Creek drainage.

3. To address the concern about increased recreational angling pressure and poaching, the Service recommends the Forest support a creel census survey to determine pre- and post project changes in levels of fishing pressure in Rock Creek. This effort should be coordinated with MFWP and the Service recommends that the survey be included in the Aquatic and Fisheries and Mitigation Plan.

4. To progress toward bull trout recovery in the Clark Fork River Management unit, the Service encourages the Forest to consider incorporating recommended recovery tasks of the bull trout draft recovery plan (USDI 2002c).

5. The Service encourages the Forest and Revett to coordinate and cooperate with local planning groups such as the Rock Creek Watershed Council, and regional efforts such as the Avista Native Salmonid Restoration Program, whose efforts are targeted for conservation of bull trout in the lower Clark Fork River and to ensure the mine's project activities and mitigation plans are not in conflict with these efforts.

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

REINITIATION NOTICE

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

Heavy Metal Contamination

The Service is concerned that the proposed mining activities in post-implementation years 1 through 35, or beyond, could increase the risk of incidental take of bull trout due to dissolved concentrations heavy metal contamination in Rock Creek. These changes are not anticipated at this time, due in part, to Revett's commitment to the Project's water treatment plant.

However, it is reasonable to assert that, over the long-term, new information from monitoring water quality may reveal changes in water chemistry. Specifically, the gradual accumulation of heavy metals that could occur over the 35 year life of the project and that may persist for some period after the project ends. To address the chemical contamination concern, the Service will depend on the heavy metal concentration standards and intensive monitoring under the MPDES permit system. The MPDES standards of allowable concentrations of heavy metals are adequately restrictive whereby these standards would be out of compliance well in advance of anticipated adverse impacts to fish resources, including bull trout. It is likely the MPDES permit requirements would necessitate corrective actions before incidental take to bull trout would occur. For the Service to determine whether the risk of incidental take is elevated in Rock Creek due to project implementation, frequent long-term intensive monitoring and reporting is crucial. If monitoring results during project implementation indicate incidental take is anticipated, this would constitute new information of anticipated effects and reinitiation of consultation would be required.

Groundwater Influence

The proposed mining activities may intercept sources of groundwater that enter into Rock Creek through springs and seeps located in or adjacent to streambanks or in-channel areas. These inputs of cold water are important in maintaining stream temperatures and instream flows for bull trout in Rock Creek, especially base flows during seasonal low flow periods such as late summer, early fall. The Service is concerned that changes to the down gradient groundwater system for Rock Creek may occur by the mine's dewatering and drainage operations. Mitigation has been proposed to minimize these effects (i.e., 1,000 foot buffer zones around Cliff Lake and Moran Basin); however, it is unknown how effective the mitigation will be with regard to groundwater drainage stress. Incidental take of bull trout is not anticipated at this time; however, due to the uncertainty of the mitigation effectiveness, it is reasonable to assert that over the long-term, new information from monitoring water quality may reveal an increase in the risk of incidental take to bull trout due to changes in stream temperature and instream flows that result from influence of the mine's activities on the groundwater system that sustains Rock Creek. Therefore, intensive long-term monitoring of stream temperatures and seasonal instream flows is essential in order to detect mining induced changes in the groundwater system that may elevate the risk of incidental take to Rock Creek bull trout. If monitoring results during project implementation indicate incidental take is anticipated, this would constititute new information of anticipated effects and reinitiation of consultation would be required.

R. Mark Wilson

R. Mark Wilson, Field Supervisor
Montana Ecological Services Field Office

10-11-06

Date

REFERENCES

Adams, S.B., and T.C. Bjornn. 1997. Bull trout distributions related to temperature regimes in four central Idaho streams. Pages 371-380 *in* W.C. Mackay, M.K. Brewin, and M. Monita, editors. Friends of the bull trout conference proceedings. Bull Trout Task Force (Alberta), c/o Trout Unlimited Canada, Calgary.

Allan, J.H. 1980. Life history notes on the Dolly Varden char (*Salvelinus malma*) in the Upper Clearwater River, Alberta. Manuscript Report. Energy and Natural Resources, Fish and Wildlife Division, Red Deer, Alberta.

Avista Corporation. 2003. The Clark Fork project FERC project no.2058. 2002 annual report implementation of PM&E measures. February 2003 Draft. Spokane, Washington.

Baxter, C.V., C.A. Frissell, and F.R. Hauer. 1999. Geomorphology, logging roads, and the distribution of bull trout spawning in a forested river basin: implications for management and conservation. Transactions of the American Fisheries Society 128:854-867.

Baxter, C.V., and F.R. Hauer. 2000. Geomorphology, hyporheic exchange, and selection of spawning habitat by bull trout (*Salvelinus confluentus*). Canadian Journal of Fisheries and Aquatic Sciences 57:1470-1481.

Belt, G.H., J. O'Laughlin, and T. Merrill. 1992. Design of forest riparian buffer strips for the protection of water quality: analysis of scientific literature. Idaho Forest, Wildlife and Range Policy Analysis Group report No. 8. University of Idaho, Moscow.

Bjornn, T.C., and D.W. Reiser. 1991. Habitat requirements of salmonids in streams. Pages 83-138 *in* W.R. Meehan, editor, American Fisheries Society Special Publication 19.

Bjornn, T.C., and others. 1977. Transport of granitic sediment in streams and its effects on insects and fish. University of Idaho; Forest, Wildlife, and Range Experiment Stn., Bull. 17, Moscow.

Bjornn, T.C., and others. 1974. Sediment in streams and its effects on aquatic life. University of Idaho, Water Resources Research Institute; Technical Completion Rpt., Project B-025-IDA, Moscow.

Bjornn, T.C., and J. Mallet. 1964. Movements of planted and wild trout in an Idaho river system. Transactions of the American Fisheries Society 93:70-76.

Boag, T.D., and P.J. Hvenegaard. 1997. Spawning movements and habitat selection of bull trout in a small Alberta foothills stream. Pages 317-323 *in* W.C. Mackay, M.K. Brewin, and M. Monita, editors. Friends of the bull trout conference proceedings. Bull Trout Task Force (Alberta), c/o Trout Unlimited Canada, Calgary.

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

Bonneau, J.L., and D.L. Scarnecchia. 1996. Distribution of juvenile bull trout in a thermal gradient of a plunge pool in Granite Creek, Idaho. Transactions of the American Fisheries Society 125:628-630.

Buckman, R.C., W.E. Hosford, and P.A. Dupee. 1992. Malheur River bull trout investigations. Pages 45-57 *in* P.J. Howell and D.V. Buchanan, editors. Proceedings of the Gearhart Mountain bull trout workshop. Oregon Chapter of the American Fisheries Society, Corvallis.

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

Chamberlain, T.W., R.D. Harr, and F.H. Everest. 1991. Timber harvesting, silviculture, and watershed processes. American Fisheries Society Special Publication 19:181-205.

Chandler, J.A., M.A. Fedora, and T.R. Walters. 2001. Pre- and post-spawn movements and spawning observations of resident bull trout in the Pine Creek watershed, eastern Oregon. Pages 167-172 *in* M.K. Brewin, A.J. Paul, and M. Monita, editors. Bull trout II conference proceedings. Trout Unlimited Canada, Calgary, Alberta.

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

Costello, A.B., T.E. Down, S.M. Pollard, C.J. Pacas, and E.B. Taylor. 2003. The influence of history and contemporary stream hydrology on the evolution of genetic diversity within species: an examination of microsatellite DNA variation in bull trout, *Salvelinus confluentus* (Pisces: Salmonidae). Evolution. 57(2): 328-344.

Craig, S.D. 2001. Bull trout, baseflows and water temperatures: quantifying minimum surface water discharges in small groundwater influenced catchments. Pages 129-135 *in* M.K. Brewin, A.J. Paul, and M. Monita, editors. Bull trout II conference proceedings. Trout Unlimited Canada, Calgary, Alberta.

Cummins, K.W., and G.H. Lauff. 1969. The influence of substrate particle size on the microdistribution of stream benthos. Hydrobiologia 34:145-181.

Dambacher, J.M., and K.K. Jones. 1997. Stream habitat of juvenile bull trout populations in Oregon and benchmarks for habitat quality. Pages 353-360 *in* W.C. Mackay, M.K. Brewin, and M. Monita, editors. Friends of the bull trout conference proceedings. Bull Trout Task Force (Alberta), c/o Trout Unlimited Canada, Calgary.

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

Downs, C.C. and R. Jakubowski. 2004. Lake Pend Oreille/Clark Fork River fishery research and monitoring. Avista Corporation; IDFG -05-51. 155 pp.

Dunham, J.B., and G.L. Chandler. 2001. Models to predict suitable habitat for juvenile bull trout in Washington State. Final report to U.S. Fish and Wildlife Service, Lacey, Washington.

Earle, J.E., and J.S. McKenzie. 2001. Microhabitat use by juvenile bull trout in mountain streams in the Copton Creek system, Alberta and its relation to mining activity. Pages 121-128 *in* M.K. Brewin, A.J. Paul, and M. Monita, editors. Bull trout II conference proceedings. Trout Unlimited Canada, Calgary, Alberta.

Everest, F.H., R.L. Beschta, J.C. Scrivener, K.V. Koski, J.R. Sedell and C.J. Cederholm. 1987. Fine sediment and salmonid production: a paradox. Pages 98-142 *in* E. Salo and T. Cundy, editors. Streamside management: forestry and fishery interaction. University of Washington, College of Forest Resources, Contribution 57, Seattle.

Federal Energy Regulatory Commission. 1999. Biological assessment on the effects of Cabinet Gorge, Noxon and Thompson Falls Dams. On File at U.S. Fish and Wildlife Service, Helena, Montana.

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

Fredenberg, W. 2002a. Further evidence that lake trout displace bull trout in mountain lakes. Intermountain Journal of Sciences 8(3): 143-152.

Fredenberg, W. 2002b. Personal communication. Fishery biologist. U.S. Fish and Wildlife Service, Creston Fish and Wildlife Center. Kalispell, Montana.

Frissell, C.A. 1993. A new strategy for watershed restoration and recovery of Pacific salmon in the Pacific Northwest. The Pacific Rivers Council, Eugene, Oregon.

Furniss, M.J., T.D. Roelofs, and C.S. Yee. 1991. Road construction and maintenance. Pages 297-323 *in* W.R. Meehan, editor. American Fisheries Society Special Publication 19.

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

Goetz, F.A. 1991. Bull trout life history and habitat study. Final report prepared for Deshutes National Forest. Oregon State University, Corvallis.

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

Graham, P.J., B.B. Shepard, and J.J. Fraley. 1981. Use of stream habitat classifications to identify bull trout spawning areas in streams. Pages 186-190 *in* Acquisition and utilization of habitat inventory information: proceedings of the symposium. American Fisheries Society, Western Division, Portland, Oregon.

Gurrieri, J. 2001. Hydrology and Chemistry of Wilderness Lakes and Evaluation of Impacts from Proposed Underground Mining, Cabinet Mountains Wilderness, Montana. In Proceedings of Mine Design, Operations & Closure Conference, Whitefish, Montana.

Haas, G.R., and J.D. McPhail. 1991. Systematics and distributions of Dolly Varden *(Salvelinus malma*) and bull trout (*Salvelinus confluentus*) in North America. Canadian Journal of Fisheries and Aquatic Sciences 48:2191-2211.

Haas, G.R. and J.D. McPhail. 2001. The post-Wisconsin glacial biogeography of bull trout (*Salvelinus confluentus*): a multivariate morphometric approach for conservation biology and management. Canadian Journal of Fisheries and Aquatic Sciences 58:2189-2203

Hansen, B. 2001. Threats to the persistence of a small disjunct bull trout population on the Flathead Indian Reservation, western Montana, USA. Pages 233-236 *in* M.K. Brewin, A.J. Paul, and M. Monita, editors. Bull trout II conference proceedings. Trout Unlimited Canada, Calgary, Alberta.

Harvey B.C., and T.E Lisle. 1998. Effects of suction dredging on streams; a review and an evaluation strategy. Fisheries 23(8):8-17.

Hauer, R.F., G.C. Poole, J.T. Gangemi, and C.V. Baxter. 1999. Large woody debris in bull trout (*Salvelinus confluentus*) spawning streams of logged and wilderness watersheds in northwest Montana. Canadian Journal of Fisheries and Aquatic Sciences 56:915-924.

Henry, M.G., and G.J. Atchison. 1991. Metal effects on fish behavior-advances in determining the ecological significance of responses. Pages 131-143 *in* M.C. Newman, and A.W. McIntosh, editors. Metal Ecotoxicology: Concepts and Applications. Lewis Publishers, Chelsea, Michigan.

Idaho Fish and Game. 1995. Assessment and conservation strategy for bull trout. Idaho Department of Fish and Game, Boise.

Jakober, M.J. 1998. Role of stream ice on fall and winter movements and habitat use by bull trout and cutthroat trout in Montana headwater streams. Transactions of the American Fisheries Society 127:223-235.

Kanda, N. and F.W. Allendorf. 2001. Genetic population structure of bull trout from the Flathead River basin as shown by microsatellites and mitochondrial DNA markers. Transactions of the American Fisheries Society 130:92-106.

Ketcheson, G.L. and W.F. Megahan. 1996. Sediment production and downslope sediment transport from forest roads in granitic watersheds. Research Paper INT-RP-486. USFS Intermoountian Research Station. Ogden, Utah. 12pp.

Kleinschmidt Associates. 1996. Fish entrainment mortality study, Black River, FERC No. 2569 (Herrings). Report prepared for Niagara Mohawk Power Corp., Syracuse, NY.

Lake Pend Oreille Bull Trout Watershed Assessment Group. 1999. On file at U.S. Fish and Wildlife Service, Helena, Montana.

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

Lee, D.C., J.R. Sedell, B.E. Rieman, R.F. Thurow, and J.E. Williams. 1997. Chapter 4: Broadscale assessment of aquatic species and habitats. Pages 1057-1496 *in* T.M. Quigley, and S.J. Arbelbide, editors. An Assessment of Ecosystem Components in the Interior Columbia Basin and Portions of the Klamath and Great Basins: Volume III. PNW-GTR-405. USDA Forest Service, Portland, Oregon.

Liermann, B.W. and T.D. Tholl. 2005. Native Salmonid Abundance Monitoring. Montana Tributary Habitat Acquisition and Recreational Fishery Enhancement Program, Appendix B. Progress Report – 2003.

Liermann, B.W. 2004. Native Salmonid Abundance Monitoring. Avista Corporation, Spokane, Washington.

Liermann, B.W., Katzman, L.M., and T.D. Tholl. 2003. Habitat Restoration Monitoring. Montana Tributary Habitat Acquisition and Recreational Fishery Enhancement Program, Appendix B. Comprehensive Report – 2001-2002.

Light, J.T., L.G. Herger, and M. Robinson. 1996. Upper Klamath Basin bull trout conservation strategy, a conceptual framework for recovery. Part One. The Klamath Basin Bull Trout Working Group. (As referenced in USDI 1998c).

Lockard, L. and Hintz, D. 2005. Upstream Fish Passage Studies. Fish Passage/Native Salmonid Restoration Program, Appendix C. Annual Progress Report – 2004. Avista Corp. Spokane, Washington.

Lockard, L., M. Carlson, and L. Hintz. 2004. Fisheries investigations and monitoring. Annual progress report - 2003. Fish Passage / Native Salmonid Restoration Program. Avista Corp., Spokane, Washington.

Lockard, L., R. Weltz, and E. Stender-Wormwood. 2005. Tributary Trapping and Downstream Juvenile Bull Trout Transport Program. Fish Passage Native Salmonid Program, Appendix C. Annual Progress Report – 2004. Avista Corp. Spokane, Washington.

Lockard, L., R. Weltz, and E. Stender. 2004. Tributary Trapping and Downstream Juvenile Bull Trout Transport Program. Fish Passage Native Salmonid Program, Appendix C. Annual Progress Report – 2003. Avista Corp. Spokane, Washington.

Lockard, L., R. Weltz, E. Stender, J. Storaasli, and J. Stover. 2003. Tributary Trapping and Downstream Juvenile Bull Trout Transport Program. Fish Passage Native Salmonid Program, Appendix C. Annual Progress Report – 2002. Avista Corp. Spokane, Washington.

Lockard, L., S. Wilkinson, and S. Skaggs. 2002a. Experimental adult fish passage studies annual progress report–2001 fish passage/native salmonid program, Appendix C. Prepared for Avista Corporation, Noxon, Montana.

Lockard, L., R. Weltz, J. Stover, and R. Lockard. 2002b. Tributary Trapping and Downstream Juvenile Bull Trout Transport Program. Fish Passage Native Salmonid Program, Appendix C. Annual Progress Report – 2001. Avista Corp. Spokane, Washington.

Long, M.H. 1997. Sociological implications of bull trout management in northwest Montana: illegal harvest and game warden efforts to deter. *In*: W.C. Mackay, M.K. Brewin, and M. Monita, editors. Friends of the bull trout conference proceedings, Bull Trout Task Force (Alberta), c/o Trout Unlimited Canada, Calgary pp. 71-74.

Martin, S. 1992. Southeast Washington species interaction study: Bull trout (*Salvelinus confluentus*), Steelhead trout (*Onchorhynchus mykiss*), and spring chinook salmon (*Onchorhynchus tshawytscha*). Information report no. 92-1, BPA, WDW, and Eastern Washington University.

Martin S.B., and W.S. Platts. 1981. Effects of mining. GTR-PNW-119, USDA Forest Service, Pacific Northwest Forest and Range Experiment Station.

McLeay D.J., I.K. Birtwell, G.F. Hartman, and G.L. Ennis. 1987. Response of Arctic grayling to acute and prolonged exposure to Yukon placer mining sediment. Canadian Journal of Fisheries and Aquatic Sciences 44:658-673.

McPhail, J.D. and C. Murray. 1979. The early life history and ecology of Dolly Varden (*Salvelinus malma*) in the upper Arrow Lakes. Rpt to the BC Columbia Hydro and Power Authority and Kootenay Dept of Fish and Wildlife.

Meehan, W.R. 1991. Introduction and overview. Pages 1-15 *in* W.R. Meehan, editor. Influences of Forest and Rangeland Management on Salmonid Fishes and Their Habitats. American Fisheries Society Special Publication 19.

Montana Bull Trout Restoration Team. 2000. Restoration Plan For Bull Trout In The Clark Fork River Basin And Kootenai River Basin Montana. Prepared for Governor Marc Racicot. Helena, Montana.

Montana Bull Trout Scientific Group. 1995a. Bitterroot River drainage bull trout status report. Prepared for The Montana Bull Trout Restoration Team, Montana Fish, Wildlife, and Parks, Helena.

Montana Bull Trout Scientific Group. 1996a. Swan River drainage bull trout status report (including Swan Lake). Prepared for The Montana Bull Trout Restoration Team, Montana Fish, Wildlife, and Parks, Helena.

Montana Bull Trout Scientific Group. 1996b. Lower Clark Fork River drainage bull trout status report (Cabinet Gorge Dam to Thompson Falls). Prepared for The Montana Bull Trout Restoration Team, Montana Fish, Wildlife, and Parks, Helena.

Montana Bull Trout Scientific Group. 1996c. Middle Clark Fork River drainage bull trout status report (from Thompson Falls to Milltown, including the lower Flathead River to Kerr Dam). Prepared for The Montana Bull Trout Restoration Team, Montana Fish, Wildlife, and Parks, Helena.

Montana Bull Trout Scientific Group. 1998. The relationship between land management activities and habitat requirements of bull trout prepared for The Montana Bull Trout Restoration Team, Montana Fish, Wildlife and Parks, Helena.

Montana Department of Environmental Quality and USDA Forest Service. 2001. Final Environmental Impact Statement Rock Creek Project, Volume 1 and Volume 11 (Appendices). Helena, Montana.

Moran, S. 2006. Lower Clark Fork River, Montana - Avista Project Area - 2005 Annual Bull and Brown Trout Redd Survey Report. Avista Corporation. Noxon, Montana.

Moran, S. 2005. Lower Clark Fork River, Montana - Avista Project Area - 2004 Annual Bull and Brown Trout Redd Survey Report. Avista Corporation. Noxon, Montana.

Moran, S. 2004. Lower Clark Fork River, Montana - Avista Project Area - 2003 Annual Bull and Brown Trout Redd Survey Report. Avista Corporation. Noxon, Montana.

Nelson R. L.M.L. McHenry, and W.S. Platts. 1991. Mining. Pages 425-457 *in* W.R. Meehan, editor. Influences of Forest and Rangeland Management on Salmonid Fishes and Their Habitats. American Fisheries Society Special Publication 19.

Nelson, M.L., T.E. McMahon, and R.F. Thurow. 2002. Decline of the migratory form in bull charr, *Salvelinus confluentus*, and implications for conservation. Environmental Biology of Fishes 64:321-332.

Neraas, L.P. and P. Spruell. 2001. Fragmentation of riverine systems: the genetic effects of dams on bull trout (Salvelinus confluentus) in the Clark Fork River system. Molecular Ecology (10):1153-1164.

Oligher, R.C. and I.J. Donaldsen. 1966. Fish passage through turbines. Tests at Big Cliff Hydroelectric Plant, Progress Report No.6. Report prepared for the Department of the Army, Corps of Engineers, Walla Walla District, WA.

Overton, C.K., M.A. Radko, and R.L. Nelson. 1993. Fish habitat conditions; using the northern/intermountain regions inventory procedures for detecting differences on two differently managed watersheds. GTR-INT-300, USDA Forest Service, Ogden, Utah.

Pratt, K.L. 1984. Habitat use and species interactions of juvenile cutthroat (*Salmo clarki lewisi*) and bull trout (*Salvelinus confluentus*) in the upper Flathead River basin. M.S. Thesis. University of Idaho, Moscow.

Pratt, K.L. 1985. Pend Oreille trout and char life history study. Idaho Department of Fish and Game, Boise.

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

Pratt, K.L., and J.E. Huston. 1993. Status of bull trout (*Salvelinus confluentus*) in Lake Pend Oreille and the lower Clark Fork River: draft. The Washington Power Company, Spokane.

Quigley, T.M., and S.J. Arbelbide. 1997. An assessment of ecosystem components in the interior Columbia basin and portion of the Klamath and Great basins: Volume III. Pages 1,057-1,713 *in* T.M. Quigley, editor. The Interior Columbia Basin Ecosystem Management Project: Scientific Assessment. PNW-GTR-405.USDA Forest Service, Portland, Oregon.

Ralph, S.C., G.C. Poole, L.L. Conquest, and R.J. Naiman. 1994. Stream channel morphology and woody debris in logged and unlogged basins of western Washington. Canadian Journal of Fisheries and Aquatic Sciences 51:37-51.

Ratliff, D.E. 1992. Bull trout investigations in the Metolius River- Lake Billy Chinook system. Pages 37-44 *in* P.J. Howell and D.V. Buchanan, editors. Proceedings of the Gearhart Mountain bull trout workshop. Oregon Chapter of the American Fisheries Society, Corvallis.

Ratliff, D.E., and P.J. Howell. 1992. The status of bull trout populations in Oregon. Pages 10-17 *in* P.J. Howell and D.V. Buchanan, editors. Proceedings of the Gearhart Mountain bull trout workshop. Oregon Chapter of the American Fisheries Society, Corvallis.

Reiser, D.W., E. Conner, K. Binkley, K. Lynch, and D. Paige. 1997. Evaluation of spawning habitat used by bull trout in the Cedar River watershed, Washington. Pages 331-338 *in* W.C. Mackay, M.K. Brewin, and M. Monita, editors. Friends of the bull trout conference proceedings. Bull Trout Task Force (Alberta), c/o Trout Unlimited Canada, Calgary.

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

Riehle, M., W. Weber, A.M. Stuart, S.L. Thiesfeld, and D.E. Ratliff. 1997. Progress report of the multi-agency study of bull trout in the Metolius River system, Oregon. Pages 137-144 *in* W.C. Mackay, M.K. Brewin, and M. Monita, editors. Friends of the bull trout conference proceedings. Bull Trout Task Force (Alberta), c/o Trout Unlimited Canada, Calgary.

Rieman, B.E., and J.D. McIntyre. 1993. Demographic and habitat requirements for conservation of bull trout. GTR-INT-302. USDA Forest Service, Boise, Idaho.

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

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

Rieman, B.E., and D.L. Myers. 1997. Use of redd counts to detect trends in bull trout (*Salvelinus confluentus*) populations. Conservation Biology 11:1015-1018.

Rieman, B.E., D.C. Lee, and R.F. Thurow. 1997. Distribution, status, and likely future trends of bull trout in the interior Columbia River basin and Klamath River basins. North American Journal of Fisheries Management 17:1111-1125.

RMC. 1994. Survival of fish in turbine passage through the Townsend Dam, Pennsylvania (FERC Project No. 3451). Report prepared for Beaver Falls Municipal Authority, Beaver Falls, PA.

Rode, M. 1990. Bull trout (*Salvelinus confluentus Suckley*) in the McCloud River: status and recovery recommendations. California Department of Fish and Game, Inland Fisheries Administrative Report No. 90-15, Sacramento.

Ross, M.R.. 1997. Fisheries Conservation and Management. Chapter 4: The Human Factor in Fisheries Conservation and Management. Prentice Hall, New Jersey. 374pp.

Saffel, P.D., and D.L. Scarnecchia. 1995. Habitat use by juvenile bull trout in belt-series geology watersheds of northern Idaho. Northwest Science 69:304-317.

Saunders, R.L., and J.B. Sprague. 1967. Effects of copper-zinc mining pollution on a spawning migration of Atlantic salmon. Water Research 1:419-432. (As referenced in Henry and Atchison 1991).

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

Schmetterling, D.A. and D.H. McEvoy. 2000. Abundance and diversity of fishes migrating to a hydroelectric dam in Montana. North American Journal of Fisheries Management 20:711-719.

Sedell, J.R., P.A. Bisson, F.J. Swanson, and S.V. Gregory. 1988. What we know about large trees that fall into streams and rivers. Pages 47-81 *in* C. Maser, R.F. Tarrant, J.M. Trappe, and J.F. Franklin, editors. From the forest to the sea: a story of fallen trees. GTR-PWR 229. USDA Forest Service, Portland, Oregon.

Selong, J.H., T.E. McMahon, A.V. Zale, and F.T. Barrows. 2001. Effect of temperature on growth and survival of bull trout, with application of an improved method for determining thermal tolerance in fishes. Transactions of the American Fisheries Society 130:1026-1037

Shepard, B.B., J.J. Fraley, T.M. Weaver, and P. Graham. 1982. Flathead River fisheries study 1982. Montana Department of Fish, Wildlife and Parks, Helena.

Shepard, B.B., S.A. Leathe, T.M. Weaver, and M.D. Enk. 1984. Monitoring levels of fine sediment within tributaries to Flathead Lake, and impacts of fine sediment on bull trout recruitment. Pages 146-156 *in* Proceedings of the Wild Trout III Symposium, Yellowstone National Park, Wyoming.

Sheridan, D. 1977. Hard rock mining on the public land. Council of Environmental Quality. U.S. Government Printing Office, Washington, D.C. (As referenced in Nelson et al. 1991).

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

Sprague, J.B., and W.J. Logan. 1979. Separate and joint toxicity to rainbow trout of substances used in drilling fluids for oil exploration. Environmental Pollution 19:269-281. (As referenced in Nelson et al. 1991).

Sprague, J.B., P.F. Elson, and R.L. Saunders. 1965. Sublethal copper-zinc pollution in a salmon river-a field and laboratory study. International Journal of Air and Water Pollution 9:531-543. (As referenced in Henry and Atchison 1991).

Spruell, P., B.E. Rieman, K.L. Knudsen, F.M. Utter, and F.W. Allendorf. 1999. Genetic population structure within streams: microsatellite analysis of bull trout populations. Ecology of Freshwater Fish (8):114-121.

Spruell, P., and 7 others. 2000. Genetic management plan for bull trout in the Lake Pend Oreille - Lower Clark Fork River system. Report to the Avista Aquatic Implementation Team by the bull trout Genetics Advisory Panel; November 15, 2000. UM Wild Trout and Salmon Genetics Lab, University of Montana, Missoula.

Spruell, P., A.R. Hemmingsen, P.J. Howell, N. Kanda, and F. Allendorf. 2003. Conservation genetics of bull trout: Geographic distribution of variation at microsatellite loci. Conservation Genetics 4: 17-29.

Tappel, P.D. and T.C. Bjornn. 1983. A new method of relating size of spawning gravel to salmonid embryo survival. North American Journal of Fisheries Management 3:123-135.

Taylor, E.B., S. Pollard, and D. Louie. 1999. Mitochondrial DNA variation in bull trout (*Salvelinus confluentus*) from northwestern North America: implications for zoogeography and conservation. Molecluar Ecology. 8:1155-1170.

Thomas, G. 1992. Status report: bull trout in Montana. Montana Department of Fish, Wildlife and Parks, Helena.

Thurow, R.F. 1987. Evaluation of the South Fork Salmon River steelhead trout fishery restoration program. Performed for USDI Fish and Wildlife Service.

USDA Forest Service. 1987. Kootenai National Forest Plan. Kootenai National Forest, Libby, Montana.

USDA Forest Service. 1999. Bull trout biological assessment for Rock Creek Mine. Kootenai National Forest, Libby, Montana.

USDA Forest Service. 2000. Watershed baseline information for Rock Creek watershed. Kootenai National Forest, Libby, Montana.

USDA Forest Service. 2006. Final geotechnical assessment report sinkhole development at the Troy Mine and implications for the proposed Rock Creek Mine, Lincoln and Sanders Counties, Montana. Prepared for Forest Supervisor, Kootenai National Forest; Prepared by Tetra Tech, Inc.(Helena, MT) and R Squared Incorporated (Denver, CO); 42 pages plus attachments.

USDA Forest Service, USDI Fish and Wildlife Service, and Bureau of Land Management. 1998a. Guidance to USDA Forest Service, USDI Fish and Wildlife Service, and Bureau of Land Management on section 7 consultation–conference for bull trout.

USDA Forest Service, USDI Fish and Wildlife Service, and Bureau of Land Management. 1998b. Guidance to USDA Forest Service, USDI Fish and Wildlife Service, and Bureau of Land Management on approach for completing Forest Service/BLM section 7 consultation on the effects of actions to bull trout.

USDI Fish and Wildlife Service. 1997. Administrative 12-month finding on the petition to have bull trout listed as an endangered species. Pages 99-114 *in* W.C. Mackay, M.K. Brewin, and M. Monita, editors. Friends of the bull trout conference proceedings. Bull Trout Task Force (Alberta), c/o Trout Unlimited Canada, Calgary.

USDI Fish and Wildlife Service. 1998a. A framework to assist in making endangered species act determinations of effect for individual or grouped action at the bull trout core area watershed scale. Region 1, USFWS.

USDI Fish and Wildlife Service. 1998b. Endangered and threatened wildlife and plants; determination of threatened status for the Klamath River and Columbia River distinct population segments of bull trout. Federal Register 63(111):31647-31674.

USDI Fish and Wildlife Service. 1998c. Klamath River and Columbia River bull trout population segments: status summary and supporting documents lists. Prepared by bull trout listing team, USFWS.

USDI Fish and Wildlife Service. 1998d. Biological opinion for the effects to bull trout from the continued implementation of land and resource management plans and resource management plans as amended by the interim strategies for managing fish producing watersheds in eastern Oregon and Washington, Idaho, western Montana and portions of Nevada (INFISH) and the interim strategy for managing anadromous fish-producing watersheds in eastern Oregon and Washington, Idaho and portions of California (PACFISH). Region 1, USFWS.

USDI Fish and Wildlife Service. 1998e. Bull trout interim conservation guidance. Prepared by the USFWS.

USDI Fish and Wildlife Service. 1999. Determination of threatened status for the bull trout in the coterminous United States; Final Rule. Federal Register 64(210):58909-58933.

USDI Fish and Wildlife Service. 2002a. Endangered and Threatened Wildlife and Plants; Proposed Designation of Critical Habitat for the Klamath River and Columbia River Distinct Population Segments of Bull Trout. Federal Register 67(230):71285-71334.

USDI Fish and Wildlife Service. 2002b. Chapter 1, Introduction. Bull Trout *(Salvelinus confluentus*) Draft Recovery Plan. Portland, Oregon.

USDI Fish and Wildlife Service. 2002c. Chapter 3, Clark Fork River Recovery Unit, Montana, Idaho, and Washington. Bull Trout *(Salvelinus confluentus*) Draft Recovery Plan. Portland, Oregon.

USDI Fish and Wildlife Service. 2002d. Chapter 4, Kootenai River Recovery Unit, Montana, Idaho, and Washington. Bull Trout *(Salvelinus confluentus*) Draft Recovery Plan. Portland, Oregon.

USDI Fish and Wildlife Service. 2003. Effects of Actions that Have Undergone Section 7 Consultation for Bull Trout Under the Endangered Species Act. U.S. Fish and Wildlife Service, Portland, Oregon.

USDI Fish and Wildlife Service. 2004a. Draft Recovery Plan for the Coastal-Puget Sound Distinct Population Segment of Bull Trout (*Salvelinus confluentus*). U.S. Fish and Wildlife Service, Portland, Oregon.

USDI Fish and Wildlife Service. 2004b. Draft Recovery Plan for the Jarbidge Distinct Population Segment of Bull Trout (*Salvelinus confluentus*). U.S. Fish and Wildlife Service, Portland, Oregon.

USDI Fish and Wildlife Service. 2004c. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Klamath River and Columbia River Distinct Population Segments of Bull Trout; Final Rule. Federal Register 69(193):59996-60076.

USDI Fish and Wildlife Service. 2005a. Bull trout core area templates - complete core area by core area analysis. W. Fredenberg and J. Chan, *editors*. U. S. Fish and Wildlife Service. Portland, Oregon. 660 pages.

USDI Fish and Wildlife Service. 2005b. Bull trout core area conservation status assessment. W. Fredenberg, J. Chan, J. Young and G. Mayfield, *editors*. U. S. Fish and Wildlife Service. Portland, Oregon. 95 pages plus attachments.

USDI Fish and Wildlife Service. 2005c. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Bull Trout. Federal Register 70(185):56211-56311.

Washington Water Power. 1995a. 1994 Water quality and limnologic evaluations on the lower Clark Fork River. The Washington Water Power Company, Spokane.

Washington Water Power. 1995b. Fish community assessment on Cabinet Gorge and Noxon Rapids Reservoirs. The Washington Water Power Company, Spokane.

Washington Water Power. 1996. Lower Clark Fork River tributary survey. The Washington Water Power Company, Spokane.

Walters, T.F. 1995. Sediment in streams: sources, biological effects, and control. American Fisheries Society Monograph 7. 251pp.

Washington Water Power. 1998. Final report: historic and current resources for the Washington Water Power Cabinet Gorge and Noxon Rapids hydrologic projects. The Washington Water Power Company, Spokane.

Watershed Consulting. 1997. 1996 Field data summary report for Rock Creek near Noxon, Montana: final. Watershed Consulting, Polson, Montana.

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

Weaver T.M., and J.J. Fraley. 1993. A method to measure emergence success of westslope cutthroat trout fry from varying substrate compositions in a natural stream channel. North American Journal Fisheries Management 13:817-822.

Weaver, T.M. and R.G. White. 1985. Coal Creek Fisheries Monitoring Study No.III. Quarterly Progress Report. U.S. Forest Service, Montana State Cooperative Fisheries Research Unit, Bozeman. MT.

Webb, M., H. Ruber, and G. Leduc. 1976. The toxicity of various mining flotation reagents to rainbow trout (*Salmo gairdneri*). Water Research 10:303-306.

Weber, D.D., D.J. Maynard, W.D. Gronlund, and V. Konchin. 1981. Avoidance reactions of migrating adult salmon to petroleum hydrocarbons. Canadian Journal of Fisheries and Aquatic Sciences 38:779-781.

Wels, P., and J.S. Wels. 1991. The developmental toxicity of metals and metalloids in fish. Pages 145-169 *in* M.C. Newman and A.W. McIntosh, editors. Metal Ecotoxicology: Concepts and Applications. Lewis Publishers, Chelsea, Michigan.

Whitesel, T.A. and 7 coauthors. 2004. Bull trout recovery planning: A review of the science associated with population structure and size. Science Team Report #2004-01, U.S. Fish and Wildlife Service, Region 1, Portland, Oregon.

Williams, R.N., R.P. Evans, and D.K. Shiozawa. 1997. Mitochondrial DNA diversity patterns of bull trout in upper Columbia River basin. Pages 283-297 *in* W.C. Mackay, M.K. Brewin, and M. Monita, editors. Friends of the bull trout conference proceedings. Bull Trout Task Force (Alberta), c/o Trout Unlimited Canada, Calgary.

Williams, J.E., J.E. Johnson, D.A. Hendrickson, S. Contreras-Balderas, J.D. Williams, M. Navarro-Mendoza, D.E. McAlliser and J.D. Decon. 1989. Fishes of North America: endangered, threatened, or of special concern. Fisheries 14(6):2-20.

Woodward, D.F., J.N. Goldstein, and A.M. Farag. 1997. Cutthroat trout avoidance of metals and conditions characteristic of a mining waste site: Coeur d'Alene River, Idaho. Transactions of the American Fisheries Society 126:699-706.

Woodward, D.F., J.A. Hansen, H.L. Bergman, E.E. Little, and A.J. DeLonay. 1995. Brown trout avoidance of metals in water characteristic of the Clark Fork River, Montana. Canadian Journal of Fishery and Aquatic Sciences 52:2031-2037.

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

APPENDICES

Appendix A: Region 1 Email Regarding Jeopardy Analysis.

John Al Young/RO/R1/FWS/DOI
02/02/2001 11:45 AM

To Tim Bodurtha/R6/FWS/DOI@FWS, Lori Nordstrom/R6/FWS/DOI@FWS, Kate Walker/R6/FWS/DOI@FWS
cc
bcc
Subject subpopulation jeopardy and DPS jeopardy

hey folks: attached is the jeopardy approach that Region 1 has developed to address section 7 until the Recovery Plan is finalized, as we discussed and for your review and comments; I will copy Jill separately, because I wanted to delve into a few issues with you three per our recent and brief conversation after the BT meeting.

You mentioned that the approach caused you some concern, because any (or many) action(s) in the Bitterroot watershed would lead to a jeopardy conclusion under the approach (focusing the J analysis on a subpopulation). The status review/science assessment states that 24 of the 27 subpopulations in the basin are currently at risk of extirpation.

To start, let's address the Warm Springs Creek subpopulation, which I infer is one of the most important subpopulations in the basin because of strong numbers, although apparently only resident forms are present. Because of this status, I would suggest that if a proposed action were to be reasonably certain to result in an appreciable reduction in this subpopulation to the extent that its continued survival was in question, a FWS biologist might find her/him self contemplating a jeopardy BO, even if the jeopardy analysis was based on the DPS. This is because, although only one of the 141 subpopulations in the DPS is theoretically affected, the loss of that one, especially the most robust in the basin containing 27 subpopulations, would appreciably reduce the DPS in the wild in terms of reproductive capability and numbers of individuals, if not distribution as well.

For the next case, let's consider the weakest subpopulation in the Bitterroot basin, whatever one that may be. The status review states that some of these are composed of low numbers of individuals and declining. I suggest that the same biologist would come to the same conclusion relative to the same proposed action, were it to affect this small subpopulation, because the result would be the same, an appreciable reduction in the functionality of the DPS due to reduced reproductive capability, reduced numbers of individuals, and possibly reduced distribution. To come to a different conclusion, one would have to accept the notion that some individual subpopulations are dispensable (not an important factor relative to the three components of a jeopardy analysis - numbers, reproductive capability, and distribution of the DPS).

So, if one can accept the notion that some subpopulations are indeed dispensable (not an important factor relative to the three components of a jeopardy analysis - numbers, reproductive capability, and distribution), then there is a big difference between focusing the jeopardy analysis on the DPS vs. the subpopulation. But, if one can support the position that, because bull trout distribution has been reduced to only 45% of the historical range in the Columbia River DPS, with similar affects to the parameters of numbers of individuals and reproductive capability, further reductions in these parameters to the point of jeopardizing the continuing existence of the remaining subpopulations would appreciably reduce the viability of the DPS as a whole in terms of numbers, reproduction and distribution, then there is no difference between the two scales of analysis.

Finally, if one were embrace the last sentence, above, the question might arise: if there is no difference, then why go to the trouble of justifying a new scale of analysis (at the subpopulation level)? I guess the answer is that many of our folks were having a difficult time envisioning a potential jeopardy scenario relative to, for example, an action affecting only one of 141 subpopulations for a DPS that is spread over such a large area, and presenting a sound rationale for such an argument in a biological opinion. By plugging in the new scale of analysis rationale, that argument is presented and the biologist can focus on analyzing the effects at hand and determining if indeed the action in question represents the likelihood of jeopardizing the continued existence of the subpopulation in question.

Your comments and further discussion are encouraged!

bulltrout.wpd

[This discussion should be placed in the "Status of the Species" section of Biological Opinions addressing effects to bull trout.]

STATUS OF THE SPECIES

Bull trout were listed under the Act as threatened within the coterminous United States on November 1, 1999 (64 FR 58910). This listing encompasses five previously recognized distinct population segments (DPS) of the bull trout: Klamath River, Columbia River, Jarbidge River, Coastal-Puget Sound, and St. Mary-Belly River. Factors contributing to the decline of bull trout populations are identified in the listing rule and include: restriction of migratory routes by dams and other unnatural barriers; forest management, grazing, and agricultural practices; road construction; mining; introduction of non-native species; and residential development resulting in adverse habitat modification, overharvest, and poaching.

The listing rule specifies that, in recognition of the scientific basis for the identification of bull trout DPSs (i.e., population segments are disjunct and geographically isolated from one another with no genetic interchange between them due to natural and man-made barriers), for the purposes of consultation and recovery planning these DPSs will serve as interim recovery units in the absence of an approved recovery plan. On that basis, the geographic scope of jeopardy analyses for actions under formal consultation will be at the DPS level as opposed to the entire coterminous United States range of this species.

[Insert the appropriate DPS status discussions below into the opinion.]

Bull Trout Status in the Klamath River Basin DPS

Bull trout have been extirpated from several streams in this DPS. Although migratory forms were present historically, bull trout currently occur only as resident forms in headwater streams. Currently, seven subpopulations of the bull trout occur within the basin. The risk of extinction for this DPS over the next 100 years has been estimated at 70 to 90 percent (K. Schroeder and H. Weeks, OCAFS, *in litt.* 1997 *in* 63 FR 31647). The Service considers six of the seven bull trout subpopulations in the basin to be at risk of extirpation from naturally occurring events due to their depressed status (63 FR 31647). Reductions in the amount of riparian vegetation and road construction in the Klamath River basin due to timber harvest, grazing, and agricultural practices have contributed to bull trout habitat degradation through elevated stream temperatures, increased sedimentation, and channel embeddedness.

Bull Trout Status in the Columbia River Basin DPS

Bull trout are estimated to occur in approximately 45% of their historical range in the Columbia River basin (Quigley and Arbelbide 1997 *in* 63 FR 31647). Currently, 141 subpopulations of the bull trout are known to occur in the basin. The Service considers 71 of these subpopulations to

be at risk of extirpation from naturally occurring events due to their depressed status (63 FR 31647). The listing rule characterizes the Columbia River DPS as having some strongholds, but generally occurring as isolated subpopulations, without a migratory life form to maintain the biological cohesiveness of the subpopulations, and with trends in abundance declining or of unknown status.

Extensive habitat loss and fragmentation of subpopulations have been documented for bull trout in the Columbia River basin and elsewhere within its range (Rieman and McIntyre 1993). Reductions in the amount of riparian vegetation and road construction in the Columbia River basin due to timber harvest, grazing, and agricultural practices have contributed to habitat degradation through elevated stream temperatures, increased sedimentation, and channel embeddedness. Mining activities have further compromised habitat conditions by discharging waste materials into streams and diverting and altering stream channels. Residential development has also threatened water quality by introducing domestic sewage and altering riparian conditions. Dams of all sizes (i.e., mainstem hydropower and tributary irrigation diversions) have severely limited migration of bull trout in the Columbia River basin.

Bull Trout Status in the Coastal-Puget Sound DPS

At least 22 of the 34 subpopulations of the bull trout within this DPS are affected by past or present forest management activities such as timber harvest and road construction (64 FR 58910). Other subpopulations within this DPS occur in National Parks or Wilderness Areas and are not affected by such activities. Agriculture, urbanization, and man-made barriers are also significant factors affecting habitat utilized by bull trout. Over 35 percent of natural forested areas in the Puget Sound region have been eliminated (WDFW 1997 *in* 64 FR 58910). Of the 34 subpopulations identified within the DPS, 11 are likely to be affected by elevated stream temperatures resulting from past forest practices (Phinney and Bucknell 1975; Williams et al. 1975; Hiss and Knudsen 1993; EDFW 1997a; WDOE 1997 *in* 64 FR 58910). Within National Forests in Washington, large deep pools have been reduced by 58 percent due to sedimentation and loss of pool forming structures (USDA et al. 1993 *in* 64 FR 58910), resulting in significant habitat loss for bull trout.

Bull Trout Status in the St. Mary-Belly River DPS

Bull trout in this DPS are fragmented and isolated by dams and diversions. Seasonal dewatering of streams reduces the amount of habitat available, and unscreened diversions may result in entrainment of bull trout, effectively removing them from the reproductive population. Historical and continuing harvest of bull trout has contributed to low abundance levels. Forest management practices, livestock grazing, and mining are not considered major factors affecting this DPS (64 FR 58910).

Bull Trout Status in the Jarbidge River DPS

This DPS is extremely depressed, consisting of only an estimated 50-125 spawners throughout the basin annually. Degraded habitat conditions (channelization, removal of large woody debris)

resulting from long term human activities, such as road development, mining and residential development, has resulted in decreased stream channel stability and elevated water temperatures. Impassable culverts may also prohibit bull trout from accessing additional habitat (63 FR 31693).

Rangewide Conservation Needs of the Bull Trout

Recovery of bull trout in the Klamath River, Columbia River, and Coastal-Puget Sound DPSs is likely to be enhanced through future reductions in the adverse effects resulting from timber harvest and road building, including remedying legacy effects from past activities. Improved grazing practices will benefit bull trout in the Klamath and Columbia River DPSs. Providing for both upstream and downstream passage at dams and culverts of all sizes will facilitate recolonization of previously occupied habitat and promote genetic exchange throughout the Columbia River, Coastal-Puget Sound, Jarbidge, and St. Mary-Belly River DPSs. Screening water diversions will prevent entrainment of bull trout throughout the Columbia River, Klamath River, and St. Mary-Belly River DPSs. Improvement of agricultural practices affecting water quality will benefit bull trout within the Columbia River, Klamath River, and Coastal-Puget Sound DPSs. Similarly, improved approaches to increased urbanization, such as requiring setbacks from stream banks and avoiding contamination of streams, will contribute to the recovery of the Coastal-Puget Sound and Columbia River DPSs.

Relative to other salmonids, bull trout survival is likely to be more dependent on habitat conditions that more closely resemble the historical, undisturbed environment because (1) they are top carnivores that are more vulnerable to environmental disturbances and more prone to extinction than species at lower trophic levels (M.Gilpin *in litt.* 1996); (2) their delayed sexual maturity (5-7 years; Rieman and McIntyre 1993) is likely to prolong recovery time from the effects of adverse actions; (3) unlike anadromous salmon, bull trout display little or no anadromy (i.e., none for the Columbia River, Jarbidge River, St. Mary-Belly River, and Klamath River DPSs) and, therefore, spend their entire life cycle in freshwater habitat, making them especially vulnerable to habitat disturbance; (4) bull trout require a long incubation and nursery period of time (220+ days) prior to fry emergence, making them especially vulnerable to water temperature changes, sediment deposition, and bedload movement; (5) bull trout juveniles are strongly associated with cover, including the interstitial spaces in the substrate, which makes them especially vulnerable to effects of sediment deposition, bedload movement, and changes in channel morphology (Weaver and Fraley 1991); (6) bull trout are vulnerable to hybridization with brook trout, a widely introduced species, as well as competition with other introduced exotics (e.g., lake trout) that can displace native bull trout; and (7) bull trout require colder water temperature than other native salmonids (Rieman and McIntyre 1993), thus restricting the available habitat compared to other salmonids and making them especially vulnerable to habitat alterations that affect stream temperatures.

Relationship of Subpopulations to Survival and Recovery of Bull Trout in a DPS

Leary and Allendorf (1997) reported evidence of genetic divergence among bull trout subpopulations, indicating relatively little genetic exchange between them. Recolonization of

habitat where isolated bull trout subpopulations have been lost is either unlikely to occur (Rieman and McIntyre 1993) or will only occur over extremely lengthy time periods. Remnant or regional populations without the connectivity to refound or support local populations have a greater likelihood of extinction (Rieman and McIntyre 1993, Rieman et al. 1997, Montana Bull Trout Scientific Group 1998).

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

Based on this information, the Service concludes that each bull trout subpopulation is an important phenotypic, genetic, and distributional component of its respective DPS. Therefore, adverse effects that compromise the functional integrity of a bull trout subpopulation will be considered an appreciable reduction in the likelihood of survival and recovery of the DPS by reducing its distribution and potential ecological and genetic diversity.

Literature Cited

Frissel, C., W. Liss, and D. Bayles. 1993. An integrated, biopohysical strategy for ecological restoration of large watersheds. American Water Resources Association. June 1993.

Gilpin, M. 1996. Analysis towards a PVA for the bull trout in western Montana: a progress report for the Montana Bull Trout Science Group. Draft. Bozeman, MT.

Hard, J. 1995. A quantitative genetic perspective on the conservation of intraspecific diversity. American Fisheries Society Symposium 17:304-326, 1995.

Healy, M.C. and A. Prince. 1995. Scales of variation in life history tactics of Pacific salmon and the conservation of phenotype and genotype. American Fisheries Society Symposium 17:176-

184, 1995.
Leary, R.F. and F.W. Allendorf. 1997. Genetic confirmation of sympatric bull trout and Dolly Varden in western Washington. Transactions of the American Fisheries Society 126:715-720.

Montana Bull Trout Scientific Group. 1998. The relationship of land management activities and habitat requirements of bull trout.

Rieman, B. and J. McIntyre. 1993. Demographic and habitat requirements for conservation of bull trout. USDA Intermountain Research Station General Technical Report INT-302.

Rieman, B.E., D.C. Lee, and R.F. Thurow. 1997. Distribution, status, and likely future trends of bull trout within the Columbia River and Klamath River basins. North Amer. J. of Fisheries Management 17:1111-1125.

Weaver, T.M. and J.J. Fraley. 1991. Factors affecting the distribution and abundance of bull trout: an investigation at hierarchical scales. North Amer. J. Fisheries Management. 17:237-252.

(This discussion would appear as a standard appendix to BOs addressing effects to bull trout during the interim period before finalization of a recovery plan; as recovery plans are developed for the respective DPS', this approach would be superseded)

The Columbia River and Klamath River bull trout DPS' have been severely reduced in terms of geographic distribution, abundance, and reproductive capacity, which led to their listing as threatened species in June, 1998. Factors contributing to the decline of bull trout populations are identified in the listing rule (FR 31647-31674) and include restriction of migratory routes by dams and other unnatural barriers, forest management practices, grazing practices, agricultural practices, road construction, mining, introduction of non-native species, and residential development resulting in adverse habitat modification, overharvest, and poaching.

Bull trout have been extirpated from several streams in the Klamath River basin and, although migratory forms were present historically, currently occur only as resident forms in headwater streams. The risk of extinction for this DPS over the next 100 years has been estimated at 70% to 90% (K. Schroeder and H. Weeks, OCAFS, *in litt.* 1997 *in* FR 31647-31674), and the Service considers six of the seven subpopulations in the Klamath River basin at risk of extirpation from naturally occurring events due to their depressed status (FR 31647-31674).

Bull trout have been extirpated from approximately 55% of their historical habitat in the Columbia River Basin (Quigley and Arbelbide 1997 *in* FR 31647-31674) and the Service considers 71 of the 141 subpopulations in this DPS at risk of extirpation from naturally occurring events due to their depressed status (FR 31647-31674). The listing rule characterizes the Columbia River DPS as having some strongholds, but generally occurring as isolated subpopulations, without a migratory life form to maintain the biological cohesiveness of the subpopulations, and with trends in abundance declining or of unknown status. Extensive habitat loss and fragmentation of populations have been documented for bull trout rangewide (Rieman and McIntyre 1993). As emphasized by Frissel et al. 1993, this degree of habitat degradation and the associated reduction in population and reproduction potential emphasizes the need to identify, protect, and restore the last patches of the landscape that continue to function in support of remnant bull trout populations

Adverse effects in the form of habitat degradation and other factors may be exacerbated for bull trout relative to other salmonids because (1) they are top carnivores that are more vulnerable to environmental disturbances and more prone to extinction than species at lower trophic levels (M.Gilpin *in litt.* 1996); (2) their delayed sexual maturity (5-7 years; Rieman and McIntyre 1993) is likely to prolong recovery time from the effects of adverse actions; (3) unlike anadromous salmon, bull trout display little or no anadromy (i.e., none for the Columbia River and Klamath River DPS') and, therefore, spend their entire life cycle in freshwater habitat, making them especially vulnerable to habitat disturbance; (4) bull trout require a long incubation and nursery period of time (220+ days) prior to fry emergence, making them especially vulnerable to water temperature changes, sediment deposition, and bedload movement; (5) bull trout juveniles are strongly associated with cover, including the interstitial spaces in the substrate, which makes them especially vulnerable to effects of sediment deposition, bedload movement, and changes in channel morphology (Weaver and Fraley 1991); (6) bull trout are vulnerable to hybridization

with brook trout, a widely introduced species, as well as competition with other introduced exotics (e.g., lake trout) that can displace native bull trout; and (7) bull trout require colder water temperature than other native salmonids (Rieman and McIntyre 1993), thus restricting the available habitat compared to other salmonids and making them especially vulnerable to habitat alterations that affect stream temperatures. Accordingly, actions that affect bull trout habitat have a particular potential to result in severe adverse effects more readily than a similar action might, for instance, affect anadromous salmonids that spend the majority of their life cycle away from freshwater habitat.

Given the severely degraded status of bull trout DPS', the maintenance of remnant bull trout subpopulations within these DPS' is critical to the long-term survival of the respective DPS'. Because there is evidence of genetic divergence among bull trout subpopulations, indicating relatively little genetic exchange between bull trout subpopulations (Leary and Allendorf 1997), and because recolonization of habitat where isolated subpopulations have been lost is either unlikely to occur (Rieman and McIntyre 1993) or will only occur over extremely lengthy time periods, maintenance of the component subpopulations is critical to ensuring the continued survival and potential recovery of the DPS'. Additionally, because remnant or regional populations without the connectivity to refound or support local populations have a greater likelihood of extinction (Rieman and McIntyre 1993; Rieman et al. 1997), continued erosion of the baseline (i.e., the "snapshot of the species' condition) relative to isolated/individual subpopulations is likely to contribute toward the possible extinction of these subpopulations. This was recognized by the Montana Bull Trout Scientific Group in their stated goal of "establishing a baseline of existing conditions and monitoring to ensure those conditions are maintained or improved" (MBTSG 1998).

Healy and Prince (1995) observe that, because phenotypic diversity is a consequence of the genotype interacting with the habitat, the conservation of phenotypic diversity is achieved through conservation of the subpopulation within its habitat. They further note that adaptive variation among salmonids has been observed to occur under relatively short time frames (e.g., changes in genetic composition of salmonids raised in hatcheries; rapid emergence of divergent phenotypes for salmonids introduced to new environments). These observations support the notion that each subpopulation is a valuable biological component of its respective DPS. Healy and Prince (1995) conclude that while the loss of a few subpopulations within an ecosystem might have only a small effect on overall genetic diversity, the effect on phenotypic diversity and, potentially, overall population viability could be substantial. This concept of preserving variation in phenotypic traits that is determined by both genetic and environmental (i.e., local habitat) factors has also been identified by Hard (1995) as an important component in maintaining intraspecific adaptability (i.e., phenotypic plasticity) and ecological diversity within a genotype. He argues that adaptive processes are not entirely encompassed by the interpretation of molecular genetic data (i.e., phenotypic and genetic variation in adaptive traits may exist without detectable variation at the molecular genetic level, particularly for neutral genetic markers). Therefore, the effective conservation of genetic diversity necessarily involves consideration of the conservation of biological units smaller than taxonomic species or DPS's.

The intuitively obvious conclusion that individual subpopulation baseline improvements are the

building blocks of overall DPS baseline improvement (and that baseline improvement is necessary) is bolstered by the generally depressed and fragmented status of bull trout DPS', the species' particular sensitivity to habitat disturbance, the lack of genetic exchange between subpopulations, probable phenotypic diversity resulting from response to different isolated environments, and the vulnerability of component subpopulations within a DPS to anthropogenic an natural extinction risks. Therefore, adverse effects that would tend to threaten the existence of a subpopulation constitute an unacceptable risk to the DPS because the action can be considered as also threatening the integrity of the DPS as a whole. Ongoing and new activities that proceed without regard to adverse effects to bull trout will continue to erode the baseline, preserve conditions that led to the listing, and threaten the continued existence of the DPS. Therefore, actions resulting in adverse effects must be designed so as to contribute to the improvement of the overall baseline in the intermediate to longer term, even if short term adverse effects are not entirely eliminated. The risk of short term impacts must still be thoroughly evaluated to ensure that a subpopulation is not lost and the DPS jeopardized.

In order to provide for the survival and recovery of the species, there is a need to apply these conclusions to ongoing and future actions that affect bull trout. Simply put, specific actions and categories of actions must be designed, as described above, so as to contribute to the improvement of the baseline relative to bull trout at both the individual subpopulation and DPS-wide scales. This does not necessarily mean that no timber harvest, grazing operations, road building, mines, etc. will occur. These and other categories of actions are ongoing and comprise the current baseline. It does mean that implementation of specific activities should be designed to reduce the adverse effects (i.e., both direct [take of individuals] and indirect [habitat degradation]) so that the overall action category's adverse effects are reduced. Actions that incorporate measures to reduce adverse effects (potential baseline improvement) at one scale but retain a significant potential of severe adverse effects (potential baseline detriment) to bull trout subpopulations at another scale because of their geographical location should be considered for relocation or otherwise further modified in order to avoid jeopardizing the species.

Appendix C: Guidance for Jeopardy Determinations under Section 7 of the Endangered Species Act for the Bull Trout

United States Department of the Interior

FISH AND WILDLIFE SERVICE

911 NE 11th Avenue
Portland, Oregon 97232-4181

FWS/R1/AES-TE

Memorandum

APR 20 2006

To: Ecological Services Project Leaders
Idaho, Oregon, Washington

From: Assistant Regional Director-Ecological Services, Region 1
Portland, Oregon

Subject: Jeopardy Determinations under Section 7 of the Endangered Species Act for the Bull Trout

The purpose of this memorandum is to affirm that jeopardy determinations are made at the scale of the listed entity. In the case of the bull trout, the listed entity is the coterminous United States population (64 FR 58910). The preamble to the final listing rule for the bull trout at 64 FR 58930 further discusses application of the jeopardy standard relative to this species:

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

National policy, via the Director's March 6, 2006, memorandum on "Recovery Units and Jeopardy Determinations under Section 7 of the Endangered Species Act" and page 4-38 of the *Endangered Species Consultation Handbook*, establishes that:

> When an action impairs or precludes the capacity of a recovery unit from providing both the survival and recovery function assigned to it, that action may represent jeopardy to the species. When using this type of analysis, include in the biological opinion a description of how the action affects not only the recovery unit's capability, but the relationship of the recovery unit to both the survival and recovery of the listed species as a whole.

Based on the above, use the following analytical framework to make jeopardy determinations for Federal actions affecting the bull trout:

TAKE PRIDE IN AMERICA

1. In the *Status of the Species* section acknowledge that the bull trout is listed as threatened in the coterminous United States, cite the final listing rule and include the text quoted above, and concisely discuss the relationship between each of the interim recovery units and the survival and recovery of the coterminous United States population of the bull trout.

2. In the *Environmental Baseline* section concisely discuss the relationship between the action area and the survival and recovery function assigned to the affected interim recovery unit(s). Currently, the draft *Bull Trout Recovery Plan* recognizes the importance of viable bull trout core area populations in the conservation of the bull trout within the interim recovery units.

3. In the *Effects of the Action* section concisely discuss the significance of adverse and beneficial effects in relation to the role of the action area in the conservation of the bull trout at the interim recovery unit scale.

4. In the *Cumulative Effects* section concisely discuss the significance of adverse and beneficial effects in relation to the role of the action area in the conservation of the bull trout at the interim recovery unit scale.

5. In the *Conclusion* section concisely discuss how the effects of the action, taking into account any cumulative effects, are likely to influence the survival and recovery function assigned to the affected interim recovery unit(s) as the basis for determining if the proposed action is likely to appreciably reduce both the survival and recovery of the coterminous United States population of the bull trout in the wild.

If you have any questions regarding this guidance, please contact Larry Salata at (503) 231-2350.

cc: ARD-ES, CNO
ARD-ES, Region 6

Appendix B: Effects Of Actions That Have Undergone Section 7 Consultation For Bull Trout Under The Endangered Species Act From Listing To August 2003.

Date prepared: October 3, 2003.

Effects of actions that have undergone section 7 consultation for bull trout under the Endangered Species Act.

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
Kerr Dam - Hydropower	10/24/00	FERC – regulation of river flows and lake level	Flathead Lake, Lower Flathead River	Clark Fork River Basin	50 years (2035)	Unquantifiable effects to spawning adults due to lake level management and entrainment; annual gill-netting operations for 2000-2001 may take up to 30 adults	Unquantifiable effects to adults and juveniles due to lake level management, entrainment, and downstream river flow regulation. Long-term benefits from co-management planning and habitat acquisition and restoration
White Pine Project	9/13/01	Watershed restoration, timber harvest, road work	Noxon Reservoir - Lower Clark Fork, Little trout Creek	Clark Fork River Basin	10 years 200-2011	Unquantifiable – short-term habitat impacts from sediment input affecting spawning & rearing habitat and food supply Long-term benefits from stream restoration efforts	Unquantifiable – short-term habitat impacts from sediment input affecting spawning & rearing habitat and food supply. Long-term benefits from stream restoration efforts for both adults and juvenile fish. Effects are temporary on feeding and sheltering.
Avista dams (Cabinet Gorge and Noxon	8/5/99	FERC – flow regulation, fish	Lower Clark Fork River Basin -	Clark Fork River Basin	45 years (2045)	25 spawning adults/yr due to fish	490/yr of migratory juveniles due to

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
dams) - Hydropower		passage, habitat restoration	Cabinet and Noxon reservoirs			blockage and spawning migration delay. Loss of reproduction annually of migratory form of bull trout. Expect long-term benefits from habitat restoration and fish passage	entrainment and 100 juveniles due to gas bubble disease during spill years, and 40/yr juveniles due to predation and an unquantifiable number of juveniles due to competition and predation in reservoirs and recreational by-catch. Long-term recovery due to permanent fish upstream and downstream fish passage and habitat restoration
Forest Service – roads programmatic	8/1/01	Road maintenance, road obliteration, road closure, culvert & bridge replacement, stream restoration	Six western Montana national forests and one BLM district	Western Montana RUs	5 years with renewal option at end	Unquantifiable- Harm and Harassment from short-term habitat degradation & displacement	Unquantifiable - Harm and Harassment from short-term habitat degradation & displacement during construction
1-4-00-FW-343 Revised Section 7 programmatic consultation on issuance of a Section 10(a)(1)(A) scientific	2/14/00	Population surveys using electrofishing, netting, trapping, capturing, marking, tagging,	Coterminous listed bull trout population.	All bull trout Recovery Units.	1 year.	Capturing, retaining, handling, possibly killing for scientific purposes, possibility of injury and mortality from	Capturing, retaining, handling, possibly killing for scientific purposes, possibility of injury and mortality from electrofishing and

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
take permits and Section 6(c)(1) exemption from take for Bull Trout. (Section 10(a)(1)(A) permit)U.S. Fish and Wildlife Service		tissue sampling; collection for hatchery propagation and outplanting activities. Habitat restoration or enhancement activities.				electrofishing and handling. Harassment (via catch and release) as a result of scientific monitoring and evaluation, which may involve a few thousand individual bull trout. Long term impacts of actions to benefit recovery of bull trout.	handling. Harassment (via catch and release) as a result of scientific monitoring and evaluation. Long term impacts of actions to benefit recovery of bull trout, which may involve a few thousand individual bull trout.
U.S. National Forest Service Flathead National Forest, 10a1A permit Road reclamation	7/13/99	Road reclamation to reduce sediment delivery Roc, Coal, and Big creeks	Rock Creek, Coal Creek, and Big Creek on the Flathead National Forest	Clark Fork River Basin	3 years	Unquantifiable; Short-term degradation due to sediment input during construction – long-term benefits by reducing sediment input in spawning areas	Unquantifiable; short-term impact due to sediment causing displacement – harm and harass; long-term benefits through habitat improvement and sediment reduction; improved fish passage at stream crossings.
Chicken Creek emergency sandbag placement project. (Habitat restoration	11/18/02	Emergency placement of sandbag wall to divert flow in recently formed	Chicken Creek (tributary to the West Fork of the Bitterroot River), Flathead National	Clark Fork River Basin	July 8, 2002 (placement of sandbag wall)	About 100 feet of braided channel dried up. Due to the low density of bull trout in the project	N/A

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
action) U.S. Forest Service		braided channel back (formed as a result of severe erosion following fire in August 2000) to historic creek channel.	Forest, Montana.			area, it is likely that no bull trout were killed by implementation of the action or stranded in the dry channel; however the possibility that at least one bull trout was killed as a result of sandbag placement cannot be discounted.	
Effects of the Moose Post-Fire Project on Bull Trout, Flathead National Forest. (Resource/land management plan or program) U.S. Forest Service	11/14/02	Salvage harvest (2,300 acres), alternative bark beetle control measures (pheromone baited traps), fuels reduction (235 acres, thinning prescription), road management (road decommissioning [56 miles], gating and restricted seasonal use of roads, culvert removal).	Big Creek, Coal Creek and North Fork Flathead River watersheds, Flathead National Forest, Montana.	Clark Fork River Basin	2003-2010	Harm and harassment from short term degradation of aquatic habitat parameters as a result of increased sediment; an increase in sedimentation is anticipated to adversely affect feeding and sheltering patterns of juvenile and adult fish.	Harm and harassment from short term degradation of aquatic habitat parameters as a result of increased sediment; an increase in sedimentation is anticipated to adversely affect feeding and sheltering patterns of juvenile and adult fish.

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
Replacement of Blackfoot River Bridge, FHWA Helmville. (Bridge work action) Federal Highway Administration	10/21/02	Replace bridge.	Blackfoot River, Helmville, Powell County, Montana.	Clark Fork River Basin	2003	N/A	Unquantifiable: harm and harassment from short term degradation of aquatic habitat parameters including substrate quality, rearing habitat, and food supply; an increase in sedimentation is anticipated to adversely affect feeding and sheltering patterns of adult and juvenile fish.
Proposed changes to theYellowstone pipeline project. (Pipeline project action) U.S. Forest Service	8/7/02	Reroute a section of pipeline away from creek and create a new pipeline crossing buried under streambed.	Prospect Creek, Twenty-four Mile Creek, Lolo National Forest, Sanders County, Montana.	June-September 2001	Clark Fork River Basin	Unquantifiable: harm and harassment from short term (short duration, localized and small in extent) degradation of aquatic habitat parameters as a result of increased sediment; an increase in sedimentation may occur that could adversely affect feeding and sheltering patterns of juvenile fish.	Unquantifiable: harm and harassment from short term (short duration, localized and small in extent) degradation of aquatic habitat parameters as a result of increased sediment; an increase in sedimentation may occur that could adversely affect feeding and sheltering patterns of juvenile fish.

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
Moose Fire Best Management Practices (BMPs) Implementation Project 2002 - Flathead National Forest. (Resource/land management plan or program) U.S. Forest Service	7/18/02	BMPs following the Moose fire: road management and maintenance, road decommissioning.	North Fork and Middle Fork of the Flathead River, Flathead Lake, and Big Creek and Coal Creek drainages, Flathead National Forest, Montana.	Clark Fork River Basin	2002-2005	Harm and harassment from short term degradation of aquatic habitat parameters as a result of increased sediment; an increase in sedimentation is anticipated to adversely affect feeding and sheltering patterns of juvenile fish. Long term benefit to bull trout recovery is anticipated.	Harm and harassment from short term degradation of aquatic habitat parameters as a result of increased sediment; an increase in sedimentation is anticipated to adversely affect feeding and sheltering patterns of juvenile fish. Long term benefit to bull trout recovery is anticipated.
Lolo National Forest post burn project 2002. (Resource/land management plan or program) U.S. Forest Service	7/12/02	Soil stabilization on 1,200 acres, riparian planting on 38 acres, dam and mine site reclamation, road maintenance and upgrade (290 miles), culvert removal and replacement to eliminate fish	Middle Clark Fork River watershed, Lolo National Forest, Montana.	Clark Fork River Basin	2-7 years	Harm and harassment (along a total of 120 miles of stream reach) from short term degradation of aquatic habitat parameters including substrate quality, rearing habitat, and food supply; an increase in	Harm and harassment (along a total of 120 miles of stream reach) from short term degradation of aquatic habitat parameters including substrate quality, rearing habitat, and food supply; an increase in sedimentation is anticipated to adversely

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
		passage barriers, road decommissioning, reforestation (12,900 acres), fuel reduction and prescribed burns (1,700 acres), timber salvage harvest on 4,700 acres.				sedimentation is anticipated to adversely affect feeding and sheltering patterns of adult and juvenile fish.	affect feeding and sheltering patterns of adult and juvenile fish.
Replacement of the bridge over the Swan River, west of Condon, in Missoula County, Montana. (Bridge work action) Federal Highway Administration	5/25/02	Replace timber structure bridge with concrete clear span bridge.	Swan River, west of Condon, Missoula County, Montana.	Clark Fork River Basin	July 15 to August 31 (for instream work)	Unquantifiable: harm and harassment from short term degradation of aquatic habitat parameters including substrate quality, rearing habitat, and food supply; an increase in sedimentation is anticipated to adversely affect feeding and sheltering patterns of adult and juvenile fish	Unquantifiable: harm and harassment from short term degradation of aquatic habitat parameters including substrate quality, rearing habitat, and food supply; an increase in sedimentation is anticipated to adversely affect feeding and sheltering patterns of adult and juvenile fish.
Spotted beetle resource management	3/8/02	Vegetation management:	South Fork Flathead River drainage,	Clark Fork River Basin	June 15 - September 1,	Unquantifiable: small amount (short	Unquantifiable: small amount (short duration,

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
project - Spotted Bear Ranger District, Flathead National Forest. (Resource/land management plan or program) U.S. Forest Service		lodgepole pine only timber harvest (945 acres). Road management: road decommissioning (49 miles), remove culverts, road closures (29 miles).	Spotted Bear Ranger District, Flathead National Forest, Flathead County, Montana.		2002-2008.	duration, localized, small in extent at any point in time) of harm and harassment from temporary increases in sedimentation and degradation of water quality that adversely affect feeding, spawning and sheltering patterns of juvenile and adult fish.	localized, small in extent at any point in time) of harm and harassment from temporary increases in sedimentation and degradation of water quality that adversely affect feeding, spawning and sheltering patterns of juvenile and adult fish.
Reconstruction of State Route 200, FHWA Weeksville - West project. (Road work action) Federal Highway Administration	1/4/02	Reconstruct 6.5 miles of highway.	Middle Clark Fork River drainage including Munson Creek and Weeksville Creek, State Route 200, Sanders County, Montana.	Clark Fork River Basin	2002	Unquantifiable: harm and harassment from short term degradation of aquatic habitat parameters including substrate quality, rearing habitat, and food supply; an increase in sedimentation is anticipated to adversely affect feeding and sheltering patterns of adult and juvenile fish.	Unquantifiable: harm and harassment from short term degradation of aquatic habitat parameters including substrate quality, rearing habitat, and food supply; an increase in sedimentation is anticipated to adversely affect feeding and sheltering patterns of adult and juvenile fish.

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
Bureau of Land Management Whitaker Bridge boat launches: Upgrade project. (Recreation action) Bureau of Land Management	12/10/01	Actions completed at the Whitaker Bridge boat launch site exceed the anticipated level of streambank disturbance analyzed for the original proposal: Road excavation, regrade and enlarge access road; 7,200 sq. feet of fill spread in Riparian Habitat Conservation Area. Various actions proposed to reduce the potential for sediment delivery to the river.	Blackfoot River, Missoula County, Montana.	Clark Fork River Basin	2001-2002	N/A	Harm and harassment from short term degradation of aquatic habitat parameters including substrate quality, pool quality and frequency, rearing habitat, and food supply; an increase in sedimentation is anticipated to adversely affect spawning, feeding and sheltering patterns of fish.
Bitterroot National Forest Burned Area Recovery Plan. (Resource/land	11/19/01	Broad scale treatment of forested land and associated land management	Bitterroot watershed, Bitterroot National Forest Ravalli County, Montana.	Clark Fork River Basin	2001- 2004	Harm and harassment from short term degradation of aquatic habitat	Harm and harassment from short term degradation of aquatic habitat parameters including substrate

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
management plan or program) U.S. Forest Service		related features within or immediately adjacent to National Forest Service lands impacted by the 2000 Bitterroot fires: salvage harvest, road work (maintenance and upgrade, decommissioning or recontouring, remove culverts), reforestation, temporary road construction, helicopter landing sites.				parameters including substrate quality, rearing habitat, and food supply; increases in sedimentation is anticipated to adversely affect spawning, feeding and sheltering patterns of adult and juvenile fish along a total of 160 miles of stream reach. Habitat degradation could occur as a result of implementation of timber salvage harvest and watershed improvement projects in post-implementation years 1 through 5.	quality, rearing habitat, and food supply; increases in sedimentation is anticipated to adversely affect spawning, feeding and sheltering patterns of adult and juvenile fish along a total of 160 miles of stream reach.. Habitat degradation could occur as a result of implementation of timber salvage harvest and watershed improvement projects in post-implementation years 1 through 5.
Reconstruction of US Highway 93, FHWA Evaro - Polson, Montana. (Road work action)	10/19/01	Reconstruct 61 miles of highway.	Flathead River and tributaries, US Highway 93, between Evaro in Missoula County to Polson in Lake	Clark Fork River Basin	2003-2009, six year project duration.	Unquantifiable: harm and harassment from short term degradation of aquatic habitat	Unquantifiable: harm and harassment from short term degradation of aquatic habitat parameters including substrate quality, rearing

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
Federal Highway Administration			County, Montana.			parameters including substrate quality, rearing habitat, and food supply; an increase in sedimentation is anticipated to adversely affect feeding and sheltering patterns of adult and juvenile fish.	habitat, and food supply; an increase in sedimentation is anticipated to adversely affect feeding and sheltering patterns of adult and juvenile fish
Implementation of and associated actions for Plum Creek Timber Company road access - Hemlock, and Montana Department of Natural Resources and Conservation (MDNRC) easement - South Fork Lost Creek, in Swan River watershed. (Road work action) U.S. Forest Service	6/5/01	Provide access through U.S. Forest Service (FS) lands to private timber lands: construct 860 feet of road. Road reclamation, culvert removal, site reseeding. Road easement (10 miles long) exchange between FS and MDNRC including road relocation and construction away from creek and	Glacier Creek, Kraft Creek, Cilly Creek, Soup Creek, South Fork Lost Creek, in Swan River watershed, Montana.	Clark Fork River Basin	July 15 to September 1	Unquantifiable: harm and harassment from degradation of aquatic habitat parameters including substrate quality, rearing habitat, and food supply; an increase in sedimentation is anticipated to adversely affect eggs, larval and juvenile fish, and impair spawning, feeding and sheltering patterns of adult and juvenile fish.	Unquantifiable: harm and harassment from degradation of aquatic habitat parameters including substrate quality, rearing habitat, and food supply; an increase in sedimentation is anticipated to adversely affect spawning, feeding and sheltering patterns of adult and juvenile fish.

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
		road site reclamation (1.7 miles long).					
Implementation of the Nevada Dalton vegetation and travel management project. (Multiple project action) U.S. Forest Service	5/15/01	Timber harvest (500 acres), thinning cuts (1,600 acres), salvage cut (100 acres), prescribed burn (7,000 acres), ground and aerial application of herbicides (4,000 acres), road obliteration, road maintenance and travel plan revision	Blackfoot River watershed including Nevada Creek and Sauerkraut Creek, Lincoln Ranger District, Helena National Forest, Montana.	Clark Fork River Basin	2001-2013, up to 12 years.	Harm and harassment from short term degradation of aquatic habitat parameters including substrate quality, rearing habitat, and food supply; an increase in sedimentation is anticipated to adversely affect feeding and sheltering patterns of adult and juvenile fish.	Harm and harassment from short term degradation of aquatic habitat parameters including substrate quality, rearing habitat, and food supply; an increase in sedimentation is anticipated to adversely affect feeding and sheltering patterns of adult and juvenile fish.
Replacement of US Highway 2 Bridge over the Middle Fork of the Flathead River, southeast of Essex, Flathead County, MT; FHWA Sula North & South.(Bridge work action) Federal Highway	5/4/01	Replacement of and construction of bridge, placement of riprap.	Middle Fork of the Flathead River, southeast of Essex, in Flathead County, Montana.	Clark Fork River Basin	2001-2002	N/A	Unquantifiable: harm and harassment from degradation of aquatic habitat parameters including substrate quality, rearing habitat, and food supply; an increase in sedimentation is anticipated to adversely affect feeding and

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
Administration							sheltering patterns of adult and juvenile fish.
Operations and maintenance of the Big Flat and Frenchtown Irrigation Diversions 2003 - Bureau of Reclamation. (Water diversion/irrigation action) Bureau of Reclamation	7/7/03	Unscreened diversion of water from two rivers for the purpose of irrigation; also includes obstruction of flow of a river side channel, application of a biocide, and periodic manipulation of bedload and gravel bar deposits.	Bitterroot and Clark Fork Rivers, Montana.	Clark Fork River Basin	April 15 through October 31	N/A	Unquantifiable: entrainment into unscreened irrigation sytem resulting in permanent loss of individual fish from bull trout populations in the Bitterroot and Clark Fork rivers.
Operation, maintenance and expansion of Snowbowl Ski Area including road and parking improvements 2003. (Recreation action) U.S. Forest Service	4/28/03	Continued operation and maintenance of ski area, add 18 additional ski runs on 45 acres, install culvert in creek channel, construct sediment settling retention area for parking lot runoff, upgrade 5 miles	Snowbowl Ski Area (12 miles northwest of Missoula), Middle Clark Fork watershed including LaValle Creek, Butler Creek and Grant Creek, Missoula Ranger District, Lolo National Forest, Montana	Clark Fork River Basin	Not determined.	Harm and harassment from short term degradation of aquatic habitat parameters as a result of increased sediment; an increase in sedimentation is anticipated to adversely affect feeding and	N/A

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
		of road, construct parking lots.				sheltering patterns of juvenile and adult fish.	
Implementation of proposed actions associated with Clearwater Ecosystem Management and Timber Sale Project. (Timber sale/harvest action) U.S. Forest Service	3/6/01	Timber harvest (570 acres), prescribed burn (150 acres), road construction (12 miles), road obliteration (13 miles), noxious weed spot spraying (along 10 miles of road).	Upper and East Fork Clearwater River drainages, 12 miles northeast of Seely Lake, Lolo National Forest, Montana.	Clark Fork River Basin	2001	Unquantifiable: harm and harassment from degradation of aquatic habitat parameters including spawning habitat, rearing habitat, and food supply; an increase in sedimentation is anticipated to adversely affect spawnin, feeding and sheltering patterns of adult and juvenile fish.	Unquantifiable: harm and harassment from degradation of aquatic habitat parameters including substrate quality, rearing habitat, and food supply; an increase in sedimentation is anticipated to adversely affect spawning, feeding and sheltering patterns of adult and juvenile fish.
Implementation of proposed actions associated with plans of operations for Sterling Corporation Rock Creek Silver/Copper Mine. (Mining action)	12/15/00	10,00-ton per day underground copper and silver mine: includes 483 surface acres of ground disturbance, 9 miles of road construction, water treatment facility and	Rock Creek drainage (tributary to Cabinet Gorge Reservoir on Clark Fork River), Kootenai National Forest, near Noxon, Sanders County, Montana.	Clark Fork River Basin	35-year project life (including 5.5 years for development, 27.5 years for operation and production, 2 years for reclamation).	Unquantifiable: harm and harassment from degradation of aquatic habitat parameters including spawning habitat, rearing habitat, and food supply; increases in sedimentation,	Unquantifiable: harm and harassment from degradation of aquatic habitat parameters including spawning habitat, rearing habitat, and food supply; increases in sedimentation, degradation of water quality, and changes in

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
U.S. Forest Service		discharge to river, tailings paste facility, rail loadout, evaluation adit, underground mine workings, 1,078 surface acres remain undisturbed. (Project site includes 48% private land and 52% National Forest lands)				degradation of water quality, and changes in habitat complexity are anticipated to adversely affect spawning, feeding and sheltering patterns of adult and juvenile fish. It is likely that long term effects of mining operations will continue indefinitely after mine closure.	habitat complexity are anticipated to adversely affect spawning, feeding and sheltering patterns of adult and juvenile fish. It is likely that long term effects of mining operations will continue indefinitely after mine closure.
Permitting of outfitter services - Flathead National Forest. (Recreation action) U.S. Forest Service	9/21/98	Issuance of permits for commercial outfitting services: use of 15 outfitter camps including those with livestock (horses).	South Fork and Middle Fork of the Flathead River, Flathead National Forest, Montana.	Clark Fork River Basin	1998-2003, 5-year permit period.	Harm and harassment due to the potential harmful effects from horses trampling redds, impairment of essential breeding behavior, and "take" of bull trout through legal harvest of other game fish	Harm and harassment due to the potential harmful effects from horses trampling redds, impairment of essential breeding behavior, and "take" of bull trout through legal harvest of other game fish.
Issuance of a Section 10(a)(1)(B) Incidental	10/24/00	Management activities on Plum	Although activities covered by the	Clark Fork River Basin	Duration of permit is 30	Unquantifiable: harm and	Unquantifiable: harm and harassment, if it

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
Take Permit to Plum Creek Timber Company for the Proposed Native Fish Habitat Conservation Plan (NFHCP) in the States of Washington, Idaho, and Montana. (Resource/land management plan or program) U.S. Fish and Wildlife Service National Marine Fisheries Service		Creek lands covered by the Incidental Take Permits consist of commercial forestry and associated activities: including silvicultural activities (tree planting, site preparation, prescribed burning, timber harvest in riparian and upland areas, stand maintenance, forest nurseries, and seed orchards), as well as related actions of logging road construction and maintenance and gravel quarrying for roads. Other forestry activities include forest fire suppression, open range cattle grazing, miscellaneous	permits are restricted to Plum Creek lands (i.e., the 1.6 million acre NFHCP covered lands), the effects of the action on the covered species may extend beyond this area. For this consultation, we therefore define the action area to include the 16.5 million acre planning area, which is partially intermingled in a checkerboarded ownership pattern with about 14.9 million acres of lands owned and managed by the U.S. Forest Service, State, tribal, and other private owners, and areas outside the planning area in Idaho and Washington. The action area in Idaho includes the	(MT). Clearwater River Basin (ID). Lower Columbia River Basin and Middle Columbia River Basin (WA).	years.	harassment, if it occurs, only a limited number of individuals would likely be affected and impacts should be infrequent and localized; site specific increases in sediment and stream temperature may adversely affect fish at a number of life-history stages. Adverse effects would likely be limited to temporary and relatively minor increases in sediment levels and water temperatures and decreases in availability of large woody debris in affected streams.	occurs, only a limited number of individuals would likely be affected and impacts should be infrequent and localized; site specific increases in sediment and stream temperature may adversely affect fish at a number of life-history stages. Adverse effects would likely be limited to temporary and relatively minor increases in sediment levels and water temperatures and decreases in availability of large woody debris in affected streams.

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
		forest and land product sales, and conservation activities. Additional land use activities that are non-forest actions and special forest uses include commercial outfitting, recreation, electronic facility sites, and mill site facilities that manufacture various forest products.	Lochsa River sub-basin, and the mainstem Clearwater River below the confluence with the Lochsa River. The action area in Washington includes the Yakima, Cowlitz, Kalama, and Lewis river sub-basins. The action area consists of 15 planning area sub-basins where covered species are known to occur, and those sub-basins in Idaho and Washington (above) where covered activities may affect designated critical habitat or listed species downstream from the planning area. There are 10 sub-basins in Montana, 1 in				

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
			Idaho, and 4 in Washington and the associated land ownership in each planning area sub-basin plus a few outliers, which occur outside, but near the 15 planning area sub-basins. The majority of the NFHCP lands are located in Montana, approximately 1.4 million acres or 94 percent with the greatest Plum Creek ownership in Middle Clark Fork River, Middle Kootenai River, and Blackfoot River sub-basins. In Idaho, Plum Creek lands are located in the Lochsa River Basin only and total 40,424 acres (3 percent). Plum Creek NFHCP lands in Washington occur in four sub-basins that total				

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
			70,462 acres (4 percent); Yakima, Lewis, Cowlitz, and Kalama River sub-basins. The incidental take that would be permitted under the section 10(a)(1)(B) permit applies to lands where covered activities occur and Plum Creek lands to which the NFHCP's conservation and mitigation measures apply. These lands include all lands owned by Plum Creek as a matter of public record on the effective date when the Implementing Agreement was signed within the planning area sub-basins identified and those lands located outside of the planning area sub-basins identified in the Implementing Agreement. Lands				

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
			covered under the NFHCP also include those lands owned by others but on which Plum Creek holds timber cutting rights of 30-years duration or longer. Additionally, other lands covered under the NFHCP include lands owned or managed by others over which Plum Creek holds access easements, rights-of-way, access permits, or which are subject to a road cost-share agreement to which Plum Creek is a party, and which access NFHCP lands owned by Plum Creek.				
Implementation of ongoing action: Washington Gulch Mining Plan of Operation.	7/31/00	Placer mining pit operation within mainstem of creek, stream diversion for gravel washing,	Washington Creek drainage, Blackfoot River subbasin, Helena National Forest, Montana.	Clark Fork River Basin	4 to 5 year project.	Harm and harassment from short term degradation of aquatic habitat parameters including	Harm and harassment from short term degradation of aquatic habitat parameters including substrate quality, rearing habitat,

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
(Mining action) U.S. Forest Service		clearing all streamside vegetation and trees at mining site, upgrade access roads, construction of haul roads. Reclamation including revegetation of site at the end of each mining season.				substrate quality, rearing habitat, and food supply; an increase in sedimentation is anticipated to adversely affect feeding and sheltering patterns of adult and juvenile fish. Entrainment of fish at diversion structure.	and food supply; an increase in sedimentation is anticipated to adversely affect feeding and sheltering patterns of adult and juvenile fish. Entrainment of fish at diversion structure.
Ongoing actions associated with plans of mining operations for: Promise, CC and R, Ace Placer, Wildcat 1, Reel Placer, J and L Mine, Kanco, Lost Gulch, Deep Creek Placer, Hopeful Placer, Gold Bug Mine, and Tarbox Mine, Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Action.	5/12/00	Placer mining, suction dredge mining. Mining operations include mitigation and/or reclamation plans.	Cedar Creek, Trout Creek, Deep Creek, South Fork Little Joe Creek, Packer Creek, Middle Clark Fork subbasin, Lolo National Forest, Montana.	Clark Fork River Basin	July 15-September 1 (instream mining period). Near-stream mining activity period has not been determined.	Unquantifiable: harm and harassment from degradation of aquatic habitat parameters including substrate quality, rearing habitat, and food supply; an increase in sedimentation, changes in channel and habitat complexity is anticipated to adversely affect egg, larval, juvenile,	Unquantifiable: harm and harassment from degradation of aquatic habitat parameters including substrate quality, rearing habitat, and food supply; an increase in sedimentation, changes in channel and habitat complexity is anticipated to adversely affect egg, larval, juvenile, and adult fish life stages.

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
(Mining action) U.S. Forest Service						and adult fish life stages.	
Bass Creek Bridge and West Fork Stabilization ; Bitterroot National Forest. (Bridge work action) U.S. Forest Service	2/5/00	Replace bridge, realignment of approach road to bridge. Stabilization of 250 feet of river bank: placement of rock and log/rootwad vanes along bank and extend into river at 35-45° angle	West Fork of the Bitterroot River, Bitterroot National Forest, Montana.	Clark Fork River Basin	September through November, 2001	Harm and harassment from short term degradation of aquatic habitat (cobble/boulder streambed) parameters and a risk of crushing juvenile fish (during heavy equipment operation in the stream channel).	Harm and harassment from short term degradation of aquatic habitat (cobble/boulder streambed) parameters and a risk of crushing juvenile fish (during heavy equipment operation in the stream channel).
Orange Street Bridge replacement. (Bridge work action) Federal Highway Administration	12/30/99	Replace 2-lane bridge with a 4-lane bridge: work includes instream pier construction.	Clark Fork River, within City of Missoula, Missoula County, Montana.	Clark Fork River Basin	2000	N/A	Unquantifiable: harm and harassment from degradation of aquatic habitat parameters including substrate quality, rearing habitat, and food supply; an increase in sedimentation is anticipated to adversely affect feeding and sheltering patterns of adult and juvenile fish.

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
Plan of operation of the Vermillion River suction dredge project. (Mining action) U.S. Forest Service	7/30/99	Small-scale portable suction dredge placer mining within a 1,300 linear feet reach of stream channel.	Vermillion River, Cabinet Ranger District, Kootenai National Forest, Sanders County, Montana.	Clark Fork River Basin	June 1 to September 1 of each year for four years (1999-2003).	Harm and harassment from entrainment into suction dredge of mostly juvenile fish, but may include eggs, embryo and alevins along 1,300 feet of stream reach.; also substrate disturbance, changes in channel morphology, and short-term effects to food supply and water quality.	Harm and harassment from entrainment into suction dredge of mostly juvenile fish, but may include eggs, embryo and alevins along 1,300 feet of stream reach.; also substrate disturbance, changes in channel morphology, and short-term effects to food supply and water quality.
Bigfork Hydroelectric Project, FERC No. 2652-007. (Hydropower action) Federal Energy Regulatory Commission	5/21/03	Issue 50-year license to operate and maintain the Bigfork hydroelectric power project: includes installation of fish screens, release 70 cfs minimum flow.	Bigfork Dam, Swan River, Montana.	Clark Fork River Basin	License hydroelectric power generation for a period of 50 years.	Unquantifiable: small amount of harm and harassment from sediment input, entrainment and impingement of all fish life stages, and from operation and maintenance of fish screens; anticipate adverse affects from harm and impairment of feeding, spawning, and sheltering	Unquantifiable: small amount of harm and harassment from sediment input, entrainment and impingement of all fish life stages, and from operation and maintenance of fish screens; anticipate adverse affects from harm and impairment of feeding, spawning, and sheltering patterns of fish.

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
						patterns of fish.	
Ongoing Range Management Projects - Three (3) range management actions in the Swan River watershed, Flathead National Forest. (Grazing action) U.S. Forest Service	6/30/99	Grazing in 3 allotments.	Swan River watershed, Flathead National Forest, Montana.	Clark Fork River Basin	June 1 to September 30, 1999-2001.	Unquantifiable: harm and harassment from sedimentation and bank damage that adversely affects eggs, larval and juvenile fish and impairs spawning, feeding and sheltering patterns of juvenile and adult fish.	Unquantifiable: harm and harassment from sedimentation and bank damage that adversely affects eggs, larval and juvenile fish and impairs spawning, feeding and sheltering patterns of juvenile and adult fish.
Ongoing Range Management Projects - Twenty (20) range management projects in the Upper Clark Fork River, Rock Creek and Middle Clark Fork River subbasins. (Grazing action) U.S. Forest Service Bureau of Land Management	6/22/99 (Incidental Take Statements in this Biological Opinion have been revised in each of the following years: 2000, 2001, 2002)	Grazing in 20 allotments.	Upper Clark Fork River subbasin in Helena National Forest and Beaverhead-Deerlodge National Forest, Rock Creek subbasin (on BLM lands), and Middle Clark Fork River subbasin in Lolo National Forest, Montana.	Clark Fork River Basin	Time frame varies from 4 to 10 years between 1999 to 2009 depending on the specific allotment being grazed.	Unquantifiable: harm and harassment from degradation of aquatic habitat parameters including substrate quality, rearing habitat, and food supply; increases in sedimentation and damage to riparian vegetation adversely affects eggs, larval and juvenile fish and impairs spawning,	Unquantifiable: harm and harassment from degradation of aquatic habitat parameters including substrate quality, rearing habitat, and food supply; increases in sedimentation and damage to riparian vegetation adversely affects eggs, larval and juvenile fish and impairs spawning, feeding and sheltering patterns of juvenile and adult fish.

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
						feeding and sheltering patterns of juvenile and adult fish.	
Ongoing timber sales - Boulder Wyman timber sale (Beaverhead-Deerlodge National Forest) and Mocassin timber sale (Lolo National Forest). (Timber sale/harvest action) U.S. Forest Service	1/11/99	Timber sales and harvest: including prescribed burns (on 5,000 acres), clearcuts (800 acres), thinning cut (1,300 acres), shelterwood cut (71 acres), seedtree cut, temporary road construction.	Upper Clark Fork River subbasin, Lolo National Forest and Beaverhead Deerlodge National Forest, Montana.	Clark Fork River Basin	1999	Harm and harassment from short term degradation of aquatic habitat parameters including substrate quality, rearing habitat, and food supply; an increase in sedimentation is anticipated to adversely affect feeding and sheltering patterns of adult and juvenile fish.	Harm and harassment from short term degradation of aquatic habitat parameters including substrate quality, rearing habitat, and food supply; an increase in sedimentation is anticipated to adversely affect feeding and sheltering patterns of adult and juvenile fish .
Ongoing timber sales - Northside timber sale and Reset timber sale. (Timber sale/harvest action)U.S. Forest Service	1/11/99	Timber sales and harvest: including prescribed burns (on 800 acres), timber harvest (1,400 acres), road reconstruction (16 miles), road decommissioning	Butler Creek, Twomile Creek, Little Joe Creek, Middle Clark Fork River subbasin, Lolo National Forest, Montana.	Clark Fork River Basin	1999	Harm and harassment from short term degradation of aquatic habitat parameters including substrate quality, rearing habitat, and food supply; an increase in	Harm and harassment from short term degradation of aquatic habitat parameters including substrate quality, rearing habitat, and food supply; an increase in sedimentation is anticipated to adversely

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
		(36 miles), road closures (22 miles).				sedimentation is anticipated to adversely affect feeding and sheltering patterns of adult and juvenile fish.	affect feeding and sheltering patterns of adult and juvenile fish.
Knox Brooks timber sale and road rehabilitation. (Timber sale/harvest action) U.S. Forest Service	4/30/01	Timber harvest (2,500 acres) including clear cut, shelterwood cut, thinning cut, and seedtree cut, prescribed burn (300 acres), reforestation, and road reconstruction, obliteration and closings.	Twelvemile Creek watershed, Lolo National Forest, near De Borgia, Montana.	Clark Fork River Basin	2001	Unquantifiable: harm and harassment from degradation of aquatic habitat parameters including substrate quality, rearing habitat, and food supply; an increase in sedimentation is anticipated to adversely affect feeding and sheltering patterns of adult and juvenile fish.	Unquantifiable: harm and harassment from degradation of aquatic habitat parameters including substrate quality, rearing habitat, and food supply; an increase in sedimentation is anticipated to adversely affect feeding and sheltering patterns of adult and juvenile fish.
1-7-99-F-117 Oregon Conservation Reserve Enhancement Program. (Resource/land management plan or program)	6/2/99	State-wide program designed to reduce and mitigate agriculture related impacts on streams that provide current or historical habitat	All streams in Oregon that provide current or historical habitat for salmon and trout, which are listed under the ESA.	All bull trout recovery units in Oregon: Willamette River, Deschutes River, Klamath River, Hood River, John Day	10 to 15 years (the duration of contract with landowner)	Some negative short term impacts to fish during migration, spawning and juvenile rearing. Impacts include disturbance, displacement, alteration of habitat,	Some negative short term impacts to fish during migration, spawning and juvenile rearing. Impacts include disturbance, displacement, alteration of habitat, and physical interaction with eggs,

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
U.S. Department of AgricultureFarm Services Agency		for salmon and trout listed pursuant to the Endangered Species Act. Primary mechanism is through establishment of forested riparian buffers (up to 95,000 acres), and up to 5,000 acres of wetlands to be restored or enhanced. The total acreage enrolled for the entire Program is 100,000 acres.		River, Umatilla Walla Walla River, Grande Ronde River, Malheur River, Imnaha Snake River, Hells Canyon Complex		and physical interaction with eggs, juveniles or adults, or short term sedimentation during any instream or near stream restoration work. Long term benefits contributing to the recovery of salmonids.	juveniles or adults, or short term sedimentation during any instream or near stream restoration work. Long term benefits contributing to the recovery of salmonids.
1-4-99-F-21 Red River Meadow Restoration Project (phases III and IV). (Habitat restoration) Bonneville Power Administration	6/25/99	Ecosystem enhancement: 2,800 feet of stream channel reconstruction, reshaping, realignment, dewatering existing channel using staged diversions;	Red River, Lower Red River Meadow, near Elk City, Idaho County, Idaho.	Clearwater River Basin	1999-2000 (project phases III and IV of an eight phase project)	Sedimentation (expected to be short term) along 6.5 miles of stream reach. Unquantifiable adverse affect: There is the potential for a fuel spill to occur during fuel hauling,	Sedimentation (expected to be short term) along 6.5 miles of stream reach. Unquantifiable adverse affect: There is the potential for a fuel spill to occur during fuel hauling, transfer and storage operations

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
		establish native riparian and meadow plant species. Project related diesel fuel transport, handling and storage.				transfer and storage operations Possibility of injury and mortality from electrofishing and handling. Long-term effects of habitat enhancement project likely to benefit bull trout (improve habitat conditions and complexity).	Possibility of injury and mortality from electrofishing and handling. Long-term effects of habitat enhancement project likely to benefit bull trout (improve habitat conditions and complexity).
1-4-99-F-2 Operation of the Lower Snake River Compensation Plan Program. (River compensation plan program) U.S. Fish and Wildlife Service	4/8/99	Fish production program comprised of 23 fish hatcheries, associated acclimation and holding ponds, and other facilities. Water diversions, hatchery effluent discharge, weir operation and trapping of adult and smolt salmonids, release	*Idaho*: Clearwater River in Clearwater and Idaho counties; Payette River in Valley County; Salmon River in Custer and Valley counties; Snake River in Gooding and Idaho counties. *Oregon*: Columbia River in Morrow County; Grande Ronde River in Union and Wallowa counties; Imnaha	Clearwater River Basin Southwest Idaho River Basin Salmon River Basin Imnaha-Snake River Basin Grande Ronde River Basin Snake River	Proposed and ongoing; daily, seasonal, and year-round; ranging from short term (hours or days) to long term (several years).	N/A (All actions occur downstream of spawning streams)	Weirs and traps may be migration obstacles or barrires, which detain or delay migrating fish. Harassment of about 400 fish per year (via catch and release) as a result of scientific monitoring and evaluation of salmonids. Displacement (release of hatchery-reared fish cause loss of food and cover utilized by bull trout).

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
		of hatchery-reared juvenile salmonids, monitoring and evaluation of salmonids.	River in Wallowa County.*Washington*: Grande Ronde River in Asotin County; Snake River in Asotin and Franklin counties; Tucannon River in Columbia County; Walla Walla River in Columbia County .	Basin in Wash. Umatilla-Walla Walla River Basins			In-stream flow reductions (along an average of 200 meters of stream reach at each of 19 facilities that have water diversions). Increased levels of nutrients and sediment (along an average of 100 meters of stream reach at each of 26 facilities that discharge effluent).
1-9-98-F-7 St. Joe and North Fork of the Clearwater River Watersheds Biological Assessment. (Multiple project action) U.S. Forest Service	5/31/99	900 actions: timber sales and harvest; road construction, obliteration and repair; grazing; noxious weed management; mining.	St. Joe River and North Fork of the Clearwater River watersheds, Idaho Panhandle National Forests, Idaho.	Clearwater River Basin Couer D'Alene Lake Basin	Seasonal (July through September road work)	Unquantifiable. Sedimentation causing degradation of spawning and rearing habitat; harassment of juveniles.	Unquantifiable. Sedimentation causing degradation of spawning and rearing habitat; harassment of migratory individuals.
1-7-01-F-925 Non-capacity license amedment for the Pelton Round Butte Project FERC No. 2030.	10/2/01	Installation of two turbine runners, continued operation of Pelton Round Butte Project (3	Pelton Round Butte Project (Round Butte Dam, Pelton Dam, Regulating Dam) on Deschutes	Deschutes River Basin	Year round.	N/A	Unquantifiable: harm, harassment, or mortality by entrainment into project turbines, migration delays for upstream movement, and

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
(Hydropower action) Federal Energy Regulatory Commission		dams) modified run-of-river system that includes store-and-release facility operating in peaking mode, and implementation of fish conservation strategy (fish bypass, Merwyn trap fish collection, mark/tag and monitoring).	River, Oregon.				increased cannabilism due to lack of cover available to juvenile fish. Conservation measures potentially reduce present level of harm and harassment, and contribute to bull trout recovery.
1-7-00-F-479 Warm Springs Reservation bridge replacements. (Bridge work action) Bureau of Indian Affairs	6/30/00	Replace three bridges, instream work to remove concrete slabs, and placement of riprap.	Mill Creek, Badger Creek, Shitike Creek, South Fork Warm Springs River, Warm Springs Reservation, Oregon.	Deschutes River Basin	July 1 to August 10	Unquantifiable: short term detrimental effects on parameters such as water temperature, food supply, substrate quality, suspended sediment, and spawning success causing harm and harassment. Long term benefits include better fish passage.	Unquantifiable: short term detrimental effects on parameters such as water temperature, normal behavior, food supply, substrate quality, and sediment levels causing harm and harassment. Long term benefits include better fish passage.

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
1-7-98-F-274 Biological Assessment for Bull Trout in the Deschutes River Basin for the Deschutes National Forest and Bureau of Land Management, Prineville District. (Multiple project action) U.S. Forest Service Bureau of Land Management	8/25/98	Proposed multiple land management actions: timber sales/harvest, prescribed burning, thinning cuts, fuel treatments, campground and trail rehabilitation and use, road maintenance and management actions, grazing allotments.	All lands within the Deschutes National Forest and the Prineville District of the Bureau of Land Management, Oregon; includes the Deschutes River and its tributaries, Metolius River drainage, and the Trout Creek drainage.	Deschutes River Basin Odell Lake	1998	Unquantifiable: Detrimental effects on parameters such as water temperature, substrate quality, bank stability, food supply, spawning success, and suspended sediment levels.	Unquantifiable: Detrimental effects on parameters such as water temperature, substrate quality, bank stability, food supply, spawning success, and suspended sediment levels.
1-7-98-F-324 Effects to bull trout from continued implementation of land and resource management plans and resource management plans as amended by the interim strategy for managing fish-producing watersheds in eastern Oregon and	**4/14/98**	**Land and resource management plans (LRMPs) as modified by INFISH and PACFISH; includes 24 U.S. Forest Service and 16 Bureau of Land Management LRMPs.The LRMPs provide**	**The action area encompasses all or parts of the following National Forests (NF) of the USFS, and Resource Areas (RA) of the BLM for the Columbia River and Klamath River DPSs of bull trout.** **USFS National**	**Deschutes River Basin** **John Day River Basin** **Grande Ronde River Basin** **Hells Canyon Complex** **Hood River Basin**	**Indefinite**	**Unquantifiable.**	**Unquantifiable.**

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
Washington, Idaho, western Montana, and portions of Nevada (INFISH), and the Interim strategy for managing anadromous fish-producing watersheds in eastern Oregon and Washington, Idaho, and portions of California (PACFISH). **(Resource/land management plan or program)** **U.S. Forest Service** **Bureau of Land Management**		**direction and standards for broad classes of project activities and land and water management practices that may affect bull trout. The projects and activities include forest management, recreation, range management, mining, watershed restoration, fish and wildlife habitat management, fire and fuels management, land exchanges and acquisitions, and a variety of special uses (commercial, utilities, road use and construction, and rights-of-**	**Forest (NF) lands: *Within Klamath River Distinct Population Segment (DPS)*-- Fremont NF, Winema NF; *within Columbia River DPS* -- Colville NF, Deschutes NF, Malheur NF, Ochoco NF, Okanogan NF, Umatilla NF, Wallowa-Whitman NF, Wenatchee NF, Columbia River Gorge National Scenic Area, Bitterroot NF, Clearwater NF, Flathead NF, Helena NF, Kootenai NF, Lolo NF, Beaverhead-Deerlodge NF, Idaho Panhandle NF, Nez Perce NF, Boise NF, Payette NF, Salmon-Challis NF, Sawtooth NF.**	**Malheur River Basin** **Umatilla-Walla Walla River Basins** **Imnaha Snake River Basins** **Upper Columbia River Basin** **Middle Columbia River Basin** **Lower Columbia River BasinNortheast Washington River Basin** **Snake River Basin in Washington** **Kootenai River Basin**			

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
		way.	**BLM Resource Area (RA) lands: *Within Klamath River DPS* -- Klamath Falls RA (Oregon); *within Columbia River DPS* -- Baker RA, Central Oregon RA, Deschutes RA, Three Rivers RA, Malheur RA, Border RA, Wenatchee RA, (Washington-Oregon); Cascade RA, Cottonwood RA, Emerald Empire RA, Shoshone RA, Big Butte RA, Lemhi RA, Challis RA (Idaho); Garnet RA (Montana).**	**Clark Fork River Basin** **Clearwater River Basin** **Salmon River Basin** **Little Lost River Basin** **Couer D'Alene Lake Basin** **Southwest Idaho River Basins.**			
1-7-01-F-319 Bureau of Land Management's Vale District integrated noxious weed management program: 2001 to 2011.	1/10/02	Herbicide use for weed control., as well as the use of physical, cultural, and biological control methods.	BLM Vale District (includes Baker, Jordan, and Malheur Resource Areas), Baker, Malheur, Morrow, Umatilla, and Wallowa	Grande Ronde River Basin Hells Canyon Complex Imnaha Snake	2001-2011, 10 years	N/A due to absence of spawning adjacent to BLM lands.	Unquantifiable (sublethal effects from herbicide use).

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
(Weed management) Bureau of Land Management			counties, Oregon.	River Basins John Day River Basin Malheur River BasinUmatilla-Walla Walla River Basin			
1-7-01-F-609 Catherine Creek Bridge replacement. (Bridge work action) Federal Highway Administration	6/12/01	Construct new bridge, remove old bridge structures, placement of riprap.	Catherine Creek, within the city of Union, Union County, Oregon.	Grande Ronde River Basin	July 1-July 31	Harassment from sedimentation (expected to be short term) along 1,000 feet of stream reach.	Harassment from sedimentation (expected to be short term) along 1,000 feet of stream reach.
1-4-99-F-11 Ongoing and proposed actions in the Lostine and Wallowa Watersheds. (Multiple project action) U.S. Forest Service	3/26/99	Road maintenance. Campground, trailhead, and horse camp maintenance and improvement projects. Wilderness trail and campsite	Lostine and Wallowa Watersheds, Wallowa Whitman National Forest, Wallowa County, Oregon.	Grande Ronde River Basin	Annual road maintenance. Duration of recreational facilities maintenance actions may be short term, seasonal or have not been determined.	Low level of sedimentation effecting spawning and rearing habitat along 10 miles of stream reach.	N/A

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
		restoration projects.					
1-7-02-F-405 Lower Perry Interchange (Grande Ronde River) Bridges. (Bridge work action) U.S. Army Corps of Engineers	4/16/02	Bridge replacement.	Grande Ronde River at I-84 mile post 257.2 near La Grande, Union County, Oregon.	Grande Ronde River Basin	3 years	N/A	Harassment of migratory fish within 100 feet upstream of project site and downstream to confluence of next major stream because of disturbance, delay or alteration of bull trout movements and decreased use of foraging resources in project area.
1-7-01-F-610 Milk Creek habitat enhancement. (Habitat restoration action) U.S. Army Corps of Engineers	6/14/01	Restore approximately 930 feet of Milk Creek to natural condition, culvert replacement.	Milk Creek (tributary to Catherine Creek), Union County, Oregon.	Grande Ronde River Basin	Summer 2001	Unquantifiable sedimentation (expected to be short term) along 1,000 feet of stream reach. Long term benefits expected.	Unquantifiable sedimentation (expected to be short term) along 1,000 feet of stream reach. Long term benefits expected.
1-4-99-F-3 Ongoing and proposed Federal Forest Service actions in the Pine Creek watershed.	1/29/99	Timber sale and related activities. Livestock grazing.	Pine Creek Watershed, Wallowa-Whitman National Forest, Baker County, Oregon.	Hells Canyon Complex	Seasonal (June to September)	Sedimentation (low level, short term pulses). Displacement (short term).	N/A

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
(Multiple project action) U.S. Forest Service		Mining. Road maintenance. Outfitter/Guide activities (recreation)				Harm or harassment of eggs, fry, and spawning fish along 39 miles of spawning and rearing habitat.	
1-7-99-F-414 Fish habitat improvement cluster projects: Clear Branch Creek rechannelization, Pinnacle Creek bridge, placement of log structures and riparian restoration in the rock quarry on Clear Branch Creek. (Habitat restoration action) U.S. Forest Service	10/8/99	Four projects to improve habitat conditions and fish passage: creek channel realignment, placement of large wood/logs/trees, restore riparian flood prone area, culvert removal and bridge contruction.	Upper middle Fork of the Hood River, Hood River Ranger District, Mt. Hood National Forest, Hood River County, Oregon.	Hood River Basin	Up to 120 days.	N/A	Harm and harassment from short term detrimental effects, along 0.5 mile of stream reach, from increased suspended sediment levels and disturbance from instream work. Long term effects are anticipated to be beneficial.
1-7-01-F-936 Farmers Irrigation District irrigation system improvement project.	9/4/01	Upgrade irrigation delivery system: replace intake and flume, sediment excluder sills, install new	Hood River, Hood River County, Oregon.	Hood River Basin	July - August (in-water work)	Unquantifiable, harm or harassment, at fish screen or during short term instream work.	Unquantifiable, harm or harassment, at fish screen or during short term instream work.

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
(Water diversion/irrigation action) Bonneville Power Administration		fish screens and bypass.					
1-7-98-F-283 "Batch 5" restoration projects, Hood River County, Oregon. (Habitat restoration action) U.S. Forest Service	8/25/98	Remove 1,500 feet of riprap levee, placement of large woody material (logs, trees, log/boulder combinations) instream for habitat restoration.	East Fork Hood River, Clear Branch Creek, Lake Branch, Hood River County, Oregon	Hood River Basin	June 15 to September 8	Unquantifiable: harassment along a total of 0.6 mile of stream reach from short term detrimental effects on suspended sediment, substrate quality, bank stability, water temperature, and food supply. Long term benefit contributing to bull trout recovery, along a total of 0.6 mile of stream reach.	Unquantifiable: harassment along a total of 0.6 mile of stream reach from short term detrimental effects on suspended sediment, substrate quality, bank stability, water temperature, and food supply. Long term benefit contributing to bull trout recovery, along a total of 0.6 mile of stream reach.
1-17-03-F-0394 Imnaha/Big Sheep multi-species Biological Assessment for ongoing and proposed actions, Imnaha Subbasin,	6/3/03	60 actions including bridge replacement and repair, culvert replacement and repair, road maintenance,	Big Sheep Creek, Lick Creek, Summit Creek, and Imnaha River, Wallowa Whittman National Forest, Wallowa	Imnaha Snake River Basins	Seasonal, July to August road work, May through September water diversion.	Short term sedimentation, disturbance or harassment from road work. Seasonal diversion	Short term sedimentation, disturbance or harassment from road work. Seasonal diversion may

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
Wallowa County, Oregon. (Multiple project action) U.S. Forest Service		screened water diversion (2.8 cfs).	County, Oregon.			may cause changes in peak/base flows; harm or harassment to individuals that get temporarily trapped between diversion and screen.	cause changes in peak/base flows; harm or harassment to migrating individuals that get temporarily trapped between diversion and screen.
1-4-01-F-29 Little Sheep Creek bridge replacement. (Bridge work action) Federal Highway Administration	1/26/01	Replace two timber structure bridges with two new concrete bridges including instream and streambank work.	Imnaha River watershed, Wallowa County, Oregon.	Imnaha Snake River Basin	July 2001 to October 2001, 4 months; instream work confined to July 15 to Sept 15.	Temporary, short term harassment/ disturbance of rearing juveniles. Short term turbidity and sedimentation. Removal of creosote timber structure is a long term benefit.	Temporary, short term harassment/ disturbance or delay of migrating adults. Short term turbidity and sedimentation. Removal of creosote timber structure is a long term benefit.
1-7-01-F-846 Malheur National Forest's 2001 grazing management program. (Grazing action) U.S. Forest Service	7/30/01	Range allotment projects: livestock grazing in 20 allotments and 2 crossings.	Middle Fork John Day River, Upper John Day River, Upper Malheur River, Malheur National Forest, Grant, Baker, and Harney counties, Oregon.	John Day River Basin Malheur River Basin	2001	Unquantifiable detrimental effects on parameters such as spawning success, normal behavior, substrate quality, and sediment levels causing harm and harassment.	Unquantifiable detrimental effects on parameters such as water temperature, normal behavior, food supply, substrate quality, and sediment levels causing harm and harassment.
1-7-99-F-444	10/12/99	Livestock grazing	Middle Fork John	John Day River	1998-1999	Unquantifiable:	Unquantifiable:

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
Effects of Malheur National Forest's 1998-1999 grazing management program on bull trout. (Grazing action) U.S. Forest Service		in 19 allotments	Day River, Upper John Day River, Upper Malheur River, Malheur National Forest, Grant, Baker, and Harney counties, Oregon.	Basin Malheur River Basin		detrimental effects on parameters such as spawning success, normal behavior, substrate quality, and sediment levels causing harm and harassment.	detrimental effects on parameters such as spawning success, normal behavior, substrate quality, and sediment levels causing harm and harassment.
1-7-00-F-476 Malheur National Forest's 2000 grazing management program. (Grazing action) U.S. Forest Service	7/12/00	Livestock grazing in 19 allotments.	Middle Fork John Day River, Upper John Day River, Upper Malheur River, Malheur National Forest, Grant, Baker, and Harney counties, Oregon.	John Day River Basin Malheur River Basin	2000	Unquantifiable detrimental effects on parameters such as spawning success, normal behavior, substrate quality, and sediment levels causing harm and harassment.	Unquantifiable detrimental effects on parameters such as water temperature, normal behavior, food supply, substrate quality, and sediment levels causing harm and harassment.
1-7-02-F-746Malheur National Forest's 2002 grazing management program. (Grazing action) U.S. Forest Service	7/19/02	Range allotment projects: livestock grazing in 17 allotments and 2 crossings.	Middle Fork John Day River, Upper John Day River, Upper Malheur River, Malheur National Forest, Grant, Baker, and Harney counties, Oregon.	John Day River Basin Malheur River Basin	2002 grazing season.	Unquantifiable detrimental effects on parameters such as spawning success, normal behavior, substrate quality, and sediment levels causing harm and harassment.	Unquantifiable detrimental effects on parameters such as water temperature, normal behavior, food supply, substrate quality, and sediment levels causing harm and harassment.
1-17-03-F-0411 Effects of Malheur	7/16/03	Livestock grazing in 18 allotments	Middle Fork John Day River, Upper	John Day River Basin	2003	Unquantifiable effects: It is	Unquantifiable effects: It is unlikely that effects

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
National Forest's 2003 grazing management program on bull trout and critical habitat. (Grazing action) U.S. Forest Service		with implementation of conservation measures.	John Day River, Upper Malheur River, Malheur National Forest, Grant, Baker, and Harney counties, Oregon.	Malheur River Basin		unlikely that effects from the grazing activities, as proposed, will impair productivity, distribution, or population numbers of bull trout. Potential effects to fish and habitat attributed to grazing activities are anticipated to be low because of implementation of conservation measures and utilization standards.	from the grazing activities, as proposed, will impair productivity, distribution, or population numbers of bull trout. Potential effects to fish and habitat attributed to grazing activities are anticipated to be low because of implementation of conservation measures and utilization standards.
1-7-00-F-648 Malheur National Forest's 2000 ongoing and new activities, Middle Fork John Day sub-basin. (Multiple project action) U.S. Forest Service	9/22/00	Recreation program: providing, maintaining and monitoring 2 developed campgrounds and 3 Forest camps, numerous trail heads and associated roads, and several hundred dispersed	Granite-Boulder Creek, Clear Creek, Big Creek, and Middle Fork John Day River sub-basin, Malheur National Forest, Grant County, Oregon.	John Day River Basin	2000	Unquantifiable: harm and harassment along a total of 39 miles of stream reach from detrimental effects on normal behavior, spawning success, suspended sediment, substrate quality, bank stability, water temperature, and food supply.	Unquantifiable: harm and harassment along a total of 39 miles of stream reach from detrimental effects on normal behavior, migration to spawning areas, suspended sediment, substrate quality, bank stability, water temperature, and food supply.

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
		campsites. Transportation program: general road maintenance, road closure and obliteration, drainage structure maintenance, logging out, and bridge maintenance					
1-10-00-F-071 Grazing within Silver Creek pasture of the Foster Butte Allotment, Silver Lake District, Fremont National Forest. (Grazing action) U.S. Forest Service	7/26/02	Grazing	Coyote Creek in Silver Creek pasture of the Foster Butte Allotment, Silver Lake District, Fremont National Forest, Klamath and Lake counties, Oregon.	Klamath River Basin	May 15 to July 31	Effects are expected to be low to undetectable since no grazing will occur in or near bull trout occupied streams.	Effects are expected to be low to undetectable since no grazing will occur in or near bull trout occupied streams.
1-10-98-F-83 Fremont National Forest 1998 Bull Trout Programmatic Consultation. (Grazing action)	10/20/98	Grazing	North Fork Sprague River and Upper Sycan River subwatersheds, Bly, Paisley, and Silver Lake Ranger Districts, Fremont National Forest,	Klamath River Basin	Ongoing, 1998 until 2007	Effects are expected to be low to undetectable since no grazing will occur in or near bull trout occupied streams.	Effects are expected to be low to undetectable since no grazing will occur in or near bull trout occupied streams.

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
U.S. Forest Service			Klamath and Lake counties, Oregon.				
1-10-98-F-40 Road construction and maintenance activities affecting listed suckers and bull trout within four basins on the Fremont National Forest. (Road work action) U.S. Forest Service	7/10/98	Repair road fill, culvert replacement, improving drainage on roads, road decommisioning.	Warner Basin, Gerber Basin, Clear Lake Basin, Sprague River Basin, Fremont National Forest, Oregon.	Klamath River Basin	1998 to 2008	Unquantifiable.	Unquantifiable.
1-10-99-F-067 Degree restoration Project and the North Fork Sprague River Stream Restoration Projects. (Habitat restoration action) U.S. Forest Service	7/20/99	Restore or maintain late and old structure stands and restore meadows and/or riparian areas; silvicultural treatments, commercial and precommercial thinning; road closure and obliteration. Three miles of stream restoration: bank	North Fork of the Sprague subwatershed of the Sprague River Basin, Paisley Ranger District, Fremont National Forest, Oregon.	Klamath River Basin	Not determined.	In most cases, effects from sedimentation are short term, lasting only a few hours to days. In the long term, stream restoration is expected to have beneficial effects.	In most cases, effects from sedimentation are short term, lasting only a few hours to days. In the long term, stream restoration is expected to have beneficial effects.

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
		excavation and angle reduction, revegetation.					
1-4-98-FW-6 Section 7 programmatic consultation on issuance of a Section 10(a)(1)(A) scientific take permits and Section 6(c)(1) exemption from take for Bull Trout. **(Section 10(a)(1)(A) permit)** **U.S. Fish and Wildlife Service**	**9/4/98**	**Population surveys using electrofishing, netting, trapping, capturing, marking, tagging, tissue sampling, collection for hatchery propagation and outplanting activities. Also anticipate habitat restoration or enhancement activities.**	**Klamath River and Columbia River Basins**	**Klamath River Basin and all Columbia River Basins (as stated in the B.O.)** **(i.e., Willamette River Basin, Deschutes River Basin, John Day River Basin, Grande Ronde River Basin, Hells Canyon Complex, Hood River Basin, Odell Lake, Malheur River Basin, Umatilla-Walla Walla River Basins, Imnaha Snake River Basins, Upper**	**1 year.**	**Capturing, retaining, handling, possibly killing for scientific purposes, possibility of injury and mortality from electrofishing and handling.** **Harassment (via catch and release) as a result of scientific monitoring and evaluation, which may involve a few thousand individual bull trout.** **Long term impacts of action to benefit recovery of bull trout.**	**Capturing, retaining, handling, possibly killing for scientific purposes, possibility of injury and mortality from electrofishing and handling.** **Harassment (via catch and release) as a result of scientific monitoring and evaluation, which may involve a few thousand individual bull trout.** **Long term impacts of action to benefit recovery of bull trout.**

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
				Columbia River Basin, Middle Columbia River Basin, Lower Columbia River Basin, Northeast Washington River Basin, Snake River Basin in Washington, Kootenai River Basin, Clark Fork River Basin, Clearwater River Basin, Salmon River Basin, Little Lost River Basin, Couer D'Alene Lake Basin, Southwest Idaho River Basins.			
Wigwam watershed restoration project, Kootenai National	8/11/03	Various watershed restoration	Upper Kootenai River drainage, Kootenai National	Kootenai River Basin	September 2003 to September 2004	Unquantifiable: harm and harassment from	Unquantifiable: harm and harassment from temporary increases in

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
Forest. (Habitat restoration action) U.S. Forest Service		activities to restore the natural drainage patterns of tributary channels to the Wigwam River: removal of 47 culverts and 2 log bridges, install ditch relief channels; also, electroshock recovery and relocation of fish from project sites	Forest, Lincoln County, Montana.			temporary increases in sedimentation (expected to be minimal), and electroshock capture and handling are anticipated to adversely affect feeding, spawning, and sheltering patterns of adult and juvenile fish. Long term beneficial effects are expected from culvert removal.	sedimentation (expected to be minimal), and electroshock capture and handling are anticipated to adversely affect feeding, spawning, and sheltering patterns of adult and juvenile fish. Long term beneficial effects are expected from culvert removal.
Kootenai National Forest's Spar and Lake Subunits Forest Health Project. (Multiple project action) U.S. Forest Service	3/9/01	Vegetation management and watershed restoration: timber harvest treatments (2,200 acres) including fuel treatments, regeneration harvests, thinning cuts, salvage; road decommissioning (5.4 miles), replace culverts, road reconstruction	Lake Creek and Keeler Creek watersheds, Bull Lake, Three Rivers Ranger District, Kootenai National Forest, Montana.	Kootenai River Basin	2001-2009	Unquantifiable: Harm and harassment associated with short term sedimentation and turbidity adversely affecting eggs, larval and juvenile life stages by harming or impairing feeding, spawning feeding and sheltering patterns.	Unquantifiable: Harm and harassment associated with short term sedimentation and turbidity adversely affecting feeding and sheltering patterns of adult and juvenile fish.

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
		(7.4 miles).					
Northwest Montana Gold Prospectors Association, William Gross - Crazyman Placer, and Linda and Robert Taylor suction dredging. (Mining action) U.S. Forest Service	7/13/00	Ongoing and proposed placer, sluicing, and suction dredge mining activities.	Libby Creek, Big Cherry Creek, Leigh Creek, Kootenai National Forest, Montana.	Kootenai River Basin	May through September	Unquantifiable: Harm and harassment from degradation of aquatic habitat parameters including substrate quality, rearing habitat, and food supply; increases in sedimentation, changes in channel and habitat complexity is anticipated to adversely affect eggs, larval and juvenile life stages by harming or impairing feeding, spawning, and sheltering patterns.	Unquantifiable: Harm and harassment from degradation of aquatic habitat parameters including substrate quality, rearing habitat, and food supply; increases in sedimentation, changes in channel and habitat complexity is anticipated to adversely affect feeding and sheltering patterns of adult and juvenile fish.
Highway 2 Reconstruction, Pleasant Valley. (Road work action) Federal Highway Administration	5/30/00	Reconstruct (widen, regrade and resurface) 8 miles of highway.	Fisher River and tributaries, Pleasant Valley, Lincoln County, Montana.	Kootenai River Basin	2000	N/A	Unquantifiable: Harm and harassment from short term degradation of aquatic habitat parameters including substrate quality, rearing habitat, and food supply; an increase in

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
							sedimentation is anticipated to adversely affect feeding and sheltering patterns of adult and juvenile fish.
Highway 2 Reconstruction, Swamp Creek. (Road work action) Federal Highway Administration	7/9/01	Reconstruct (widen, regrade and resurface) 12 miles of highway; replace bridges and culverts; realignment, restoration and enhancement of 2.5 miles of creek channel.	Libby Creek, Swamp Creek, Fisher River and tributaries, Pleasant Valley, Lincoln County, Montana.	Kootenai River Basin	2001	Unquantifiable: Harm and harassment from short term degradation of aquatic habitat parameters including substrate quality, rearing habitat, and food supply; an increase in sedimentation is anticipated to adversely affect feeding and sheltering patterns of adult and juvenile fish Long term beneficial effects from creek channel modification and restoration.	Unquantifiable: Harm and harassment from short term degradation of aquatic habitat parameters including substrate quality, rearing habitat, and food supply; an increase in sedimentation is anticipated to adversely affect feeding and sheltering patterns of adult and juvenile fish Long term beneficial effects from creek channel modification and restoration.
1-9-99-F-6 BlueGrass Bound Timber Sale, Boundary Creek Road	7/1/99	Timber harvest on 2,567 acres. Road construction	Boundary Creek watershed, Bonners Ferry Ranger District, Idaho	Kootenai River Basin	Seasonal grazing July to September.	Short term turbidity and sedimentation along 10 miles of stream reach; in the	Short term turbidity and sedimentation along 10 miles of stream reach; in the long term, road

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
obliteration, and Grass Creek range allotment. (Multiple project action) U.S. Forest Service		(1 mile), decommissioning (97 miles) and obliteration (5 miles); bridge repair and culvert replacement. Grazing.	Panhandle National Forest, Boundary County, Idaho.		1999-2007 (timber harvest and road work)	long term, road decommission and obliteration is expected to have beneficial effects. Unquantifiable (effects of grazing): sedimentation, nutrient loading, streambank devegetation, trampling effects.	decommissioning and obliteration is expected to have beneficial effects. Unquantifiable (effects of grazing): sedimentation, nutrient loading, streambank devegetation, trampling effects.
1-4-01-F-0014 Little Lost River flood control project. (Flood control action) Bureau of Land Management	4/5/02	Winter seasonal dewatering of 10.5 miles of river by diversion of stream flow into sink trenches.	Little Lost River, BLM Idaho Falls District, Idaho.	Little Lost River Basin	Seasonal, December to March	Loss of an estimated 53 large fluvial individual bull trout per year, along a 10.5 mile long reach of river.	Loss of an estimated 53 large fluvial individual bull trout per year, along a 10.5 mile long reach of river.
1-3-00-F-1858 Proposed and ongoing projects and programs in the Upper Cowlitz River Subbasin. (Multiple project action)	9/26/00	Road repair, culvert replacement, road resurfacing. Stream inventory and instream restoration. Pump chances.	Yellowjacket Creek, Cispus River and North Fork Cispus River, Clear Fork Cowlitz River, and Upper Cowlitz River subbasin, Gifford Pinchot National Forest,	Lower Columbia River Basin	5 years, 2000 to 2005	Localized short-term, increases in turbidity and sediment. In the long-term, restoration actions are expected to improve habitat.	Localized short-term, increases in turbidity and sediment. In the long-term, restoration actions are expected to improve habitat. Harm and harassment

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
U.S. Forest Service		Campgrounds maintenance. Timber sale, commercial thinning and harvest.	Washington			Harm and harassment resulting from projects and programs affecting 72 miles of streams.	resulting from projects and programs affecting 72 miles of streams.
1-9-99-F-3 Yakima Klickitat Fisheries Project. (Research action) Bonneville Power Administration	5/17/99	Ongoing studies, research and artificial production of coho and chinook salmon; collection of broodstock, hatchery rearing, and release of smolts, trapping and seining, monitoring and electrofishing.	Yakima and Klickitat River systems, Washington.	Lower Columbia River Basin Middle Columbia River Basin	1999-2003	Weirs and traps may be migration obstacles or barriers, which detain or delay migrating fish; anticipated to be low in magnitude. Harassment (via catch and release) as a result of scientific monitoring and evaluation of salmonids; anticipated to be low in magnitude. Displacement (release of hatchery-reared fish cause loss of food and cover utilized by bull trout); anticipated to be low	Weirs and traps may be migration obstacles or barriers, which detain or delay migrating fish; anticipated to be low in magnitude. Harassment (via catch and release) as a result of scientific monitoring and evaluation of salmonids; anticipated to be low in magnitude. Displacement (release of hatchery-reared fish cause loss of food and cover utilized by bull trout);anticipated to be low in magnitude. Possibility of injury and mortality from electrofishing, handling

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
						in magnitude. Possibility of injury and mortality from electrofishing, handling and temporary confinement in nets or traps; anticipated to be low in magnitude.	and temporary confinement in nets or traps; anticipated to be low in magnitude.
1-3-00-F-1854 Recreational trail bridge replacements on Wicky and Morrison Creeks, and Pacific Crest Trail bridge repair on Rock Creek. (Bridge work action) U.S. Forest Service	9/18/00	Trail foot bridge construction and repair; install timber and rock bridge footings.	Wicky Creek and Morrison Creek in Upper White Salmon Watershed, and Rock Creek in Rock Creek Watershed, Gifford Pinchot National Forest, Skamania County, Washington	Lower Columbia River Basin	Construction work lasting 1-day to 1-week between June and October.	The amount of sediment that may potentially be introduced to the creeks is not expected to be of a magnitude sufficient to change the environmental baseline conditions. Harassment of juvenile fish along a total of 300 feet of stream reach for up to 1-week.	N/A
1-7-02-F-205 Columbia River channel improvements project.	5/20/02	Channel deepening by dredging and annual	Columbia River (river miles 3 to 106.5), Oregon and	Lower Columbia River Basin	May through October dredging.	N/A	Short term harm (injury and mortality) from blasting and entrainment; short term

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
(Navigation channel improvement/dredging action) U.S. Army Corps of Engineers		maintenance dredging, dredge spoil disposal.	Washington.		30-year project life.		effects from dredge and disposal induced turbidity. Low level of long term but unquantifiable effects over life span of project.
1-3-99-F-897Ongoing grazing activities on the Twin Buttes sheep and goat and Mt. Adams cattle allotments. (Grazing action) U.S. Forest Service	8/18/99	Grazing	Middle and Upper Lewis Rivers and Upper White Salmon watersheds, Gifford Pinchot National Forest, Skamania County, Washington	Lower Columbia River Basin	Seasonal	Small, minor to undetectable, localized stream bank erosion and sedimentation along a total of 300 feet of stream reach. Unquantifiable effect on spawning habitat at stream site livestock crossing.	N/A
1-3-99-F-289 Ongoing and proposed USDA Forest Service activities (24 projects) affecting the Columbia River distinct population segment of bull trout within the Southwest Washington Province, Lewis River Basin	5/19/99	Flood repair and restoration actions: road decommissioning, culvert removal, stream channel reconstruction, bridge removal, culvert replacement, road fill repair, erosion	Lower Lewis River, Middle Lewis River, Upper Lewis River, and Muddy River, Gifford Pinchot National Forest, Skamania County, Washington	Lower Columbia River Basin	Not determined.	Localized short term increases in turbidity and sediment causing harm or harassment along a total of 23 miles of stream reach. In the long-term, restoration actions are expected to	N/A

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
(Multiple project action) U.S. Forest Service		control.				improve habitat.	
1-7-02-F-773Merit Vegetation Project (Bridge work) U.S. Forest Service	7/18/02	Bridge removal and replacement (for trail bikes and snowmobile use).	Lake Creek an Crooked Creek, Malheur headwaters watershed, Malheur National Forest, near Prairie City, Grant County, Oregon.	Malheur River Basin	5 days during July-August.	Unquantifiable.Short term pulses of sediment and turbidity (lasting less than 1 hour) likely to have detrimental effects on spawning success.	Unquantifiable.Short term pulses of sediment and turbidity (lasting less than 1 hour) may delay migratory movement of adult fish.
1-7-00-F-133 Effects of Malheur National Forest's 2000 ongoing activities, North Fork Malheur sub-basin. (Multiple project action) U.S. Forest Service	12/5/00	Recreation program: providing, maintaining and monitoring 3 developed campgrounds, numerous trail heads and associated roads, and numerous dispersed campsites. Transportation program: general	North Fork Malheur sub-basin, Grant Harney, Malheur and Baker counties, Oregon.	Malheur River Basin	2000	Unquantifiable: harm and harassment along a total of 39 miles of stream reach from detrimental effects on normal behavior, spawning success, suspended sediment, substrate quality, bank stability, water temperature, and food supply.	Unquantifiable: harm and harassment along a total of 39 miles of stream reach from detrimental effects on normal behavior, migration to spawning areas, suspended sediment, substrate quality, bank stability, water temperature, and food supply.

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
		road maintenance, road closure and obliteration, drainage structure maintenance, logging out, and bridge maintenance.					
1-7-00-F-362 2000 grazing activities on North Fork Malheur River allotments, Bureau of Land Management. (Grazing action) Bureau of Land Management	8/7/00	Grazing	North Fork Malheur River, Grant, Baker and Harney counties, Oregon.	Malheur River Basin	2000	Unquantifiable: Harm and harassment from detrimental effects on suspended sediment, substrate quality, bank stability, water temperature, and food supply along a total of 5 river miles.	Unquantifiable: Harm and harassment from detrimental effects on migration to spawning areas, suspended sediment, substrate quality, bank stability, water temperature, and food supply along a total of 5 river miles.
1-4-02-F-336 Southeast Oregon Resource Management Plan. (Resource/land management plan or program) Bureau of Land Management	1/23/02	Land use plan components: Rangeland Vegetation Management; Forest and Woodlands Management; Areas of Critical Environmental Concern; Wild and Scenic	Jordan and Malheur Resource Areas of the Vale District, BLM; 6.3 million acres in Grant, Harney, and Malheur counties, Oregon. (In the action area, bull trout occur only in the North Fork	Malheur River Basin	20-year plan	N/A	Not determinable. Unable to specifically identify form or extent of impacts because specific future actions have yet to be identified, proposed or analyzed.

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
		Rivers; Land and Realty Management; Energy and Mineral Resource Development; Fire Management; Rangeland Grazing Use Management; Recreation; Off Highway Vehicles; Roads Management.	Malheur River on the Malheur Resource Area, where BLM administers 4.5 miles of migratory habitat).				
1-7-01-F-213 2001 grazing activities on North Fork Malheur River allotments, Bureau of Land Management. (Grazing action) Bureau of Land Management	5/22/01	Grazing	North Fork Malheur River, Grant, Baker and Harney counties, Oregon.	Malheur River Basin	2001	Unquantifiable: Harm and harassment from detrimental effects on suspended sediment, substrate quality, bank stability, water temperature, and food supply along a total of 6.5 river miles.	Unquantifiable: Harm and harassment from detrimental effects on migration to spawning areas, suspended sediment, substrate quality, bank stability, water temperature, and food supply along a total of 6.5 river miles.
1-17-03-F-0358 Effects of 2003-2004 trail maintenance activities for the North Fork Malheur River,	5/23/03	Trail maintenance	North Fork Malheur River, Sheep Creek, and Crane Creek, Malheur National Forest, near Prairie	Malheur River Basin	Seasonal	Unquantifiable: potential for short term sedimentation; long term effects are	Unquantifiable: potential for short term sedimentation; long term effects are not

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
Sheep Creek, and Crane Creek Trails. (Recreation action)U.S. Forest Service			City, Grant County, Oregon.			not expected.	expected.
1-9-98-FC-4 SR 970 Teanaway River Bridge protection. (Bridge work action) U.S. Army Corps of Engineers (State of Washington Department of Transportation)	9/17/98	Redirection of Teanaway River (at river mile 3.7-4.0) to its former channel.	SR 970 Bridge, Teanaway River, Kittitas County, Washington	Middle Columbia River Basin	30-days in July	N/A	Temporary sedimentation. Harassment and displacement anticipated to be short term along 1,000 feet of stream reach.
1-3-98-F-336 Ongoing activities in the Upper Tieton Watershed Project (Recreation action) U.S. Forest Service	8/14/98	Dispersed recreation including road and trail use, ORV trail use.	Upper Tieton Watershed, Naches Ranger District, Wenatchee National Forest, Yakima County, Washington	Middle Columbia River Basin	Seasonal	Harm and harassment, along a total of 0.25 mile of stream reach, from sedimentation at ORV stream crossing sites and stream bank erosion effecting redds, early life stages of fish	N/A

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
						and rearing habitat.	
01-FC-E0396 Proposed Tieton Dam Hydroelectric Project in the Yakima Basin (Hydropower action) Federal Energy Regulatory Commission Bureau of Reclamation	12/20/02	Construct and operate a 13.6 megawatt run-of-the-river hydroelectric project at the base of Tieton Dam. Hydropower operation whenever release of sufficient flow is made from Rimrock Lake impoundment for irrigation, flood control, and other water uses.	Rimrock Lake, Tieton River (at river mile 21.2), Yakima County, Washington	Middle Columbia River Basin	Construction completed by May 2004;hydropower operation occurs whenever release of sufficient flow is made from the impoundment for irrigation, flood control, and other water uses.	N/A	Unquantifiable: harm and harassment from entrainment through the outlet works and/or turbine draft tubes.
1-9-98-FC-3 Stimson Lumber Company cost share roads project. (Road work action) U.S. Forest Service	7/14/98	Road construction, reconstruction, and removal of right-of-way timber.	Le Clerc Creek, Le Clerc Creek watershed, Sullivan Lake Ranger District, Colville National Forest, Pend Oreille County, Washington.	Northeast Washington River Basins	1998-2000	Sedimentation causing degradation of spawning and rearing habitat at 33 stream crossings and along 1.25 miles of stream reach.	N/A

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
1-9-00-F-3 Stimson ANILCA access easement project. (Road work action) U.S. Forest Service	5/17/01	Construct, reconstruct and use specific roads.	LeClerc Creek Watershed, Sullivan Lake Ranger District, Colville National Forest, Pend Oreille County, Washington.	Northeast Washington River Basins	Seasonal	Sedimentation of spawning and rearing habitat at 30 stream crossings and from 18 miles of road surface.	N/A
1-9-99-F-1 Continued use and maintenance of the Stimson Lumber Company Cost-share Road 1935. (Road work action) U.S. Forest Service	6/25/99	Use and maintenance of 2.5 miles of road.	Middle Branch Le Clerc Creek, Le Clerc Creek watershed, Sullivan Lake Ranger District, Colville National Forest, Pend Oreille County, Washington.	Northeast Washington River Basins	Ongoing Maintenance: June through October Public traffic use: year-round	Sedimentation causing degradation of spawning and rearing habitat resulting in harm and harassment from sediment delivery from 2.5 miles of road adjacent to stream.	N/A
1-9-99-F-2 Le Clerc grazing allotment. (Grazing action) U.S. Forest Service	5/12/99	Grazing	Le Clerc Creek watershed, Sullivan Lake Ranger District, Colville National Forest, Pend Oreille County, Washington.	Northeast Washington River Basins	Seasonal, June through September	Sedimentation, streambank devegetation, trampling effects,and stream temperature increase causing degradation of spawning and rearing habitat and loss of eggs, fry, and alvins	N/A

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
1-7-99-F-474Trapper Creek restoration project. (Habitat restoration action) U.S. Forest Service	9/27/99	Re-route creek and construct new channel to create habitat elements more suitable for bull trout spawning and rearing.	Trapper Creek (lower reach of Trapper Creek at Odell Lake) Crescent Ranger District, Deschutes National Forest, Klamath County, Oregon.	Odell Lake Basin	10 to 20 days (construction time) during two year project time frame. Instream work May 1 to July 31 for each years' work.	Harm and harassment to 3 age classes of juvenile fish because of short term degradation of water quality and other habitat elements in an 0.8 mile of stream reach. Long term benefits.	N/A
1-3-01-F-1914 Emergency Relief for Federally Owned Roads project FS Road 2180 decommissioning. (Road work action) U.S. Forest Service	9/10/01	Decommissioning 7 miles of roads including culvert removal, road fill removal, slope stabilization and revegetation.	Dilley Creek, Sams River, Pacific Ranger District, Olympic National Forest, Jefferson County, Washington.	Olympic Peninsula	July 2002 to October 2003	Harassment resulting from minor sedimentation and turbidity along 4.5 miles of stream reach (expected to be short term). Long term benefit anticipated.	Harassment resulting from minor sedimentation and turbidity along 4.5 miles of stream reach (expected to be short term). Long term benefit anticipated.
1-3-01-F-2222 Canyon River Emergency Relief for Federally Owned Roads reconstruction project.(Road work action)	9/2001	Reconstruction of storm damaged road streamcrossing sites; culvert replacement, road fill, erosion control and	Canyon River, Hood Canal Ranger District, Olympic National Forest, Grays Harbor and Mason counties, Washington.	Olympic Peninsula	5 to 35 day work period between July and October, 2001 to 2003	Minor sedimentation and turbidity along 14 miles of stream reach (expected to be short term during fall), affecting spawning and rearing habitat.	N/A

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
U.S. Forest Service		revegetation.				Long term benefit anticipated.	
1-3-01-F-1458 Upper Dungeness Roads Project. (Road work action) U.S. Forest Service	6/25/01	Decommissioning 3.8 miles of roads, stabilizing 6.3 miles of roads, repair 10 flood damaged sites; culvert replacement or removal, road and slope fill, erosion control and revegetation.	Eddy Creek, Gold Creek, Dungeness River, Gray Wolf River, Hood Canal Ranger District, Olympic National Forest, Callam County, Washington	Olympic Peninsula	June through September, 2001 to 2003	Localized short-term, increases in turbidity and sediment. In the long-term, restoration actions are expected to improve habitat. Harm and harassment resulting from sediment affecting about 8 miles of streams.	Localized short-term, increases in turbidity and sediment. In the long-term, restoration actions are expected to improve habitat. Harm and harassment resulting from sediment affecting about 8 miles of streams.
1-3-02-F-1584 Falls Creek channel restoration and bridge replacement project. (Multiple project action) U.S. Forest Service	8/8/02	Trail bridge replacement, removal of fishway, placement of in-channel flow structures, removal of hazard trees, streambank stabilization.	Falls Creek, Pacific Ranger District, Olympic National Forest, Grays Harbor County, Washington.	Olympic Peninsula	September to October 2002	Minor sedimentation and turbidity along 1,150 feet of stream reach (expected to be short term). Long term benefit anticipated from project.	Minor sedimentation and turbidity along 1,150 feet of stream reach (expected to be short term). Long term benefit anticipated from project.

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
1-3-00-F-1155 Olympic National Park Upper Hoh Road Protection project at mile post 1.55 and 1.75. (Erosion control action) National Park Service	8/7/00	Riprap riverbank by placement of large rocks at two locations, along 250 feet at each site and 45 feet into channel, in the vicinity of river mile 32.	Hoh River, Olympic National Park, Jefferson County, Washington	Olympic Peninsula	2001-2002	Localized short-term, increases in turbidity and sediment, and effects to food supply and habitat until area stabilizes. Harm and harassment resulting from project affects to about 4 miles of stream.	Localized short-term, increases in turbidity and sediment, and effects to food supply and habitat until area stabilizes. Harm and harassment resulting from project affects to about 4 miles of stream.
1-3-99-F-742 Land exchange between Forest Service and Plum Creek Timber Company (Land exchange action) U.S. Forest Service	12/23/99	Exchange 11,556 acres of public lands for 31,705 acres of Plum Creek Timber Company lands.	Yakima River, Cle Elum, Teanaway, Little Naches, Taneum Manastash, South Fork Snoqualmie River, Green River, Carbon River, and Upper Kalama watersheds, Wenatchee, Mount Baker- Snoqualmie, and Gifford Pinchot National Forests, and land parcels in Cowlitz, King, Kittitas, Lewis, Pierce, and	Puget Sound Lower Columbia River Basin	Permanent.	Effects not determined.	Effects not determined.

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
			Skamania counties, Washington.				
1-3-02-F-1484 SR 104 Hood Canal Bridge retrofit and east half replacement project. (Bridge work action) Federal Highway Administration	5/5/03	Construction of bridge approaches, floating bridge and anchoring; pile driving and graving dock operations; demolition of old bridge and piers.	Hood Canal, Jefferson and Kitsap counties, Washington.	Puget Sound	4 years, 2003 to 2007	N/A	Harassment of migratory fish due to disruption of migratory and foraging behaviors within 300 feet of construction zone; harm to anadromous adult and sub-adult fish within 100 feet of pile driving and graving docks.
1-3-02-F-1161 State Route 522: Paradise Lake Road to Cathart Road widening and improvements. (Road work action) Federal Highway Administration	5/20/03	Roadway improvements, resurfacing and construction, placement of stormwater outfall and riprap; temporary dewatering and diversion of flow.	Daniels Creek subbasin in the Sammamish River/Issaquah Creek Basin, and Elliot, Evans and Anderson Creek subbasins in the Snohomish River/ Skykomish River Basin, Snohomish County, Washington.	Puget Sound	July to September 2004	N/A	Sedimentation along 600 feet of stream reach (expected to be short term). Temporary flow diversion and fish salvage may cause harassment to migrating individuals along 600 feet of stream reach.
1-3-03-F-1615 Haller/Nugents Bridge demolition.	5/20/03	Bridge demolition: includes bridge paint removal	Stillaguamish River, near Arlington, Snohomish County and Nooksack River	Puget Sound	July 15-31, 2003, and August 15 to September 15, 2003	N/A	Sedimentation and turbidity along 600 feet of stream reach (expected to be short

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
(Bridge work action) Federal Highway Administration		sandblasting, bridge structure and pier removal, road surface removal.	near Bellingham, Whatcom County, Washington.				term). Harassment and displacement anticipated to be short term along 600 feet of stream reach.
1-3-00-F-1442Muckleshoot Indian Tribe's White River Amphitheater project. (Land exchange action) Bureau of Indian Affairs	1/9/01	Transfer 324 acres of Tribal lands into trust status by Bureau of Indian Affairs; land uses include 217 acres for fish and wildlife management, 98 acres for development of amphitheater and related features, 9 acres for construction of Counseling Center.	Pussyfoot Creek and White River, King and Pierce counties, Washington	Puget Sound	Construction in 2002; year round use of facilities upon completion of development.	N/A	Harm and harassment associated with short to long term habitat and food supply effects along a 0.28 mile reach of stream, which will affect adult and sub-adult migratory fish
1-4-99-F-28 Ongoing actions affecting bull trout in the Panther Creek subpopulation. (Grazing action)	9/6/02	Grazing	Panther Creek watershed, Camas Creek watershed, and Pahsimeroi River to East Fork of the Salmon River watershed, Salmon Cobalt Ranger	Salmon River Basin	Seasonal, June to October.	Unquantifiable: sedimentation, nutrient loading, streambank devegetation, trampling effects.	N/A

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
U.S. Forest Service Bureau of Land Management			District, Salmon Challis National Forest, and Upper Columbia Salmon Clearwater Districts, BLM, Idaho.				
1-4-99-F-25 Two studies: (1) Monitoring the migrations of wild Snake River spring/summer chinook salmon smolts; and (2) A genetic monitoring and evaluation program for supplemented populations of chinook salmon and steelhead in the Snake River Basin. (Research action) National Marine Fisheries Service	8/6/99	Smolt migration study and parr genetics study: electrofishing, seine netting, rotary screw trapping, anesthetizing and insertion of PIT tags (passive integrated transponder tags).	Upper Salmon River drainage, Idaho. Middle Fork salmon River drainage, Idaho. South Fork Salmon River drainage, Idaho. Clearwater River drainage, Idaho. Imnaha River drainage, Oregon. Grande Ronde River drainage, Oregon. Tucannon River drainage, Washington.	Salmon River Basin. Imnaha Snake River Basins. Clearwater River Basin. Grande Ronde River Basin. Snake River Basin in Washington.	1999 through September 2003.	Possibility of injury and mortality from electrofishing, handling and temporary confinement in nets or traps; anticipated to be low in magnitude.	Possibility of injury and mortality from electrofishing, handling and temporary confinement in nets or traps; anticipated to be low in magnitude.

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
1-4-99-F-23 Ongoing actions in the Lemhi River watershed. (Grazing action) U.S. Forest Service Bureau of Land Management	9/15/99	Grazing	Hawley Creek, near the town of Leadore, Lemhi River watershed, Leadore Ranger District, Salmon-Challis National Forest, and Lemhi Resource Area, Upper Columbia Salmon Clearwater Districts of Bureau of Land Management, Idaho.	Salmon River Basin	Seasonal, July through September	Unquantifiable: sedimentation, nutrient loading, streambank devegetation, trampling effects.	N/A
1-4-99-F-22 Ongoing actions within the East Fork of the Salmon River. (Grazing action) U.S. Forest Service	8/3/99	Grazing	East Fork subwatershed, headwaters of East Fork of the Salmon River, Sawtooth National Recreation Area, Sawtooth National Forest, Idaho.	Salmon River Basin	Seasonal, June to October.	Unquantifiable: sedimentation, nutrient loading, streambank devegetation, trampling effects.	N/A
1-4-03-F-427 Clean Slate Ecosystem Management Project. (Resource/land management plan or program)	7/29/03	Watershed aquatic restoration and terrestrial vegetative community restoration:	Slate Creek drainage, Salmon River Ranger District, Nez Perce National Forest, Idaho County,	Salmon River Basin	2004-2013 Instream work confined to July 1 to August 15.	Short term harassment or disturbance of resident and migrating fluvial fish with potential for harm and	Short term harassment or disturbance of resident and migrating fluvial fish with potential for harm and harassment to eggs, fry and juvenile fish.

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
U.S. Forest Service		prescribed burning, timber harvest (2,900 acres) road stabilization and construction, riparian enhancement (planting, thinning, fertilizing), restore whitebark pine, drainage improvement.	Idaho.			harassment to eggs, fry and juvenile fish. Restoration activities are expected to lead to long term improvement of bull trout habitat conditions.	Restoration activities are expected to lead to long term improvement of bull trout habitat conditions.
1-7-00-F-336 Request for re-initiation of consultation for expanded study on marine nutrients from spawning salmon in Columbia and Snake River Basins. (Research action) National Marine Fisheries Service	6/1/00	Electrofishing and collecting by use of seining, dip netting, and angling for juvenile chinook salmon and steelhead parr from spawning and rearing areas, as well as resident fish outside of anadromous influence.	20 streams in Salmon River Basin, Idaho Multiple sites in John Day River Basin, Oregon.	Salmon River Basin John Day River	2000-2003	Possibility of injury or mortality from electrofishing, handling and temporary confinement in nets or traps.	Possibility of injury or mortality from electrofishing, handling and temporary confinement in nets or traps.

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
1-4-98-F-3 Road reconstruction and emergency watershed protection projects on Forest Development Road (FDR) 340 and 337, replacement of midvale telephone lines and road use agreement in the Lower South Fork Salmon River. (Road work action) U.S. Forest Service	7/24/98	(1) Road reconstruction of portions of FDR 340 and 337 and implementation of Emergency Watershed Protection projects; (2) Replacement of Midvale telephone lines; (3) Approval and issuance of a road use agreement with Idaho Dept of Lands to haul fuel and logs; (4) All road improvement, repair, and funding actions outlined in 3/13/98 MOA (memorandum of agreement).	South Fork Salmon River, Payette National Forest, Idaho.	Salmon River Basin	Not determined.	Sedimentation. Unquantifiable: There is the potential for a fuel spill to occur during fuel hauling and handling operations during the period of road construction.	Sedimentation. Unquantifiable: There is the potential for a fuel spill to occur during fuel hauling and handling operations during the period of road construction.
1-4-99-F-14 Federal Highway Administration and	3/30/99	Remove slide material, placement and	Salmon River, Idaho County, Idaho.	Salmon River Basin	Unknown	N/A	Negligible effects from placement of fill.

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
Idaho Transportation Department, Highway 95 Milepost 210 landslide remediation. (Landslide remediation) Federal Highway Administration		retention of fill in Salmon River, river banks and wetland for highway detour bypass lanes.					
1-4-03-F-546 The Golden Hand No. 3 and No. 4 Lode Mining Claims Proposed Plan of Operations, Idaho and Valley Counties, Idaho. (Mining action) U.S. Forest Service	4/28/03	Development of mine claims: road construction and maintenance; culverts, log-stringer bridge and geo-grid ford installations, heavy equipment use and fuel transport, drill operations, stream water withdrawal, seasonal and site reclamation.	Coin Creek, Frank Church River of No Return Wilderness, Payette National Forest, (50 miles northeast of McCall) Idaho and Valley counties, Idaho.	Salmon River Basin	June through September for 3 years.	Sedimentation, stream flow reductions, potential for chemical contamination. The action will alter primary constituent elements (PCEs) of critical habitat through mobilization and deposition of sediment and potential releases of toxic substances, but these effects are expected to be minor, localized, and short term . Harm and harassment to eggs,	Sedimentation, stream flow reductions, potential for chemical contamination. The action will alter primary constituent elements (PCEs) of critical habitat through mobilization and deposition of sediment and potential releases of toxic substances, but these effects are expected to be minor, localized, and short term. Harm and harassment to resident and migratory individuals along 300 feet of stream reach.

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
						alevins and fry along 300 feet of stream reach	
1-4-99-F-1 Ongoing actions within Upper Canyon subpopulation (of bull trout) watershed. (Grazing action) U.S. Forest Service	10/22/98	Livestock grazing	Upper Canyon Watershed, Sawtooth National Recreation Area, Sawtooth National Forest, Idaho.	Salmon River Basin	Ongoing seasonal (July to September)	Unquantifiable: sedimentation, nutrient loading, trampling effects.	Unquantifiable: sedimentation, nutrient loading, trampling effects.
1-4-99-F-16 Warren Profile Gap Road (Forest Development Road FDR #340). (Road work action) U.S. Forest Service	4/26/99	Road repair and reconstruction; bridge removal, replacement and installation; fuel hauling and storage.	Elk Creek and Pony Creek subwatersheds (near South Fork Salmon River), Payette National Forest, Valley County (northeast of the town of McCall), Idaho.	Salmon River Basin	Until construction is completed.	Sedimentation (expected to be short term). Unquantifiable adverse affect: There is the potential for a fuel spill to occur during fuel hauling, transfer and storage operations during the period of road/bridge construction.	Sedimentation (expected to be short term). Unquantifiable adverse affect: There is the potential for a fuel spill to occur during fuel hauling, transfer and storage operations during the period of road/bridge construction.

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
1-4-99-F-4 Ongoing actions within the Sawtooth Valley subpopulation (of bull trout) watershed. (Multiple project action) U.S. Forest Service	12/15/98	Water diversion (for irrigation). Rough fish barrier. Campground (maintenance and recreational use).	Sawtooth Valley Watershed, Sawtooth National Recreation Area, Sawtooth National Forest, Idaho.	Salmon River Basin	Seasonal (irrigation). Permanent barrier. Duration of recreational activities and recreational facilities maintenance actions may be short term and seasonal (May to September)	Unquantifiable: Harm and harassment caused by in-stream flow reductions, diversion entrainment and entrapment, barrier to fish passage, effects from recreational activities.	Unquantifiable: Harm and harassment caused by barrier to fish passage.
1-4-03-F-776 East Fork John Day culvert replacement project, Idaho County. (Habitat restoration) Bureau of Land Management	7/16/03	At stream mile 0.45, replace the existing round culvert with an open bottom arch culvert; construct instream fish habitat improvement structures (stone weirs) and place wood debris; includes project site temporary dewatering, and	East Fork John Day Creek in Lower Salmon River subbasin, Upper Columbia Salmon Clearwater District, Bureau of Land Management, Idaho County, Idaho.	Salmon River Basin	July 1-August 15	Harm and harassment from instream work of limited duration, short term disturbance to water quality and habitat, and any capture, handling and relocation activity along a 300 feet of stream reach.	Harm and harassment from instream work of limited duration, short term disturbance to water quality and habitat, and any capture, handling and relocation activity along a 300 feet of stream reach.

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
		the capture and relocation of fish from project site.					
1-4-99-F-13 Ongoing and proposed actions in the west-half South Fork Boise River. (Mining action) U.S. Forest Service	4/15/99	Mining (placer)	South Fork Boise River Watershed, Mountain Home Ranger Distrcit, Boise National Forest, Idaho.	Southwest Idaho River Basins	Ongoing (seasonal, July through October)	Unquantifiable: sedimentation.	N/A
1-4-99-F-15 Ongoing and proposed actions within the Bear Valley subpopulation (of bull trout) watershed. (Grazing action) U.S. Forest Service	4/30/99	Livestock grazing	Bear Valley watershed, Lowman Ranger District, Boise National Forest, Idaho.	Southwest Idaho River Basins	Ongoing (seasonal, July to October)	Unquantifiable: sedimentation, nutrient loading, streambank devegetation, trampling effects.	Unquantifiable: sedimentation, nutrient loading, streambank devegetation, trampling effects.
1-4-98-F-1	10/15/99	Operation and	Snake River and its	Southwest	Ongoing	N/A	Entrainment through or

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
Bureau of Reclamation operations and maintenance activities in the Snake River Basin upstream of Lower Granite Dam Reservoir. (Hydropower action) Bureau of Reclamation		maintenance of dams.	tributaries in Idaho and Oregon.	Idaho River Basins Clearwater River BasinMalheur River Basin			over dams. Migration delays or barriers. Harm to at least 7 percent of the population at each reservoir by entrainment through dams at Arrowrock, Anderson Ranch, Beulah Reservoir and other BR facilities is anticipated to occur.
1-4-03-F-526 Revision of Land and Resource Management Plans for the Boise, Payette, and Sawtooth National Forests. (Resource/land management plan or program) U.S. Forest Service	5/30/03	Land use plan : Rangeland Resource Management; Recreation Resource Management; Soil, Water, Riparian, Aquatic Resource Management; Timber and Vegetation Resource Management; Land and Special Uses; Facilities and Roads; Fire Management;	Boise, Payette, and Sawtooth National Forests, Idaho.	Southwest Idaho River Basins Salmon River Basin Hells Canyon Complex Imnaha Snake River Basins	10- to 15-year plan.	Not determinable. Unable to specifically identify form or extent of impacts because specific future actions have yet to be identified, proposed or analyzed.	Not determinable. Unable to specifically identify form or extent of impacts because specific future actions have yet to be identified, proposed or analyzed.

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
		Minerals Managemnt; Non-native Plant Management and Chemical Use; Watershed restoration.					
1-4-99-F-17 Ongoing and proposed actions within the Lower Boise River subpopulation (of bull trout) watershed. (Multiple project action) U.S. Forest Service	6/9/99	Grazing. Road reconstruction.	Rattlesnake Creek, Lower Boise River watershed, Mountain Home Ranger District, Boise National Forest, Idaho.	Southwest Idaho River Basins	Seasonal (grazing), May through October). June through August (road construction).	Unquantifiable (effects of grazing): sedimentation, nutrient loading, streambank devegetation, trampling effects. Sedimentation (expected to be short term effects from road construction).	N/A
1-4-01-F-0376 Atlanta Power Station Hydroelectric Project License Application. (Hydropower action) Federal Energy Regulatory Commission	8/2001	Proposed licensing of Atlanta Power Station Hydroelectric Project (includes, construction, and operation of fish screen at power house intake and downstream fish passage facility).	Kirby Dam on Middle Fork Boise River, near Atlanta, Elmore County, Idaho.	Southwest Idaho River Basins	License ongoing hydroelcetric power generation for a period of 50 years; (operation of fishway is April 15 to August 15 each year)	N/A	Possible delay of upstream and downstream migration. Individual fish may be injured going over spillway; juvenile fish may be impinged and injured at fish screen.

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
1-4-99-F-5 Ongoing actions in the Weiser River watershed. (Multiple project action) U.S. Forest Service	5/5/99	Landscape vegetation management (timber harvest, skid trail construction, prescribed fire, silvicultural treatments, skid trail obliteration, site rehabilitation, road removal and obliteration, road reconstruction, culvert replacement). Irrigation ditch operation and maintenance (water diversion, install fish screens, ditch cleaning, install temporary weirs). Fish surveys (snorkeling, trapping, electrofishing). Livestock grazing.	Weiser River watershed, Payette National Forest, Idaho.	Southwest Idaho River Basins	Post timber sale activities are planned to continue until 2005. Seasonal (spring through fall) operation of ditch. Seasonal (spring through fall) grazing. Fish surveys (through December 31, 2000).	Sedimentation, altered stream temperatures, reduced amount of woody debris (all expected to be short term effects caused by disturbance of spawning and rearing habitat) along 12 miles of stream reach. Diversion entrainment and entrapment (minimized by fish screens). Possibility of injury and mortality from electrofishing and handling.Trampling of redds and streambanks.	N/A

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
1-4-99-F-12 Proposed and ongoing actions (46 ongoing actions) within the South Fork Boise River Watershed. (Multiple project action) U.S. Forest Service	3/10/99	Livestock grazing, water diversions related to irrigation for livestock grazing and corral sites. Mining. Stream and fish habitat survey & monitoring.	South Fork Boise River Watershed, Fairfield Ranger District, Sawtooth National Forest, Idaho.	Southwest Idaho River Basins	Ongoing (some seasonal or intermittent)	Unquantifiable: sedimentation, nutrient loading, streambank devegetation, trampling effects; diversion entrainment and entrapment; possibility of injury and mortality from electrofishing and handling.	Unquantifiable: sedimentation, nutrient loading, streambank devegetation, trampling effects; diversion entrainment and entrapment; possibility of injury and mortality from electrofishing and handling.
1-7-98-F-375 Private access to South Fork Walla Walla Road. (Instream crossing for vehicles) Bureau of Land Management	12/11/98	Seven crossing locations for vehicles along a 2.5 mile reach of river. Each access ford crosses an 80 to 100 foot width of river.	South Fork Walla Walla Road, South Fork of the Walla Walla River (2.5 mile reach above Harris Park), Umatilla County, Oregon.	Umatilla-Walla Walla River Basins	July 1 to August 15 (vehicular access permitted in and across river only during this time period).	Unquantifiable: harm and harassment from intermittent vehicular use (driving across river) causing disturbance to stream substrate, stream bank and riparian habitat, and potential introduction of contaminants, which directly or indirectly affect fish along a 2.5 mile reach of river.	Unquantifiable: harm and harassment from intermittent vehicular use (driving across river) causing disturbance to stream substrate, stream bank and riparian habitat, and potential introduction of contaminants, which directly or indirectly affect fish along a 2.5 mile reach of river.
1-9-01-F-255		Stream restoration	Walla Walla River,	Umatilla-Walla	July through		Short term turbidity and

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
Milton Freewater 1135 setback levee project. (Habitat restoration action) U.S. Army Corps of Engineers	5/7/01	including removal of riprap, car bodies and manmade debris along 1,200 feet of riverbank.	near town of Milton Freewater, Umatilla County, Oregon.	Walla River Basins	October	N/A	sedimentation; in the long term, stream restoration is expected to have beneficial effects along 1,200 feet of stream reach.
1-7-00-F-711 McKay Creek Bridge scour repair project. (Bridge work action) Federal Highway Administration	12/1/00	Excavating streambed, place riprap, temporary cofferdam for dewatering of excavation area.	McKay Creek (at US Hwy 395), Pendleton, Umatilla County, Oregon.	Umatilla-Walla Walla River Basins	November to March	N/A	Harm and harassment caused by short term turbidity and sedimentation, disruption of habitat at project site by instream equipment work, and displacement of individual fish.
1-9-98-FC-005 Animal and Plant Health Inspection Service squawfish removal program at Rock Island and Rocky Reach Dams. (Fishery management/predator control action) U.S. Department of Agriculture,	6/29/98	Removal of northern squawfish by angling.	Rock Island and Rocky Reach Dams on Columbia River, Douglas and Chelan counties, Washington.	Upper Columbia River Basin	May through October	N/A	Potential for catching bull trout by angling causing harm or mortality; not expected to exceed 6 and 2 fish respectively per year.

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
Animal and Plant Health Inspection Service							
1-3-99-F-1321 (through 1323) Special use permits for proposed ditch and water diversion projects. (Water diversion/irrigation action) U.S. Forest Service	9/29/99	Continued use and associated maintenance of five water diversions and ditches for water conveyance across National Forest lands to individuals who hold valid water rights.	Twisp, Wolf and Chewuch River watersheds on the Methow Valley Ranger District, Okanogan National Forest, Okanogan County, Washington	Upper Columbia River Basin	Seasonal to year-round use.	Harm and harassment due to unscreened ditch diverting fish and removing present and future adult reproduction, as well as causing direct mortality; also water diversions affecting peak and base flows in about 23 miles of stream affecting fluvial, adfluvial and resident fish.	Harm and harassment due to unscreened ditch diverting fish and removing present and future adult reproduction, as well as causing direct mortality of fluvial fish; also water diversions affect peak and base flows in about 23 miles of stream, which adversely effects fluvial and adfluvial fish.
1-3-98-F-406 Early Winter Stream Habitat Restoration Project (Habitat restoration action) U.S. Forest Service	9/28/98	Instream and riparian habitat restoration: placement of instream large woody debris and boulder structures, streambed channel and pool excavation, streambank terracing, planting	Early Winters Creek and Early Winters Creek watershed (within the Upper Methow River watershed), Methow Valley Ranger District, Okanogan National Forest, Okanogan County, Washington	Upper Columbia River Basin	10 days during low flow season.	Harm and harassment from heavy equipment working in stream channel for 10 days; short term degradation of food supply and water quality, sedimentation in about 0.5 mile of stream.	Harm and harassment from heavy equipment working in stream channel for 10 days; short term degradation of food supply and water quality, sedimentation in about 0.5 mile of stream.

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
		native vegetation.					
1-7-00-F-106 Proposed water temperature control project at Cougar Dam in the McKenzie River sub-basin. (Hydropower action) U.S. Army Corps of Engineers	3/8/00	Modify the Cougar Dam intake structure to provide control of the water temperature of the outflow.	Cougar Dam, South Fork of the McKenzie River, Lane County, Oregon.	Willamette River Basin	Construction during April through October for 3 years, 2000-2003	Unquantifiable: Harm and harassment from short term decreased water quality, reduced flows, entrainment, migration delays; and from the capture and handling of individual fish.	Unquantifiable: Harm and harassment from short term decreased water quality, reduced flows, entrainment, migration delays; and from the capture and handling of individual fish.
1-7-03-F-0019 Willamette National Forest Salmon Creek levee reconstruction project. (Levee repair action) U.S. Forest Service	6/5/03	Repair 2,050 feet of flood damaged levee: stream diversion and dewatering at 5 sites along levee, excavation and placement of fill, and construction of fish habitat enhancement rock structures.	Salmon Creek, Oakridge, Lane County, Oregon.	Willamette River Basin	July to August 2003	N/A	Harm and harassment caused by short term turbidity and sedimentation, and instream equipment work.
1-7-00-F-068 Ongoing Forest Service and Bureau of Land Management Activities within the	4/14/00	Road maintenance. Aquatic habitat restoration.	McKenzie River and Middle Fork Willamette River, Willamette National Forest, and BLM	Willamette River Basin Hood River Basin	2000	Harassment from short term detrimental effects on suspended sediment, substrate	Harassment from short term detrimental effects on suspended sediment, substrate quality, bank stability, water

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
Willamette and a portion of the Deschutes Provinces. (Multiple project action) U.S. Forest Service Bureau of Land Management		Trail maintenance and construction. Repair storm damaged roads. Road decommissioning and obliteration. Instream surveys. Pump chances.Water withdrawal permits. Use of haul roads from rock quarries. Boat ramp use. Public use of developed sites and dispersed use.	Eugene District, Oregon. Hood River, Mt. Hood National Forest, Oregon.			quality, bank stability, water temperature, and food supply. Unquantifiable beneficial effects from management actions.	temperature, and food supply. Unquantifiable beneficial effects from management actions.
1-7-99-F-500 Proposed issuance of original hydropower license for McKenzie Hydroelectric Project	11/22/99	Operation of run-of-river hydroelectric dam project including installation of fish	McKenzie River (at river mile 73.5) near McKenzie Bridge, Lane County, Oregon.	Willamette River Basin	50 year license for project operation. Up to 18 months	N/A	Unquantifiable: Harm and harassment of fish from entrainment into turbines prior to construction of fish

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
(FERC No. 11512), Oregon. (Hydropower action) Federal Energy Regulatory Commission		screen and bypass, adult fish barrier in tailrace, annual removal of sediment at headgate.			for installation of fish screens and bypass.		screens, migration delays for upstream migrating fish, sediment and temperature effects, and operation of new fish passage facility.
1-7-99-F-431 Ongoing Forest Service and Bureau of Land Management Activities within the Willamette and a portion of the Deschutes Provinces. (Multiple project action) U.S. Forest Service Bureau of Land Management	5/12/99	Road maintenance. Aquatic habitat restoration. Trail maintenance and construction. Repair storm damaged roads. Road decommissioning and obliteration. Instream surveys. Pump chances. Water withdrawal permits. Use of haul roads	McKenzie River and Middle Fork Willamette River, Willamette National Forest, and BLM Eugene District, Oregon. Hood River, Mt. Hood National Forest, Oregon.	Willamette River Basin Hood River Basin	1999	Harassment from short term detrimental effects on suspended sediment, substrate quality, bank stability, water temperature, and food supply. Unquantifiable beneficial effects from management actions.	Harassment from short term detrimental effects on suspended sediment, substrate quality, bank stability, water temperature, and food supply. Unquantifiable beneficial effects from management actions.

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
		from rock quarries. Boat ramp use. Public use of developed sites and dispersed use.					
1-7-02-F-279 Ongoing Forest Service and Bureau of Land Management Activities within the Willamette and a portion of the Deschutes Provinces. (Multiple project action) U.S. Forest Service Bureau of Land Management	5/8/02	Road maintenance. Aquatic habitat restoration. Trail maintenance and construction. Repair storm damaged roads. Road decommissioning and obliteration. Instream surveys. Pump chances. Water withdrawal permits. Use of haul roads	Columbia River in Columbia River Gorge National Scenic Area, Oregon. McKenzie River and Middle Fork Willamette River, Willamette National Forest, and BLM Eugene District, Oregon. Hood River, Mt. Hood National Forest, Oregon.	Willamette River Basin. Hood River Basin.	2002	Harassment from short term detrimental effects on suspended sediment, substrate quality, bank stability, water temperature, and food supply. Unquantifiable beneficial effects from management actions.	Harassment from short term detrimental effects on suspended sediment, substrate quality, bank stability, water temperature, and food supply. Unquantifiable beneficial effects from management actions.

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
		from rock quarries. Boat ramp use. Public use of developed sites and dispersed use.					
1-7-02-F-484 Staley, Upper Liz, Tumbler, and Happy Bird timber sales. (Timber sale/harvest action) U.S. Forest Service	5/7/02	675 acre timber sale for shelterwood harvest, seed trees with reserves harvest, commercial thinning; includes construction of temporary roads, and moderate-level road reconstruction, hydrologic closure of roads.	Upper Middle Fork Willamette watershed, Willamette National Forest, Oregon.	Willamette River Basin	July-August	N/A	Due to elevation and distance away from bull trout habitat, project effects are negligible.
1-7-99-F-423 Simco, Staley, Upper Liz, Tumbler and Happy Bird timber sales in the Upper Fork of the Willamette.	9/23/99	1,116 acre timber sale and harvest including regeneration cut (shelterwood and seedtree), thinning; includes construction	Upper Fork of the Willamette River, Middle Fork Ranger District, Willamette National Forest, Oregon.	Willamette River Basin	1999, July-August road work.	Harm and harassment from short term detrimental effects on suspended sediment levels, substrate quality, bank stability, water	Harm and harassment from short term detrimental effects on suspended sediment levels, substrate quality, bank stability, water temperature, and food

Action Includes biological opinion/consultation file number (if any), name of the action, general category of the action, and the Federal action agency(s).	**Date Issued**	**Type of Action**	**Location**	**Draft Recovery Unit(s)**	**Duration of Action**	**Anticipated Effects** (N/A = not applicable to this habitat because the action did not occur in a migratory corridor or a spawning stream)	
						Spawning Streams	**Migratory Corridors**
(Timber sale/harvest action) U.S. Forest Service		and/or reconstruction of 98 miles of roads, and 9 miles of road closure.				temperature, and food supply.	supply.
1-7-98-F-356 Middle Fork Willamette River, Upper South Fork McKenzie, and Roaring River Aquatic Restoration projects, Lane County, Oregon. (Habitat restoration action) U.S. Forest Service	8/24/98	Placement of large woody material (logs, single pieces and multiple complexes) into tributaries and side channels, culvert treatment for fish passage, riparian silviculture treatment (thinning overstocked stands, riparian zone conifer planting)	Middle Fork Willamette River and 6 tributaries (Windfall, Gold, Pine, Estep, Snake, and Young Creeks), Roaring River, South Fork McKenzie River, Middle Fork Ranger District, Willamette National Forest, Lane County, Oregon.	Willamette River Basin	August - September 1998 and July-August 1999.	Unquantifiable: harassment along a total of 34 miles of stream reach from short term detrimental effects on suspended sediment, substrate quality, bank stability, water temperature, and food supply. Long term benefit contributing to bull trout recovery, along a total of 34 miles of stream reach.	Unquantifiable: harassment along a total of 34 miles of stream reach from short term detrimental effects on suspended sediment, substrate quality, bank stability, water temperature, and food supply. Long term benefit contributing to bull trout recovery, along a total of 34 miles of stream reach.

Appendix D: Consolidation of Bull Trout Core Areas on the Lower Clark Fork River

United States Department of the Interior

FISH AND WILDLIFE SERVICE
MONTANA FIELD OFFICE
100 N. PARK, SUITE 320
HELENA, MONTANA 59601
PHONE (406) 449-5225, FAX (406) 449-5339

July 14, 2006

MEMORANDUM

To: Assistant Regional Director, Ecological Services, Region 1, Portland, OR
(Attn: Larry Salata, Daniel Brown, Sarah Hall, Patrick Sousa)

From: Field Supervisor, Montana Ecological Services Field Office, Helena, MT R. Mark Wilson

Subject: Consolidation of bull trout core areas on the Lower Clark Fork River

After thoughtful consideration, Region 6 has decided to consolidate several bull trout core areas in the Lower Clark Fork River drainage. At the time the Draft Bull Trout Recovery Plan was developed (circa 2001), four core areas (Clark Fork River Section 3 upstream of Thompson Falls Dam, Lower Flathead River, Noxon Reservoir, and Cabinet Gorge Reservoir) that were artificially fragmented by the presence of Cabinet Gorge, Noxon Rapids, and Thompson Falls Dams were identified as representative of the existing condition. The Bull Trout Recovery Unit Team (RUT) for that area felt that due to habitat limitations bull trout populations in those core areas could not persist in isolation. As a result, the Draft Bull Trout Recovery Plan specifically identified restoration of connectivity as one of the recovery criteria and the Plan treated the unified core area (termed the Lower Clark Fork River Complex) as a single unit for purposes of determining recovered abundance (see Table 3 on page 131 in the Draft Bull Trout Recovery Plan - Chapter 3).

In the past five years the Avista Fish Passage / Native Salmonid Restoration Program, mandated by the 1999 FERC settlement for Cabinet Gorge and Noxon Rapids Dams, has made major progress in reconnecting upstream bull trout passage. They have developed a trap and haul operation with to pass adult bull trout over the dams and use genetic assignments to determine the proper upstream locations for release. Through this program they have documented successful passage of 174 adult bull trout upstream (total for 2001-2005; between 29 and 42 annually). Significantly, some of those bull trout that were passed upstream over Cabinet Gorge and Noxon Dams have been documented successfully spawning in tributary streams, through the use of radio telemetry. While the numbers of bull trout successfully passed may not seem meaningful, due to the fecundity of these large adfluvial fish (i.e., each female carrying several thousand eggs) each fish potentially makes a substantial genetic contribution to the reconnected population. A total of 1,249 juvenile bull trout (between 87 -416 annually), were also captured in 2001-2005 from Montana tributaries and either transported downstream (to the Clark Fork River in Idaho downstream of Cabinet Gorge Dam) or tagged and allowed to volitionally migrate. In 2006, one of those fish PIT tagged as a juvenile was recaptured as an adult at the base of the dam.

As a result of a lawsuit, the Service's 2003 Rock Creek Mine biological opinion was remanded back to us for further consideration (Rock Creek is a small tributary to Cabinet Gorge Reservoir which contains a local population of bull trout). The combination of further scrutiny mandated by the court decision along with the updated analysis presented in the remanded biological opinion, have resulted in a reevalution of whether the improved connectivity resulting from AVISTA Corporation's fish passage programs at Noxon and Cabinet Gorge dams is now sufficient, in concert with other actions, to consider these fragmented core areas functionally restored to their historically interconnected status. We have determined that doing so is consistent with the best available science and is a natural progression down the path set forth in the Draft Bull Trout Recovery Plan.

Specifically, the Draft Recovery Plan states: "**Lower Clark Fork River** (includes four currently fragmented population segments: Lower Flathead River, Thompson Falls Reservoir, Noxon Reservoir, and Cabinet Gorge Reservoir; these segments are currently treated as separate core areas). Note that these core areas were historically connected and must be functionally rejoined under recovered conditions." In treating the Lower Clark Fork as a single core area in the future, the collective number of local populations currently identified is raised to 14 (7 in the lower Flathead; 2 in the Thompson River; 3 in Noxon Reservoir; and 2 in Cabinet Gorge Reservoir), and the likelihood of meeting recovery goals for abundance and distribution are increased.

A natural progression or continuation of this approach will eventually incorporate the Lower Clark Fork core area into Lake Pend Oreille, fully restoring the natural configuration. However, at this time fish passage is primarily limited to trap and haul at Cabinet Gorge Dam and the majority of fish spawning in the four former core areas are still fluvial or adfluvial fish that reside in the reservoirs. In recent years, approximately 100 bull trout redds have been identified annually in the consolidated Lower Clark Fork core area, with up to 15-20% of those redds likely constructed from fish that were passed over the dams. In balance, the fish passage program is now making substantial contributions annually to genetic connectivity. However, full numerical contributions to two-way connectivity with Lake Pend Oreille will not be realized until Cabinet Gorge passage is fully developed and additional passage is implemented at the upstream dams (Noxon Rapids and Thompson Falls) in the next few years. The Avista program is continuing to evolve and expanded passage at Thompson Falls is anticipated through similar cooperative efforts of PPL Montana.

We also anticipate that, in the near future, the removal of Milltown Dam near Missoula (currently scheduled for the spring of 2008 as a result of Superfund cleanup) will result in a similar consolidation of core areas in the upper portion of the Clark Fork River.

It is important for the Regional Office to recognize that identification of bull trout core areas will continue to be an iterative and dynamic process as barrier removal progresses and studies across the range continue to improve our understanding of migratory connectivity. For that reason, the Bull Trout Recovery Program leaders should keep an accurate accounting of these changes as they are proposed by the field in order to oversee consistency in this approach.

Please contact Wade Fredenburg of my staff at 406/758-6872, if you have any questions pertaining to this matter.

Appendix E: Guidance on Application of the Destruction or Adverse Modification Standard Under Section 7(A)(2) of the Endangered Species Act.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Washington, D.C. 20240

In Reply Refer To:
FWS/AES/DCHRS/019634

December 9, 2004

Memorandum

To: Regional Directors, Regions 1, 2, 3, 4, 5, 6, and 7
Manager, California-Nevada Operations Office

From: Acting Director

Subject: Application of the "Destruction or Adverse Modification" Standard under Section 7(a)(2) of the Endangered Species Act

Recent litigation has focused on the regulatory standard for determining whether proposed Federal agency actions are likely to result in the "destruction or adverse modification" of designated critical habitat under Section 7(a)(2) of the Endangered Species Act (ESA). On August 6, 2004, the Ninth Circuit Court of Appeals rendered a decision in *Gifford Pinchot Task Force v. U.S. Fish and Wildlife Service*, No. 03-35279, finding that the Service's regulatory definition of "destruction or adverse modification" of critical habitat, at 50 C.F.R. § 402.02, is contrary to law. Previous Federal court rulings have reached similar conclusions (see *Sierra Club v. U.S. Fish and Wildlife Service*, 245 F.3d 434 (5th Cir. 2001) (held regulation to be facially invalid); *American Motorcycle Ass'n District 37 v. Norton*, Civ. No. C03-0209-S.I. (N.D. Cal., Aug. 3, 2004) (California Desert Conservation Area case)). Due to the strategic importance of the 9th Circuit ruling, the potential effects of the ruling on recent and prospective biological opinions, and the need for interim measures to be in place while the Department proceeds with a proposed rulemaking early next year that addresses this ruling, the following guidance is provided to Service biologists conducting Section 7 consultations pending the adoption of any new regulatory definition of "destruction or adverse modification."

Destruction or adverse modification determinations will be made using the analytical framework described below. First, however, I (along with our counsel in the Solicitor's Office) want to emphasize that when we conduct a Section 7 consultation that involves the evaluation of whether a Federal agency action is likely to destroy or adversely modify designated critical habitat, we do **not** cite to or use the regulatory definition of "destruction or adverse modification" at any point in the consultation process. In fact, our biological opinion should state explicitly that we do not rely on this regulatory definition, using this language:

> "This biological opinion does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 C.F.R. 402.02. Instead, we have relied upon the statutory provisions of the ESA to complete the following analysis with respect to critical habitat."

TAKE PRIDE IN AMERICA

Analytical Framework for Adverse Modification Determinations

Until we have promulgated a new regulatory definition of "destruction or adverse modification," our evaluation of effects to proposed or designated critical habitat should consider the statutory concepts embodied in Sections 3 (the definitions of "critical habitat" and "conservation"), 4 (the procedures for delineating and adjusting areas included in a designation), and 7 (the substantive standard in paragraph (a)(2) and the procedures in paragraph (b)). The analytical framework described here will guide Service biologists in applying these considerations in Section 7(a)(2) consultations on Federal actions that may affect designated critical habitat, and to Section 7(a)(4) conferences on proposed critical habitat, when conference is requested by the Federal action agency. The following framework is intended to be applied as a whole since the individual parts have no meaning outside of the context of this guidance.

1. In the "Status of the Species/Critical Habitat" analysis in the biological opinion, discuss the entire designated critical habitat area in terms of the biological and physical features that are essential to the conservation (discussion of "survival" in this and other sections of the adverse modification analysis is not appropriate) of the species. This analysis should identify and discuss the primary constituent elements of the critical habitat (as described in the final rule) and, very importantly, the current condition, the factors responsible for that condition, and the conservation role of individual critical habitat units.

   Many critical habitat designations pre-date the requirement for identification of primary constituent elements that are essential for the conservation of the listed species. In consultations on actions that involve this type of critical habitat, the best available scientific and commercial data should be used to determine and document these elements or habitat qualities.

2. In the "Environmental Baseline" analysis, discuss the current condition of the critical habitat unit(s) in the action area, the factors responsible for that condition, and the conservation roles of the unit(s), with appropriate supporting documentation. In particular, discuss the relationship of the affected unit(s) in the action area to the entire designated or proposed critical habitat with respect to the conservation of the listed species, unless the proposed or final rule designating critical habitat has already clearly done so.

   Based on the results of this analysis, we will have a clear and credible basis for determining the significance of any adverse or beneficial effects of the action (and cumulative effects) on the function and conservation role of the affected unit(s).

3. In the "Effects of the Action" analysis, characterize the direct and indirect effects of the action and those of interrelated and interdependent actions on the proposed or designated critical habitat. Describe how the primary constituent elements or habitat qualities essential to the conservation of the species are likely to be affected and, in turn, how that will influence the function and conservation role of the affected critical habitat unit(s). This part of the analysis should focus exclusively on the effects to critical habitat. Conservation activities (e.g., management, mitigation, etc.) outside of critical habitat should not be

considered when evaluating effects to critical habitat. Based on the analyses under (1) and (2) above, discuss the significance of anticipated effects to critical habitat.

4. In the "Cumulative Effects" analysis, characterize the effects of future, non-Federal actions reasonably certain to occur in the action area in terms of how the primary constituent elements or habitat qualities essential to the conservation of the species are likely to be affected and, in turn, how that will influence the function and conservation role of the affected critical habitat unit(s). Based on the analyses under (1) and (2) above, discuss the significance of these anticipated effects to critical habitat.

5. In the "Conclusion" section, following the standard text, present the reasons why we reached our 7(a)(2) conclusion. Discuss whether, with implementation of the proposed Federal action, critical habitat would remain functional (or retain the current ability for the primary constituent elements to be functionally established) to serve the intended conservation role for the species, based on the analyses under (1) **through** (4) above.

Reevaluation of Existing Biological Opinions

Over the next few months Federal action agencies are likely to examine, in the context of the 9th Circuit ruling in *Gifford Pinchot*, consultations that have been completed on a variety of Federal actions. The Solicitor's Office has advised us that this review should not be premised on the theory that the ruling has necessarily invalidated all existing opinions. We recognize, however, that these reviews may result in a number of requests for reinitiation of formal consultation to examine more closely "no destruction or adverse modification" conclusions. This analytical framework should be used in any reinitiated consultations. Please work with the action agencies to give the appropriate priority to any reinitiated consultations, in light of other consultations with these agencies and your available resources.

This guidance is provided to enhance national consistency in the conduct of Section 7 consultations (and conferences) where effects to designated (and proposed) critical habitat are being evaluated, in light of recent Court decisions; it does not set forth binding legal interpretations. This guidance will be in effect until a new regulation has been adopted or revised guidance issued. Please contact Patrick Leonard, Chief, Division of Consultation, Habitat Conservation Planning, Recovery, and State Grants, at (703) 358-2171 if you have any questions.

Appendix F: Effects of Actions That Have Undergone Section 7 Consultation for Bull Trout under the Endangered Species in the Clark Fork River Management Unit (August 2003-July 2006)

Effects of actions that have undergone section 7 consultation for bull trout under the Endangered Species Act in the Clark Fork River Management Unit (August 2003-July2006).

Core Area (Local Populations)	Action Agency Consultation Type	Date Issued	Type of Action	Duration of Action/Take	Frequency	Effect	Type	Surrogate	Comments	Long Term Beneficial Effect
Clark Fork Section 2 (Rattlesnake Petty Fish Trout Cedar Creeks, St. Regis River)	Frenchtown Face FS, Individual Project	4/4/05	Forest Management (timber harvest roads, culverts, rehab mine site)	2005 to 2010	Frequent	Sediment, competition	Egg, Larval, Juvenile, Adult	36 miles	Ninemile Rock, Bulter, McCormick, Stony, Sixmile Long term sediment reduction and improved fish passage	X
	Lookout Pass	10/21/04	FHWA	2 months		Sediment			Long Term Loss of LWD	X
	Chunky Monkey, FS, Individual Project	12/29/04	Mining	2005 to 2006	Frequent	Sediment, reduction in habitat complexity	Egg, Larval, Juvenile,	2 miles	Ward Creek (trib to St. Regis	
	Milltown Reservoir EPA, Fish and Wildlife Service, Batched (Milltown and Stimson dams)	12/16/04	Dam Removal	2004 to 2010	Frequent	Mechanical, stranding, sediment, water quality	Juvenile, Adult	1.4 Blackfoot, 4.5 miles Clark Fork	Main stem Clark Fork and Blackfoot Significant long term beneficial	X
	Big Creek Rehabilitation and Stimson Land Access, FS, Individual Project	02/12/04	Access for PVT Forest Management and FS roads, culverts, rehab work)	2004 to unknown PVT) 2004-2006(FS)	Frequent	Sediment,	Egg, Larval, Juvenile, Adult	Big, West Fork Big Creek	Trib to St. Regis River long term improvement on FS lands	X
	Savenac Creek	8/13/03	Bank	2003 to	Frequent	Sediment	Juvenile,	Low amount	Savenac, St	X

Core Area (Local Populations)		Action Agency Consultation Type	Date Issued	Type of Action	Duration of Action/Take	Frequency	Effect	Type	Surrogate	Comments	Long Term Beneficial Effect
		Rehabilitation Maintenance, FS, Individual Project		Stabilization	ongoing			Adult	unquantifiable	Regis long term improvement 50-75 feet of stream bank restoration	
		Big Flat and Frenchtown Irrigation Diversions, BOR Individual Project	7/7/03	Irrigation entrainment	2003 to ongoing	Continuous (while in operation (April to Octuber	Entrainment	Juvenile, Adult	Unquantifiable	Clark Fork and Bitterroot Rivers Do to staffing storages FWS has not responded to request to discontinue measures described on the Take Statement	
		Operation Maintenance and Expansion of Snowbowl Ski Area including Road and Parking Improvements FS, Individual Project	4/28/03	Road and parking lots, ski runs	2003 to ongoing	Frequent	Sediment	Egg, Larval, Juvenile,	Butler Creek		
Lower Clark Fork Core Area	**Lower Flathead River (Post, Mission, Dry, South Fork Middle**	Jocko River Stream Restoration BIA S 10 permit	8/2/04	Habitat restoration	2004 to ongoing	Frequent	Sediment, mechanical	Egg, Larval, Juvenile, Adult		Long term improvement Low risk of take do to low density of BT	X
		FHWA Evaro to Polson HWY 93	3/5/04								X

Core Area (Local Populations)		Action Agency Consultation Type	Date Issued	Type of Action	Duration of Action/Take	Frequency	Effect	Type	Surrogate	Comments	Long Term Beneficial Effect
	Fork North Fork, Jocko River)										
	Clark Fork Section 3 (Fishtrap, West Fork Fishtrap, Creeks)	Fishtrap FS, Individual Project	10/7/05	Forest Management (timber harvest, road and culvert)	2007 to2009	Frequent	Sediment	Egg, Larval, Juvenile, Adult	7 miles Fishtrap Creek, 5 miles West Fork Fishtrap Creek	Short term adverse Long term sediment reduction and improved fish passage	X
	Noxon (Prospect, Graves, Vermillion River)	Vermillion Suction Dredge FS, Individual Project	8/13/03	Mining	2003 to 2007	Frequent	Entrainment degradation of aquatic habitat, sediment	Egg, Larval, Juvenile, Adult	Unquantifiable	low level of take due to low level of activity	
		Thomson Falls 10a1a	4/13/04	FERC, PPL	04-06		Harm and Harass (Electrofishig , trapping)	Adults		Research for passing fish (tailrace studies). Information used to pass fish in future	X
	Cabinet Gorge (Rock Creek Bull River	Kootenai Idaho panhandle and Lolo NF Land and Resource Management Plans Amendment for Motorized Access Management within the Selkirk and Cabinet-Yaak	2/9/04	Roads						No take issued to date for project conducted under this programmatic consultation	X

Core Area (Local Populations)	Action Agency Consultation Type	Date Issued	Type of Action	Duration of Action/Take	Frequency	Effect	Type	Surrogate	Comments	Long Term Beneficial Effect
	Grizzly Bear Recovery Zones, FS,									
Clark Fork Section 1 (upstream of Milltown Dam)	Powell County Bridges	08/10 04	FHWA	3yr		Sediment			Restore: Floodplain connectivity	X
Rock Creek	LNF Rock Creek Fuels Reduction	05/08/03	Fuel reduction	2003-10		Sediment		Miles of stream	(Sediment) incidental take of bull trout in the form of harm, harassment or mortality related to on the expected short-term degradation of aquatic habitat parameters as a result of increased activity (Rock Cr) (Sediment) incidental take of bull trout in the form of harm, harassment or mortality related to on the expected short-term degradation of aquatic habitat parameters as a result of increased activity created sediment	X

Core Area (Local Populations)	Action Agency Consultation Type	Date Issued	Type of Action	Duration of Action/Take	Frequency	Effect	Type	Surrogate	Comments	Long Term Beneficial Effect
									(Gilbert, Brewster, Ranch, Butte Cabin, Wahlquist, Cougar, Hogback, Grizzly Dalles, Bobcat, Fourth of July, Little Hogback,Howell, Creeks, Waho Gulch minor (road BMP, fish passage improvement)	
Blackfoot	Snow Talon Salvage	12/15/04	Salvage	2004-09	Frequent	Sediment	Egg, Larval, Juvenile, Adult	9.4 miles of stream	Short-term sediment effects long-term benefits	X
	Lincoln complex Fires Emergency	11/03/04	Emergency fire	Unquantifiable	Frequent	Sediment in water quality	Egg, Larval, Juvenile, Adult		Mortality of fish in copper Creek from fire retardant	X
Clearwater River and Clearwater Lake chain	Seeley Fuels Reduction	03/01/04	Fuels reduction	2004-08	Frequent				Take would occur in Alva Richmond Clearwater less Clearwater Findell Murphy Benedict Rice dear Yankee Seeley Morrell	X
Bitterroot River	Conner North-South FHWA	6/24/04		(3yr)		Sediment			Restore Major: Floodplain Connectivity	X

Core Area (Local Populations)	Action Agency Consultation Type	Date Issued	Type of Action	Duration of Action/Take	Frequency	Effect	Type	Surrogate	Comments	Long Term Beneficial Effect
	Hamilton Florence	4/22/03	FHWA	6 yr		Sediment			Restore Major: Floodplain Connectivity	X
	West Side Reservoir Post Fire project	12/21/04	Fire Salvage	6 yr		Sediment (limited in spawning habitat)			Short-term minor degrade long-term restore: Subpopulation Size, Sediment, Substrate Embeddedness, Pool Frequency and Quality	X
	Burned Area Road Maintenance Projects	07/01/04	Road BMP	6 yr		Sediment			Hungry Horse; Swan L.; FL. Short-term D Long-term R. - Subpop. Size, Sediment, Substrate Embeddedness, Pool Freq. and Quality. Restore: Drainage Netw. Incr. And RHCA's.	X
	Bob Marshall Wilderness Complex Outfitter and Guide Permit	2/9/04	Fishing/camping	30 fish a yr for 5 yrs		Harassment/trampling			Hungry Horse, Swan, Blackfoot, Big Salmon: Local pops White River, Big Salmon, Litle	X

Core Area (Local Populations)	Action Agency Consultation Type	Date Issued	Type of Action	Duration of Action/Take	Frequency	Effect	Type	Surrogate	Comments	Long Term Beneficial Effect
									Salmon, Youngs, Schafer(includes Dolly Varden)	
Swan Lake	South Swan Grazing Allotment	8/27/04	Grazing	2004-14					harm, harassment, mortality related to localized areas of nutrient loading reduced stream bank stability and sedimentation (Barber Creek, Holland Creek below Lk)	X
Flathead Lake	Robert Wedge Post Fire project	09/04/04	Fire Salvage/Road Decommissioning	6 yr		Sediment (very limited in spawning habitat) no impact in Trail Cr			Minor D: Subpopulation Size; Minor D/Longterm improve Sediment, Substrate Embeddedness Pool Freq, and Quality, Road Density and Location. Restore peak and base flow and drainage network incr.	X
Lake McDonald	10a1A	5/5/03	Research - Gillnetting/radio telemetry	2 yr		Harm and Harrass - short-term effects	Sub-adults, adults		Long-term benefits through from findings	X

Core Area (Local Populations)	Action Agency Consultation Type	Date Issued	Type of Action	Duration of Action/Take	Frequency	Effect	Type	Surrogate	Comments	Long Term Beneficial Effect
									and management adjustments	
Lower Clark Fork	10a1A – Thompson Falls- PPL Montana	4/29/06	Research - Electrofishing, tagging, trapping, radio-telemetry	3 yr		Harm and Harrass - short-term effects	Sub-adults, adults		Long-term benefits from findings for fish passage development and design.	X
Lake Pend Oreille	Corps of Engineers Recreational water use	8/5/05	Marina development	1-2 years	July-Sept	Harm and Harrasment; sediment, noise habitat modification	Juvenile, sub-adults, adults		Adverse effects from short-term sediment input, noise from pile-driving, & habitat modification of 9.63 miles of riverine surface area and 860 feet of shoreline habitat	
	Federal Highway Administration	3/28/06	Bridge replacement	1 year	May-July	Harm and Harrass, sediment, habitat mod	Migrating adult		Sediment input impacts during construction of bridge and streambank and inchannel work. Take of one bull trout.	X

* Frequent = activity occurs once or twice a year for a short time period (usually 1 to several days)

Appendix G: A Framework to Assist In Making Endangered Species Act Determinations of Effect for Individual or Grouped Actions at the Bull Trout Subpopulation Watershed Scale

A Framework
to Assist in Making Endangered Species Act Determinations
of Effect for Individual or Grouped Actions
at the Bull Trout Subpopulation Watershed Scale

Prepared by
U.S. Fish and Wildlife Service
(adapted from the National Marine Fisheries Service)

February 1998

A Framework to Assist in Making Endangered Species Act Determinations of Effect for Individual or Grouped Actions at the Bull Trout Subpopulation Watershed Scale

Table of Contents

Overview 3

Before You Begin 5

Description Of The Matrix: 8

Description Of The Checklist: 9

Description Of The Dichotomous Key For Making Esa Determinations Of Effect And Documentation Of Expected Incidental Take: 10

Definitions Of Esa Effects Thresholds And Examples 12

Sample Species Narrative 15

Documentation Of Expected Incidental Take 32

Appendix A 34

Appendix B 47

List of Tables

Table 1. **Matrix Of Diagnostics / Pathways And Indicators** 20

Table 2. **Checklist For Documenting Environmental Baseline And Effects Of Proposed Action(S) On Relevant Indicators** 29

Table 3. **Dichotomous Key For Making Esa Determination Of Effects** 31

OVERVIEW

The following framework was designed to facilitate and standardize determinations of effect for Endangered Species Act (ESA) conferences, consultations and permits focusing on bull trout (*Salvelinus confluentus)*. We recommend that this framework be applied to individual actions or grouped similar activities at the 5th or 6th field Hydrologic Unit Code (HUC) watershed scale. Subsequent Conference Reports or Biological Opinions that you will receive from the U.S. Fish and Wildlife Service (USFWS) will address the effects of your actions at the bull trout subpopulation level. Maps of bull trout subpopulation watersheds will be provided to you for your area and generally are similar to the 4th field Hydologic Unit Code (HUC). It will be necessary for you to aggregate your 5th or 6th field HUC framework determinations to the subpopulation watershed level in any Biological Assessment that you submit.

When USFWS conducts an analysis of a proposed activity or grouped activities, it involves the following steps: (1) define the biological requirements of the listed species; (2) evaluate the relevance of the environmental baseline to the species' current status; (3) determine the effects of the proposed or continuing action(s) on listed and proposed species; and (4) determine whether all the life stages and forms of the species can be expected to survive, with an adequate potential for recovery, to be self-sustaining and self-regulating under the effects of the proposed or continuing action(s), the environmental baseline, and any cumulative effects. The last item (item 4) addresses considerations given during a jeopardy analysis. <u>Please recognize, however, that this framework document does not address jeopardy or identify the level of take or adverse effects which would constitute jeopardy</u>. Jeopardy is determined on a case by case basis involving the specific information on habitat conditions and the health and status of the fish population. USFWS is currently preparing a set of guidelines, to be used in conjunction with this document, to help in the determination of jeopardy.

This framework document provides a consistent, logical line of reasoning to aid in determining when and where adverse effects occur and why they occur. It is a framework or template to stimulate discussion among Level 1 and Interdisciplinary teams regarding the influence of important habitat variables or indicators on bull trout populations. It is not an aquatic conservation strategy. <u>This framework does not replace watershed analysis nor attempt to define data standards</u>. Using available data, results from watershed analyses, and team discussions, the framework will help the teams arrive at an ecologically defendable and trackable determination of the effects of proposed actions on the species and its habitat.

This framework document contains definitions of ESA effects and examples of effects determinations, a recommended reading list to help in understanding the importance of an indicator on bull trout, a matrix of diagnostics/pathways of effects and indicators of those effects, a checklist for documenting the environmental baseline and effects of the proposed action(s) on the relevant indicators, and a dichotomous key for making determinations of effect and documenting expected incidental take. None of the tools identified in this document are new inventions. The matrix, check list, and dichotomous key format have been adapted from the matrix, check list, and dichotomous key developed by the National Marine Fisheries Service (NMFS) to determine the effects of actions on listed anadromous fish species. Although some identifying words and values in this framework have been changed from those in the NMFS document, the format is very similar. The matrix developed here reflects the information needed to evaluate effects of proposed and on-going land management actions of the U.S. Forest Service and U.S. Bureau of Land Management on the persistence and potential recovery of proposed/listed bull trout subpopulations. The similarity between the NMFS's document and this framework should facilitate a blending of the matrices by Level 1 teams during combined consultation/conference efforts with the two regulatory agencies, as well as formal integration of the matrices by the two agencies in the future.

Using these tools, the Federal agencies and Non-Federal Parties (both will be referred to as evaluators in the remainder of this document) can make determinations of effect for proposed projects (i.e. "no effect"/"may affect" and "may affect, not likely to adversely affect"/"may affect, likely to adversely affect") on listed and proposed species. As explained below, these determinations of effect will depend on whether a proposed action (or group of actions) hinders the attainment of relevant environmental conditions (identified in the matrix as pathways and indicators) and further impacts the status of a bull trout subpopulation (also identified in the matrix as diagnostics and indicators), and/or results in "take" of a proposed or listed species, as defined in the ESA.

Finally, this framework is a **draft** document designed to be applied to a wide range of environmental conditions. This means it must be flexible and will be refined. It also means that a certain degree of professional judgement will be required in its application. **There will be circumstances where the numeric values or descriptions in the matrix simply do not apply to a specific watershed, are unavailable, or exist in a different format. In each case, the evaluator will need to provide more ecologically appropriate values using local data when available, including data sources and techniques used, as well as provide adequate documentation and rationale (see amendment to Streamlining direction) that justify changes or deletions of a diagnostic/pathway indicator(s). All documentation must be presented in each associated biological assessment, habitat conservation plan, or other appropriate document. This documentation will be used by USFWS in preparation of a section 7 consultation, habitat conservation plan, or other appropriate biologically based document.**

Before You Begin

To facilitate effective use of the framework, it will be necessary to gather and familiarize yourself with several documents and reports ranging in scope from general bull trout life history information to specific stream reach survey information. It would be difficult to even begin to list all the important information sources that can help you better understand the biology of bull trout and its interrelationship with its environment. To begin your information search, any watershed analysis and previous biological assessments pertaining to the watershed under consideration, as well as all the maps, data findings and results, and historical accounts you can gather, will be essential information in assessing your integrated environmental and population baseline and arriving at a biologically sound effects determination.

Below are listed a few sources that may be helpful to you in your information search. Many of those recommended are referred to or cited in the framework.

Behnke, R.J. 1992. Native trout of western North America. Monograph No. 6, American Fishereis Society. 275 p.

Biological Opinion on Implementation of Interim Strategies for Managing Anadromous Fish-producing Watersheds in Eastern Oregon and Washington, Idaho, and Portions of California (PACFISH). National Marine Fisheries Service, Northwest Region, January 23, 1995.

Buchanan, D.V.; Gregory, S.V. . 1997. Development of water temperature standards to protect and restore habitat for bull trout and other cold water species in Oregon. *In* W.C. Mackay, M.K. Brewin, and M. Monita, eds. Friends of the Bull Trout Conference Proceedings. P8.

Frissell, C.A.; Liss, W.J.; Bayles, D. 1993. An Integrated Biophysical Strategy for Ecological Restoration of Large Watersheds. *In* Potts, D., ed. Proceedings from the Symposium on Changing Roles in Water Resources Management and Policy, June 27-30, 1993. Herndon, VA: American Water Resources Association: p. 449-456.

Interior Columbia Basin Ecosystem Management Project Draft Environmental Impact Statement and Appendices.

Lee, D.C.; Sedell, J.R.; Rieman, B.E.; Thurow, R.F.; Williams, J.E. and others. 1997. Chapter 4: Broadscale Assessment of Aquatic Species and Habitats. *In* T.M. Quigley and S. J. Arbelbide eds “An Assessment of Ecosystem Components in the Interior Columbia Basin and Portions of the Klamath and Great Basins Volume III”. U.S. Department of Agriculture, Forest Service, and U.S. Department of Interior, Bureau of Land Management, Gen Tech Rep PNW-GTR-405.

Leopold, L.B.; Maddock, T., J. 1953. The hydraulic geometry of stream channels and some physiographic implications. Professional Paper 252. U.S. Department of the Interior, Geological Survey. 56p.

Leopold, L.B.; Wolman, M.G.; Miller, J.P. 1964. Fluvial processes in geomorphology. San Francisco: W.H. Freeman and Co. 522p.

Menning, K.M.; Erman, K.; Johnson, N.; Sessions, J. 1996. Modeling aquatic and riparian systems, assessing cumulative watershed effects, and limiting watershed disturbance. Davis, CA: University of California-Davis, Sierra Nevada Ecosystem Project.

Montgomery, D.R.; Buffington, J.M.; Smith, R.D.; Schmidt, K.M.; Press, G. 1995. Pool spacing in forest channels. Water Resources Research Vol. 31, No. 4. April 1995: p. 1097-1105.

Montgomery, D.R.; Buffington, J.M. 1993. Channel classification, prediction of channel response and assessment of channel condition. Report TFW-SH10-93-002. June 24, 1993. 84p.

Northwest Forest Plan, 1994. Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl. USDA Forest Service and USDI Bureau of Land Management.

Overton, C.K.; McIntyre, J.D.; Armstrong, R. ; Whitewell, S.L.; Duncan, K.A.. 1995. User's guide to fish habitat: descriptions that represent natural conditions in the Salmon River Basin, Idaho. U.S. Department of Agriculture, Forest Service, Intermountain Research Station, Gen Tech. Rep. INT-GTR-322.

Overton, C.K.; Wollrab, S.P.; Roberts, B.C.; Radko, M.A.. 1997. R1/R4 (Northern/Intermoutain Regions) Fish and Fish Habitat Standard Inventory Procedures Handbook. U.S. Department of Agriculture, Forest Service, Intermountain Research Station, Gen Tech. Rep. INT-GTR-346.

Reid, L.M. 1993. Research and cumulative watershed effects. U.S. Department of Agriculture, forest Service, Pacific Southwest Research Station, Gen Tech. Rep. PSW-GTR-141.

Rieman, B.E.; McIntyre, J.D.. 1993. Demographic and habitat requirements for conservation of bull trout. U.S.D.A. Forest Service, Intermountain Research Station, Boise, ID.

Rieman, B.E.; Meyers, D.L. . 1997. Use of redd counts to detect trends in bull trout (*Salvelinus confluentus)* populations. Conservation Biology 11(4): 1015-1018.

Rosgen, D.L. 1994. A classification of natural rivers. Catena. Vol. 22, No. 3, June 1994: 169-199.

Shepard, B.B.; Pratt, K.L.; Graham, P.J. . 1984. Life histories of westslope cutthroat and bull trout in the Upper Flathead River Basin, MT. Environmental Protection Agency Rep. Contract No. R008224-01-5.

Washington Timber/Fish Wildlife Cooperative Monitoring Evaluation and Research Committee, 1993. Watershed Analysis Manual (Version 2.0). Washington Department of Natural Resources.

Winward, A.H., 1989 Ecological Status of Vegetation as a base for Multiple Product Management. Abstracts 42nd annual meeting, Society for Range Management, Billings MT, Denver CO: Society For Range Management: p277.

Description of the Matrix:

The objective of the "Matrix of Diagnostics/Pathways and Indicators" (Table 1, Page 19) is to integrate the biological and habitat conditions to arrive at a determination of the potential affect of land management activities on a proposed or listed species. This matrix is divided into seven overall diagnostics/pathways (major rows in the matrix) and a summary integration diagnostic:

Species Diagnostics
-- Subpopulation Characteristics
Habitat Pathways
-- Water Quality
-- Habitat Access
-- Habitat Elements
-- Channel Condition and Dynamics
-- Flow/Hydrology
-- Watershed Conditions
Habitat and Species
–Integration of Species and Habitat Condition

The above were designed to simplify arriving at an effects determination with a firm understanding of the status of the bull trout subpopulation in the watershed being considered for management activities, the environmental baseline (current condition) of the habitat, and how that subpopulation might be affected (beneficially or not) by changes in its habitat as a result of the proposed action(s). It is essential that each diagnostic/pathway be addressed. The species diagnostic “Subpopulation Characteristics” is designed to help you evaluate the status of the bull trout subpopulation in the area of the proposed action(s) under current habitat conditions. Each of the above listed diagnostic tools relating to habitat represents a pathway by which actions can have potential effects on bull trout. It is essential to have an understanding of both the condition of the habitat and the status of the subpopulation when proposing activities that will change the environmental baseline and potential risk to the species. Integration of these diagnostics and pathways is needed to make an appropriate effects determination.

The diagnostics and pathways are further broken down into "indicators." Within the habitat pathways, indicators are generally arranged from a finer to a broader scale. For example, under the pathway “Habitat Elements”, the indicators ask you to consider information from the reach level, (substrate embeddedness), to the grouped reach level (large woody debris, pool frequency and quality, large pools), to the entire stream length (off-channel habitat), and finally the complete subpopulation watershed (refugia). Indicators are generally of two types: (1) Metrics that have associated numeric values (e.g. "4 - 9 ° C"); and/or (2) descriptions (e.g. "adequate habitat refugia do not exist"). The purpose of having both types of indicators in the matrix is that numeric data are not always readily available for making determinations or there may be no reliable numeric indicator for a specific environmental or population attribute. In this case, a description of overall condition may be the only appropriate method available. When a numeric value and a description are combined in the same cell in the matrix, it is because accurate assessment of the indicator requires attention to both. Values and descriptions are presented to

stimulate discussion within Level 1 and interdisciplinary teams. They provide a diagnostic tool that should be evaluated for reliability in describing environmental functional relationships specific to the watershed you are considering for management activity. **The numeric values are not presented as absolutes nor to define data standards.** They are presented as diagnostic tools to promote discussion of differences between local data or findings and values suggested in the matrix. If local data relating to a specific indicator is not available for comparison and verification, then proposed management activities should be designed to minimize impacts to that indicator. If a numeric indicator suggested in the matrix is not functionally attainable given the inherent characteristics of the watershed being considered or if an equivalent value is available using a different field technique, Level 1 and Interdisciplinary teams should replace the numeric value with local data and professional judgement. When this occurs, changes must be accompanied by rigorous discussion within the team, which is integrated into adequate documentation complete with supportive local data and the technique used to compile the data, and/or scientifically supported reasoning, logic, or professional judgement for the change. Likewise, if a team decides not to use all indicators in a diagnostic or pathway, the team must provide defendable and trackable documentation on why an indicator was not considered.

Diagnostics, pathways, and indicators may overlap in their scope and data components. This is to provide a cross check that ensures potential effects are viewed from more than one perspective. Likewise, it provides an avenue for integration among habitat variables and between the condition of a bull trout subpopulation and its habitat.
The columns in the matrix correspond to levels of condition of the indicator. There are three condition levels: "functioning appropriately," "functioning at risk," and "functioning at unacceptable risk." These three categories of function are defined for each indicator in the "Matrix of Diagnostics/Pathways and Indicators". In concept, indicators in a watershed are "functioning appropriately" when they maintain strong and significant populations that are interconnected and promote recovery of a proposed or listed species or its critical habitat to a status that will provide self-sustaining and self-regulating populations. When the indicators are "functioning at risk", they provide for persistence of the species but in more isolated populations and may not promote recovery of a proposed or listed species or its habitat without active or passive restoration efforts. "Functioning at unacceptable risk" suggests the proposed or listed species continues to be absent from historical habitat, or is rare or being maintained at a low population level; although the habitat may maintain the species at this low persistence level, active restoration is needed to begin recovery of the species.

Description of the Checklist:

The "Checklist for Documenting Environmental Baseline and Effects of Proposed Action(s) on Relevant Indicators" (Table 2, page 25) is designed to be used in conjunction with the matrix. The checklist has six columns. The first three describe the condition of each indicator (which when taken together encompass the environmental baseline and condition of the bull trout subpopulation), and the second three describe the effects of the proposed action(s) on each indicator. As with the matrix, rigorous discussion among Level 1 or Interdisciplinary teams should occur when making checklist selections. Likewise, documentation and rationale supporting each checklist selection must be made available.

Description of the Dichotomous Key for Making ESA Determinations of Effect and Documentation of Expected Incidental Take:

The "Dichotomous Key for Making ESA Determinations of Effect" (Table 3, page 27) is designed to aid in determinations of effect for proposed actions that require a section 7 consultation/conference or permit under Section 10 of the ESA. Once the matrix has been modified with watershed specific local data (if necessary) to meet the needs of the evaluators, and the checklist has been discussed and filled out, the evaluators should use the key to help make their ESA determinations of effect. If it is determined that the proposed actions will result in a “take”, identify the expected “take” on the “Documentation of Expected Incidental Take” form that accompanies the Dichotomous Key.

How to Use the Matrix, Checklist, and Dichotomous Key

1) Group similar projects when possible that are proposed within a 5th or 6th field HUC watershed.

2) Using the Matrix provided (or a version modified and documented by the evaluator) **evaluate environmental and subpopulation baseline conditions** (mark on checklist), use all 7 pathways (identified in the matrix). Summarize the matrix in the "Habitat and Species: Integration of Habitat and Species Conditions" indicator.

3) **Evaluate effects of the proposed action** at both the 5th or 6th and watershed levels using the matrix. Do they restore, maintain or degrade existing baseline conditions? Mark on checklist, and provide

written logic and rationale

4) Take the checklist you marked and the dichotomous key and answer the questions in the key, substantiated by a written rationale and logic, **to reach a determination of effects.**

Matrix of Diagnostics/Pathways and Indicators

Use to describe the Environmental and Subpopulation Baseline Conditions

Subpopulation Characteristics, Water Quality, Habitat Access, Habitat Elements, Channel Condition and Dynamics, Flow/Hydrology, Watershed Condition, Integration of Species and Habitat Conditions

and

Then use the same Diagnostics/ Pathways and Indicators to evaluate the Effects of Proposed Projects on Species and its Habitat

↓

Mark Results on Checklist

↓

Checklist

Environmental Baseline			Effects of the Action	
Funct. Appro-priately	Funct Degrade At Risk	Funct at Unaccept-able Risk	Maintain	Restore

↓

Use Professional Judgement, Level 1 Team Discussions, written documentation and rationale, and the Checklist to Work through the Dichotomous Key

Dichotomous Key

Yes/No

No Effect
May Effect
Not Likely to Adversely Affect
Likely to Adversely Affect

(Note: Actual Matrix is on page 19 through 24. Actual Checklist on page 25 and 26. Actual Dichotomous key on page 27).

DEFINITIONS OF ESA EFFECTS THRESHOLDS AND EXAMPLES

Following are definitions of ESA effects (sources in *italics*):

"No effect:"

This determination is only appropriate "if the proposed action will literally have no effect whatsoever on the species and/or critical habitat, not a small effect or an effect that is unlikely to occur." (From "*Common flaws in developing an effects determination*", Olympia Field Office, U.S. Fish and Wildlife Service). Furthermore, actions that result in a "beneficial effect" do not qualify as a no effect determination. If a “no effect” determination is derived, conference/consultation does not need to proceed, but it is recommended that these determinations be shared within the Level 1 team. Documentation to substantiate this determination must be filed in evaluator’s records.

"May affect, not likely to adversely affect:"

"The appropriate conclusion when effects on the species or critical habitat are expected to be beneficial, discountable, or insignificant. Beneficial effects have contemporaneous positive effects without any adverse effects to the species or habitat. 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." (From "*Draft Endangered Species Consultation Handbook; Procedures for Conducting Section 7 Consultations and Conferences*," USFWS/NMFS, 1994). The term "negligible" has been used in many ESA consultations involving anadromous fish in the Snake River basin. The definition of this term is the same as "insignificant." Consultation/conference is required for this effect determination, but can proceed as informal.

"May affect, likely to adversely affect"

Unfortunately, there is no definition of adverse effects in the ESA or its implementing regulations. The draft Endangered Species Consultation Handbook (NMFS/USFWS, November 1994) provides this definition for "Is likely to adversely affect” - the appropriate conclusion if any adverse effect to listed species or critical habitat may occur as a direct or indirect result of the proposed action or its interrelated or interdependent actions. In the event the overall effect of the proposed action is beneficial to the listed species or critical habitat, but is also likely to cause some adverse effects, then the proposed action 'is likely to adversely affect' the listed species or critical habitat. An “is likely to adversely affect” determination requires formal section 7 consultation.

The following is a definition specific to anadromous salmonids developed by NMFS, the FS, and the BLM during the PACFISH consultation and is given as example: "Adverse effects include short or long-term, direct or indirect management-related, impacts of an

individual or cumulative nature such as mortality, reduced growth or other adverse physiological changes, harassment of fish, physical disturbance of redds, reduced reproductive success, delayed or premature migration, or other adverse behavioral changes to listed anadromous salmonids at any life stage. Adverse effects to designated critical habitat include effects to any of the essential features of critical habitat that would diminish the value of the habitat for the survival and recovery of listed anadromous salmonids" (From *NMFS' Pacfish Biological Opinion, 1/23/95*). Interpretation of part of the preceding quotation has been problematic. The statement "...impacts of an individual or cumulative nature..." has often been applied only to actions and impacts, not organisms. NMFS' concern with this definition is that it does not clearly state that the described impacts include those to individual eggs or fish. However, this definition is useful if it is applied on the individual level as well as on the subpopulation and population levels.

For the purposes of Section 7, any action which has more than a negligible potential to result in "take" (see definition at bottom of Dichotomous Key, p. 27 of this document) is likely to adversely affect a proposed/listed species. It is not possible for NMFS or USFWS to concur on a "not likely to adversely affect" determination if the proposed action will cause take of the listed species. Take can be authorized in the Incidental Take Statement of a Biological Opinion after the anticipated extent and amount of take has been described, and the effects of the take are analyzed with respect to jeopardizing the species or adversely modifying critical habitat. <u>Take, as defined in the ESA, clearly applies to the individual level, thus actions that have more than a negligible potential to cause take of individual eggs and/or fish are "likely to adversely affect."</u>

"Likely to jeopardize the continued existence of"

The regulations define jeopardy as "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" (*50 CFR §402.02*).

"**Take**"

The ESA (Section 3) defines take as "to harass, harm, pursue, hunt, shoot, wound, trap, capture, collect or attempt to engage in any such conduct". The USFWS further defines "harm" to include "significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns such as breeding, feeding, or sheltering", and "harass" as "actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering".

Examples of Effects Determinations

"No effect"

USFWS is encouraging evaluators to conference/consult at the subpopulation or watershed scale (i.e., on all proposed actions in a particular watershed or within the range of a bull trout subpopulation) rather than on individual projects. Due to the strict definition of "no effect" (above), the interrelated nature of in-stream conditions and watershed conditions, and the watershed scale of these conferences, consultations, and activities, "no effect" determinations for all actions in a watershed will be unusual when proposed/listed species are present in or downstream from a given watershed. This is reflected in the dichotomous key, however the evaluator may identify some legitimate exceptions to this general rule.

Example:

The proposed project is in a watershed where available monitoring information indicates that in-stream habitat is functioning appropriately and riparian vegetation is at or near potential. The proposed activity will take place on stable soils and will not result in increased sediment production. No activity will take place in the riparian zone and no listed/proposed species or designated critical habitat exist in the watershed or immediately downstream of the watershed where the activity will take place.

"May affect, not likely to adversely affect"

Example:

The proposed action is in a watershed where bull trout exists. Available monitoring information indicates that in-stream habitat is functioning appropriately and riparian vegetation is at or near potential. Past monitoring indicates that this type of action has led to the present condition (i.e., timely recovery has been achieved with the kind of management proposed in the action). No activity will take place in the riparian zone. Given available information, the potential for take to occur is negligible.

"May affect, likely to adversely affect"

Example:

The proposed action is in a watershed that has a remnant resident population of bull trout in very low numbers and the migratory form is no longer present. The watershed is in relatively good condition, however a few in-stream indicators show degradation, such as excess fine sediment, moderate cobble embeddedness, and poor pool frequency/quality. If the action will further degrade any of these indicators, the determination is clearly "likely to adversely affect".

A less obvious example would be a proposed action in the same watershed that is designed to improve baseline conditions, such as road obliteration or culvert repair. Even though the intent is to improve the degraded conditions over the long-term, if any short-term impacts (such as temporary sedimentation) will cause take (adverse effects), then the determination is "likely to adversely affect."

Sample Species Narrative

(*should be modified to address the specific bull trout population in the watershed where an action is proposed to occur*)

Bull Trout (*Salvelinus confluentus)*

Endangered Species Act Status: Proposed threatened Columbia River population segment and endangered Klamath River population segment, June 10, 1997. All life forms are included in this proposal.

Description. For years, the bull trout and Dolly Varden (*Salvelinus malma* Girard) were combined under one name, the Dolly Varden (*Salvelinus malma* Walbaum). In 1991, with the support of the American Fisheries Society, they became two distinct species. A couple of the most useful characteristics in separating the two species are the shape and size of the head (Cavender 1978). The head of a bull trout is more broad and flat on top, being hard to the touch, unlike Dolly Varden. Bull trout have an elongated body, somewhat rounded and slightly compressed laterally, and covered with cycloid scales numbering 190-240 along the lateral line. The mouth is large with the maxilla extending beyond the eye and with well developed teeth on both jaws and head of the vomer (none on the shaft). Bull trout have 11 dorsal fin rays, 9 anal fins, and the caudal fin is slightly forked. Although they are often olive green to brown with paler sides, color is variable with locality and habitat. Their spotting pattern is easily recognizable showing pale yellow spots on the back, and pale yellow and orange or red spots on the sides. Bull trout fins are tinged with yellow or orange, while the pelvic, pectoral, and anal fins have white margins. There should be no black or dark markings on the fins.

Historical and Current Distribution. The historical range of bull trout was restricted to North America (Cavender 1978; Haas and McPhail 1991). Bull trout have been recorded from the McCloud River in northern California, the Klamath River basin in Oregon and throughout much of interior Oregon, Washington, Idaho, western Montana, and British Columbia, and extended into Hudson Bay and the St. Mary's River Saskatchiwan.

Bull trout are believed to be a glacial relict (McPhail and Lindsey 1986), and their broad distribution has probably contracted and expanded periodically with natural climate change (Williams and others, in press). Genetic variation suggests an extended and evolutionarily important isolation between populations in the Klamath and Malheur Basins and those in the Columbia River basin (Leary and others 1993). Populations within the Columbia River basin are more closely allied and are thought to have expanded from common glacial refugia or to have maintained higher levels of gene flow among populations in recent geologic time (Williams and others, in press).

It is unlikely that bull trout occupied all of the accessible streams at any one time. Distribution of existing populations is often patchy even where numbers are still strong and habitat is in good condition (Rieman and McIntyre 1993; Rieman and McIntyre 1995). Habitat preferences or selection is likely important (Dambacher and others, in press; Goetz 1994; Rieman and McIntyre

1995); but more stochastic extirpation and colonization processes may influence distribution even within suitable habitats (Rieman and McIntyre 1995).

Even though bull trout may move throughout whole river basins seasonally, spawning and juvenile rearing appear to be limited to the coldest streams or stream reaches. The lower limits of habitat used by bull trout are strongly associated with gradients in elevation, longitude, and latitude, that likely approximate a gradient in climate across the Basin (Goetz 1994). The patterns indicate that spatial and temporal variation in climate may strongly influence habitat available to bull trout (see Meisner 1990 for an example with brook trout). While temperatures are probably suitable throughout much of the northern portion of the range, predicted spawning and rearing habitat are restricted to increasingly isolated high elevation or headwater "islands" toward the south (Goetz 1994; Rieman and McIntyre 1995).

Bull trout are now extinct in California and only remnant populations are found in much of Oregon (Ratliff and Howell 1992). A small population still exists in the headwaters of the Jarbidge River, Nevada which represents the present southern limit of the species range. Bull trout are known or predicted to occur in 45 percent of watersheds in the historical range and to be absent in 55 percent.

Migratory life histories have been lost or limited throughout the range (for example, Goetz 1994; Jakober 1995; Montana Bull Trout Scientific Committee, in preparation; Pratt and Huston 1993; Ratliff and Howell 1992; Rieman and McIntyre 1993, 1995). There is evidence of declining trends in some populations (Mauser and others 1988; Pratt and Huston 1993; Schill 1992; Weaver 1992) and extirpations of local populations are reportedly widespread.

Life History Characteristics. Bull trout spawn from August through November (McPhail and Murray 1979; Pratt 1992). Hatching may occur in winter or early spring, but alevins may stay in the gravel for an extended period after yolk absorption (McPhail and Murray 1979). Growth, maturation, and longevity vary with environment, first spawning is often noted after age four, with individuals living 10 or more years (Rieman and McIntyre 1993).

Two distinct life-history forms, migratory and resident, occur throughout the range of bull trout (Pratt 1992; Rieman and McIntyre 1993). Migratory forms rear in natal tributaries before moving to larger rivers (fluvial form) or lakes (adfluvial form) or the ocean (anadromous) to mature. Migratory bull trout may use a wide range of habitats ranging from 2nd to 6th order streams and varying by season and life stage. Seasonal movements may range up to 300 km as migratory fish move from spawning and rearing areas into overwinter habitat in downstream reaches of large basins (Bjornn and Mallet 1964; Elle and others 1994). The resident form may be restricted to headwater streams throughout life. Both forms are believed to exist together in some areas, but migratory fish may dominate populations where corridors and subadult rearing areas are in good condition (Rieman and McIntyre 1993).

Habitat Relationships. Bull trout appear to have more specific habitat requirements than other salmonids (Rieman and McIntyre 1993). Habitat characteristics including water temperature, stream size, substrate composition, cover and hydraulic complexity have been associated with

the distribution and abundance (Dambacher and other, in press; Jakober 1995; Rieman and McIntyre 1993).

Stream temperatures and substrate composition may be particularly important characteristics of suitable habitats. Bull trout have repeatedly been associated with the coldest stream reaches within basins. Goetz (1994) did not find juvenile bull trout in water temperatures above 12.0°C. The best bull trout habitat in several other Oregon streams was where water temperature seldom exceeded 15°C (Buckman et al. 1992; Ratliff 1992; Ziller 1992). Temperature also appears to be a critical factor in the spawning and early life history of bull trout. Bull trout in Montana spawned when temperatures dropped below 9 to 10°C (Fraley and Shepard 1989). McPhail and Murray (1979) reported 9°C as the threshold temperature to initiate spawning for British Columbia bull trout. Temperatures fell below 9°C before spawning began in the Metolius River, Oregon (Riehle 1993). Survival of bull trout eggs varies with water temperature (McPhail and Murray 1979). They reported that 0-20%, 60-90%, and 80-95% of the bull trout eggs from British Columbia survived to hatching in water temperatures of 8-10°C, 6°C, and 2-4°C, respectively. Weaver and White (1985) found that 4-6°C was needed for egg development for Montana bull trout. Temperature may be strongly influenced by land management (Henjum and others 1994) and climate change; both effects may play an important role in the persistence of bull trout.

Bull trout are more strongly tied to the stream bottom and substrate than other salmonids (Pratt 1992). Substrate composition has repeatedly been correlated with the occurrence and abundance of juvenile bull trout (Dambacher and others in press; Rieman and McIntyre 1993) and spawning site selection by adults (Graham and others 1981; McPhail and Murray 1979). Fine sediments can influence incubation survival and emergence success (Weaver and White 1985), but might also limit access to substrate interstices that are important cover during rearing and overwintering (Goetz 1994; Jakober 1995).

Key Factors. Angling is a factor influencing the current status of bull trout. Bull trout may be vulnerable to over-harvest (Ratliff and Howell 1992; Rieman and Lukens 1979). Poaching is viewed as an important cause of mortality, especially in accessible streams that support large migratory fish (N. Horner, Idaho Department of Fish and Game and J. Vasho, Montana Department of Fish, Wildlife and Parks, pers. comm.).

Watershed disruption is a second factor that has played a role in the decline of bull trout. Changes in or disruptions of watershed processes likely to influence characteristics of stream channels are also likely to influence the dynamics and persistence of bull trout populations. Bull trout have been more strongly associated with pristine of only lightly disturbed basins (Brown 1992; Clancy 1993; Cross and Everest 1995; Dambacher and others, in press; Huntington 1995; Ratliff and Howell 1992).

Patterns of stream flow and the frequency of extreme flow events that influence substrates are anticipated to be important factors in population dynamics (Rieman and McIntyre 1993). With overwinter incubation and a close tie to the substrate, embryos and juveniles may be particularly vulnerable to flooding and channel scour associated with the rain-on-snow events common in some parts of the range within the belt geography of northern Idaho and northwestern Montana

(Rieman and McIntyre 1993). Channel dewatering tied to low flows and bed aggradation has also blocked access for spawning fish resulting in year class failures (Weaver 1992).

Changes in sediment delivery, aggradation and scour, wood loading, riparian canopy and shading or other factors influencing stream temperatures, and the hydrologic regime (winter flooding and summer low flow) are all likely to affect some, if not most, populations. Significant long-term changes in any of these characteristics or processes represent important risks for many remaining bull trout populations. Populations are likely to be most sensitive to changes that occur in headwater areas encompassing critical spawning and rearing habitat and remnant resident populations.

Introduced species are a third factor influencing bull trout. More than 30 introduced species occur within the present distribution of bull trout. Some introductions like kokanee may benefit bull trout by providing forage (Bowles and others 1991). Others such as brown, brook, and lake trout are thought to have depressed or replaced bull trout populations (Dambacher and others, in press; Donald and Alger 1992; Howell and Buchanan 1992; Kanda and others, in press; Leary and others 1993; Ratliff and Howell 1992). Brook trout are seen as an especially important problem (Kanda and others, in press; Leary and others 1993) and may progressively displace bull trout through hybridization and higher reproductive potential (Leary and others 1993). Brook trout now occur in the majority of the watersheds representing the current range of bull trout. Introduced species may pose greater risks to native species where habitat disturbance has occurred (Hobbs and Huenneke 1992).

Isolation and fragmentation are the fourth factor likely to influence the status of bull trout. Historically bull trout populations were well connected throughout the Basin. Habitat available to bull trout has been fragmented, and in may cases populations have been isolated entirely. Dams have isolated whole subbasins throughout the Basin (see for example, Brown 1992; Kanda and other, in press; Pratt and Huston 1993; Rieman and McIntyre 1995). Irrigation diversions, culverts, and degraded mainstem habitats have eliminated or seriously depressed migratory life histories effectively isolating resident populations in headwater tributaries (Brown 1992; Montana Bull Trout Scientific Committee, in preparation; Ratliff and Howell 1992; Rieman and McIntyre 1993). Introduced species like brook trout may displace bull trout in lower stream reaches further reducing the habitat available in many remaining headwater areas (Adams 1994; Leary and others 1993). Loss of suitable habitat through watershed disturbance may also increase the distance between good or refuge habitats and strong populations thus reducing the likelihood of effective dispersal (Frissell and others 1993).

References: Much of the narrative was taken from Lee, D.C., J.R. Sedell, B.E. Rieman, R.F. Thurow, J.E. Williams and others. 1997. Chapter 4: Broadscale Assessment of Aquatic Species and Habitats. *In* T.M. Quigley and S. J. Arbelbide eds “An Assessment of Ecosystem Components in the Interior Columbia Basin and Portions of the Klamath and Great Basins Volume III”. U.S. Department of Agriculture, Forest Service, and U.S. Department of Interior, Bureau of Land Management, Gen Tech Rep PNW-GTR-405). For complete citations, refer to that document.

Other references used but not contained in Lee and others 1997:

Brown, C. J. D. 1971. Fishes of Montana. The Endowment and Research Foundation, Montana State University, Bozeman, MT.

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

Simpson, J. C. and R. L White 1982. Fishes of Idaho. University Press of Idaho, Moscow, ID.

Table 1. Matrix Of Diagnostics / Pathways And Indicators

(Remember, the values of criteria presented here are <u>NOT absolute</u>, they may be adjusted for local watersheds given supportive documentation. See p. 7)

DIAGNOSTIC OR PATHWAY	INDICATORS	FUNCTIONING APPROPRIATELY	FUNCTIONING AT RISK	FUNCTIONING AT UNACCEPTABLE RISK
SPECIES:				
Subpopulation Characteristics within subpopulation watersheds	Subpopulation Size	Mean total subpopulation size or local habitat capacity more than several thousand individuals. All life stages evenly represented in the subpopulation.[1]	Adults in subpopulation are less than 500 but >50.[1]	Adults in subpopulation has less than 50. [1]
	Growth and Survival	Subpopulation has the resilience to recover from short term disturbances (e.g. catastrophic events, etc) or subpopulation declines within one to two generations (5 to 10 years).[1] The subpopulation is characterized as increasing or stable. At least 10+ years of data support this estimate.[2]	When disturbed, the subpopulation will not recover to predisturbance conditions within one generation (5 years). Survival or growth rates have been reduced from those in the best habitats. The subpopulation is reduced in size, but the reduction does not represent a long-term trend. [1]. At least 10+ years of data support this characterization.[2] If less data is available and a trend can not be confirmed, a subpopulation will be considered at risk until enough data is available to accurately determine its trend.	The subpopulation is characterized as in rapid decline or is maintaining at alarmingly low numbers. Under current management, the subpopulation condition will not improve within two generations (5 to 10 years). [1] This is supported by a minimum of 5+ years of data.
	Life History Diversity and Isolation	The migratory form is present and the subpopulation exists in close proximity to other spawning and	The migratory form is present but the subpopulation is not close to other subpopulations or habitat	The migratory form is absent and the subpopulation is isolated to the local stream or a small

DIAGNOSTIC OR PATHWAY	INDICATORS	FUNCTIONING APPROPRIATELY	FUNCTIONING AT RISK	FUNCTIONING AT UNACCEPTABLE RISK
		rearing groups. Migratory corridors and rearing habitat (lake or larger river) are in good to excellent condition for the species. Neighboring subpopulations are large with high likelihood of producing surplus individuals or straying adults that will mix with other subpopulation groups. [1]	disruption has produced a strong correlation among subpopulations that do exist in proximity to each other. [1]	watershed not likely to support more than 2,000 fish.[1]
	Persistence and Genetic Integrity	Connectivity is high among multiple (5 or more) subpopulations with at least several thousand fish each. Each of the relevant subpopulations has a low risk of extinction. [1] The probability of hybridization or displacement by competitive species is low to nonexistent.	Connectivity among multiple subpopulations does occur, but habitats are more fragmented. Only one or two of the subpopulations represent most of the fish production. [1] The probability of hybridization or displacement by competitive species is imminent, although few documented cases have occurred.	Little or no connectivity remains for refounding subpopulations in low numbers, in decline, or nearing extinction. Only a single subpopulation or several local populations that are very small or that otherwise are at high risk remain.[1] Competitive species readily displace bull trout. The probability of hybridization is high and documented cases have occurred.
HABITAT:				
Water Quality:	Temperature	7 day average maximum temperature in a reach during the following life history stages: [1, 3] incubation 2 - 5°C rearing 4 - 12 °C spawning 4 - 9°C also temperatures do not exceed 15°C in areas used by adults during migration (no thermal	7 day average maximum temperature in a reach during the following life history stages:[1, 3] incubation <2°C or 6°C rearing <4°C or 13 - 15 °C spawning <4 °C or 10°C also temperatures in areas used by adults during migration sometimes exceeds 15°C	7 day average maximum temperature in a reach during the following life history stages:[1, 3] incubation <1°C or >6°C rearing >15 °C spawning <4 °C or > 10°C also temperatures in areas used by adults during migration regularly exceed 15°C (thermal barriers

DIAGNOSTIC OR PATHWAY	INDICATORS	FUNCTIONING APPROPRIATELY	FUNCTIONING AT RISK	FUNCTIONING AT UNACCEPTABLE RISK
		barriers)		present)
	Sediment (in areas of spawning and incubation; rearing areas will be addressed under "substrate embeddedness")	Similar to chinook salmon [1]: for example (e.g.): < 12% fines (<0.85mm) in gravel[4]; e.g. ≤20% surface fines of ≤6mm[5, 6]	Similar to chinook salmon [1]: e.g. 12-17% fines (<0.85mm) in gravel[4]; e.g. 12-20% surface fines [7]	Similar to chinook salmon [1]: e.g. >17% fines (<0.85mm) in gravel[4]; e.g. >20% fines at surface or depth in spawning habitat[7]
	Chemical Contamination/ Nutrients	low levels of chemical contamination from agricultural, industrial and other sources, no excess nutrients, no CWA 303d designated reaches[8]	moderate levels of chemical contamination from agricultural, industrial and other sources, some excess nutrients, one CWA 303d designated reach[8]	high levels of chemical contamination from agricultural, industrial and other sources, high levels of excess nutrients, more than one CWA 303d designated reach[8]
Habitat Access:	Physical Barriers (address subsurface flows impeding fish passage under the pathway "flow/hydrology")	man-made barriers present in watershed allow upstream and downstream fish passage at all flows	man-made barriers present in watershed do not allow upstream and/or downstream fish passage at base/low flows	man-made barriers present in watershed do not allow upstream and/or downstream fish passage at a range of flows
Habitat Elements:	Substrate Embeddedness in rearing areas (spawning an1d incubation areas were addressed under the indicator "sediment")	reach embeddedness <20%[9, 10]	reach embeddedness 20-30% [9,10]	reach embeddedness >30%[4,10]
	Large Woody Debris	current values are being maintained at greater than 80 pieces/mile that are >24"diameter	current levels are being maintained at minimum levels desired for "functioning appropriately", but	current levels are not at those desired values for "functioning appropriately", and potential

DIAGNOSTIC OR PATHWAY	INDICATORS	FUNCTIONING APPROPRIATELY	FUNCTIONING AT RISK	FUNCTIONING AT UNACCEPTABLE RISK
		and >50 ft length on the Coast[9], or >20 pieces/ mile >12"diameter >35 ft length on the Eastside[11] ; also adequate sources of woody debris are available for both long and short-term recruitment	potential sources for long term woody debris recruitment are lacking to maintain these minimum values	sources of woody debris for short and/or long term recruitment are lacking
	Pool Frequency and Quality	pool frequency in a reach closely approximates [5]: Wetted width (ft) / #pools/mile 0-5 / 39 5-10 / 60 10-15 / 48 15-20 / 39 20-30 / 23 30-35 / 18 35-40 / 10 40-65 / 9 65-100 / 4 (can use formula: pools/mi = 5,280/wetted channel width / #channel widths per pool); also, pools have good cover and cool water[4], and only minor reduction of pool volume by fine sediment	pool frequency is similar to values in “functioning appropriately”, but pools have inadequate cover/temperature[4], and/or there has been a moderate reduction of pool volume by fine sediment	pool frequency is considerably lower than values desired for “functioning appropriately”; also cover/temperature is inadequate[4], and there has been a major reduction of pool volume by fine sediment
	Large Pools (in adult holding, juvenile rearing, and overwintering reaches where streams are >3m in wetted width at baseflow)	each reach has many large pools >1 meter deep[4]	reaches have few large pools (>1 meter) present[4]	reaches have no deep pools (>1 meter)[4]

DIAGNOSTIC OR PATHWAY	INDICATORS	FUNCTIONING APPROPRIATELY	FUNCTIONING AT RISK	FUNCTIONING AT UNACCEPTABLE RISK
	Off-channel Habitat (see reference 18 for identification of these characteristics)	watershed has many ponds, oxbows, backwaters, and other off-channel areas with cover; and side-channels are low energy areas[4]	watershed has some ponds, oxbows, backwaters, and other off-channel areas with cover; but side-channels are generally high energy areas[4]	watershed has few or no ponds, oxbows, backwaters, or other off-channel areas[4]
	Refugia (see Checklist footnotes for definition of this indicator)	habitats capable of supporting strong and significant populations are protected and are well distributed and connected for all life stages and forms of the species[12, 13]	habitats capable of supporting strong and significant populations are insufficient in size, number and connectivity to maintain all life stages and forms of the species[12, 13]	adequate habitat refugia do not exist[12]
Channel Condition & Dynamics:	Average Wetted Width/ Maximum Depth Ratio in scour pools in a reach	≤ 10[7, 5]	11 - 20[5]	>20[5]
	Streambank Condition	>80% of any stream reach has $\geq$90% stability[5]	50 - 80% of any stream reach has $\geq$90% stability[5]	<50% of any stream reach has $\geq$90% stability[5]
	Floodplain Connectivity	off-channel areas are frequently hydrologically linked to main channel; overbank flows occur and maintain wetland functions, riparian vegetation and succession	reduced linkage of wetland, floodplains and riparian areas to main channel; overbank flows are reduced relative to historic frequency, as evidenced by moderate degradation of wetland function, riparian vegetation/succession	severe reduction in hydrologic connectivity between off-channel, wetland, floodplain and riparian areas; wetland extent drastically reduced and riparian vegetation/succession altered significantly
Flow/Hydrology:	Change in Peak/ Base Flows	watershed hydrograph indicates peak flow, base flow and flow timing characteristics comparable to an undisturbed watershed of	some evidence of altered peak flow, baseflow and/or flow timing relative to an undisturbed watershed of similar size, geology	pronounced changes in peak flow, baseflow and/or flow timing relative to an undisturbed watershed of similar size, geology

DIAGNOSTIC OR PATHWAY	INDICATORS	FUNCTIONING APPROPRIATELY	FUNCTIONING AT RISK	FUNCTIONING AT UNACCEPTABLE RISK
		similar size, geology and geography	and geography	and geography
	Increase in Drainage Network	zero or minimum increases in active channel length correlated with human caused disturbance	low to moderate increase in active channel length correlated with human caused disturbance	greater than moderate increase in active channel length correlated with human caused disturbance
Watershed Conditions:	Road Density & Location	<1mi/mi² [13]; no valley bottom roads	1 - 2.4 mi/mi² [13]; some valley bottom roads	>2.4 mi/mi² [13]; many valley bottom roads
	Disturbance History	<15% ECA of entire watershed with no concentration of disturbance in unstable or potentially unstable areas, and/or refugia, and/or riparian area; and for NWFP area there is an additional criteria of ≥15% LSOG in watersheds[14]	<15% ECA of entire watershed but disturbance concentrated in unstable or potentially unstable areas, and/or refugia, and/or riparian area; and for NWFP area there is an additional criteria of ≥15% LSOG in watersheds[14]	>15% ECA of entire watershed and disturbance concentrated in unstable or potentially unstable areas, and/or refugia, and/or riparian area; does not meet NWFP standard for LSOG
	Riparian Conservation Areas (RHCA - PACFISH and INFISH) (Riparian Reserves - Northwest Forest Plan)	the riparian conservation areas provide adequate shade, large woody debris recruitment, and habitat protection and connectivity in subwatersheds, and buffers or includes known refugia for sensitive aquatic species (>80% intact), and adequately buffer impacts on rangelands: percent similarity of riparian vegetation to the potential natural community/ composition >50%[15]	moderate loss of connectivity or function (shade, LWD recruitment, etc.) of riparian conservation areas, or incomplete protection of habitats and refugia for sensitive aquatic species (≈70-80% intact), and adequately buffer impacts on rangelands : percent similarity of riparian vegetation to the potential natural community/composition 25-50% or better[15]	riparian conservation areas are fragmented, poorly connected, or provides inadequate protection of habitats for sensitive aquatic species (<70% intact, refugia does not occur), and adequately buffer impacts on rangelands : percent similarity of riparian vegetation to the potential natural community/composition <25%[15]
	Disturbance Regime	Environmental disturbance is short lived; predictable hydrograph, high quality habitat and watershed complexity providing refuge and	Scour events, debris torrents, or catastrophic fire are localized events that occur in several minor parts of the watershed. Resiliency	Frequent flood or drought producing highly variable and unpredictable flows, scour events, debris torrents, or high probability

DIAGNOSTIC OR PATHWAY	INDICATORS	FUNCTIONING APPROPRIATELY	FUNCTIONING AT RISK	FUNCTIONING AT UNACCEPTABLE RISK
		rearing space for all life stages or multiple life-history forms. [1] Natural processes are stable.	of habitat to recover from environmental disturbances is moderate.	of catastrophic fire exists throughout a major part of the watershed. The channel is simplified, providing little hydraulic complexity in the form of pools or side channels. [1] Natural processes are unstable.
Species and Habitat				
Integration of Species and Habitat Conditions		Habitat quality and connectivity among subpopulations is high. The migratory form is present. Disturbance has not altered channel equilibrium. Fine sediments and other habitat characteristics influencing survival or growth are consistent with pristine habitat. The subpopulation has the resilience to recover from short-term disturbance within one to two generations (5 to 10 years). The subpopulation is fluctuating around an equilibrium or is growing.[1]	Fine sediments, stream temperatures, or the availability of suitable habitats have been altered and will not recover to predisturbance conditions within one generation (5 years). Survival or growth rates have been reduced from those in the best habitats. The subpopulation is reduced in size, but the reduction does not represent a long-term trend. The subpopulation is stable or fluctuating in a downward trend. Connectivity among subpopulations occurs but habitats are more fragmented.[1]	Cumulative disruption of habitat has resulted in a clear declining trend in the subpopulation size. Under current management, habitat conditions will not improve within two generations (5 to 10 years). Little or no connectivity remains among subpopulations. The subpopulation survival and recruitment responds sharply to normal environmental events. [1]

[1] Rieman, B.E. and J.D. McIntyre. 1993. Demographic and habitat requirements for conservation of bull trout. U.S.D.A. Forest Service, Intermountain Research Station, Boise, ID.

[2] Rieman, B.E. and D.L. Meyers. 1997. Use of redd counts to detect trends in bull trout (*Salvelinus confluentus)* populations. Conservation Biology 11(4): 1015-1018.

[3] Buchanan, D.V. and S.V. Gregory. 1997. Development of water temperature standards to protect and restore habitat for bull trout and other cold water species in Oregon. *In* W.C. Mackay, M.K. Brewin, and M. Monita, eds. Friends of the Bull Trout Conference Proceedings. P8.

[4] Washington Timber/Fish Wildlife Cooperative Monitoring Evaluation and Research Committee, 1993. Watershed Analysis Manual (Version 2.0). Washington Department of Natural Resources.

[5] Overton, C.K., J.D. McIntyre, R. Armstrong, S.L. Whitewell, and K.A. Duncan. 1995. User's guide to fish habitat: descriptions that represent natural conditions in the Salmon River Basin, Idaho. U.S. Department of Agriculture, Forest Service, Intermountain Research Station, Gen Tech. Rep. INT-GTR-322.

[6] Overton, C.K., S.P. Wollrab, B.C. Roberts, and M.A. Radko. 1997. R1/R4 (Northern/Intermoutain Regions) Fish and Fish Habitat Standard Inventory Procedures Handbook. U.S. Department of Agriculture, Forest Service, Intermountain Research Station, Gen Tech. Rep. INT-GTR-346.

[7] Biological Opinion on Land and Resource Management Plans for the: Boise, Challis, Nez Perce, Payette, Salmon, Sawtooth, Umatilla, and Wallowa-Whitman National Forests. March 1, 1995.

[8] A Federal Agency Guide for Pilot Watershed Analysis (Version 1.2), 1994.

[9] Biological Opinion on Implementation of Interim Strategies for Managing Anadromous Fish-producing Watersheds in Eastern Oregon and Washington, Idaho, and Portions of Calfornia (PACFISH). National Marine Fisheries Service, Northwest Region, January 23, 1995.

[10] Shepard, B.B., K.L. Pratt, and P.J. Graham. 1984. Life histories of westslope cutthroat and bull trout in the Upper Flathead River Basin, MT. Environmental Protection Agency Rep. Contract No. R008224-01-5.

[11] Interior Columbia Basin Ecosystem Management Project Draft Environmental Impact Statement and Appendices.

[12] Frissell, C.A., Liss, W.J., and David Bayles, 1993. An Integrated Biophysical Strategy for Ecological Restoration of Large Watersheds. Proceedings from the Symposium on Changing Roles in Water Resources Management and Policy, June 27-30, 1993 (American Water Resources Association), p. 449-456.

[13] Lee, D.C., J.R. Sedell, B.E. Rieman, R.F. Thurow, J.E. Williams and others. 1997. Chapter 4: Broadscale Assessment of Aquatic Species and Habitats. *In* T.M. Quigley and S. J. Arbelbide eds "An Assessment of Ecosystem Components in the Interior Columbia Basin and Portions of the Klamath and Great Basins Volume III". U.S. Department of Agriculture, Forest Service, and U.S. Department of Interior, Bureau of Land Management, Gen Tech Rep PNW-GTR-405.

[14] Northwest Forest Plan, 1994. Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl. USDA Forest Service and USDI Bureau of Land Management.

[16] Winward, A.H., 1989 Ecological Status of Vegetation as a base for Multiple Product Management. Abstracts 42nd annual meeting, Society for Range Management, Billings MT, Denver CO: Society For Range Management: p277.

Table 2. Checklist For Documenting Environmental Baseline And Effects Of Proposed Action(S) On Relevant Indicators

DIAGNOSTICS/ PATHWAYS: INDICATORS	POPULATION AND ENVIRONMENTAL BASELINE (list values or criterion and supporting documentation)			EFFECTS OF THE ACTION(S)			
	Functioning Appropriately	Functioning At Risk	Functioning at Unacceptable Risk	Restore[1]	Maintain[2]	Degrade[3]	Compliance with ACS
Subpopulation Characteristics: Subpopulation Size							
Growth and Survival							
Life History Diversity and Isolation							
Persistence and Genetic Integrity							
Water Quality: Temperature							
Sediment							
Chem. Contam./Nutrients							
Habitat Access: Physical Barriers							
Habitat Elements: Substrate Embeddedness							
Large Woody Debris							
Pool Frequency and Quality							
Large Pools							
Off-channel Habitat							
Refugia[4]							
Channel Cond. & Dynamics: Wetted Width/Max.Depth Ratio							
Streambank Condition							
Floodplain Connectivity							
Flow/Hydrology: Change in Peak/Base Flows							
Drainage Network Increase							
Watershed Conditions: Road Density & Location							
Disturbance History							
Riparian Conservation Areas							
Disturbance Regime							
Integration of Species and Habitat Conditions							

Watershed Name: Location:

[1] For the purposes of this checklist, "restore" means to change the function of a "functioning at risk" indicator to "functioning appropriately", or to change the function of a "functioning at unacceptable risk" indicator to "functioning at risk" or "functioning appropriately" (i.e., it does not apply to "functioning appropriately" indicators). Restoration from a worse to a better condition does not negate the need to consult/confer if take will occur.

[2] For the purposes of this checklist, "maintain" means that the function of an indicator does not change (i.e., it applies to all indicators regardless of functional level).

[3] For the purposes of this checklist, "degrade" means to change the function of an indicator for the worse (i.e., it applies to all indicators regardless of functional level). In some cases, a "functioning at unacceptable risk" indicator may be further worsened, and this should be noted.

[4] Refugia = watersheds or large areas with minimal human disturbance having relatively high quality water and fish habitat, or having the potential of providing high quality water and fish habitat with the implementation of restoration efforts. These high quality water and fish habitats are well distributed and connected within the watershed or large area to provide for both biodiversity and stable populations.

(adapted from discussions on “Stronghold Watersheds and Unroaded Areas” in Lee, D.C., J.R. Sedell, B.E. Rieman, R.F. Thurow, J.E. Williams and others. 1997. Chapter 4: Broadscale Assessment of Aquatic Species and Habitats. *In* T.M. Quigley and S. J. Arbelbide eds “An Assessment of Ecosystem Components in the Interior Columbia Basin and Portions of the Klamath and Great Basins Volume III”. U.S. Department of Agriculture, Forest Service, and U.S. Department of Interior, Bureau of Land Management, Gen Tech Rep PNW-GTR-405).

Table 3. Dichotomous Key For Making Esa Determination Of Effects (circle the conclusion at which you arrive)

1. Are there any proposed/listed fish species and/or proposed/designated critical habitat in the watershed or downstream from the watershed?

   NO ..... **No effect**

   YES (or unknown) ..... Go to 2

2. Will the proposed action(s) have any effect whatsoever[1] on the species and/or critical habitat:

   NO ..... **No effect**

   YES ..... Go to 3

3. Does the proposed action(s) have the potential to hinder attainment of relevant "functioning appropriately" indicators (from table 2)?

   A. NO ..... Go to 4

   B. YES ..... Go to 5

4. Does the proposed action(s) have the potential to result in "take"[1] of any proposed/listed fish species or destruction/adverse modification of proposed/designated critical habitat? [3]

   A. NO ..... **Not likely to adversely affect**

   B. YES ..... **Likely to adversely affect**

5. Does the proposed action(s) have the potential to result in "take"[1] of any proposed/listed fish species or destruction/adverse modification of proposed/designated critical habitat? [3]

   A. NO ..... **Not likely to adversely affect**

   B. YES ..... **Likely to adversely affect**

[1] **"Any effect whatsoever"** includes small effects, effects that are unlikely to occur, and beneficial effects (all of which are recognized as "may effect" determinations). A **"no effect"** determination is only appropriate if the proposed action **will literally have no effect whatsoever** on the species and/or critical habitat, **not** a small effect, an effect that is unlikely to occur, or a beneficial effect.

[2] **"Take"** - The ESA (Section 3) defines take as "to harass, harm, pursue, hunt, shoot, wound, trap, capture, collect or attempt to engage in any such conduct". The USFWS (USFWS, 1994) further defines "harm" as "significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns such as breeding, feeding, or sheltering", and "harass" as "actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering".

[3] **Document expected incidental take** on next page of this key.

DOCUMENTATION OF EXPECTED INCIDENTAL TAKE

Name and location of action(s):_____ Species:_____

1. The proposed action may result in incidental take through which of the following mechanisms (circle as appropriate)?

   Harm: Significant impairment of behavioral patterns such as breeding, feeding, sheltering, and others (identify).

   Harass: Significant disruption of normal behavior patterns which include, but are not limited to, breeding, feeding, sheltering, or others (identify).

   Pursue, Hunt, Shoot, Wound, Capture, Trap, Collect.

2. What is the approximate duration of the effects of the proposed action(s) resulting in incidental take?

3. Which of the following life stages will be subject to incidental take (circle as appropriate)?

   Fertilization to emergence (incubation)

   Juvenile rearing to adulthood

   Adult holding and overwintering

   Adults spawning

   Adults migrating

4. Which life form and subpopulation status are present in the watershed or downstream of the watershed where the activities will take place (circle as appropriate)?

Life Form:	Subpopulation status:
Resident	**Stronghold population**
Adfluvial	**Depressed population**
Fluvial	

Anadromous

5. What is the location of the expected incidental take due to the proposed action(s)?

Basin and watershed:

Stream reach and habitat units:

6. Quantify your expected incidental take:

Length stream affected (miles):

Individuals (if known):

Appendix A

Examples of Some of the Influences of Human Activities on Aquatic Ecosystems

The following, except the section on water temperature, are excerpts generally from two sources: 1. "An Assessment of Ecosystem Components in the Interior Columbia Basin and Portions of the Klamath and Great Basins, Volume III, Chapter 4, 1997, (referred to as Lee and others 1997), and 2) Rieman and McIntyre 1993. These descriptions are generated to stimulate biologist's thought and Level 1 team discussion on evaluation of all the diagnostics/pathways through which habitat degradation could occur and aquatic populations can be altered. These examples are not all inclusive. We recommend that biologists review all the recommended reports and papers suggested on page **** and use them to gain a more complete insight into each indicator listed in the matrix. The Interior Columbia Basin Assessment can be acquired from the U.S. Forest Service, Pacific Northwest Research Station, 3200 SW Jefferson Way, Corvallis, OR 97331.

Channel Stability (excerpts from Rieman and McIntyre 1993)

"Young bull trout are closely associated with stream channel substrates. Incubation occurs over a prolonged period through the winter. Juvenile fish are found in close association with the bottom of the channel, often using substrate for cover (Fraley and Shepard 1989; Oliver 1979; Pratt 1984; Shepard and others 1984b). The association with substrate appears more important for bull trout than for other species (Nakano and others 1992; Pratt 1984).

The extended tie to substrate and the presence of embryos and alevins in substrate during winter and spring suggests that highly variable stream flows, bed load movements, and channel instability will influence the survival of young bull trout (Goetz 1989; Weaver 1985). The embryos and young of fish that spawn in the fall are particularly vulnerable to flooding and scouring during winter and early spring (Elwood and Waters 1969; Seegrist and Gard 1972; Wickett 1958) and to low winter flows or freezing within the substrate." "Low habitat complexity, the frequency of bed load scour and the frequency of low flows may be aggravated by watershed disruption and problems of channel instability in many bull trout streams."

Channel Substrate (excerpts from Rieman and McIntyre 1993)

"Increased sediments reduce pool depth, alter substrate composition, reduce interstitial space, and cause channels to braid (Beschta and Platts 1986; Clifton 1989; Everest and others 1987; Lisle 1982; Megahan and others 1980). Initial work on the influence of fine sediments (Shepard and others 1984a; Weaver and White 1985) suggested that incubating bull trout embryos tolerated fine sediments (less than 6.35 millimeters) better than cutthroat trout, steelhead trout, and brook trout. Their tolerance appeared similar to that of chinook salmon (Hausle and Coble 1976; Irving and Bjornn 1984; Tappel and Bjornn 1983). More recent work (Weaver and Fraley 1991), however, indicated that any increase in fine sediments reduces survival. Others have found that when the percent of fine sediments in the substrate was higher, rearing bull trout were also less abundant (Leathe and Enk 1985; McPhail and Murray 1979; Shepard and others 1984a; Weaver and Fraley 1991)." "Spawners may also "select" sites where substrate is not highly compacted (Graham and others 1981; McPhail and Murray 1979).

It is difficult to predict how much a particular change in substrate composition will affect survival for any salmonid (Chapman 1988; Everest and others 1987; Weaver and Fraley 1991). Some substrates are more likely to accumulate fines than others, and some populations probably are more sensitive than others. In the absence of detailed local information on population habitat dynamics, any increase in the proportion of fines in substrates should be considered a risk to productivity of an environment and to the persistence of associated bull trout populations."

Cover (excerpts from Rieman and McIntyre 1993)

"Bull trout usually associate with complex forms of cover and with pools. Juveniles live close to in-channel wood, substrate, or undercut banks (Goetz 1991; Pratt 1984, 1992). Young-of-the-year bull trout use side channels, stream margins, and other areas of low velocity. Older fish use pools (Hoelscher and Bjornn 1989; Pratt 1984) and areas with large or complex woody debris and undercut banks (Graham and others 1981; Oliver 1979; Pratt 1985; Shepard and others 1984b). Woody debris correlated significantly with densities of bull trout sampled in streams in the Bitterroot National Fores (Clancy 1992)." "Cover is important in winter and is thought to limit many fish populations (Chapman 1966; Cunjak and Power 1986). Cover clearly influences population density and overwinter survival of brook trout (Boussu 1954; Hunt 1976; Saunders and Smith 1962)."

Water Temperature

Researchers recognize temperature more consistently than any other factor influencing bull trout distribution, based mostly on correlative evidence (Reiman and McIntyre 1993). Water temperatures in excess of about 15°C are thought to limit bull trout distribution (Rieman and McIntyre 1993). McPhail and Murray (1979) reported that the survival of bull trout eggs to hatching varied with water temperature: 0-20% survival in 8-10°C, 60-90% in 6°C, and 80-95% in 2-4°C. Temperatures between 4-6°C were needed for egg development in Montana streams (Weaver and White 1985). Water temperature also appears to be a critical factor in the spawning and early life history of bull trout. Spawning has been observed to occur in British Columbia, Oregon, and Montana at or below 9°C (Fraley and Shepard 1989, McPhail and Murray 1979, Riehle 1993).

Water Quality (excerpts from Lee et al. 1997)

"The extent and intensity of land development and land-use activities have increased during the past century." "Aquatic ecosystem perturbations related to these activities include: 1) thermal pollution; 2) toxicity due to the presence of organic compounds (synthetic and natural) and heavy metal ions; 3) introduction of pathogenic organisms; 4) organic wastes that result in potentially catastrophic changes in dissolved oxygen levels; 5) acidification; 6) elevated sedimentation rates; and 7) increased eutrophication (Ellis 1989).

Eutrophication is indicative of deteriorating water quality associated with a buildup of nutrients, especially nitrogen and phosphorus. Increased rates of nutrient loading can be related to changes an/or disturbances within a watershed (Brugam and Vallarino 1989; Dojlido and Best 1993; Stauffer 1991). Development activities that contribute to increased nutrient levels include point sources such as industrial effluents and water-borne sewage systems and nonpoint sources such as agricultural operations, residential development and septic systems, road construction, and forest practices (Dojlido and Best 1993; Spencer 1991; Thralls 1991).

Nonpoint source pollution may be the most problematic cause of water quality deterioration because the origin of perturbation is often difficult to identify and control." "Development can result in increases of nitrogen and phosphorus in surface waters resulting from: septic system effluents (Scott 1991; Sorrie 1994; Stauffer 1991), runoff from fertilized lawns and agricultural lands (Lewis and others 1984; Power and Schepers 1989), and runoff from highways and road (Ehrenfeld and Schneider 1991; Lewis and others 1984)."

Some Major Activities and their Effects

(All of the following are excerpts from Lee and others 1997)

Water diversions and dams

"Trends in the number of dams constructed over time and impounded water volumes indicate that many streams and rivers have experienced a rapid and massive change in their hydrology. Even though the rate of increase in storage volume has leveled since the mid-1970s, the total number of dams continues to increase, suggesting that new construction is focused on smaller dams (National Research Council 1995)."

"Reservoir operation has resulted in long-term changes in downstream water temperatures and the annual discharge of water and sediments. The pattern and timing of the annual hydrograph have been altered in most basins on scales ranging from hours to months and even years. In many instances dams have changed large river systems to isolated fluvial fragments between lakes. In arid areas of the Basin, stream diversions have reduced flows to a trickle."

"Water withdrawals for off-stream uses include rural domestic use, stock watering, irrigation, public water supply, commercial and industrial supply, and thermoelectric cooling."
"Agricultural irrigation is by far the dominant off-stream use in the Basin."

"Most irrigation diversions on Forest Service and BLM-administered lands are operated by private individuals, but a few water rights are held by federal agencies."

" Irrigation has contributed to the extirpation of salmon and steelhead from many small streams in the Salmon National Forest (Keifenhiem 1992). Many streams in the Sawtooth National Recreation Area have inadequate instream flow as a result of irrigation." " The cumulative loss of spawning and rearing habitat in these tributaries is significant."

Grazing and Farming

"The proportion of land in the Pacific Northwest dedicated to agriculture is relatively small (approximately 16%). However, agricultural practices can have considerable effects on aquatic resources because the lands are often located on historic flood plains and valley bottoms. The effects of farming on aquatic systems include loss of native vegetation, bank instability, loss of floodplain function, removal of large woody debris sources, changes in sediment supply, changes in hydrology, increases in water temperature, changes in nutrient supply, chemical pollution, channel modification, and habitat simplification (Spence and others 1995)."

“The effects of livestock grazing on aquatic systems are related, in part, to the biophysical attributes of the site (Archer and Smeins 1991).” “Unstable stream conditions often exist as part of the natural conditions of streams; however, grazing can amplify these unstable conditions. In some cases, livestock use may initiate additional instability within a stream system.

Overgrazing by livestock can lead to a reduction of soil structure, soil compaction, and damage or loss of vegetative cover. All of these processes contribute to an increase in the rate and erosive force of surface runoff (Meehan and Platts 1978; Thurow 1991). Resulting increases in soil erosion lead to a loss of stored nutrients in the soil and a decrease in the level of vegetative productivity (Thurow 1991). The degree of soil erosion associated with livestock grazing is related to slope gradient and aspect of the site being grazed, the condition of the soil, type and density of vegetation, and the accessibility of the site to livestock (Meehan and Platts 1978).

Riparian areas maintain stream structure and function through processes such as water filtration, bank stabilization, water storage, groundwater recharge, nutrient retention, regulation of light and temperature, channel shape and pattern (morphology and micro-topography), and dispersal of plants and animals (Cummins and others 1984; Gregory and others 1991; Minshall 1967, 1994; Sullivan and others 1987).” “Livestock grazing can alter the species composition of stream-side vegetation (Archer and Smeins 1991; Platts 1978; Stebbins 1981; Thurow 1991; Vollmer and Kozel 1993) and diminish vegetative productivity (Archer and Smeins 1991; Horning 1994; Meehan and Platts 1978; Platts 1978; Thurow 1991; Vollmer and Kozel 1993). Grazing alters riparian vegetation by removing deep rooting plant species and decreasing canopy cover and riparian vegetation height (Platts 1991). Grazing has been implicated in the alteration of species composition of vegetative communities and associated fire regimes (Agee 1993; Leopold 1924).

Grazing is a major nonpoint source of channel sedimentation (Dunne and Leopold 1978; MacDonald and others 1991; Meehan 1991; Platts 1991). Grazed watersheds typically have higher stream sediment levels than ungrazed watersheds (Lusby 1970; Platts 1991; Rich and others 1992; Scully and Petrosky 1991). Increased sedimentation is the result of grazing effects on soils (compaction), vegetation (elimination), hydrology (channel incision, overland flow), and bank erosion (sloughing) (Kauffman and others 1983; MacDonald and others 1991; Parsons 1965; Platts 1981a, 1981b; Rhodes and others 1994). Sediment loads that exceed natural background levels can fill pools, silt spawning gravels, decrease channel stability, modify channel morphology, and reduce survival of emerging salmon fry (Burton and others 1993; Everest and others 1987; MacDonald and others 1991; Meehan 1991; Rhodes and others 1994). In addition, runoff contaminated by livestock wastes can cause an increase in potentially harmful bacteria (for example, *Pseudomonas aeruginosa* and *Aeromonas hydrophila*) (Taylor and others 1989; Hall and Amy 1990; Thurow 1991). Compared to ungrazed sites, aquatic insect communities in stream reaches associated with grazing activities often are composed of organisms more tolerant of increased silt levels, increased levels of total alkalinity and mean conductivity, and elevated water temperatures (Rinne 1988).”

Timber harvest

“Anderson (1988), citing a 1986 report of the Montana State Water Quality Bureau, suggested that the single greatest threat to watersheds and aquatic life is timber harvest and associated road building within forests. This threat is due, in part, to the increased level of harvesting timber from steeper, more environmentally sensitive terrain (Anderson 1998; Platts and Megahan 1975). Accelerated surface erosion and increased levels of sedimentation can decrease after initial disturbance but may remain above natural levels for many years (Platts and Megahan 1975; Spencer 1991; Swanson 1981).” “Vulnerable watersheds generally have high slope gradients, high levels of potential soil erodibility, soils having moderate to very poor drainage, or soil moisture contents in excess of field capacity for long periods of the year (van Kesteren 1986).

Soil and site disturbance that inevitably occur during timber harvest activities are often responsible for increased rates of erosion and sedimentation (Chamberlain and others 1991; FEMAT 1993; MacDonald and others 1991; Meehan 1991; Reid 1993; Rhodes and others 1994); modification and destruction of terrestrial and aquatic habitats (FEMAT 1993; van Kesteren 1986); changes in water quality and quantity (Bjornn and Reiser 1991; Brooks and others 1992; Chamberlain and others 1991; Rhodes and others 1994); and perturbation of nutrient cycles within aquatic ecosystems (Rowe and others 1992). Physical changes affect runoff events, bank stability, sediment supply, large woody debris retention, and energy relationships involving temperature (Li and Gregory 1995). All of these changes can eventually culminate in the loss of biodiversity within a watershed (FEMAT 1993; Rowe and others 1992).

Increased delivery of sediments, especially fine sediments, is usually associated with timber harvesting and road construction (Eaglin and Hubert 1993; Frissell and Liss 1986; Havis and others 1993; Platts and Megahan 1975). As the deposition of fine sediments in salmonid spawning habitat increase, mortality of embryos, alevins, and fry rises. Erosion potential is greatly increased by reduction in vegetation, compaction of soils and desruption of natural surface and subsurface drainage patterns (Chamberlain and others 1991; Rhodes and others 1994). Generally, logged slopes contribute sediment to streams based on the amount of bare compacted soils that are exposed to rainfall and runoff. Slope steepness and proximity to channels determine the rate of sediment delivery.

Water quality (for example, water temperature, dissolved oxygen, and nutrients) can be altered by timber harvest activities (Chamberlain and others 1991). Stream temperature is affected by eliminating stream-side shading, disrupted subsurface flows, reduced stream flows, elevated sediments, and morphological shifts toward wider and shallower channels with fewer deep pools (Beschta and others 1987; Chamberlain and others 1991; Reid 1993; Rhodes and others 1994). Dissolved oxygen can be reduced by low stream flows, elevated temperatures, increased fine inorganic and organic materials that have infiltrated into stream gravels retarding intergravel flows (Bustard 1986; Chamberlain and others 1991). Nutrient concentrations may increase following logging but generally return quickly to normal levels (Chamberlain and others 1991).

Because the supply of large woody debris to stream channels is typically a function of the size and number of trees in riparian areas, it can be profoundly altered by timber harvest (Bisson and others 1987; Sedell and others 1988; Robison and Beschta 1990). Shifts in the composition and size of trees within the riparian area affect the recruitment potential and longevity of large

woody debris within the stream channel. Large woody debris influences channel morphology, especially in forming pools and instream cover, retention of nutrients, and storage and buffering of sediment. Any reduction in the amount of large woody debris within streams, or within the distance equal to one site-potential tree height from the stream, can reduce instream complexity (Rainville and others 1985; Robison and Beschta 1990). Large woody debris increases the quality of pools, provides hiding cover, slow water refuges, shade, and deep water areas (Rhodes and others 1994). Ralph and others (1994) found instream wood to be significantly smaller and pool depths significantly shallower in intensively logged watersheds. The size of woody debris in a logged watershed in Idaho was smaller than that found in a relatively undisturbed watershed (Overton and others 1993).

Because water is often delivered to lakes via stream channels, we can infer that effects to streams related to timber harvest and road construction may eventually be manifested within lakes." "Birch and others (1980) reported that timber harvest activities caused increases in lake sedimentation rate and lake productivity in three of four lakes studied in western Washington, accelerating the rate of change in the trophic status of each lake. Timber harvest activities and road construction, including railroad construction, increased sedimentation rates above natural levels in three lades of the Flathead Basin (Spencer 1991). Road construction appeared to be the greatest cause of disturbance resulting n enhanced fine sediment deposition in lakes downstream from the construction areas."

Roads

"Roads contribute more sediment to streams than any other land management activity (Gibbons and Salo 1973; Meehan 1991), but most of the land management activities, such as mining, timber harvest, grazing, recreation, and water diversions are dependent on roads. The majority of sediment from timber harvest activities are related to roads and road construction (Chamberlain and others 1991; Dunne and Leopold 1978; Furniss and others 1991; Megahan and others 1978; MacDonald and Ritland 1989) and associated increased erosion rates (Beschta 1978; Gardner 1979; Meehan 1991; Reid 1993; Reid and Dunne 1984; Rhodes and others 1994; Swanson and Dyrness 1975; Swanston and Swanson 1976)." "Roads can also affect water quality through applied road chemicals and toxic spills (Furniss and others 1991; Rhodes and others 1994)."

"Roads directly affect natural sediment and hydrologic regimes by altering streamflow, sediment loading, sediment transport and deposition, channel morphology, channel stability, substrate composition, stream temperatures, water quality, riparian conditions within a watershed. For example, interruption of hill-slope drainage patterns alters the timing and magnitude of peak flows and changes base stream discharge (Furniss and others 1991; Harr and others 1975) and sub-surface flows (Furniss and others 1991; Megahan 1972). Road-related mass soil movements can continue for decades after the roads have been constructed (Furniss and others 1991). Such habitat alterations can adversely affect all life-stages of fishes, including migration, spawning, incubation, emergence, and rearing (Furniss and others 1991; Henjum and others 1994; MacDonald and others 1991; Rhodes and others 1994)."

"Road/stream crossings can also be a major source of sediment to streams resulting from channel fill around culverts and subsequent road crossing failures (Furniss and others 1991). Plugged

culverts and fill slope failures are frequent and often lead to catastrophic increases in stream channel sediment, especially on old abandoned or unmaintained roads (Weaver and others 1987). Unnatural channel widths, slope, and stream bed form occur upstream and downstream of stream crossings (Heede 1980), and these alterations in channel morphology may persist for long periods of time. Channelized stream sections resulting from riprapping of roads adjacent to stream channels are directly affected by sediment from side casting, snow removal, and road grading; such activities can trigger fill slope erosion and failures. Because improper culverts can reduce or eliminate fish passage (Belfore and Gould 1989), road crossings are a common migration barrier to fishes (Evans and Johnston 1980; Furniss and others 1991; Clancy and Reichmuth 1990)."

Mining

"Although any mining activity may have negative effects on aquatic ecosystems (according to the Pacific States Marine Fisheries Commission 1994, 14,400 kilometers of rivers and streams in the western United States have been polluted by mining), the largest impacts are generally associated with surface mining."

"Mining activities can affect aquatic systems in a number of ways: through the addition of large quantities of sediments, the addition of solutions contaminated with metals or acids, the acceleration of erosion, increased bank and streambed instability, and changes in channel formation and stability. Sediments enter streams through erosion of mine tailings (Besser and Rabeni 1987), by direct discharge of mining wastes to aquatic systems, and through movement of groundwater (Davies-Colley and others 1992). Coarse particles that enter watersheds are likely to settle relatively rapidly (Davies-Colley and others 1992), and therefore, effects on aquatic systems are greatest near mining activities. Fine inorganic particles (like clays) settle slowly and may travel great distances from the point of their introduction and therefore may have a greater effect on water bodies such as lakes further from mining activities. Fine suspended material reduces the amount of light available for benthic algae and plants, and thereby, biomass and primary production are diminished. Fine suspended materials may also reduce the quantity and quality of epilithon (substrate surface biofilm) that serves as food for benthic invertebrates. If suspended sediments damage respiratory structures of benthic invertebrates, their abundance may decline (Davies-Colley and others 1992)."

"Acidification of surface waters, a process associated with surface mining, mobilizes toxic metals naturally embedded in soils and streambeds." "Acidification of surface waters can affect organisms directly, such as salmonids which experience reduced egg viability, fry survival, growth rate, and other ills, or indirectly from toxic metals or substances which can affect growth, reproduction, behavior, and migration of salmonids and production of benthic algae (Spence and others 1995). Ecosystem responses to contaminants are dependant on the chemical, physical, biological, and geological processes at each site (Pascoe and others 1993). Depending on concentration, trace metal toxicity may reduce growth and reproduction or cause death of aquatic organisms (Leland and Kuwabara 1985). Adult stages of mollusks and fish can generally withstand higher concentrations of metals than other organisms (Leland and Kuwabara 1985), but embryonic and larval stages are quite sensitive to heavy metals (Leland and Kuwabara 1985). The combination of some metals may inhibit primary production more than any single

metal alone (Wong and others 1978); therefore, when several metals are present, water quality criteria for single metals are insufficient for protecting aquatic life (Borgmann 1980)."

"Surface mining practices of dredging and placer mining have altered aquatic habitats by destroying riparian vegetation and reworking channels."

Common practice for extracting gold today involves heap leach mining, a form of open-pit mining used for low-grade ore deposits. Piles of crushed ore are sprayed with a solution of sodium-cyanide (NaCN) that bonds with gold particles and is deposited in pools from which the gold is recovered. Numerous, small help leach fields are located in the Basin, primarily in floodplains of rivers or streams which are susceptible to large floods, creating the potential for flood inundation of the toxic leach pools and consequent contamination of river or stream habitats."

Non-native Fish Species

"Most introductions have been made with the intent of creating or expanding fishing opportunities and were initiated in earnest as early as the late 1800's (Evermann 1893; Simpson and Wallace 1978). Stocking of mountain lakes with cultured stocks of cutthroat, brook, and rainbow trout has been extensive (Bahls 1992; Liss and others 1995; Reiman and Apperson 1989)." "A variety of species such as kokanee salmon, chinook salmon, lake trout, brown trout, Atlantic salmon, coho salmon, black bass and other centrarchids, and ictalurids were introduced in these systems to diversify angling opportunities, create trophy fisheries, and to provide forage for potential trophy species."

"Although introductions have provided increased fishing opportunities and socioeconomic benefits, they have also led to catastrophic failures in some fisheries and expanded costs to management of declining stocks (Bowles and others 1991; Gresswell 1991; Gresswell and Varley 1988; Wydoski and Bennett 1981)."

"Non-native fishes also threaten native species through hybridization and subsequent loss of the native genome through introgression." "Hybridization between brook trout and bull trout appears to be common where the species overlap (Adams 1994; Leary and others 1993; Reiman and McIntyre 1993), and elimination or displacement of bull trout can be a common outcome (Leary and others 1993).

Predation by non-native species may have an important influence on some native cyprinids and catostomids (Williams and others 1990), resident trout populations (Griffith 1988; Reiman and Apperson 1989), and on the survival of juvenile anadromous salmonids (Reiman and others 1991)." "Predation by introduced fishes is also commonly identified as a major factor in the isolation and decline of native amphibians (Bahls 1992; Bradford and others 1993; Liss and others 1995) and has important effects on local invertebrate faunas as well (Bahls 1992; Liss and others 1995)."

"Consequences of introducing non-native species are not limited to a few interacting species. Effects frequently cascade through entire ecosystems (Winter and Hughes 1995) and compromise structure and ecological function in ways that rarely can be anticipated (Li and

Moyle 1981; Magnuson 1976; Moyle and others 1986)."

"There is growing recognition that biological integrity and not just species diversity (Angermeier 1994; Angermeier and Karr 1994) is an important characteristic of aquatic ecosystem health. The loss or restriction of native species and the dramatic expansion of non-native species leave few systems that are not compromised."

Hatcheries

"Although the cultured stocks of salmonids have been frequently used to mitigate the effects of over-harvest and habitat degradation, there is substantial evidence that this practice has detrimental effects on native populations (Hindar and others 1991; Krueger and May 1991; Marnell 1986; Miller 1954). Offspring of hatchery fish spawning in the wild do not survive as will as the offspring of wild fish (Chilcote and others 1986; Leider and others 1990; Nickelson and others 1986), even if the hatchery stock was developed from wild adults (Reisenbichler and McIntyre 1977). There is unavoidable selection for traits favoring survival in the artificial conditions of egg trays, tanks, raceways, and holding ponds. Hatchery fish thus become genetically distinct from wild fish. If they stray and subsequently spawn with wild fish in natural areas, survival of the offspring is compromised (Chilcote and others 1986).

Despite lower survival, hatchery fish occupy habitat that would otherwise be used by wild fish (Miller 1954). In addition, artificially high densities of fish returning to hatcheries attract intensive fisheries that can over-harvest wild fish (Reisenbichler, in press; Wright 1981, 1993)."

"Many hatcheries located on tributaries of the Columbia River have water intakes upstream of structures designed to divert migrating fish into hatchery ponds. In order to reduce the risk of transmitting diseases to the hatchery via its water intake, adult fish are not passed upstream of the intake barrier at many sites. Protection of hatchery water supplies often prevents natural populations from accessing large tracts of historic spawning and nursery area."

Commercial and Recreational Harvest

"Angler harvest directly increases mortality and thereby influences total population abundance, size- and age-structure, and reproductive potential (Ricker 1975). Fishing may lead to substantial declines in abundance, especially in populations that are extremely vulnerable to certain types of gear." "Although high catchability may be desirable in sport fisheries, it may lead to substantial declines in abundance and changes in population structure without restrictions (Gresswell 1990; Gresswell and others 1994; Gresswell and Liss 1995).

Although management agencies have attempted to reduce or eliminate fishing as a source of mortality, incidental harvest of many sensitive native fish stocks is a problem in the Basin." "Anglers may also affect fish stocks by altering fish habitat through redd trampling and increased bank erosion. Roberts and White (1992) demonstrated that wading on trout redds can cause mortality to eggs and fry. For many years, stream reaches in some states have been closed to angling during salmon spawning season to reduce harassment of spawning fish."

"Within the past decade, many agencies have adopted new philosophies of management that prioritize restoration and management of native fish stocks and their habitats (Idaho Department of Fish and Game (IDFG) 1991) and recognize the non-consumptive values of fish (Botsford 1994; Gresswell 1994). Where habitat for native species remains suitable, fish populations have increased substantially following implementation of restrictive harvest regulations (Gresswell 1990; Varley and Gresswell 1988)." "Bull trout numbers and redds also increased in response to decreased harvest (Ratliff 1992). These examples suggest that where populations retain resilience, restoration efforts can be successful."

Habitat Fragmentation and Simplification

"Aquatic habitat fragmentation (impassable obstructions, temperature increases, and water diversion) and simplification (channelization, removal of woody debris, channel bed sedimentation, removal of riparian vegetation, and water flow regulation) have resulted in a loss of diversity within and among native fish populations."

"Theories from population and conservation biology predict that smaller or more isolated populations have an increased risk of extirpation, and that smaller patches of habitat are likely to support less diverse communities (Boyce 1992; Gilpin and Soule 1986; MacArthur and Wilson 1967; Simberloff 1988). There is empirical evidence that these are important issues for many aquatic communities and species (Gilpin and Diamond 1981; Hanks 1991; Sjogren 1991) including fishes (Reiman and McIntyre 1995; Schlosser 1991; Sheldon 1988). At the same time species and communities that are spatially diverse face lower risks of regional extirpation in highly variable environments (den Boer 1968; Simberloff 1988). Core or source populations that are resistant to disturbance may support populations in other marginal or ephemeral habitats through dispersal (Bowers 1992; Simberloff 1988). The quality and distribution of even a few such key areas may ultimately dominate the dynamics of whole systems (Bowers 1992).

The heterogeneity of habitats for aquatic organisms, and particularly fishes, has been clearly recognized at multiple scales from microhabitat units to entire basins (Sedell and others 1990; Schlosser 1991). This spatial complexity is seen as an important factor influencing species diversity and ecosystem stability (Bowers 1992; Gresswell and others 1994; Schlosser 1991) and results in discontinuous distribution of life stages, populations, metapopulations, or subspecies and species as well. Important habitat types, such as pools or off-channel rearing areas, are discontinuous within stream reaches and influence the distributions and relative abundances of a species or life stages at that scale (Schlosser 1991). At larger watershed scales the distribution among reaches and among streams may be influenced by such things as local climate, stream temperature, stream gradients, the distribution of suitable spawning sites and gravels, and stream size (Fausch and others 1994; McIntyre and Rieman 1995; Rieman and McIntyre 1995). Spawning and rearing of bull trout and westslope and Yellowstone cutthroat trout, for example, may be restricted to smaller, headwater streams both by temperature and stream size even though subadults and adults may move widely throughout entire river basins (Gresswell 1995; McIntyre and Reiman 1995; Reiman and McIntyre 1995)."

"Fringe environments that do not support a large abundance of fishes may actually contribute much of the genetic variability to the population and may contribute in a critical way to the

persistence of much larger systems (Northcote 1992; Scudder 1989). The connection among spatially diverse and temporally dynamic habitats and populations is likely to be a critical factor to persistence and integrity of aquatic communities.

Fishes, particularly salmonids, exhibit remarkable diversity of life-history strategies (Lichatowich and Mobrand 1995; Reiman and McIntyre 1993; Thorpe 1994) and important dispersal mechanisms for dealing with naturally fragmented and variable environments (Milner and Bailey 1989; Quinn 1993; Thorpe 1994). Migratory life-history forms may be a particularly important mechanism of dispersal and risk aversion in highly variable environments for species like bull and Yellowstone cutthroat trout (Gresswell and others 1994; Reiman and McIntyre 1993).

The loss or degradation of habitats resulting form anthropogenic activities has not occurred in a random or uniformly dispersed fashion. Often lower elevation lands are more accessible, have wider floodplain valleys, and are more easily developed, hence habitat degradation has been greater in lower watersheds or in the lower reaches of larger systems. Dams and water diversions often result in fragmented streams and rivers. As a result, watershed retaining the best remaining habitats are not well dispersed throughout the individual basins; they are often restricted to less productive headwater areas. Small streams in the headwater basins actually represent more extreme or sensitive environments with limited resilience to disturbance, increased synchrony among the populations, and relatively poor potential for dispersal throughout the entire Basin.

Because life-history stages and forms are also distributed in non-uniform or non-random patterns (Lichatowich and Mobrand 1994; Reiman and Apperson 1989; Schlosser 1991), some have been more likely to disappear than others. Within heavily managed areas, disturbance has often been dispersed among watersheds in an effort to minimize damage in any single area. If most watersheds are compromised, there are few local populations with the resilience to persist in the face of major storm or other catastrophic events that eventually test those populations. When high quality habitats are isolated in a system, the loss of migratory life histories, elimination of connecting corridors, or the poor quality of interspersed habitats that may act as “stepping stones” (Gilpin 1987) for dispersal may seriously limit the connectivity among populations. Eventually the ability of populations to rebound or support those that are lost is diminished.”

“The loss of life history expression influences the connectivity and stability among populations, but it also has restricted the full potential for fish production (Lichatowich and Mobrand 1995). The challenge for aquatic ecosystem management will be the maintenance and restoration of spatially diverse, high quality habitats that minimize the risks of extinction (Frissell and others 1993; Reeves and Sedell 1992) and that provide for the full expression of potential life histories (Healey 1994; Lichatowich and Mobrand 1995).”

General Recreational Activities

“Mountain lakes, especially those in national parks and scenic forested areas, may be the most susceptible aquatic systems to the negative effects of recreation. The inherent sensitivity of a lake to pollutants influences its susceptibility to water-quality degradation (Gilliom and others

1980)." "Likelihood of pollutant-loading increases if soil, geologic, or hydrologic characteristics of a watershed favor the transport of pollutants to a lake (Gilliom and others 1980)."

"Where visitor use is high, trampling associated with foot traffic can affect vegetation along lakes and streams through direct mechanical action and indirectly through changes in soil (Liddle 1975). Resistance to trampling depends on plant life form; large and broad-leaved plants are most susceptible, and grasses generally are most resistant (Burden and Randerson 1972). Loss of vegetation from shorelines, wetlands, or steep slopes can cause erosion and pollution problems (Burden and Randerson 1972; Gilliom and others 1980)."

"Power boats can have numerous negative effects on lake environments. Resuspension of bed sediments can occur with passage of a single boat (Garrad and Hey 1987)." "Concomitant high levels of turbidity and reduced light penetration may be a major factor in declining populations of submerged macrophytes." "Power boats are also associated with the spread of the exotic Eurasion watermilfoil (*Myriophyllum spicatum*). Because it reproduces from seeds, rhizomes, and fragmented stems, this non-native plan is easily transported between water bodies when plant matter becomes entangled on boat propellers or trailers (Reed 1977)."

"Outboard engines introduce hydrocarbon emissions to the aquatic environment, and emissions have a high phenol content that is quite toxic to aquatic organisms (Wachs and others 1992). Increased lead levels in reservoirs may be attributed to recreational boating and gasoline spills (Cairns and Palmer 1993)."

"Effects of off-road recreational vehicle use on aquatic resources are documented only for a few types of natural systems. On sand dunes and shorelines, off-road vehicles can result in significant reductions of vegetation (Anders and Leatherman 1987; Wisheu and Keddy 1991)." "Disturbance associated with off-road vehicle use can alter plant community composition or create openings in cover vegetation on shorelines (Wisheu and Keddy 1991). Partial loss of vegetation from shorelines can result in increased erosion that continues until those shorelines are devoid of vegetation (Wisheu and Keddy 1991). Because seeds tend not to be deeply buried in shoreline wetlands, they may be particularly sensitive to intense disturbance (Wisheu and Keddy 1991), and recovery of disturbed shorelines may be very slow. Use of off-road vehicles may be particularly detrimental in fragile soils or in areas where habitat for sensitive species is limited (Williams 1995). Additionally, off-road vehicle use in streams can result in destruction of redds, eggs, and young."

References

Fraley, J. J. and B. B. Shepard. 1989. Life History, Ecology, and Population Status of Migratory Bull Trout (*Salvelinus confluentus*) in the Flathead Lake River System, Montana. Northwest Science 63(4);133-143.

Lee, D.C., J.R. Sedell, B.E. Rieman, R.F. Thurow, J.E. Williams and others. 1997. Chapter 4: Broadscale Assessment of Aquatic Species and Habitats. *In* T.M. Quigley and S. J. Arbelbide eds "An Assessment of Ecosystem Components in the Interior Columbia Basin and Portions of the Klamath and Great Basins Volume III". U.S. Department of

Agriculture, Forest Service, and U.S. Department of Interior, Bureau of Land Management, Gen Tech Rep PNW-GTR-405).

McPhail, J. D. and C. B. Murray. 1979. The Early Life-history and Ecology of Dolly Varden (*Salvelinus malma*) in the upper Arrow Lakes. University of British Columbia, Department of Zoology and Institute of Animal Resources, Vancouver, B.C.

Reiman, B. E. and J. D. McIntyre. 1993. Demographic and Habitat Requirements for Conservation of Bull Trout. Gen. Tech. Rep. INT-302. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station, Boise, ID. 38p

Riehle, M. D. 1993. Metolius Basin Water Resources Monitoring, Progress Report 1988-1992. U.S. Department of Agriculture, Forest Service, Deschutes National Forest, Bend, OR.

Weaver, T. M. and R. G. White. 1985. Coal Creek Fisheries Monitoring Study No. III. Quarterly Progress Report. Montana State Cooperative Fisheries Research Unit, Bozeman, MT.

Appendix B
Relating the ACS Objectives and Aquatic/Riparian Strategy Objectives with the Diagnostics/Pathways and Indicator

ACS Objectives of the Northwest Forest Plan

Forest Service and BLM-administered lands within the range of the northern spotted owl will be managed to:

1. Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations and communities are uniquely adapted.

2. Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal, and drainage network connections include floodplains, wetlands, upslope areas, headwater tributaries, and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life history requirements of aquatic and riparian-dependent species.

3. Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.

4. Maintain and restore water quality necessary to support healthy riparian, aquatic, wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities.

5. Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport.

6. Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected.

7. Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands.

8. Maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and enter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of coarse woody debris sufficient to sustain physical complexity and stability.

9. Maintain and restore habitat to support well-distributed populations of native plant, invertebrate, and vertebrate riparian-dependent species.

Aquatic/Riparian Strategy Objectives in PACFISH and INFISH

The ACS for PACFISH and INFISH is written as "Riparian Goals" that describe expectations in establishing the characteristics of healthy, functioning watersheds, riparian areas, and associated fish habitats. These are interim directions. Until a long-term direction is finalized, these goals/objectives amend LRMPs and RMP in areas within the proposed bull trout listing areas but outside of that land covered by the Northwest Forest Plan.

Maintain or restore:

1. water quality, to a degree that provides for stable and productive riparian and aquatic ecosystems;

2. stream channel integrity, channel processes, and the sediment regime (including the elements of timing, volume, and character of sediment input and transport) under which the riparian and aquatic ecosystems developed;

3. instream flows to support healthy riparian and aquatic habitats, the stability and effective function of stream channels, and the ability to route flood discharges;

4. natural timing and variability of the water table elevation in meadows and wetlands;

5. diversity and productivity of native and desired non-native plant communities in riparian zones;

6. riparian vegetation, to:
    1. provide an amount and distribution of large woody debris characteristic of natural aquatic and riparian ecosystems;
    2. provide adequate summer and winter thermal regulation within the riparian and aquatic zones; and
    3. help achieve rates of surface erosion, bank erosion, and channel migration characteristics of those under which the communities developed.

7. riparian and aquatic habitats necessary to foster the unique genetic fish stocks that evolved within the specific geo-climatic region; and

8. habitat to support populations of well-distributed native and desired non-native plant, vertebrate, and invertebrate populations that contribute to the viability of riparian-dependent communities.

A comparison between ACS Objectives of the Northwest Forest Plan and the diagnostics/ pathways and indicators used in the effects matrix.

Relation of Indicators to ACS and Aquatic/Riparian Strategy Objectives

Aquatic Conservation Strategy Objectives - Northwest Forest Plan	Aquatic/Riparian Strategy Objectives - PACFISH/INFISH	Indicators
1,8,9	7,8	Subpop Char / Subpop Size
3,4,5,9	1,2,7,8	Subpop Char / Grow & Survl
1,2,4,6,7,9	1,2,3,6,7	Subpop Char / Life History Diversity & Isolation
2,6,9	3,6,7,8	Subpop Char / Persistence & Genetic Integrity
2,4,8,9	1,5,6,7	Water Quality / Temperature
4,5,6,8,9	1,2,3,4,5,6,7	Water Quality / Sediment
2,4,8,9	1,5,7,8	Water Quality / Chemical Concentration/Nutrients
2,6,9	3,7,8	Hab Access / Phys Barriers
3,5,8,9	2,6,7,8	Hab Elem / Substrate Embed
3,6,8,9	2,3,6,7	Hab Elem / L W D
3,8,9	2,6,7	Hab Elem / Pool Freq & Qual
3,5,6,9	2,3,7	Hab Elem / Large Pools
1,2,3,6,8,9	2,3,4,6,7	Hab Elem / Off-Channel Hab
1,2,9	7,8	Hab Elem / Refugia
3,8,9	3,7,8	Chan Cond & Dynamics / Wet Width/Max Depth Ratio
3,8,9	1,2,5,6,7	Chan Cond & Dynamics / Streambank Condition
1,2,3,6,7,8,9	3,4,5,6,7	Chan Cond & Dynamics / Floodplain Connectivity
5,6,7	2,3,6	Flow/Hydrology / Change in Peak/Base Flow
2,5,6,7	2,3	Flow/Hydrology / Increase in Drainage Network
1,3,5	2,4,8	Watershed Conditions / Road Density & Location
1,5	2,6,8	Watershed Conditions / Disturbance History
1,2,3,4,5,8,9	1,2,4,5,6,7,8	Watershed Conditions / RCA, RHCA, Riparian Reserves
1,2,4,5,6,7,8,9	1,2,4,5,6,7,8	Watershed Condition / Disturbance Regime

Appendix H: Bull Trout Core Area Conservation Status Assessment

BULL TROUT CORE AREA CONSERVATION STATUS ASSESSMENT

Conducted by: U.S. Fish and Wildlife Service
Portland, Oregon
February - April, 2005

Primary Authors: Wade Fredenberg
wade_fredenberg@fws.gov
Creston Fish and Wildlife Center
Kalispell, MT

Jeff Chan
jeffrey_chan@fws.gov
Western Washington Fish and Wildlife Office
Lacey, WA

John Young
john_al_young@fws.gov
Portland Regional Office
Portland, OR

GIS and Mapping: George Mayfield
george_mayfield@fws.gov
Portland Regional Office
Portland, OR

TABLE OF CONTENTS

Map Attachments - 2

List of Tables -3

Executive Summary -4

Introduction - 5

Methods -7

Results Summary - 8

Sensitivity Analysis - 10

Aggregated Ranking by units Larger Than Core Areas - 29

Core Area Life History and Connectivity Assessment – 33

Connectivity With Canada - 41

GIS-Based Threats Analysis - 45

Literature Cited - 52

Appendix A - Core Area Rank Criteria For Bull Trout - 54

Appendix B - Bull Trout Core Area Ranking Results - 67

Appendix C - Core Area Life History and Connectivity Rule Set and Tables - 84

Appendix D - Supplemental Threats Information - 95

MAP ATTACHMENTS

Map Index	Map Name
Map A	C-Rank by Core Area
Map B	Core Area by Population Size
Map C	Core Area by Distribution
Map D	Core Area by Population Trend
Map E	Core Area by Threats
Map F	P-Value by Core Area
Map G	P-Value +0.25
Map H	P-Value +0.50
Map I	P-Value -0.25
Map J	P-Value -0.50
Map K	Dominant Life History by Core Area
Map L	Migratory Forms by Core Area
Map M	External Connectivity Among Core Areas
Map N	Internal Connectivity Within Core Areas
Map O	Core Area Interaction with Canada
Map P	Road Density by Core Area

TABLES

Table 1. Distribution of rank scores across 121 bull trout core areas in each of four ranking categories.

Table 2. Final distribution of status ranking of 121 bull trout core areas by state of origin.

Table 3. Summary of three threat categories and Federal land ownership by core area.

EXECUTIVE SUMMARY

Service scientists assembled and presented a conservation status and risk assessment for each of 121 bull trout core areas, as part of a bull trout five-year review held March 7-9, 2005, in Portland Oregon. The model used for the status ranking exercise was based on a modification of the Natural Heritage Ranking process, using NatureServe Conservation Status Assessment Criteria. The model integrates four separate ranking factors: population abundance, distribution, population trend, and threats (incorporating severity, scope, and immediacy subfactors) to arrive at an overall status ranking. Our original analysis of the 121 bull trout core areas produced categories we referred to as C-Ranks, and were distributed as follows: 43 core areas were ranked C1 = High Risk, 44 core areas were ranked C2 = At Risk, 28 core areas were ranked C3 = Potential Risk, 4 core areas were ranked C4 = Low Risk, and 2 core areas were ranked CU = Unknown.

After presenting this analysis to the review panel, we were asked to conduct additional evaluation of the model and its results. This report describes those additional evaluations in some detail and incorporates extensive GIS-based mapping of core areas to illustrate many of the examples. The Natural Heritage model assigns negative points (P-values) to populations of bull trout in most core areas, due to the relatively low population sizes and limited distribution. Population trend was unknown for most core areas. The three population parameters used in the scoring exhibited a degree of interdependency. We note that the model assigns a relatively positive P-value (0 points) in all categories where population parameters are unknown.

The model is most heavily influenced by the threat rank (particularly the severity of threats subfactor), which is less quantitative and more complex in its standard application. We found that threats were highly core area specific. Considerable familiarity with each core area and application of standard rules and assumptions was needed to apply the threat subfactors (severity, scope and immediacy) with consistency. This was particularly important, given that the model evaluated threat in the context of current conditions and the near-term future. About one-fourth of core areas were considered to have either high severity or low severity of threats, respectively, with the other half exhibiting moderate levels. There was a strong correlation between the eventual C-Rank of a core area and the threat severity ranking for the same core area, with most C1 = High Risk core areas also having high severity of threats. Some threats are quantified and presented in this report in tabular form.

We explored aggregating core areas into larger units, such as Upper Columbia, Coastal, and Snake River evolutionary blocks and examined ranking scenarios treating them as independent blocks. We determined the ranking results would be similar for each block. Another type of analysis, retaining the original scoring but weighting the core areas by the amount of key recovery habitat was more revealing, but needs additional verification. We also present summary exercises to better describe connectivity of bull trout core areas, both internally (among local populations within a core area) and externally (among core areas). We identify life history forms in each core area and discuss relevant aspects of connectivity with Canadian populations.

INTRODUCTION

As part of the technical presentation made to the bull trout 5-year review scientist and manager panels, held March 7-9, 2005 in Portland Oregon, the Service scientists identified as authors of this report assembled and presented a conservation status and risk assessment for bull trout core areas. Our primary objective in using this assessment tool was to conduct a structured evaluation of existing data that had the capability to incorporate and integrate population data and threat information available to us in a variety of nonstandard formats. We wished to spatially evaluate conservation status of the 121 bull trout core areas in order to assess overall patterns of risk and identify any relative strongholds or weak areas for bull trout conservation. We reasoned that a successful process would allow us to maximize use of data collected at the local population and core area level, where the highest degree of specificity occurs and threats are most appropriately characterized. A further goal was to roll the integrated analysis into larger blocks for the panels to use in assessing risk in the ESA context. Our search for a process that was scientifically supported, well documented and widely used led us to the Natural Heritage Ranking (www.NatureServe.org, Master et al. 2003, MNHP 2004). One strength of this process was that it could be applied on multiple scales and would therefore be an appropriate tool for quantifying conservation risk of bull trout.

Andelman et al. (2004) conducted a review of protocols for selecting species at risk in the context of viability assessments for the U.S. Forest Service. They reviewed nine published protocols (including Heritage Ranking, U.S. Fish and Wildlife Service Listing factors, IUCN classification system, and others). They concluded all were useful, but those that explicitly include threats analysis were most useful in determining which species were likely to be adversely affected by proposed management activities. The authors note that the best method for identifying and classifying risk will depend on the management scenarios proposed, the amount of data available, the time frame within which the assessment must be completed, and the scale at which the assessment is to be made (citing Lehmkuhl et al. 2001).

Andelman et al. (2004) discuss common criticisms of multi-attribute point-scoring methods such as the Heritage Ranking (e.g., they are often regarded as ad hoc, arbitrary, pay little attention to biological principles, etc.). However, they concluded the Heritage Ranks may be the most suitable of the nine existing protocols for identifying species at risk on national forests because of the flexibility of scale, potential for use of existing information, and ability to integrate threats analyses. They included a caveat that issues of scale need to be treated appropriately.

There was a close fit between the Heritage Ranking criteria that assess population size, distribution, trends and threats and the data available to us to assess the status of bull trout on the landscape. We felt that applying this process at the core area scale was the most appropriate application of the methodology, primarily because specific threats often act at that level. Bull trout populations, at the core area level, have been shown to largely function independently of other core areas (based on genetic and tracking data – see USFWS 2002, 2004A, 2004B).

For these reasons, we conducted the ranking exercise and presented it to the panels on March 8, 2005. Both the manager and science panels identified this analysis as useful within the overall context of assessing risk to bull trout at multiple spatial scales. However, having not had an opportunity to review the methodology and results beforehand, there were questions raised by the panelists about certain attributes of this relatively complex analysis. Panelists expressed a desire to see additional expansion of some of the information about individual elements of the model. In addition, this gave us an opportunity to provide more descriptive information about how these elements interface in this model. In addition, we were asked to conduct a sensitivity analysis so that panelists could better understand what factors drive the model and what happens to the rankings if certain actions occur or ranking elements are modified. We were asked to develop more quantitative evaluation of certain threats and to better describe the degree of connectivity for bull trout populations, both within core areas and among core areas in the United States. Finally, we were asked to assess the relationship between U.S. bull trout populations and potential for interaction with those in Canada.

There were practical limits on the depth and magnitude of additional evaluations we could conduct. This report does not attempt to fully describe the entire ranking process from start to finish (but see www.NatureServe.org, Master et al. 2003, MNHP 2005). Rather, we have attempted to present enough of the information that was utilized in the original panel discussion to orient readers to the model, but to focus most of our discussion on a continuation of the panel process. For that reason, some of the presentation may not stand alone, or may seem incomplete to readers examining this for the first time without the benefit of participation in the March 7-8 Science Panel review.

METHODS

On February 22-23, 2005, a team of eight Service biologists and the bull trout coordinator, most of whom have regional oversight responsibilities for bull trout activities within a State or portion of a State, gathered in Portland to conduct a ranking exercise of conservation status of bull trout core areas. Using the previously assembled information (listing documents and recovery plans) and relying heavily on the updated bull trout five-year review templates (Fredenberg and Chan 2005), which reflect agency policy on information necessary to conduct five-year reviews under section 4 of the ESA, we adapted a process used by the Montana Natural Heritage Program and Montana Fish, Wildlife and Parks (MNHP 2005) to assess relative status of each of the 121 core areas.

The model used for the ranking exercise was based on a modification of Montana's application of the NatureServe Conservation Status Assessment Criteria (see Master et al. 2003, MNHP 2004). A more complete and detailed description of the methodology is found in the Montana Natural Heritage Program documents: Montana Animal Species of Concern (2004), and State Rank Criteria for Montana Animal Species of Concern (2005). The complete application of the criteria assigns a global rank (G) to the species, indicating overall conservation status, and also assigns a State rank (S), indicating conservation status in a narrower geographic area (State boundaries). The relative rankings are then useful in identifying the conservation status of not only the species, but also a portion of its range. For example, the Montana Natural Heritage Program ranks bull trout as G3/S2. This means the Global status is G3: "Potentially at risk because of limited and/or declining numbers, range, and/or habitat, even though it may be abundant in some areas." The State status in Montana is S2: "At risk because of very limited and/or declining numbers, range, and/or habitat, making it vulnerable to extirpation in the state."

Our review of the Natural Heritage Program (Heritage) criteria indicated that most of the necessary information to conduct the ranking was available from the core area five-year review process templates (Fredenberg and Chan 2005) and other supporting materials and that the categories described in the Heritage criteria were generally consistent with attributes considered importance for bull trout persistence (USFWS 2002, 2004A, 2004B). We pared down the instruction to eliminate unnecessary or redundant categories and incorporated a few assumptions specific to our application to bull trout. The final protocol we used in the ranking process for bull trout core areas is described (Appendix A).

RESULTS SUMMARY

Summary results of the status ranking exercise for bull trout core areas indicated a diverse patchwork of population risk is widely distributed across the Pacific Northwest landscape (see Map A – *C-Rank by Core Area*). Table 1 summarizes the distribution of ranks for each of the four individual elements.

Table 1. Distribution of rank scores across 121 bull trout core areas in each of four ranking categories. Scores A–H represent a continuum of risk categories from lowest to highest; see the following sections and Appendix A for additional detail on the scoring methodology and individual core area scoring.

ALPHABETIC SCORE	**RANKING CATEGORIES**			
	Population Size	Population Distribution	Population Trend	Threats
A	15	1	4	44
B	39	22	6	31
C	27	38	4	3
D	12	45	9	7
E	3	15	18	2
F	1	-	14	19
G	-	-	-	8
H	-	-	-	5
Unknown	24	0	66	2

Table 2 presents the core area status ranking, by the primary States where each core area is located.

Table 2. Final distribution of status ranking of 121 bull trout core areas by state of origin. See the following sections and Appendix A for additional detail on the scoring methodology and individual core area scoring

CORE AREA STATUS	STATE					TOTAL
	Idaho	Montana	Oregon	Washington	Nevada	
C1 – High Risk	9	19	7	7	1	**43**
C2 – At Risk	15	14	7	8	0	**44**
C3 – Potential Risk	5	12	3	8	0	**28**
C4 – Low Risk	1	1	0	2	0	**4**
CU - Unknown	2	-	-	-	-	**2**
Total	32	46	17	25	1	**121**

Full results of the scoring exercise are presented in Appendix B. Table 1 (Appendix B) provides the alphabetical rankings assigned to each category for each core area during the scoring process. Table 2 (Appendix B) provides the conversion of those values to numerical rankings. Table 3 (Appendix B) presents the final core area list, in rank order, sorted by point value.

During the science and manager's panel we presented this information at a greater level of detail and analysis. The PowerPoint presentation given at that forum is available for review, but will not be presented again in this report.

SENSITIVITY ANALYSIS

The following discussion is a narrative summary describing certain attributes of the model and its sensitivity to change for each of the four parameters we evaluated (population size, geographic distribution, population trend, threats). Maps, used to illustrate some of the points we discuss, are referenced in the order they are described.

Because the model incorporates scoring from four separate, but somewhat interrelated parameters, we will present them in order and then discuss the synergistic relationships among them in a summary section. It may be very helpful to the reader to review Appendix A and understand the basic attributes of the Heritage Ranking system prior to reading on in this report.

Population Size

Population values input into the model were based on conservative estimates of the number of adults (as the instructions for the Natural Heritage Program require). Where data were available (about half the core areas) we were able to use those data sets to either assess adult numbers directly or extrapolate numbers from redd counts. Where data were generally unavailable, we used best professional judgment where we could justify it as being a relatively accurate characterization of the population size. Where we felt we could not justify an estimate, the population size was ranked as unknown.

The scoring system (see: Population Size – scoring; Appendix A) assigns increasingly broad categories as the adult population values increase. For example, category A is 1-50 individuals (a range of 50), but category E is 2,500-10,000 individuals (a range of 7,500). For the most part, we felt we were able to accurately assign bull trout core areas to categories, even though precise numbers are subject to year-to-year variation and point estimates were typically not available. In some very small or very large core areas, the choice of categories is truncated on either end of the range as a result of the physical extent of the habitat. Therefore, in most cases, the assignment of the proper category was a relatively easy choice between as few as two possible categories.

Map B (*Core Area by Population Size*) visually depicts the array of core area scoring by population size. In general, while we did not attempt to quantify it, there is an apparent relationship between population size and core area size, with smaller core areas tending to have lower population values (depicted in red and orange = 250 adults or fewer). In many cases these are small adfluvial populations with restricted habitat availability. Many of those populations were small even under natural conditions. Their persistence would have been extremely unlikely, however, if populations had not been higher than 50 adults for most of their history. Genetic results generally do not indicate that most of these populations have gone through severe bottlenecks (Spruell et al. 2002). In fifteen core areas, population size is currently ranked A (1-50 adults), which is well below numbers needed to maintain genetic variability and sustain population viability (core areas with A rank are depicted in red) (Rieman and Allendorf 2001, Whitesel et al. 2004).

In general, adfluvial populations have capacity for higher numbers than do fluvial populations existing without lake habitat.

Conversely, Map B (*Core Area by Population Size*) also shows that large adult populations (depicted in green and dark green = 1,000 adults or more) tend to occur in larger core areas where the key recovery habitat is spatially well-connected and well-distributed throughout the core area. All three migratory forms (fluvial, adfluvial, and anadromous) are represented in various portions of the landscape in this category.

It should not be surprising that there is a relationship between core area size and population size. But, the quality and quantity of the habitat, its relative degree of connectivity or, conversely, the degree of patchiness due to either manmade or physical variables, and the relative productivity of the habitat also play a role in determining population size.

Under natural conditions prior to European influence it is likely that many bull trout core areas had populations that supported roughly 1,000 to 10,000 adult individuals. This is admittedly somewhat speculative, but can be supported based in part on the habitat potential and observed amount of genetic variability seen in current populations. Observations of early settlers also indicate bull trout populations in some areas were much higher than current levels. The largest core areas, particularly those with highly productive lake, large river, or anadromous food resources may have exceeded 10,000, or in a few cases even 100,000 individuals. Core areas, under those conditions, would have been fewer in number and in some cases much larger and much better connected than the ones we describe today.

Under the current evaluation we assigned the following ranks to the 121 bull trout core areas for population abundance:

A = 1-50 individuals	n = 15	score = -1.0
B = 50-250 individuals	n = 39	score = -0.75
C = 250-1,000 individuals	n = 27	score = -0.5
D = 1,000-2,500 individuals	n = 12	score = -0.25
E = 2,500-10,000 individuals	n = 3	score = -0.25
F = 10,000-100,000 individuals	n = 1	score = +/- 0
U = Unknown	n = 24	score = +/- 0

These ranks result in an approximate bell-shaped distribution clustered around the mode in categories B and C. If recovery occurs and core area populations increase (or additional documentation indicates the values are higher than those we currently assigned) there is potential for population scores to elevate. In most cases, the elevation would be +0.25 points, since it's unlikely that populations would increase sufficiently to shift two categories. A shift upward through two categories would require, for example, a population that currently has <250 individuals to expand to > 1,000 adults. This is unlikely, at least in the relatively short term of five years (approximating one bull trout generation) that would occur between reviews (under ESA guidelines).

In 24 core areas the population size is currently classified as "unknown". In the majority of those cases, additional information that would allow us to classify those populations would probably shift the ranking downward (toward the red). There is no positive shift possible (toward the green), since the scoring process assigns "unknown" population size a "0", which is the same score as for a population that exceeds 10,000 adults. If we assume that populations in those 24 core areas currently classified as "unknown" are similarly distributed as the other 97 core areas we were able to assess, then most of them would receive a deduction of 0.5 points or more for population size.

If, in the future, monitoring data become increasingly unavailable due to decreasing level of effort or other factors, future rerankings could reflect a more positive score for population size even though populations are not actually increasing. Of course, those considerations might be balanced elsewhere in the ranking process (e.g., reduced levels of monitoring may be perceived as a risk, resulting in elevated threat ranking).

Additionally, categories D and E receive the same ranking score. This means that a population of 1,001 adult bull trout and a population of 9,999 individuals receive the same score. From a practical standpoint, the population size ranking is not a very sensitive indicator and should not be judged as stand-alone criteria, though it is a useful category for evaluation as part of a more comprehensive risk assessment.

Geographic Distribution

Distribution values input into the model were based on conservative estimates of currently-occupied high quality bull trout habitat (as described by the FWS overlay of Key Recovery Habitat). The key recovery habitat layer represents the Services' best current approximation of a mostly continuous stream (and lake) network that we can document as currently occupied and that would necessarily remain occupied in order to fully support bull trout recovery.

Key recovery habitat does not include all habitat that is currently occupied, however. The International Union for the Conservation of Nature (IUCN) explicitly defines area of occupancy to exclude "cases of vagrancy" and notes that portions of the area may be seasonally or temporally unoccupied. Hence, in our key recovery habitat layer we include areas that are typically downstream habitat where adult and subadult bull trout in each core area forage and overwinter as well as the migratory corridor used by those fish to access spawning and rearing areas. We have previously categorized this as foraging, migrating and overwintering (FMO) habitat. For adfluvial and anadromous fish the FMO typically would include the lake of origin, or a portion of marine nearshore waters, respectively.

In addition, the key recovery habitat where each of the 600+ previously-described local populations spawn and rear was also included. The combined FMO and spawning and rearing habitat in each core area are necessarily continuous. Though not necessarily

simultaneously occupied, the key recovery habitat that we used in our ranking is all documented as occupied habitat.

We did not include every stream or stream segment where bull trout in a core area might be found. In some cases such occurrence is only poorly documented or occasional (e.g., "vagrancy") and in other cases the population may be sufficiently depressed so that formerly occupied habitat is no longer routinely used. As a consequence, we believe the key recovery habitat represents a network of streams (and lakes or marine nearshore) that provides a healthy support network for the 121 bull trout core areas. If these waters are occupied at or near capacity then additional waters (adjacent headwater streams and perhaps infrequently unoccupied drainages) would continue to see bull trout use at some reduced level.

The Heritage scoring instructions explicitly state: "For migratory species, enter the code that reflects the current length of occupied area at the time of year when occupancy is most restricted. The IUCN criteria state that: "the area of occupancy should be at a scale appropriate to relevant biological aspects of the taxon". We believe the use of key recovery habitat as a surrogate satisfies both those conditions.

Based on the additional level of security and resources as well as expanded habitat provided by high quality lake habitat or marine nearshore habitat for adfluvial and anadromous populations, we developed an additional rule that such populations would be assigned a rank one category higher than the GIS-based output of key recovery habitat would otherwise assign (see Appendix A). Part of our rationale was that in case of natural disasters (e.g., fire, flood, debris flows) or manmade catastrophes (e.g., chemical spills) the stream habitat is much more susceptible to circumstances that could result in complete population annihilation than are lakes. In worst case, several age classes may be lost from an adfluvial population, but there would typically be a source for rapid recolonization provided in the lacustrine habitat. We did not provide that upgrade to the score in cases where the lake habitat was determined to be of poor quality for bull trout, such as in reservoirs where drawdowns or thermal conditions may limit bull trout.

Similar to the population size example cited above, the scoring system for Geographic Distribution (see: Area of Occupancy (Stream length) – scoring; Appendix A) assigns increasingly broad categories as the adult population values increase. For example, category B is 4-40 km (a range of 36), but category D is 200-1,000 km (a range of 800). Again, we felt we were able to accurately assign bull trout core areas within these broad categories. In very small core areas, the choice of categories are truncated on the low end of the range as a result of the limited physical extent of the habitat, but in most of these cases the populations are adfluvial and the rank was automatically advanced one category as described above. The persistence of many such adfluvial core areas within very limited space in the headwaters of the upper Columbia and Saint Mary drainages suggests that their likelihood of persistence is, in part, buffered by the presence of that lake habitat. Therefore, in most cases, the assignment of a category was a relatively easy choice between as few as two possible categories. It is important to acknowledge that the use of the GIS layer implies a level of precision that exceeds our true understanding of the

spatial distribution of bull trout on the landscape. The key recovery habitat represented by the GIS layer we used is a conservative representation of actual distribution at any given point in time.

Map C (*Core Area by Distribution*) visually depicts the array of core area scoring by population distribution. Any relationship between population distribution and core area size, where smaller core areas would naturally tend to have lower ranking values (depicted in red and orange = 40 km of occupied key recovery habitat or less), is partially masked by the rank increase we assigned to adfluvial and anadromous populations. In many cases, small adfluvial populations had restricted habitat availability under natural conditions. In some of the smallest core areas, the quality of the habitat available for spawning and rearing is apparently more important than the extent of same. The clustering of core areas with B rankings (orange) in the upper right corner of Map C (*Core Area by Distribution*) is an indicator of the effect of small distribution on the scoring result. Larger core areas do tend to rank out in category D (light green) or E (dark green), in part as an indication of the relative scope of the population distribution on the landscape.

If we were able to look back in time, under natural conditions prior to European influence, the higher degree of connectivity and higher densities of bull trout would have likely depicted a much wider distribution of occupied bull trout habitat on the landscape. We would caution, however, against the assumption that distribution of bull trout ever approached 100% of the watershed for many of the core areas. Bull trout naturally occur in a patchy fashion on the landscape and their distribution was naturally variable by core area, depending on the presence of geologic features, slope, elevation, aspect, water temperatures, etc. (Rieman et al. 1997).

By dividing the total stream network in a core area (1:100,000 hydrography layer) by the GIS-generated values for the length of key recovery habitat, we can obtain a relative idea of the current relative "% saturation" of bull trout key recovery habitat (as a surrogate for distribution) within the core area. This may be another informative measure of current bull trout distribution within core areas (see Appendix B – Table 4). These "saturation" values range from as little as 1% in certain core areas where the watershed is largely blocked to access for bull trout (frequently by natural barriers or other features) to as high as 93% in watersheds that have relatively high quality bull trout habitat throughout. Many of the extremes occur in very small core areas. In 85% of the core areas (103/121) the % saturation of key recovery habitat on the overall stream layer is between 5% and 50%. There is, however, no apparent correlation between percent saturation of key recovery habitat and overall core area rank, with many C1-C4 rankings appearing at both ends of the distribution.

Under the current evaluation we assigned the following ranks to the 121 bull trout core areas for area of occupancy:

A = <4 km (~2.5 miles)	n = 0	score = -1.0
B = 4-40 km (~2.5-25 miles)	n = 22	score = -0.75

C = 40-200 km (~25-125 miles)	n = 39	score = -0.5
D = 200-1,000 km (~125-620 miles)	n = 45	score = -0.25
E = 1,000-5,000 km (~620-3,000 miles)	n = 15	score = +/- 0
U = Unknown	n = 0	score = +/- 0

Because a complete data set was available, there were no core areas where the rank was unknown. In addition, no core area was found to have such a small range of habitat (< 4 km without an adfluvial element) that it achieved an A rank. Thus, the rankings for population distribution fall into four categories (B-E, above).

These ranks result in an approximate normal distribution around a mode between category C and D. Approximately two-thirds (83/121) of the core areas are either category C (n= 39, depicted in yellow) or Category D (n= 45, depicted in light green). A total of 42 core areas had between 100 and 300 miles (~160-480 km) of key recovery habitat. For those core areas, relatively minor additions or subtractions of occupied key habitat (+/_ 100 miles (~160 km) or less) could influence their ranking by 0.25 points either up or down.

Of the 15 core areas that reached Category E status (dark green), only one (Middle Fork Salmon River) contains over 1,000 miles of key recovery habitat (n = 1,011). The other 14 core areas reached the E rank because they contain over 200 miles of key recovery stream as well as suitable lake habitat or marine nearshore habitat (elevating them a rank). The second highest amount of key recovery habitat was 691 miles (in the Upper Salmon River core area) and only five of the 121 core areas exceeded 500 miles. Thus, very large increases in distribution (generally several hundred miles or more) would generally be required to drive ranks of D (light green) toward the E (dark green) category.

In some cases, a less strict interpretation of the distribution criteria (e.g., including all potentially occupied stream habitats) may elevate individual core area ranks by +0.25 point. However, we hasten to add that we already elevated all core areas which contain suitable adfluvial habitat and/or anadromous forms a full rank. We believe the application of key recovery habitat, as we have presented it, is a reasonable application of the ranking criteria based on our understanding of the rule set. In general, broadening the distribution of bull trout (either due to ongoing recovery and/or increased documentation or interpretation) will not result in major changes to the distribution ranking from categories where they are currently placed.

Short-Term Trend

Interpretation of trend in bull trout populations has been widely discussed in the literature, but there has been limited agreement on proper analytical methods and standards for assessing trends in bull trout redd counts or other monitoring data. The Service assembled existing data sets, mostly collected by States and other contributors, and evaluated the complete extent of available information. Based on that overview, we determined that 5 years would be used as the minimum continuous data set for assessing

trend information. The longest term data sets extend back about 25 years. These intervals are consistent with the planning horizon used in the Draft Bull Trout Recovery Plan. A period of 5 to 25 years approximates 1 to 5 bull trout generations. Where data sets longer than five years were available, greater emphasis was placed on the most recent 5-year period (latest generation) in assessing the rank.

Because of the extremely variable nature of the data sets, the lack of consistency in methods and protocols (snorkel counts, redd counts, weir counts, etc.), the relatively wide range in the proportion of each core area that was assessed, and previous cautions from the published literature about reliability, repeatability, and observer error in redd counts (see Maxell 1999, Dunham et al. 2000), we were necessarily conservative in our interpretation of bull trout trend information from the indices we assessed. We relied upon local knowledge provided in the five-year review process template narratives for each core area for additional interpretation of observed changes in population levels (e.g., causes, habitat variables, etc.).

The Heritage ranking categories were assigned names that provide a relative continuum (rapidly declining, stable, etc.), but the specific criteria were quantitative (30-50% decline, +/- 10% fluctuation, etc.). From a practical standpoint, due to the variables described in the paragraphs above, we were generally not able to apply the quantitative ranges through any statistical process. Rather, the assignment of ranks was based more upon the general applicability of the descriptive category (e.g., rapidly declining, stable, etc.) and the subjective evaluation of the Service biologist conducting the rankings. A strict quantitative interpretation of trend would result in nearly all bull trout data sets exhibiting unknown trend.

For those reasons, we placed a high level of importance on having each core area ranked by individuals who had strong familiarity with both the core area and the population data set that was being considered. This ranking process is extremely dependent upon having informed and knowledgeable individuals conduct the ranking. By conducting the rankings in a collaborative forum (with 9 individuals each familiar with their own area) we could discuss, contrast, and compare information. We were able to debate and record our assumptions (see Appendix A), develop standardized applications, and achieve a level of overall consistency between regions that would not be possible if rankings were done by individuals working in isolation.

Unlike the previous ranks for population size and distribution, the scoring system in this category (see: Short-term Trend – scoring; Appendix A) assigns equal increments of change across categories. For example, category B (Very Rapidly Declining) is 50-70% decline (a 20% increment) and category E (Stable) is +/- 10% fluctuation (also a 20% range).

Given the numerical nature of population data, it would be tempting to conclude that precise analytical tools could be applied to accurately determine trends. However, for many of the reasons we have already described, that is not the case. In addition, natural variability in populations can exceed 100% from year to year and other factors such as

streamflow, weather patterns, and partial barriers (such as beaver dams) may redistribute spawning bull trout. Bull trout are particularly susceptible to these factors due to the fact they spawn in the late fall when spawning streams are typically at or near seasonal low flow volume. In practicality, an approximation of trend, assigned by knowledgeable observers based on the partial count data that is available, is about as good as can be expected. For those reasons, we view the trend ranking process we used as relatively stable and repeatable.

Map D (*Core Area by Population Trend*) visually depicts the array of core area scoring by short-term population trend. As is visually apparent, in over half the core areas (n = 66) we did not feel there was adequate data to make a determination of the short-term population trend. In those cases there was either no monitoring data or data were not collected in a consistent fashion; the data that existed was intermittent or sporadic and did not provide a continuous record (at least five years); or the data were available but highly variable and we could not assess a trend with any degree of confidence.

Some spatial patterns are obvious from evaluation of Map D (*Core Area by Population Trend*). In the majority of Idaho (with the exception of the panhandle) and southwest Montana we were not able to assess population trend. For the most part, the data simply are not adequate to do so. In most of the rest of northwest Montana and the Idaho panhandle population trends have been more adequately monitored and most of the larger core areas reflect trends that are either stable (light green), declining (yellow), or increasing (dark green). In Washington and Oregon the patterns are variable.

Under natural conditions (e.g., prior to European influence) it is likely that the bull trout population trend in most core areas would have fluctuated around a stable mode, but depending on climate, natural events, and other factors there were likely periods when individual core areas would have been increasing or decreasing. The larger and more connected core areas may naturally exhibit less variability in trend, due to the interaction between these variables and the various patches of habitat on the landscape.

Under the current evaluation we assigned the following ranks to the 121 bull trout core areas for population trend:

A = Severely Declining	n = 4	score = -1.0
B = Very Rapidly Declining	n = 6	score = -0.75
C = Rapidly Declining	n = 4	score = -0.5
D = Declining	n = 9	score = -0.25
E = Stable	n = 18	score = +/- 0
F = Increasing	n = 14	score = +0.25
U = Unknown	n = 66	score = +/- 0

Among the 55 core areas we were able to rank for trend (representing 45% of all core areas) approximately equal numbers of core areas were determined to be stable (n = 18), increasing (n = 14) and decreasing at various rates (n = 23). From this analysis we might infer that the overall trend in bull trout populations across their range is neither increasing

nor decreasing. However, we also note that 14 of the 55 core areas we ranked (25%) were rapidly, very rapidly, or severely declining and some of those are not expected to recover, at least in the foreseeable future, given the forces that are operating to produce those declines.

As bull trout recovery occurs and core area populations increase (or additional documentation identifies the trend in core areas which we currently have not been able to assess), there is potential for our ranking of short-term trend to change. In most cases where core areas currently indicate a declining trend, improvement would gradually elevate the score (+0.25 points), since the entire recent trend would continue to be taken into account. Increasing trend is logically linked to population abundance and in some cases may be linked to distribution, so that additional ranking points may be simultaneously achieved in those other population categories. We would expect a relatively high degree of concordance between the three population categories, though special cases exist where these variables may not operate in unison.

In the majority of core areas (55%) short-term population trend is currently classified as "unknown". Unknown trend receives a point value of +/-0. In many of those cases, if additional information allows us to classify the trend of those populations, it will ultimately shift the ranking downward (toward the red) because any declining trend is reflected in a decreasing score. There is limited potential for a positive shift (toward the green) of +0.25 points in score for core areas where the trend is currently unknown but would be reclassified as increasing. If we assume that the true population trend in the 66 core areas currently classified as unknown are distributed similarly to the 55 core areas we were able to assess, then more of them would likely receive a deduction in score than an increase and in some cases the deduction would probably shift that core area to a lower C rank classification. In extreme cases, the deduction could be a full -1.0 point, whereas the potential for increase in score as a result of an increasing trend is only +0.25 points. In that regard, an "unknown" ranking of short-term trend reflects more positively in our ranking process than most other possible outcomes.

Threats

The fourth and final category of assessment is the threat category. The other three categories measure various aspects of population status, and are thus strongly interrelated. The threat category measures a somewhat separate variable, accounting for the anthropogenic factors that affect population status to a greater or lesser degree. Most of the population variables have quantitative elements that can be measured, but the threat category is less quantitative. In a separate portion of this report we provide tables that summarize GIS-based quantitative information describing occurrence of nonnative brook trout and lake trout, land ownership, water quality, land use, and road density. However, even those variables require interpretation by someone familiar with the core area. The potential range of threats is large and for each of the 121 core areas a distinct set of variables typically come into play. Each core area has different geographic and spatial dimensions as well as variability in biological complexity that makes the

assessment of threats a complicated exercise. In part, the existing status of bull trout in a given core area (population abundance, distribution, and trend) is a direct reflection of the threats that are present and a measure of how those threats are arrayed both spatially and temporally on the landscape.

It is important to note that the threat consideration in this ranking process is meant to be applied to the present and future status of the core area. The effects of past threats (i.e., legacy impacts) are reflected by and accounted for under short-term trend and other population status ranks (see discussion under the heading "Threats (Severity, Scope and Immediacy)" in Appendix A).

The Heritage rank criteria uses the collective assessment of three elements of threat, described as "severity", "scope", and "immediacy" and assigns rank based on the pattern in which those three separate elements are arrayed. Each of the three categories is ranked independently as either "high," "moderate", "low", or "insignificant". With three elements there are 27 possible combinations. Those 27 combinations are combined into seven risk categories (see Table 1 – Appendix A). All core areas where severity is high or moderate end up scored as category A, B, C, D or E, whereas low severity results in a rank of F or G. If scope is high, the ranking category must be A, C, or F. If scope is moderate, the ranking category is B, D, or F. If scope is low, the ranking category is E or G. If threats are of high or moderate immediacy, the ranking category is A, B, E, F, or G. Threats of low immediacy can result in threat rankings of C through G. The following discussion describes the way the three categories were applied for bull trout, in more detail.

Severity

Severity of the threat basically captures the degree to which the threat impacts the population and the degree to which the threat is reversible. High severity indicates the threat is likely to result in extreme losses of bull trout populations or habitat that are essentially irreversible. One example, in the context of bull trout, is the establishment of a reproducing lake trout population in an adfluvial core area. Given what we know about this threat, it is especially severe and likely irreversible in small core areas where habitat is limited (Donald and Alger 1993, Fredenberg 2002). Another example of a high severity threat might be the construction of a dam which is likely to create a warm-water reservoir unsuitable for bull trout and that will also inundate important spawning and rearing habitat.

The Heritage rank criteria describes a moderate severity threat as one likely to result in major reductions in the population or long-term loss of habitat that will require in the neighborhood of 50-100 years for recovery. Examples of moderate severity might be major irrigation withdrawals or watershed impacts due to timber harvest or grazing that could be expected to be minimized over a period of time after the initial impact occurs. Another example might be certain catastrophic natural events. In scoring severity, some judgment must be used to interpret the degree and longevity of the impact and interpret the appropriate rank between categories. If only a portion of a core area is likely to be affected, the threat is more likely to be moderate in severity than high. For example,

major urban development or toxic runoff from a mining project may have irreversible impacts, but affect only a portion of a core area. The severity of these impacts would likely be moderate because the threat will not be spread to other portions of the core area.

Low severity threat indicates a reduction in population or habitat could occur, but that the results are likely minor in extent or reversible in as few as 10-50 years. Examples might include minor impacts due to current timber management or roads, overfishing, or poaching activities.

Threats of insignificant severity can only occur in circumstances where no reduction of population or degradation of habitat is foreseeable. In most cases, this is only probable to occur in protected areas such as National Parks or wilderness. However, due to potential human impacts such as nonnative species introductions or other factors, one should not automatically assume that protected areas have threats of insignificant severity. This is particularly true where the core area is only partially in protected status and migratory bull trout use unprotected portions of the core area to complete a portion of their life cycle. Examples of threats of insignificant severity to bull trout might include natural disasters such as fire or floods in a wilderness landscape, or carefully regulated angling in a National Park.

Scope

Scope refers to the proportion of the core area that is affected. If greater than 60%, it is high. If 20-60%, it is moderate and 5-20% is low. If a threat affects <5% of a core area the scope of such a threat is considered insignificant. However, for bull trout we must temper that interpretation to a degree based on the nature and location of the threat. If a high severity threat affects only the spawning and rearing habitat, it may be a minor portion of the entire core area but the effects may devastate the population. For that reason, the scope ranking is subject to modification based on local expertise that can assess the impact of the location of a threat in addition to how widespread it is. Essentially, the analysis and ranking of scope should take into account the most sensitive portion of the ecosystem, which would typically be the spawning and rearing habitat for bull trout. Other sensitive portions of the ecosystem may include key migration corridors through which migratory individuals must pass to complete their life cycle.

Immediacy

The ranking for immediacy of threat is a straightforward analysis of how timely the manifestation of the threat is likely to be. High immediacy means the threat is operational now or within a year. Moderate immediacy is a 2-5 year horizon and low immediacy is a 5-20 year horizon. A threat is only considered insignificant relative to immediacy if it is not operational within 20 years. For specific projects such as mines, timber sales, or similar activities the classification of immediacy is rather straightforward. For threats that are more biological in nature, such as nonnative species introductions or disease considerations, more careful evaluation and some subjectivity is required in order to assess a rank. Often best professional judgment must be employed, based on analysis of similar circumstances, to judge the immediacy of a biological threat.

Synthesis of Severity, Scope and Immediacy
In synthesizing the three threat categories into 8 rank classifications (plus "unknown" – see bottom of this page) the Heritage criteria attaches the greatest significance to the severity of the threat, followed by scope and then immediacy. For bull trout, this rationale seems appropriate as threats of high severity are often likely to be long-lasting. Bull trout have relatively low inherent capacity to rebound from low population levels, in part due to high age of maturity and very specific habitat requirements.

The final threat ranking categories are summarized in narrative format to describe the overall condition of threats operating on the core area for the present and near future (see: Threats –scoring; Appendix A). The categories are alphabetized A through H (and U) and in that order the system assigns point values ranging from -1.0 to +1.0. It is informative to note that categories A through D, which include most of the categories with high threat severity, all produce negative point values in the ranking. Categories E and F, localized or low severity threats, are neutral (0 points). Core areas where threats are considered unknown would also receive neutral scoring (0 points). Only categories G and H, which include low or insignificant threat severity and low or insignificant scope of threats can result in positive points assigned through the ranking process. When two or more of the scoring elements (severity, scope, immediacy) are unknown the final threat ranking is considered unknown.

Map E (*Core Area by Threats*) visually depicts the array of core area scoring by threat category. All threat categories that score negative points (A-D) are displayed in shades of red to orange. Threat categories that score neutral points (E and F) are displayed in shades of yellow. Threat categories G and H (slightly threatened or unthreatened) are displayed in shades of green.

No particular patterning of threat distributions is visually striking (Map E). There are some subtle suggestions that Puget Sound bull trout core areas generally scored somewhat lower threat ratings. In the large contiguous block of bull trout core areas through western Montana and Idaho, the core areas on the east and west edges of the range tend to have somewhat higher rankings for threat than those nearer the center, but there are numerous exceptions.

Under natural conditions (prior to European influence) all core areas could be presumed to have threat rankings of F, G, or H. This would indicate Low or Insignificant severity, but variable scope and immediacy depending on what natural factors were in play at various times in prehistory.

Under the current evaluation we assigned the following ranks to the 121 bull trout core areas for threat. See Appendix A – Table 1 to review how severity, scope and immediacy are combined to produce overall threat rankings.

A = Substantial, imminent threat	n = 44	score = -1.0
B = Moderate, imminent threat	n = 31	score = -0.75
C = Substantial, non-imminent threat	n = 3	score = -0.5

D = Moderate, non-imminent threat	n = 7	score = -0.25
E = Localized, substantial threat	n = 2	score = +/-0
F = Widespread, low-severity threat	n = 19	score = +/-0
G = Slightly threatened	n = 8	score = +0.75
H = Unthreatened	n = 5	score = +1.0
U = Unknown	n = 2	score = +/-0

These ranks for overall threat are heavily clustered around category A (36% of all core areas) and Category B (26%). As we previously noted, severity of threats tends to be the most important of the three subfactors (severity, scope and immediacy) in determining the overall Heritage Rank for threat (see *Synthesis of Severity, Scope and Immediacy*, above).

If one examines the individual threat rankings in the core area scoring (see Appendix A, Table 1), it is apparent that the Service biologists conducting this exercise believed the vast majority of core areas have threats that are currently operating at high or moderate severity. About one-fourth of core areas were scored high for severity (n = 29). They tended to also have high scope (n = 27) and high immediacy values (n = 24), indicating that they were at the highest possible threat status and receiving the maximum deduction of -1.0 points.

Conversely, about the same number of core areas were ranked at the other end of the threat scale and scored low or insignificant for severity (n = 31). These core areas tended to have variable ratings for scope; but mostly insignificant, low or moderate (n = 26) values. They also tended to have low or insignificant immediacy in the threats that were characterized (n = 24).

In about half of all core areas the threat severity was considered moderate (n = 59). Scope and immediacy was mostly moderate or high in these core areas, typically placing them in ranking categories A through D.

In only 2 of 121 core areas (Granite and Sheep Creek) was the overall threat rank considered unknown. No threats were identified in the Draft Recovery Plan or templates, but Service staff felt there was not sufficient information to place these in the unthreatened category.

It is important to understand how the rankings might change if the threat categories were altered, either to the positive (toward the green) as a result of new information or threats are removed or remediated, or to the negative (toward the red) as a result of new threats or increases in their severity, scope, or immediacy. As we have indicated, the primary driver of the threat ranking is the severity.

There is a relatively gray line between high severity and medium severity of threat and that distinction is based upon how much the population or habitat is likely to be impacted (all vs. most) and the estimated potential for recovery (essentially irreversible or >100 years vs. 50-100 years). Certain threats have much higher potential for remediation than

others. For example, in core areas that are ranked high severity due to nonnative species threats (such as abundant lake trout populations in the lake that bull trout occupy), those threats are typically considered to be irreversible. Given the current state of knowledge and relatively poor ability to remediate the threat of lake trout by suppression or removal actions, we may be unable to project a scenario where the threat category could be reduced to medium in the foreseeable future. Conversely, in a core area where the legacy of past forestry activities has led to watershed degradation that is so severe that the threat severity was ranked high, it may be possible to implement a watershed restoration program that would move that threat severity into the medium category in a relatively short period of time. On the other side of the ledger, if a core area received a medium threat severity rating due to cumulative watershed impacts and a new project is permitted that is likely to have major impacts to the best remaining spawning and rearing habitat, that may be sufficient to move the threat severity rating to high. These types of shifts have the potential to affect the overall threat score by as much 1.0 point. However, in all cases, the reduction in threat scoring from high to medium severity values would remove negative points from the ranking value.

In the Heritage ranking system, in order to move the threat score from neutral or negative category into the positive category it would be necessary to shift the severity rating from moderate (or high) to low or insignificant. The potential for threat severity that is currently high or moderate to be shifted to low for bull trout core areas, especially in a matter of a few years, would seem to be limited. In managed, human-impacted landscapes (which include most bull trout core areas) there is little likelihood of removing enough of those impacts (and/or their legacy effects) to move the core area to a low threat severity rating. In most cases, because of the nature of the activities causing the threats, the threat rankings for an individual core area are likely to move incrementally within a range of either positive (0 to +1.0) or negative (0 to -1.0) values.

While this is the first time, to our knowledge, the Heritage Ranking process has been applied to bull trout core areas, it is not the first time the status of threats has been evaluated over a period of time. In most of those observations (see USFWS 2002, 2004a, 2004b) the potential for a rapid increase in threats is higher than the potential for a rapid decline. Under this ranking system, threat rankings are not likely to make a major positive jump across the full scale, going from -1.0 (substantial, imminent) to +1.0 (unthreatened), except under very unusual circumstances. Scenarios where the opposite occurs, where core areas that currently have a low threat severity rating rapidly move toward a medium or high rating, would seem to be more plausible. For example, lake trout have invaded and become established in some small adfluvial core areas in protected habitat in Glacier National Park, in essence shifting the threat ranking the full width of the scale (from green to red), in only a few generations.

Summary Rankings

Because bull trout are an apex predator species they tend to exist at naturally low densities. Due to their somewhat narrow habitat tolerance (i.e., cold, clean, complex, and

connected) they naturally occur in a patchy fashion within watersheds and are seldom distributed throughout all waters they may have access to (Rieman and McIntyre 1995, Dunham and Rieman 1998). In the Heritage Ranking description for 'environmental specificity", bull trout fit most closely in the general category of a narrow specialist. In the Heritage Ranking for "intrinsic vulnerability", bull trout would be rated moderate to high. Relative to other fish species, they are slow to mature, have inherent reproductive limitations, and exhibit low tendencies for dispersal and recolonization. As a result, impacted bull trout populations are likely to be slow to recover, typically requiring multiple generations (a bull trout generation is roughly the age to maturity – about 5 years).

The four ranking categories operate with varying degrees of interdependence to produce the final core area ranking, or what we term a C-Rank for bull trout (adapted from MNHP 2005).

Points (P)	C RANK
$P \leq 1.5$	C1 –High Risk
$1.5 < P \leq 2.5$	C2 – At Risk
$2.5 < P \leq 3.5$	C3 – Potential Risk
$3.5 < P \leq 4.5$	C4 – Low Risk

Essentially, a core area starts with a score of 3.5, putting it at the upper limit of the C3 (Potential Risk) category, just one increment (0.25 points) away from a C4 (Low Risk). If no other ranking information is available (i.e., if all four ranking categories are unknown), the core area rank stays at the C3 level. Thus, as previously described in our analysis of individual categories, the ranking process treats unknown information rather favorably in the scoring.

If a core area meets three population thresholds: 1) containing at least 10,000 reproductive individuals, 2) occupying at least 1,000 km of habitat (or at least 200 km if anadromous or adfluvial), and 3) having a stable or increasing trend; then that core area remains at the upper end of the C3 category and its' ultimate C-Rank is dependent on the threats assessment. If the core area fails to meet the three population thresholds, then its rank is reduced by the appropriate amount in 0.25 point increments in the category(ies) in which it falls short. For some core areas, especially those that are isolated within limited habitat and thus terminally restricted to small population size, the inherent population parameters will lead to C2 (At Risk) or even C1 (High Risk) status under natural conditions. This is entirely consistent with conservation biology theory which indicates small and isolated populations are inherently at higher relative risk. Factors related to the basic biology of bull trout (described above), further contribute to that inherent potential risk. This is in contrast to a species like whitetail deer or cottontail rabbits which are broad generalists, not intrinsically vulnerable, and have high inherent capability to rebound from declines.

With the three population ranking categories established, the final scoring is dependent upon the overlay of the threat ranking. Ultimately, even core areas that meet the population thresholds would not be ranked higher than C3 (Potential Risk) if there are threats of moderate or high severity. In that regard, the threat ranking may be viewed as the single most significant score in driving the Status Ranking.

Core areas with low population values will be driven to even lower C-Rank if threats are high. Core areas with low population values may be elevated up to one full C-Rank if threats are low or insignificant. Thus, even in the most extreme case of a very small population with restricted habitat and declining trend, a low or insignificant threat ranking may result in the final C-Rank being C2 (At Risk) or C3 (Potential risk). This, again, is consistent with conservation biology theory that considers small and isolated populations to be at some higher level of risk than are large and connected populations. The most at-risk core areas are those with low population values and high threats.

Core areas with high population values cannot be driven below a C2 (At Risk) ranking by threats, even if the threats are severe in nature and high in scope and immediacy. In fact, a robust population of 10,000 adult bull trout existing with over 1,000 km of habitat (or 200 km if anadromous or adfluvial) and a stable population trend would still be ranked at the upper end of the C2 (At Risk) category. Again, in line with conservation biology theory, strong populations that are well-connected and spatially distributed on the landscape are inherently more stable and resilient to threats. The least at-risk core areas, and the only ones that earn a C4 (Low Risk) ranking are those with relatively robust population parameters and low or insignificant threats.

It is important to understand that this bull trout ranking system does not imply that all core areas can eventually become C4 (Low Risk), or indeed that all core areas naturally existed at that level prior to European influence. Due to natural landscape features (e.g., barrier falls), natural patchiness of suitable habitat, historical fluctuations in climate, fire and flood, and other natural factors, it is logical to assume that bull trout core areas historically ranged from C2 (At Risk) to C4 (Low Risk). It may even be possible to estimate the historical risk ranking of individual core areas in order to determine how much space there is for currently depressed core areas to move upward toward natural condition.

It is logical to assume that over the last 10,000 years bull trout may have existed in watersheds where they were extirpated through natural factors and were not recolonized, or that multiple extirpation and recolonization events may have occurred. However, it is our assumption that under natural conditions very seldom would core areas have been ranked C1 (High Risk). Even the most isolated and small populations would logically be subjected to low threats under natural conditions. It is the added element of threat, directly as a result of human influence, that makes C1 (High Risk) and some C2 (At Risk) core areas most vulnerable to extirpation.

The effect of elevated threat in driving the C-Rankings is evidenced by comparing the individual threat rankings to the eventual C-Rank of each core area. In 22 of 29 core

areas (76%) where threat severity was rated high, the eventual C-Rank was C1 (High Risk). The remaining 7 core areas where threat severity was high were ranked C2 (At Risk). In 32 of 43 core areas (74%) ranked as C1 (High Risk), the threat ranking included either high severity of threats, high scope of threats, or both. All 11 of the other C1 (High Risk) core areas had threat rankings that included moderate severity and moderate scope.

Conversely, in 26 of 31 core areas (84%) where the threat severity was rated low or insignificant, the eventual C-Rank was C3 (Potential Risk, n = 23) or C4 (Low Risk, n= 3). The remaining 5 core areas where threat severity was low or insignificant were ranked C2 (At Risk). As well, in 29 of the 32 core areas (91%) ranked as C3 (Potential Risk, n = 30) or C4 (Low Risk, n = 4), the threat ranking included either insignificant or low severity of threats, insignificant or low scope of threats, or both. In the three remaining cases threats were ranked moderate in both severity and scope.

The degree of concordance between threat ranking and C-Rank may also be an indicator that threats largely drive population ranks. The ranking process does not determine the reason that populations are low, fragmented, or in decline, but in some cases where the causes are known those explanations are available in the five-year review template narratives. It is logical to assume that if we have properly identified and focused the ranking on the most significant threats, then those threats that act with greatest impact upon the habitat or the population are the primary drivers of low C-Ranks. In a sense, it's a chicken and egg exercise. We anticipate high threat levels to lead to low populations, and low threat levels to lead to higher populations. The co-occurrence of high threats and high populations or low threats and low populations are less logical outcomes. The ranking results bear this out (Appendix B – Table 1)

P-Value Analysis

Because the C-Ranks are discrete categories, with set boundaries (generally 1.0 points in width except at either end of the spectrum, where they may be even wider), the simplified map displaying C-Ranks (Map A - *C-Rank by Core Area*) has potential to be somewhat misleading. Adjacent core areas that appear as different colors on the map may be as little as 0.25 points apart in the ranking. As an example, the middle reach of the Clark Fork River – Section 2 (western Montana) has a P-value of 1.75 (Appendix B –Table 3) and appears as orange on Map A (*C-Rank by Core Area*). It is sandwiched between two other core areas, Clark Fork River – Section 1 and Clark Fork River – Section 3, that appear as red on the map and they each have a respective P-value of 1.5. Subtle differences in the scoring of distribution and threats account for the differential in this case. Two other core areas can have a P-value as much as P = 1.75 points apart and still be displayed as only one color apart on the map. Similarly, two core areas can both appear as the same color even though their P-value is as much as 1.75 points apart.

In a partial attempt to mitigate the simplification of using discrete categories, we have created a map of actual P-values. Map F (*P-value by Core Area*) displays each P-value

as a separate shade of the same general color scheme (red to green). In that way, core areas that are closer in value appear as one or two shades apart as opposed to more extreme differences in scoring that are separate colors. Displaying the point values associated with the core area ranking scheme in this fashion presents a somewhat different perspective on the relationship between core areas.

Unidirectional Scoring Shifts

Because we felt an illustration of the potential changes in core area rank that could occur with unidirectional shifts in the scoring might be informative, we also produced a series of maps that illustrate changes in all core areas, either up or down 0.25 or 0.5 points in P-value. Unidirectional shifts in scoring could occur if the overall scale were adjusted for some reason. As we have described above, it is highly illogical that any particular series of events could lead to all P-values simultaneously shifting up or down in unison, such as addition or removal of major threats, or major adjustments to population parameters. Therefore, this exercise is largely hypothetical. However, it may be illustrative to examine these unidirectional maps as a sort of generic evaluation of how sensitive the model is and how the overall balance amongst C-Ranks might change if the status of bull trout became collectively better or worse over time.

Starting from the original base shown in Map A (*C-Rank by Core Area*), we illustrated these unidirectional changes in sequential fashion. Map G (*P-Value +0.25*) and Map H (*P-Value +0.5*) visually illustrate the changes which would occur if all P-values were simultaneously shifted upward 0.25 or 0.5 points. Map I (*P-Value -0.25*) and Map J (*P-Value -0.5*) visually illustrates the changes which would occur if all P-values were simultaneously shifted downward 0.25 or 0.5 points. The following table shows how the array of C-Ranks would change under those various scenarios.

C-Rank	-0.5	-0.25	Existing	+0.25	+0.5
C1 (High Risk)	67	55	43	28	22
C2 (At Risk)	40	40	44	49	45
C3 (Potential Risk)	11	22	30	35	40
C4 (Low Risk)	3	4	4	9	14

As shown in this table, moving the P-value up or down has variable effects depending on the C-Rank category one chooses to examine. At one extreme, in the C1 (High Risk) category, about as many core areas are added or subtracted depending on which way the P-value moves and how far. A full half-point move downward results in 24 more core areas being added to C1, whereas a full half-point move upward removes 21 core areas from the C1 category. The existing number of core areas in the C1 category is 43, almost exactly halfway between the other extremes of 67 and 22, respectively. At the other extreme, the C4 (Low Risk) category, the move downward has little effect, but a half-point move upward would more than triple the number of core areas considered to be at low risk. The number of core areas categorized as C2 (At Risk) is remarkably stable.

Regardless of the directional shift there are always between 40 and 49 core areas in this category. The C3 (Potential Risk) category responds similar to the C4 (Low Risk) category, though not as dramatically. For each incremental unidirectional positive move in the scoring, a larger and larger number of core areas go into category C3.

AGGREGATED RANKING BY UNITS LARGER THAN CORE AREAS

One of the considerations we evaluated is whether or not bull trout core areas are the appropriate population units for conducting status rankings using the Natural Heritage protocol. By definition, each bull trout core area is considered to be a functioning, stand-alone population unit (USFWS 2002, 2004a, 2004b). While some threats occur over broad landscape areas (e.g., climate variation, some broad scale forestry impacts), many of the threats we evaluated operate completely independently on individual core areas (e.g., nonnative species, dams and diversions). For the latter category of threats the severity, scope, and immediacy (which lead to the threat ranking) can best be characterized on a core area by core area basis. As a result, we strongly believe that characterizing risk on a core area by core area basis is the most appropriate and most sensitive indicator of the overall health of bull trout across the broader landscape.

Following general guidance given by Spruell et al. (2003) and Whitesel et al. (2004), we divided the bull trout landscape into three general evolutionary units. For sake of brevity, they will be referred to as the Coastal, Snake, and Upper Columbia and are portrayed on the maps previously discussed. If we attempt to characterize bull trout status by evolutionary units (or States or other large blocks) what tends to happen is that individual core area variation is washed out and we end up with a single unified ranking.

As an example, if we score the evolutionary units independently, each would likely receive the following identical ranking values:

PARAMETER	*VALUE*	*ALPHA*	*POINT VALUE*
Population Size	>10,000	F	+/- 0
Distribution	1,000-5,000 km	E	+/_0
Trend	Unknown	U	+/_0
Severity	Moderate		
Scope	High (Moderate?)		
Immediacy	High		
Threat Factor	MHH	A	-1.0

This is largely a theoretical exercise, as we did not have the group that conducted the overall evaluations do a collective scoring by larger units. However, for most of the ranking categories there is little room for ambiguity as to which is the appropriate ranking category. Based on this scoring, with a total P-value of -1.0, each of the evolutionary units would have a score of 3.5 – 1.0 = 2.5, and would receive a C-Rank of C2 (At Risk). The only area of ambiguity would seem to be in the scope of threats. If <60% of a unit was affected by threats, the scope would be moderate (rather than high) and the Threat Factor of MMH would result in an alpha score of B = -0.75 point value. In that case, the score of 3.5 – 0.75 = 2.75 would move the overall unit over the line and into the C3

(Potential Risk) category. G3 was the global ranking assigned to bull trout under the Heritage Ranking system (MNHP 2004).

If we had not truncated the upper limits of the Heritage scoring system to make it more closely resemble the spread of values seen in bull trout core areas, then one could logically argue that positive point values for bull trout population size, distribution, and trend would be possible in sufficiently large landscape type units (or for the species rangewide). However, in order to receive a G value for population size (+0.25 point value), it would be necessary to exceed 100,000 adult bull trout. It is doubtful that many can be documented in the entire U.S. portion of the range. An H value (+0.5 point value) must exceed 1,000,000 adults.

Similarly, an F value for distribution would require 5,000-20,000 km of habitat, a G value 20,000-200,000 km, and an H value >200,000 km. Some larger units could achieve an F value. However, the scoring system does not assign positive points for distribution until the H category is reached (H = +0.25). Since there are about 18,000 miles (approx. 29,000 km) of key recovery habitat in the entire U.S. portion of the range, we would need to expand that by a factor of seven times to reach the lower threshold of the H category; a very unlikely scenario.

Given the high state of uncertainty in the data sets that express population trend, we would anticipate that any larger aggregation of core areas would demonstrate even higher uncertainty than do individual core areas. In addition, pooling of bull trout trend data sets is difficult, due to the generally nonstandardized approach for how the data have been collected and summarized. As a result, any aggregation of core areas would logically receive an Unknown trend value, with a score of +/-0. Similarly, as we noted earlier, the threats would tend to become somewhat similar as we amalgamate core areas into larger units, with moderate severity, high or moderate scope, and high immediacy the most logical pattern, resulting in a score of -1.0 or -0.75. Aggregating threats across a larger landscape would not seem to logically move threats in any fashion toward low severity, which is what is required in the scoring matrix to achieve positive point values.

Finally, what this demonstrates is that aggregating bull trout core areas for collective ranking in large blocks under the Heritage scoring process tends to reduce individual variation and result in a highly standard score, such as we presented in the analysis for the three evolutionary units (above). Assessment of threats at the aggregated level is particularly problematic, given the wide range of core area conditions and the way that certain threats tend to individually impact populations (e.g. non-native species, mining, dams, etc.).

There is another way to approach this problem. It is possible to establish a weighted average of the individual core area scores based on some factor that accurately reflects the contribution that each core area makes to the range of bull trout. The most appropriate weighting factor would be to use the amount of key recovery habitat in each core area, as it provides a surrogate measure of the amount of occupied bull trout habitat. This approach is a bit problematic, because there is a mixture of stream and lake habitat.

However, because all adfluvial and anadromous populations require streams for spawning and rearing, we chose to simplify this exercise and use only the key recovery stream habitat layer.

For each core area, we multiplied the point value (P) from the original status ranking by the amount of key recovery habitat. For example, the P-value for the Hood River core area was 1.5. The amount of key recovery habitat in the Hood River core area was 69.0 miles. The product of the two was 1.5 X 69.0 = 103.5. We did this for each of the 121 core areas, establishing a Rank Product value.

We then aggregated the core areas into various groupings. By summing the Rank Product for each aggregation and dividing by the total amount of key recovery habitat within that aggregation of core areas, we obtained a weighted average of the P-value for that aggregation. This weighted value may represent our best approximation of the overall status of core areas within each of the aggregate blocks. It should be noted that this weighted value does not incorporate extirpated bull trout watersheds (shaded black) within the aggregate blocks. These watersheds cannot be individually ranked under this process, so must be viewed in conjunction with the regional rankings.

This exercise provides some interesting output. Given that the Heritage Ranking Process is not normally applied in this fashion, further analysis is needed to assess the assumptions and validate or repudiate this approach. We would caution against using this analysis for anything more than an interpretive exercise for discussion purposes at this point in time. By the very nature of what we've done the method discounts known important habitat in lakes (and the ocean) and weights the results toward large core areas with a lot of connected habitat, even if much of the habitat may be a migration corridor that has low or intermittent occupancy. With those caveats, we present the following results.

The overall P-value for the 121 core areas, with weighting for 18,062 miles of key recovery habitat is 2.30. This would equate to a C-Rank of C2 (At Risk). If we divide the core areas up into three evolutionary units (Coastal, Snake, Upper Columbia - see Maps A-E), the 23 core areas in the Coastal Evolutionary Unit (including Klamath) have the highest weighted aggregate P-value of 2.81. This would equate to a C3 (Potential Risk) ranking. The relative strength of the weighted aggregate P-value of the Coastal Evolutionary Unit is largely provided by the relatively high ranking values and large amounts of key recovery habitat in the Skagit, Snohomish and Skykomish, Queets, and Lower Deschutes core areas. The weighted aggregate P-value would be even higher were it not for relatively low ranking values and substantial amounts of key recovery habitat in the Upper Willamette, Hood, Upper Sprague, and Hoh core areas. It should be noted that seven of the nine areas where bull trout are considered extirpated are in the Coastal Evolutionary Unit. Because they contain no currently occupied habitat, those do not factor into this analysis and do not contribute to the score.

The 44 core areas in the Snake Evolutionary Unit have an intermediate aggregate weighted P-value of 2.39. This equates to a C2 Rank (At Risk). The weighted aggregate

P-value of the Snake Evolutionary Unit is largely supported on the upper end by relatively high ranking values and large amounts of key recovery habitat in the Middle Fork Salmon, Selway, and Middle Salmon-Chamberlain core areas. On the other end of the scale are low ranking values combined with substantial amounts of key recovery habitat in the Pine Indian Wildhorse, Powder, Malheur, and Little-Lower Salmon core areas. None of the extirpated areas fall in the Snake Evolutionary Unit.

The remaining 54 core areas grouped as the Upper Columbia Evolutionary Unit have the lowest weighted aggregate P-value of 1.87. This also equates to a C2 Rank (At Risk), but is approaching the C1 (High Risk) threshold. Major factors in this relatively low aggregate ranking are the combination of high amounts of key recovery habitat and low ranking values in the Priest, Yakima, Pend Oreille River, Upper Clark Fork, Methow, and Coeur d'Alene core areas. At the other end of the scale, relatively high ranking values and large amounts of key recovery habitat occur in Hungry Horse, Blackfoot, Wenatchee, and Lake Pend Oreille core areas. Two of the nine extirpated areas are in the UPPER Columbia Evolutionary Unit. A quirk in this analysis is that the strongest core area by rank (Lake Koocanusa) receives limited weighting because most of the key recovery habitat is in Canada and is not quantified. Similar situations occur for the Chilliwack and Upper Skagit core areas in the Coastal region. The small adfluvial core areas in this evolutionary unit grouping have little weight, but are about evenly arrayed with concentrations at both ends of the scale.

A similar analysis can be done by grouping the core areas by states. Though this type of grouping has less biological significance than the evolutionary grouping, it is nonetheless informative. The same strong and weak core areas drive the results. Idaho core areas (n = 33, including Jarbidge River in Nevada) had the most key recovery habitat (7,644 miles) and the highest weighted aggregate P-Value of 2.46. Washington core areas (n = 25) had a very similar weighted aggregate P-Value of 2.43. The weighted aggregate P-Values of core areas in Montana (n = 46) and Oregon (n =25) were somewhat lower and those two units exhibited similar scores of 2.05 and 2.01, respectively. The weighted aggregate P-Value of the four states would each equate to a C2 Rank (At Risk), although Idaho and Washington would approach the upper end of that rank category (P>2.5 = C3).

CORE AREA LIFE HISTORY AND CONNECTIVITY ASSESSMENT

The maintenance of migratory forms of bull trout and the related connectivity requirements to support these forms are important factors in evaluating persistence of the species within core areas, as well as within regional or larger units. To compile this information in a consistent manner across the range, a system was developed to characterize the life history composition within each core area, the level of connectivity within each core area, and the level of potential connectivity among core areas. Definitions and guidance (rule set) were developed for each of the characterization fields to help ensure consistency (see Appendix C - Rule Set for Life History and Connectivity Characterization Definitions). As we did with the Heritage ranking process, we sent this exercise out to Service biologists whom have regional oversight responsibilities for bull trout activities within a State or portion of a State. Individual reviewers most familiar with each core area assigned the characterization for each field. Where additional explanation was judged necessary for particular entries, a comment was inserted for that entry in the spreadsheet. The final core area characterizations were analyzed across the range and by region, and mapped for evaluation of patterns. The complete results of this exercise for the 121 core areas are summarized in Appendix C. Maps, used to illustrate some of the points that are discussed, are referenced in the order they are described.

Life History Forms

Migratory Forms

There are three migratory life history forms which may be present within a core area (fluvial, adfluvial, anadromous). In core areas where more than one migratory form was present, the dominant and secondary form(s) were identified. It is important to note that the characterization of life history types as fluvial, adfluvial or anadromous is not absolute and may not be mutually exclusive. In reality, migratory fish often exhibit complex movement patterns and individual fish may utilize more than one strategy during their lifetime (e.g., adfluvial one year but fluvial the next). Map K (*Dominant Life History by Core Area*) visually depicts the array of core areas by the dominant migratory life history type that occurs in each.

Under this characterization we determined which migratory form is dominant in each of the 121 bull trout core areas:

Adfluvial	n = 58
Fluvial	n = 49
Anadromous	n = 6
*No Longer Present	n = 7
Non-migratory	n = 1
Total	**n = 121**

*No Longer Present - refers to a core area where the migratory form was historically present but only resident fish now remain.

The adfluvial form (light blue) is the dominant migratory life history found within 48% of the 121 core areas, closely followed by the fluvial form at 40% (purple). The anadromous life history form (dark blue) is found in only 5% of the core areas (6/121), and these are located solely within the Coastal-Puget Sound population segment.

In some core areas several different migratory life history strategies may overlap. Map L (*Migratory Forms by Core Area*) shows the number of migratory life history forms present in each core area.

Single migratory form	n = 83
Multiple migratory forms	n = 30
Resident form only	n = 7
None identified	n = 1
Total	**n = 121**

In 69% of the core areas (83/121), only a single migratory form is present, while 25% (30/121) contain multiple migratory forms. Only one core area, the Lower Skagit, is known to contain all three migratory forms.

Seven core areas (6% of the total) formerly had migratory fish but no longer support them (yellow - Map K – *Dominant Life History by Core Area*). Additionally, one core area is not known to have ever supported migratory bull trout (uncolored). What this analysis does not indicate is where substantial losses of the migratory form have occurred in core areas where the migratory form was once dominant but is no longer the primary life history form (i.e., remnant).

Resident Form

Some core areas include resident bull trout in portions of the watershed(s), often in addition to a migratory form(s). In a few cases the resident form may be the only one still present. Historically, where resident and migratory forms coexisted within the same core area, the migratory form was typically dominant. The evolutionary history of bull trout indicates that as an apex predator species the migratory life form was a highly successful strategy (Whitesel et al. 2004).

With fragmentation, loss, and/or degradation of habitats within a core area (particularly key migration corridors between foraging and overwintering habitats), the migratory form may no longer be dominant. The resident form is inherently at greater risk of loss to stochastic events than the migratory life history form (Rieman and McIntyre 1993, 1995; Rieman et al. 1997; USFWS 2002). If dominant within a core area, residency reduces the likelihood of persistence when compared to core areas supporting migratory forms. Map K (*Dominant Life history by Core Area*) visually depicts where the resident form is dominant (orange hashed areas) within a core area, present but not dominant (green hashed areas), or absent (grey hashed areas). There are also core areas where the resident form's presence is currently unknown (no hashing).

Under the current characterization we assigned the following resident categories to the 121 bull trout core areas:

Resident Dominant	n = 19
Resident Present	n = 34
Resident Absent	n = 34
Unknown	n = 34
Total	**n = 121**

The resident form is currently known to be dominant or present in 44% of the core areas (53/121). In the 19 core areas (16%) where the resident form is dominant, 13 contain a remnant migratory component and five have lost the migratory component. The remaining core area, Little Minam River, is a natural resident population isolated in a headwater drainage, which is not the result of the loss of the migratory form through habitat degradation or fragmentation. The resident form is known to be absent in 28% of the core areas (34/121). In one of these core areas, North Fork Payette River, the historic fluvial form is also no longer present and this core area is most likely at or near extirpation. The presence or absence of the resident form has not been determined in the remaining 28% of the core areas (34/121). In some cases, this is likely the result of the limited survey efforts within core areas, and the difficulty in distinguishing younger life stages of migratory forms from the resident form. In other cases, the diversity of habitat may be insufficient to support the resident form (e.g., small isolated mountain lakes), or harsh climatic conditions or low productivity may preclude resident fish from being able to exist without access to more productive lakes or rivers downstream.

Core Area Extent and Connectivity

Connectivity, especially hydrologic connectivity, is essential to the ecological integrity of the landscape (Pringle 2003). Connectivity of habitats within core areas, and in some cases with habitats outside of core areas, is critical for migratory bull trout to successfully complete their life history (Rieman and McIntyre 1993; MBTSG 1998; Brenkman and Corbett *in press*). Connectivity among local populations is also important to provide the opportunity for genetic exchange within core areas and for refounding after local extinction events (Rieman and McIntyre 1993; Rieman et al. 1997). Multiple local populations distributed throughout a watershed provide a mechanism for spreading risk because the simultaneous loss of all local populations is unlikely; and if well connected, provide for the resiliency of the core area through potential refounding. In some cases, connectivity among adjacent core areas is important for maintaining/restoring the original population structure that existed prior to fragmentation by artificial barriers. Connectivity among core areas also provides for the opportunity of genetic exchange (one or two-way) to maintain diversity and allows the potential for refounding.

To a certain extent, the distinction between connectivity "within" core areas and connectivity "among" core areas is a temporal distinction. By definition, a core area represents a largely self-contained biologically functioning unit for bull trout (USFWS

2002, 2004A, 2004B). Over the short term (several generations) connectivity within a core area is critical to a bull trout population maximizing its potential (abundance, distribution, trend), and perhaps even to its persistence. However, over a longer time frame, perhaps even evolutionary time, core areas necessarily share (or once shared) some degree of connectivity (Whitesel et al. 2004).

Thus, if a core area is completely isolated today (e.g., natural barriers), the lack of connectivity to other core areas in the future may not be a factor in its chances of persistence. That is not to suggest connectivity to other core areas (at least over multigenerational time periods) might not be beneficial, but rather, that from a practical standpoint future connectivity is extremely unlikely to occur. Conversely, a core area that currently maintains connectivity with other core areas both upstream and downstream (e.g., a portion of a mainstem river basin) may be considered more secure, simply because the potential for recolonization (however slight) still exists.

Core Area Extent

All core areas have a lower and upper bound which delineates the extent of the core area. These may include 1) a watershed boundary [typically the lower bound of core areas that are directly associated with the mainstem Columbia or Snake Rivers, or marine waters (i.e., Pacific Ocean, Strait of Juan de Fuca, Hood Canal, and Puget Sound)]; a dam or other artificial barrier; a natural barrier such as a waterfall or other longstanding natural habitat condition that precludes migration; or headwaters (only applicable as an upper bound to a core area). For some core areas, the upper bound may actually be the result of multiple features given the complexity of the most upstream portions of a river system. In these cases, multiple features may have been identified as upper bound(s) of the core area (e.g., headwaters/artificial barrier). We developed and applied a set of rules for use in assessing connectivity and assigning categories (Appendix C – Rule Set for Life History and Connectivity Characterization Definitions). The results of this exercise for the 121 core areas are detailed in Appendix C.

Under the current characterization we assigned the following upper and lower bound categories to the 121 bull trout core areas:

Upper Bound

Headwaters	n = 81
Watershed Boundary	n = 9
Dam/Artificial Barrier	n = 7
Natural Barrier	n = 6
(Multiple Bounds)	n = 18
Total	**n = 121**

Lower Bound

Watershed Boundary	n = 78
Dam/Artificial Barrier	n = 27
Natural Barrier	n = 16
Total	**n = 121**

As might be expected, “headwaters” were identified as the upper bound of most core areas (67%). This makes sense, given that core areas generally coincide with watersheds. An additional 5% had a natural barrier (e.g., major waterfall or other impassible feature) defined as its upper bound. Only 6% of the core areas (7/121) had a dam/artificial barrier identified as an upper bound. Fifteen percent of the core areas (18/121) had identified more than one bound type as an upper bound, due to the complexity of the upper watershed. This complexity is usually the result of a core area having multiple river forks with different boundary types. It should be noted that in all these cases either “headwaters” and/or “natural barrier” were identified as one of these multiple bounds.

The majority of core areas (64%) identified “watershed boundary” as the lower bound. Given that core areas generally extend to the bottom of a major watershed, often to major hydrologic areas such as the mainstem Columbia and Snake Rivers, Puget Sound and the Pacific Ocean, this is not unexpected. Generally, core areas with a “watershed boundary” as the lower delineation are not completely isolated from downstream core areas. However, 22% of the core areas (27/121) have a dam or other artificial barrier that was identified as a lower bound, fully isolating them from other core areas. Finally, 13% of the core areas (16/121) are naturally isolated from other core areas by a natural barrier.

Degree of External Connectivity Among Core Areas

Directly related to the boundary delineations above is the effect that these bounds have on the degree of connectivity to adjacent upstream and downstream core areas. There are generally three levels of connectivity at the upstream and downstream boundaries of core areas (No Passage, Restricted Passage, and Unrestricted Passage – see Rule Set in Appendix C). “No Passage" applies to longstanding natural habitat conditions that preclude downstream migration (e.g., Jarbidge) or dams/diversion that prevent any passage; "Restricted Passage” applies to dams/diversions with one- or two-way passage, or anthropogenic habitat conditions that significantly impair downstream migration (e.g., Yakima); and "Unrestricted Passage" applies to intact migratory corridors. This characterization only applies to the ability for fish to migrate from a core area to other downstream or upstream core areas. Note that connectivity “within” the boundaries of each core area is a separate topic dealt with in a later section of this report (see Degree of Internal Connectivity Within Core Areas below).

It is assumed that adfluvial populations typically do not migrate downstream of their lake (in part a behavior, but also because water downstream of lakes is typically warmer than bull trout prefer in the summer). Thus, for adfluvial populations, downstream passage is considered “Restricted Passage” by default, unless demonstrated otherwise.

We acknowledge that in evaluating anthropogenic habitat conditions, there is sometimes a level of interpretation in deciding when those conditions “significantly impair” downstream migration. The results of this passage exercise should therefore not be interpreted as strictly black or white, but rather as shades of gray. Information from radio

telemetry and fish passage studies has often led to surprising conclusions about the migratory movements of these highly mobile fish.

Under the current characterization we described the following level of connectivity at the upper and lower bounds of the 121 bull trout core areas:

Upper Bound

No Passage	n = 110
Restricted Passage	n = 6
Unrestricted Passage	n = 5
Total	**n = 121**

Lower Bound

No Passage	n = 16
Restricted Passage	n = 66
Unrestricted Passage	n = 39
Total	**n = 121**

In order to describe the overall degree of connectivity between adjacent core areas a simple scoring system was developed. Each level of connectivity was given a point value (No Passage = -1; Restricted Passage = 0; Unrestricted Passage = +1), and then the two resulting point values for downstream and upstream connectivity were added together. A value of "-1" is still applied to core areas having headwaters or a natural barrier as an upper bound, even though the lack of upstream connectivity to other core areas is the natural prevailing condition. This is appropriate, since we are trying to assess the overall degree of connectivity relative to other core areas, whether natural or altered.

A range of five "connectivity" scores are possible (+2, +1, 0, -1, -2). The final point value for each core area indicates its overall degree of connectivity with other core areas, with +2 being highest and -2 being lowest. This overall "connectivity score" may also be considered to provide a relative indicator of the potential for refounding if bull trout were extirpated in a core area. Map M (*External Connectivity Among Core Areas*) visually depicts the array of "connectivity" scores for each core area. The low connectivity categories (-2 or -1) are displayed in red and orange, respectively. The moderate connectivity category (0) is displayed in yellow. The high connectivity categories (+1 or +2) are displayed in shades of green.

Under the current scoring we assigned the following degrees of connectivity among each of the 121 bull trout core areas:

Low Connectivity	n = 73	score = $\leq$ -1
Moderate Connectivity	n = 43	score = 0
High Connectivity	n = 5	score = $\geq$ 1
Total	**n = 121**	

The majority (60%) scored as having "low" connectivity with other core areas. In order to achieve this score, a core area must have no passage at one of the core area's bounds and restricted passage at the other. A total of 16 core areas scored "-2", meaning that there was complete isolation with no passage at either bound. Thirty-six percent of the core areas (43/121) scored as having "moderate" connectivity with other core areas, meaning either "restricted passage" at both bounds, or "unrestricted passage" at one bound and "no passage" at the other. Only 4% of the core areas (5/121) scored as having "high" connectivity with other core areas, and only one core area scored "2", meaning "unrestricted passage at both bounds". These scoring results would suggest that current connectivity among core areas is low across the range overall. This current lack of connectivity among core areas significantly reduces the probability of refounding events should a core area become extirpated. It also illustrates why we consider core areas to be important biological units and why threats should be evaluated primarily at the core area level.

It is important to note some core areas are isolated primarily by natural conditions. Certain headwater core areas that are also isolated by natural barrier falls downstream would score -2 in this evaluation. However, in other cases, the natural degree of isolation is enhanced by artificial means, which contributes to the loss of external connectivity. The isolating mechanisms that lead to the individual core area scores are detailed in Appendix C – Table 1.

Degree of Internal Connectivity Within Core Areas

As described earlier, connectivity of habitats within core areas is also critical for migratory bull trout to successfully complete their life history. Within core area connections provide interaction among local populations to allow for genetic exchange and refounding. Similar to describing connectivity "among" core areas, the degree of connectivity "within" each core area was characterized as either low, moderate, or high. However, no scoring was used in this exercise. Categorization of each core area was rated based on the following definitions.

"Low" internal connectivity applies to core areas where the majority of local populations are artificially separated from one another, or migratory or resident forms (if dominant) have impaired access (year round or seasonally) to a majority of the habitat within the core area. Access may be impaired by degraded habitat conditions or by artificial barriers (e.g., diversions, culverts, etc.).

"Moderate" internal connectivity applies to core areas where some portion (but not the majority) of local populations are artificially separated from the others, or migratory or resident forms (if dominant) have impaired access to smaller portions of habitat within the core area. In this category connectivity issues are still considered significant.

"High" internal connectivity applies to core areas where connectivity between local populations is generally unimpaired, or where only minor or insignificant portions of usable habitat are currently inaccessible. Map N (*Internal Connectivity Within Core Areas*) visually depicts the array of core areas by "internal" connectivity category. The

low connectivity category is displayed in red, the moderate connectivity category is displayed in yellow, and the high connectivity category is displayed in green.

Under the current characterization we assigned the following degrees of connectivity within each of the 121 bull trout core areas:

Low Connectivity	n = 30
Moderate Connectivity	n = 39
High Connectivity	n = 52
Total	**n = 121**

Over half of the core areas (57%) were characterized as having "low" or "moderate" connectivity "within" the core area. This means that at least some local populations (i.e., spawning groups) were artificially separated from other local populations within the core area, and/or significant portions of usable habitat within the core area were currently inaccessible. Forty-three percent of the core areas (52/121) were characterized as having "high" connectivity within the core area.

Maintaining internal connectivity may be even more critical to the persistence of those core areas that scored "low" or "moderate" with respect to external connectivity. At the very least, core areas with low connectivity at both the internal and external level would seem to be highly vulnerable to extirpation. Twenty-five core areas (21%) characterized as having low internal connectivity also scored as having low external connectivity with other core areas. Another 17 core areas (14%) characterized as having moderate internal connectivity also scored as having low external connectivity.

CONNECTIVITY WITH CANADA

As with the assessment of connectivity within and among core areas in the United States, there are a number of watersheds where connectivity of core areas in the United States with habitat in Canada is vitally important to bull trout. In part because bull trout are not listed in Canada, and also because core area population structure has not been described north of the border, we have not extended the previous analysis of core area connectivity to Canadian waters. However, the identification of portions of the watersheds in British Columbia and Alberta, Canada that routinely interact with core areas in the United States. is relatively straightforward. Those watersheds are highlighted in Map O (*Core Area Interaction With Canada*). We will describe these in the following paragraphs, moving from west to east across the landscape.

Chilliwack River
The Chilliwack core area is delineated around those portions of the Chilliwack River and its major tributaries (Silesia Creek, Tomyhoi Creek, and Sumas River) contained within the United States. However, a significant portion of the Chilliwack River drainage lies within Canada and is functionally part of this core area. It is a transboundary system that flows from the United States northwest into British Columbia where it discharges into the lower Fraser River.

Those reaches of the Chilliwack River and Silesia Creek (spelled "Slesse" in Canada) within the United States are contained within North Cascades National Park and the Mount Baker Wilderness, respectively. The short section of the mainstem river (extending from the international border) and Chilliwack Lake, comprise Chilliwack Lake Provincial Park in British Columbia. Although Chilliwack Lake is now entirely within the Provincial Park, two of its major tributaries, Paleface and Depot Creeks, are extensively outside of the park boundary with the exception of their lower reaches. The headwater reaches of Depot Creek initiate within North Cascades National Park in the United States. Silesia Creek and Tomyhoi Creek (spelled "Tamihi" in Canada), initiate from the Mount Baker Wilderness in the United States, eventually crossing the international border and entering the Chilliwack River downstream of Chilliwack Lake. The Chilliwack River flows west out of Chilliwack Lake, eventually becoming the Vedder River, where it is then joined by the Sumas River (at Vedder Canal) before discharging into the lower Fraser River. There are at least five other tributaries on British Columbia side that appear to support spawning (Airplane, Borden, Centre, Foley, and Nesakwatch Creeks).

The bull trout within the Chilliwack system are believed to express fluvial, adfluvial, and potentially resident and anadromous life histories. Adfluvial, fluvial, and any anadromous forms spawning in the United States must migrate to British Columbia waters to complete their life histories. Adfluvial forms need to migrate only to Chilliwack Lake, while fluvial forms may migrate as far as the lower Fraser River, and any anadromous forms would have to migrate as far as the Strait of Georgia downstream though the lower Fraser River.

The other major subwatersheds within the lower Fraser system below Hells Gate (Fraser Canyon, Lillooet, Harrison River, Lower Fraser, and Squamish) are all accessible to migratory salmonids. Lillooet-Harrison River and Squamish, which enter on the north side of the Fraser River, would probably be considered separate core areas based on the definitions applied to bull trout populations within the United States. Those subwatersheds that are primarily reaches of the mainstem Fraser River (i.e., Fraser Canyon and Lower Fraser) would be considered primarily foraging, migration, and overwintering habitat. The use of these areas by bull trout from the Chilliwack River system is currently undetermined. Given the migratory patterns that have been observed for several populations within Puget Sound and the Columbia River system, it is conceivable that some bull trout from the Chilliwack system could occasionally (Lillooet-Harrison River and Squamish) or frequently (Fraser Canyon and Lower Fraser) migrate through portions of these areas. The status of bull trout in the Lillooet, Harrison River and Squamish subwatersheds likely has no direct influence on the status within the Chilliwack system, whereas portions of the Fraser Canyon and Lower Fraser subwatersheds could be important for supporting some migratory forms that spawn in the Chilliwack core area.

Upper Skagit River

A significant portion of the upper Skagit River drainage lies within British Columbia, Canada. It is a transboundary system that flows south from British Columbia into the upper end of Ross Lake, a reservoir formed by the construction of Ross Dam on the mainstem Skagit River in the United States. Ross Lake extends partially into British Columbia, but is substantially within the United States. The upper mainstem Skagit River enters Ross Lake less than 0.75 mile from the international border. Much of the bull trout habitat within the Canadian portion of the watershed is relatively undisturbed, since most lies within Skagit Valley and Manning Provincial Parks, and the Cascade Recreation Area (backcountry wilderness), which compliments protection within North Cascades National Park and the Pasayten Wilderness in the United States. The Upper Skagit core area supports populations of both bull trout and Dolly Varden. Adfluvial, fluvial, and resident life history forms of bull trout are present in the upper Skagit drainage. Adfluvial bull trout are present in many of the tributaries to Ross Lake including the upper Skagit River, while fluvial forms are found primarily in the upper Skagit River within British Columbia. Resident bull trout are also found in several British Columbia tributaries to the upper Skagit River including Nepopekum and Snass Creeks, and the Klesilkwa, Sumallo, and Skaist Rivers. The portion of the upper Skagit River drainage the lies within British Columbia should be considered functionally part of the Upper Skagit core area. It should be noted that in contrast to the Chilliwack core area, local populations (spawning groups) within the United States portion of the upper Skagit generally don't require migration into Canadian waters (with perhaps the exception of a small portion of Ross Lake) to complete their life history. However, the local populations of adfluvial bull trout in British Columbia do require access to Ross Lake in United States to complete their life history.

Columbia River Headwaters
The Columbia River heads in British Columbia at Canal Flats, adjacent to (west of) the Kootenai River, and it flows north for over 100 miles before abruptly looping south and flowing back toward the United States. On the south-flowing reaches of the upper Columbia River in British Columbia a series of reservoirs exist behind major dams (in downstream order Mica, Revelstoke, and Keenleyside). Keenleyside Dam near Castlegar, about 20 miles north of the international border, impounds Lower Arrow Lake. While there are relatively robust populations of bull trout throughout portions of the upper Columbia River system and its reservoirs in British Columbia, the Columbia River downstream from the international border (in northeast Washington) is not considered part of the existing range of bull trout. No bull trout core area was designated in the upper Columbia River after it flows into the United States and bull trout are found there only rarely. Consequently, bull trout in the entire upper Columbia River drainage in Canada should be considered disconnected from the U.S. portion of the range.

Lower Kootenay River/Lower Pend Oreille River
Similarly, the lower portions of the Kootenai River, after it leaves Kootenay Lake in British Columbia, flow into the upper Columbia River near Castlegar, about 20 miles north of the international border. Bonnington Falls is an historic natural fish passage barrier on the lower Kootenay, near the confluence of the Columbia. Additionally, the lower Pend Oreille River after leaving Lake Pend Oreille and flowing through Albeni Falls Dam in the United States, flows over Metaline Falls (a historic barrier) and then into British Columbia to enter the upper portion of the Columbia River. The area of the upper Columbia River just north of the international border, where the Kootenay and Pend Oreille Rivers join the Columbia, is heavily influenced by relatively warm summer surface water discharge from the major lakes (Arrow, Pend Oreille, and Kootenay) and is not regularly inhabited by bull trout.

Kootenai River
The Kootenai River core area in the United States. (bounded by Libby Dam with no fish passage on the upper end and the international border on the lower end) has the capability to exchange bull trout from its headwater spawning and rearing streams with downstream waters in Kootenay Lake in British Columbia. Kootenay Lake is a large natural lake, with several large tributaries entirely in Canada, including the Duncan River and Lardeau River. Kootenay Lake is a productive bull trout system, but the available evidence indicates most of the bull trout in Kootenay Lake spawn in tributaries in Canadian portions of the Kootenai River. It may be that the historic conditions of the Kootenai River upstream of Kootenay Lake prior to Libby Dam were less suitable for bull trout, or there were limited opportunities to navigate Kootenai Falls to access the best spawning and rearing habitat in the U.S. portions of the Kootenai River system. Regardless, there is limited evidence that bull trout from Kootenay Lake routinely migrate to United States portions of the Kootenai River system, or vice versa, either currently or historically. While the connectivity that does occur may be important, it is not a major migratory route.

Lake Koocanusa
Lake Koocanusa, behind Libby Dam (completed in 1972), floods into British Columbia at full pool. Only one tributary to the system (Grave Creek) on the United States side of the border supports bull trout spawning and rearing. The entire headwaters of the Kootenay River in British Columbia are largely unobstructed for fish passage, and radio telemetry studies have shown extensive migrations of bull trout from Lake Koocanusa in the U.S. to numerous watersheds in British Columbia for spawning and rearing. The White River, Skookumchuck Creek, St. Mary River, Elk River, Wigwam River, and Bull River are just some of the very important tributaries identified for this thriving population of bull trout. The maintenance of connectivity and continuing transboundary interchange of bull trout in this system are vital to the status of the species in this watershed.

Upper Flathead River
Most of the watershed of the upper Flathead River (known as the North Fork Flathead River on the United States side) is in Montana. However, adfluvial bull trout from Flathead Lake, and likely some fluvial fish from the Flathead River system routinely migrate as far as 150 miles upstream to spawn in the upper Flathead River in British Columbia. or in its tributaries (including Howell, Cabin, and Kishinehn Creeks). In recent years, as Flathead Lake bull trout populations have declined due to negative interaction with lake trout, the British Columbia. headwaters appear to have supported an increasingly larger share of the systemwide spawning. Maintenance of this historic connectivity may be key to the long-term protection of bull trout in the Flathead Lake core area.

Belly River
Both the Belly River and the Saint Mary River originate in the United States within Glacier National Park on the east slopes of the continental divide. Both rivers flow south into Alberta, Canada. Eventually, they unite into the headwaters of the Oldman River and flow to the South Saskatchewan River system on into Hudson Bay. The very small portion of the North Fork Belly River headwaters that are in the United States is disproportionately important to bull trout in the Alberta portion of the watershed. They form the only known spawning area for this population. These waters are protected in the backcountry of Glacier National Park.

Saint Mary River
Bull trout within the headwaters of the Belly and Saint Mary Rivers are isolated populations today. Irrigation diversions, dams, and rapidly degrading habitat occur in Alberta as the rivers flow northeastward onto the Great Plains. Neither population is large and both are dependent upon habitat in the United States and Alberta, Canada. Continued opportunities for connectivity and interchange of bull trout in these systems across the international border are vital to the long-term maintenance of both populations.

GIS-BASED THREATS ANALYSIS

Threats to bull trout conservation have been identified in the scientific literature (e.g., Rieman and McIntyre 1993; MBTSG 1998; Quigley and Arbelbide 1997), and summarized in several FWS listing rules (e.g., 63 FR31647). In this section we summarize three specific categories of threats (presence of two species of non-native competitors, road density, and water quality); as they are portrayed in GIS data layers, relative to the core areas identified in the FWS draft Bull Trout Recovery Plan (USFWS 2002, 2004A, 2004B).

The three categories described are not necessarily the most important or significant threats that occur in any particular core area. Rather, they are categories that were presented visually through GIS-based mapping exercises, or discussed during the March 7 and 8, 2005 Bull Trout Science Panel. We are responding to a request to provide a more quantitative summary of those results.

Also included are core area-specific information on land ownership and land use patterns (see Appendix D) which are useful in informing an overall perspective of the distribution of these and other threats (e.g., effects of forest management, development, agricultural activities) across the range of bull trout. The Core Area Connectivity Assessment section of this document discusses an additional aspect of threats.

The threats analysis summary was prepared primarily utilizing GIS data layers available from State and Federal agencies. Some of the information was available for all states within the range of bull trout in the coterminous United States, but other information was only available for portions of the five states.

GIS road densities are visually displayed in Map P (*Road Density by Core Area*). This information appears to be based on different sets of assumptions, depending on the State and agency source. For instance, a little used forest road may be included in one State's GIS layer and a comparable road not included in another State's GIS layer. For this reason we believe the best use of this particular combination of data sets is for relative comparisons of road density within two different geographic areas: coastal states of Oregon and Washington forming one block where a uniform approach to mapping occurred and interior states of Montana, Idaho, and Nevada forming a separate and distinct block. Any comparison between the two blocks would be less meaningful. If no quantitative information was available, we attempted to provide a qualitative indication of threat presence and/or severity. In these cases the primary source of information was the draft bull trout Recovery Plan (as informed by public comment and peer review). Where no information was available, it is clearly indicated.

It should also be noted that in addition to the quantitative summaries for roads, the summaries for brook trout co-occupation presented in the tables should be considered estimates. In some core areas, these numbers underestimate of the total amount of key recovery habitat actually co-occupied by brook trout, based on more recent information that we could not summarize in a GIS layer.

Some GIS layers created by different State and Federal agencies do not match up precisely, such that there is often an area of irregularity where the layers intersect (e.g., State boundaries). Because bull trout core areas or other units based primarily on biology most often do not correspond with administrative boundaries, we used our best professional judgment to make slight adjustments to "fit" the different layers. While we have made our best effort to minimize irregularities, for these reasons quantitative values should be considered as close approximations. Additionally, indications of land ownership should also be viewed as approximations if only due to the fact that land ownership is dynamic.

Table 3, "Summary of Three Threat Categories and Federal Land Ownership by Core Area" indicates (1) the percentage of key bull trout recovery habitat in core area streams co-occupied by brook trout; (2) the percentage of key bull trout recovery habitat in core area lakes and reservoirs co-occupied by lake trout; (3) core area road density; (4) water quality as indicated by the proportion of State-listed 303(d) streams relative to key bull trout recovery habitat by core area; and (5) Primary Federal or Tribal land ownership percentage by core area. Categories #1, 2, and 4 analyze only those stream or lake layers considered key recovery habitat, whereas categories #3 and 5 are inclusive of all habitat within the core area.

Table 3. Summary of three threat categories and Federal land ownership by core area. Core areas presented in order of P-Value (most at risk to least at risk).

Core Area~	**Brook Trout (% of key streams occupied)***	**Lake Trout (% of key lakes occupied)^**	**Road Density (mi/mi^2) ******	**Water Quality Key habitat on State 303(d) lists^^**	**Primary Federal or Tribal land ownership*******
Kintla Lake	0%	100%	0	none	NP = 100%
Lake McDonald	100%	100%	0.35	none	NP = 100%
Bowman Lake	0%	100%	0.02	none	NP = 100%
Logging Lake	0%	100%	0	none	NP = 100%
North Fork Payette	2%	0%	1.6	low	NF = 50%
Sycan River	present	absent	3	none	NF = 77%
Cyclone Lake	0%	0%	0.9	high	NF = 100%
Priest Lakes	48%	95%	1.7	low	NF = 53%
Sophie Lake	0%	0%	2.2	none	NA
Odell Lake	present	present	2.8	moderate	NF = 81%
Holland Lake	100%	0%	0.5	none	NF = 97%
Lower Quartz Lake	0%	100%	0	none	NP = 100%
Upper Whitefish L.	0%	0%	1.2	high	NF = 72%
Whitefish Lake	100%	100%	2.2	high	NF = 15%

Core Area~	Brook Trout (% of key streams occupied)*	Lake Trout (% of key lakes occupied)^	Road Density (mi/mi^2) **	Water Quality Key habitat on State 303(d) lists^^	Primary Federal or Tribal land ownership***
Pine, Indian & Wildhorse Creeks	present	absent	1.8	moderate	NF = 57%
Powder River	present	?	3	moderate	NF = 31%
Lucky Peak Res.	present	absent	1.8	?	NF = 90%
Weiser River	52%	0%	1.4	none	NF = 53%
Yakima River	39%	28%	2.6	moderate	TR = 24% NF = 18%
Pend Oreille River	38%	0%	2.2	elevated	NF = 48%
Skokomish River	55%	0%	2.8	low	NF = 50%
Lee Creek	0%	0%	0.5	none	TR = 63% NP = 37%
Lincoln Lake	100%	0%	0.8	none	NP = 100%
Upper Stillwater L.	100%	100%	1.5	none	NF = 63%
Malheur River	0%	0%	1.9	moderate	BLM = 41%
Fish Lake (N. Fork Clearwater River)	0%	0%	0.2	none	NF = 100%
Asotin Creek	0%	0%	1.7	low	NF = 27%
Dungeness River	0%	0%	2.1	low	W = 56%
Cabinet Gorge Res.	100%	0%	1.1	elevated	NF = 77%
Clark Fork River (Section 1)	100%	0%	1.3	high	NF = 38%
Clark Fork River (Section 3)	84%	94%	1.4	elevated	NF = 65%
Harrison Lake	100%	0%	0	none	NP = 100%
Lower Flathead R.	17%	0%	1.6	low	TR = 87%
Noxon Rapids Res.	100%	100%	1	high	NF = 81%
Upper Willamette	present	absent	3.1	moderate	NF = 56%
Hood River	present	absent	3.5	none	NF = 50%
Touchet River	0%	0%	1.6	low	NF = 7%
Coeur d'Alene Lake	20%	0%	1.9	moderate	NF = 55%
Little-Lower Salmon River	70%	0%	1.6	moderate	NF = 46%
Deadwood River	0%	0%	0.5	low	NF = 96%
Squaw Creek	19%	0%	1.4	low	NF = 42%
Methow River	91%	0%	1.3	low	NF = 50%
Jarbidge River	42%	0%	0.9	none	BLM = 61%
Bitterroot River	82%	0%	1.7	moderate	NF = 51%
Clark Fork River	94%	0%	1.7	elevated	NF = 80%

Core Area~	Brook Trout (% of key streams occupied)*	Lake Trout (% of key lakes occupied)^	Road Density (mi/mi^2) **	Water Quality Key habitat on State 303(d) lists^^	Primary Federal or Tribal land ownership***
(Section 2)					
Clearwater R. & L.	94%	0%	1.9	moderate	NF = 82%
Lindbergh Lake	92%	100%	0.3	none	W = 71%
Umatilla River	absent	absent	1.9	low	NF = 11%
Fish Lake (Lochsa)	0%	0%	0.5	none	W = 100%
Lochsa River	0%	0%	0.7	moderate	NF = 69%
No. Fk. Clearwater	18%	0%	1.4	low	NF = 66%
Lemhi River	41%	0%	0.8	moderate	NF = 40%
Anderson Ranch	26%	0%	0.8	low	NF = 97%
Entiat River	56%	0%	3.4	low	NF = 72%
Saint Mary River	45%	0%	0.7	low	NP = 57%
Upper Sprague R.	absent	absent	3.4	none	NF = 81%
Quartz Lakes	0%	0%	0	none	NP = 100%
Flathead Lake	6%	100%	1.4	moderate	NF = 38%
W. Fork Bitterroot	95%	0%	1	moderate	NF = 85%
Kootenai River	87%	0%	2	moderate	NF = 75%
Walla Walla River	absent	absent	2	moderate	NF = 12%
South Fork Clearwater River	62%	0%	1.4	elevated	NF = 62%
Middle Fork Payette River	35%	0%	1.3	low	NF = 88%
Little Lost River	84%	0%	0.4	low	NF = 44%
Elwha River	20%	0%	0.9	low	W = 88%
Hoh River	0%	0%	1.6	moderate	W = 58%
Red Eagle Lake	0%	0%	0	none	NP = 100%
Big Salmon Lake	0%	0%	0	none	W = 100%
Rock Creek	75%	0%	0.7	moderate	NF = 60%
Bull Lake	100%	0%	1.2	elevated	NF = 75%
Upper Mainstem John Day River	present	absent	2.2	elevated	NF = 33%
Middle-Lower Clearwater River	25%	0%	1.9	moderate	TR = 41%
Lake Creek	0%	0%	1	none	NF = 98%
Pahsimeroi River	12%	0%	0.7	low	NF = 46%
Arrowrock Res.	13%	0%	0.9	low	NF = 88%
Klickitat River	100%	0%	2.4	none	TR = 54%
Stillaguamish River	65%	0%	2.4	moderate	NF = 25%
Upper Klamath L.	present	absent	2.8	none	NF = 41%

Core Area~	Brook Trout (% of key streams occupied)*	Lake Trout (% of key lakes occupied)^	Road Density (mi/mi^2) **	Water Quality Key habitat on State 303(d) lists^^	Primary Federal or Tribal land ownership***
Swan Lake	100%	99%	1.3	elevated	NF = 68%
Middle Fork John Day River	absent	absent	3.8	elevated	NF = 56%
North Fork John Day River	absent	absent	3	moderate	NF = 52%
Grrande Ronde R.	absent	absent	2.8	low	NF = 30%
Middle Salmon River-Panther	26%	0%	0.7	low	NF = 68%
South Fork Salmon River	51%	0%	0.5	low	NF = 92%
Upper South Fork Payette River	12%	0%	0.6	low	NF = 83%
Puyallup River	0%	0%	4.2	low	W = 24%
Quinault River	0%	0%	1.2	none	W = 49%
Granite Creek	0%	0%	0	none	W = 99%
Imnaha River	0%	0%	1.9	low	NF = 67%
Sheep Creek	0%	0%	0.5	none	W = 99%
Opal Lake	0%	0%	0	none	NF = 100%
Upper Salmon R.	51%	0%	0.5	low	NF = 53%
Chilliwack River	0%	0%	1	none	W = 60%
Nooksack River	23%	0%	2.4	low	W = 12%
Belly River	0%	0%	0.1	none	NP = 100%
Akokala Lake	0%	0%	0	none	NP = 100%
Arrow Lake	0%	0%	0	none	NP = 100%
Blackfoot River	90%	0%	1	moderate	NF = 35%
Doctor Lake	0%	0%	0	none	W = 100%
Frozen Lake	0%	0%	1.3	none	NF = 100%
Lake Pend Oreille	84%	100%	2.1	low	NF = 39%
Trout Lake	0%	0%	0.1	none	NP = 100%
Little Minam River	0%	0%	1.2	none	W = 99%
Wenatchee River	71%	0%	2.3	low	NF = 54%
Tucannon River	0%	0%	1.6	low	NF = 20%
Chester Morse L.	0%	0%	3.4	none	NF = 100%
Slide Lake	0%	0%	0	none	NP = 100%
Isabel Lakes	0%	0%	0	none	NP = 100%
Lower Deschutes River	present	absent	2.6	moderate	TR = 24%
Selway River	32%	0%	0.2	none	W = 73%

Core Area~	Brook Trout (% of key streams occupied)*	Lake Trout (% of key lakes occupied)^	Road Density (mi/mi^2) **	Water Quality Key habitat on State 303(d) lists^^	Primary Federal or Tribal land ownership***
Middle Salmon River-Chamberlain	28%	0%	0.3	moderate	W = 65%
Lewis River	0%	0%	3.4	none	NF = 56%
Hungry Horse Res.	0%	0%	0.4	moderate	W = 61%
Upper Kintla Lake	0%	0%	0	none	NP = 100%
Snohomish & Skykomish Rivers	27%	0%	2.5	low	NF = 29%
Queets River	0%	0%	2.2	none	W = 30%
Cracker Lake	0%	0%	0	none	NP = 100%
Lake Koocanusa	69%	0%	1.9	moderate	NF = 78%
Middle Fork Salmon River	32%	0%	0.2	low	W = 77%
Lower Skagit River	29%	0%	1.5	low	W = 41%
Upper Skagit River	28%	0%	0.4	none	W = 81%

~Does not include areas of the mainstem Snake and Columbia Rivers supporting bull trout.

*Estimates based on GIS data comparing key stream recovery habitat occupied by brook trout as a percentage of total core area key recovery habitat occupied by bull trout; GIS data not available for Oregon and isolated areas of other states. In these areas only presence or absence is indicated.

^Estimates based on GIS data comparing key lake and reservoir recovery habitat occupied by lake trout as a percentage of total core area key lake and reservoir recovery habitat occupied by bull trout; GIS data not available for Oregon and isolated areas of other states. In these areas only presence or absence is indicated.

**Based on entire core area. State GIS data layers are not precisely comparable (e.g., a little used forest road may be included in one State's GIS layer and a comparable road not included in another State's GIS layer) and should be used with caution.

^^Based on proportion of key stream recovery habitat for bull trout within a core area that is 303-d listed: low = 0-25%; moderate = 26-50%; elevated = 51-75%; high = 76-100%. Some States have not completed the process of identifying water quality impaired streams.

***Only the primary Federal (or Tribal) land ownership status is indicated. NF = National Forest; W = wilderness (includes NF and NP); TR = Tribal; BLM = Bureau of Land Management; NP = National Park; NA = not applicable. See tables in Appendix D for complete land ownership by core area.

Appendix D - Table 1, "Distribution of Federal Land by Core Area" indicates a more comprehensive breakdown of Federal land allocation by core area than that presented in Table 3 (above).

Appendix D - Table 2, "Land Use by Core Area" indicates a comprehensive breakdown of land use (e.g., developed, forested, cultivated) by core area.

The Tables are fully self-explanatory and the diversity seen in these layers helps to inform certain aspects of the threats analysis. We repeat our caution against using the values in these tables as absolutes due to mismatches in the GIS layers, inconsistencies between States, and our general inability to proof all data sets. We are, however, confident that the general patterns indicated are useful and informative. We will not attempt to explain or analyze those patterns, as the complexity of that is beyond the scope of this report.

LITERATURE CITED

Andelman, S.J., C. Groves and H.M. Regan. 2004. A review of protocols for selecting species at risk in the context of US Forest Service viability assessments. Acta Oecologica 26 (2004):75-83. Elsevier SAS. Available online at >www.sciencedirect.com<.

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

Dunham, J.B. and B.E. Rieman. 1998. Metapopulation structure of bull trout: influences of physical, biotic, and geometrical landscape characteristics. Ecological Applications 9(2):642-655

Dunham, J., B. Rieman, and K. Davis. 2000. Sources and magnitude of sampling error in redd counts for bull trout (Salvelinus confluentus). North American Journal of Fisheries Management 21:343-352.

Fredenberg, W. 2002. Further evidence that lake trout displace bull trout in mountain lakes. Intermountain Journal of Sciences 8 (3): 143-152.

Fredenberg, W., J. Chan and 18 contributing authors. February, 2005. Bull Trout Core Area Templates. An unpublished compilation of bull trout core area analysis to support the five-year review. U.S. Fish and Wildlife Service. Portland, OR. 662 pages.

Lehmkuhl, J.F., Marcot, B.G. and T. Quinn. 2001. Characterizing species at risk. *In:* D.H. Johnson and T.A. O'Neill (Eds.), Wildlife Habitat Relationships in Oregon and Washington. Oregon State University Press. Corvallis, OR, pp. 474-500.

Master, L.L., L.E. Morse, A.S. Weakley, G.A. Hammerson and D. Faber-Langendoen. 2003. NatureServe Conservation Status Assessment Criteria. Nature Serve, Arlington, VA, USA.

Maxell, B.A. 1999. A power analysis on the monitoring of bull trout stocks using redd counts. North American Journal of Fisheries Management 19:860-866.

Montana Bull Trout Scientific Group. 1998. The relationship of land management activities and habitat requirements of bull trout. Montana Fish, Wildlife and Parks, Helena.

MNHP. Montana Natural Heritage Program and Montana Fish, Wildlife and Parks. 2004. Montana Animal Species of Concern. Online at >http://mtnhp.org/animal/index.html<

MNHP. Montana Natural Heritage Program. 2005. State Rank Criteria for Montana Animal Species of Concern. Online at >http://mtnhp.org/animal/index.html<

Pringle, C. 2003. What is hydrologic connectivity and why is it ecologically important? Hydrol. Process. 17, 2685-2689.

Quigley, T.M. and S.J. Arbelbide, tech. eds. 1997. An assessment of ecosystem components in the interior Columbia basin and portions of the Klamath and Great Basins: volume III. General Technical Report PNW- GTR-405. U.S. Department of Agriculture, Forest Service, and U.S. Department of Interior, Bureau of Land Management.

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

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

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

Rieman, B.E., D.C. Lee, and R.F. Thurow. 1997. Distribution, status, and likely future trends of bull trout within the Columbia River and Klamath Basins. North American Journal of Fisheries Management 17:1111-1125.

Spruell, P., J.J. Huie, M. Spade, and F.W. Allendorf. 2002. Genetic analysis of bull trout in Glacier National Park. Report 02/102 to U.S. Fish and Wildlife Service. Wild Trout and Salmon Genetics Lab, University of Montana, Missoula.

U.S. Fish and Wildlife Service. 2002. Draft Recovery Plan for the Klamath River and Columbia River Distinct Population Segments of Bull Trout (*Salvelinus confluentus*). U.S. Fish and Wildlife Service, Portland, Oregon.

U.S. Fish and Wildlife Service. 2004a. Draft Recovery Plan for the Coastal-Puget Sound Distinct Population Segment of Bull Trout (*Salvelinus confluentus*). U.S. Fish and Wildlife Service, Portland, Oregon.

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

Whitesel, T.A. and 7 coauthors. 2004. Bull trout recovery planning: A review of the science associated with population structure and size. Science Team Report #2004-01, U.S. Fish and Wildlife Service, Region 1, Portland, Oregon.

Appendix A

CORE AREA RANK CRITERIA FOR BULL TROUT

The ranking criteria described below were used in developing state ranks for vertebrate animal species in Montana. Detailed definitions and guidance for use are provided individually for each criterion. As a precursor to the exercise, the bull trout ranking team of nine individuals stepped through the criterion and customized them according to the following format. Only minor modifications were necessary from the standard. Individual reviewers most familiar with each core area assigned a rank for each criterion. The final core area ranks were then compiled, displayed on a spreadsheet, and mapped for evaluation of outliers. A group consensus on the final rankings was achieved using the process described in Appendix A, with input and review from five-year review staff and other experts.

This methodology used for bull trout has been adapted from Montana Natural Heritage Program from a process developed and proposed by scientists at NatureServe (the international affiliate for natural heritage programs), as documented in:

Master, L. L., L. E. Morse, A. S. Weakley, G. A. Hammerson, and D. Faber-Langendoen. 2003. NatureServe Conservation Status Assessment Criteria. NatureServe, Arlington, Virginia, U.S.A.

CONSERVATION CRITERIA

Population Size

Enter the code for the estimated current naturally occurring wild total population of the species within each bull trout core area. Count or estimate ONLY the number of individuals of reproductive age (ADULTS), including mature but currently non-reproducing individuals.

Guidance, consider the following points (from IUCN 2000) when estimating population numbers:

? *In the case of populations with biased adult or breeding sex ratios it is appropriate to use lower estimates for the number of mature individuals, which take this into account (e.g., the estimated effective population size).*

? *Where the population size fluctuates use a lower estimate. In most cases this will be much less than the mean.*

Assumptions:

1) For bull trout core areas we assumed categories A-F were appropriate, based on available population data across the range and on work by Rieman and Allendorf (2001).

2) In core areas where only redd counts were available, a standard conversion of two adults per redd was used to roughly estimate adult population size.

3) Population size estimates may underestimate the resident life history component where migratory and resident life forms coexist. However, the migratory form has been the predominant life history throughout the range and is the most sensitive to disruption.

Population Size – Scoring

Select from the following values:

A = 1-50 individuals
B = 50-250 individuals
C = 250-1,000 individuals
D = 1,000-2,500 individuals
E = 2,500-10,000 individuals
F = 10,000-100,000 individuals
U = Unknown

Area of Occupancy

Area of occupancy is described by IUCN (2001) for taxa as:

> *Area of occupancy is defined as the area within its 'extent of occurrence' (see definition), which is occupied by a taxon, excluding cases of vagrancy. The measure reflects the fact that a taxon will not usually occur throughout the area of its extent of occurrence, which may contain unsuitable or unoccupied habitats. In some cases (e.g., colonial nesting sites, feeding sites for migratory taxa) the area of occupancy is the smallest area essential at any stage to the survival of existing populations of a taxon. The size of the area of occupancy will be a function of the scale at which it is measured, and should be at a scale appropriate to relevant biological aspects of the taxon, the nature of threats and the available data.*

Determine the code for the estimated current area of occupancy of bull trout in the core area. For species in linear habitats (e.g., riverine shoreline), enter the code for the total length of all currently occupied habitat segments. If information on both occupied area and occupied length is available, use the one that results in the more restrictive value, but provide information on both in the comments field.

For migratory species, enter the code (area or length) that reflects the current area of occupancy (or length of occupied area) at the time of the year when occupancy is most restricted.

Assumptions:

1) For bull trout core areas we had previously conducted an exercise to identify 'key recovery habitat". That GIS layer includes the linear (and lake) extent of habitat that was included in the proposed (not the final) critical habitat rule. As such, we determined that this layer and the values generated were an appropriate surrogate for identifying the minimum distribution of bull trout within a core area. Those "key recovery habitat" values were used in assigning the rankings for area of occupancy.

2) Additionally, we determined that adfluvial and anadromous populations of bull trout likely have an extra security level built in by virtue of the habitat provided by the lake or ocean where part of the population resides. In case of natural disasters (e.g., fire, flood, debris flows) or manmade catastrophes (e.g., chemical spills) the stream habitat is much more susceptible to circumstances that could result in complete population annihilation than are lakes. In worst case, several age classes may be lost from an adfluvial population, but there would typically be a source for rapid recolonization provided in the lacustrine habitat. Because of that level of redundancy, we reasoned that adfluvial or anadromous populations, where the standing water continues to provide high quality cold water habitat suitable to support bull trout, should be elevated one level on the risk category beyond what the extent of occupancy would indicate. Thus, a lake population of bull trout with only 10 km of habitat would normally receive a B rank, but due to the lake presence we elevated that rank to a C. We did not apply this factor in a few cases where lakes were either a minor part of the core area or where the lake (or more typically reservoir) habitat was generally unsuitable for bull trout due to extreme drawdowns, thermal conditions, or other factors.

Area of Occupancy (Stream Length) Scoring:

Select from the following values:

A = <4 km (less than about 2.5 miles)
B = 4-40 km (about 2.5-25 miles)
C = 40-200 km (about 25-125 miles)
D = 200-1,000 km (about 125-620 miles)
E = 1,000-5,000 km (about 620-3,000 miles)
U = Unknown

Short-term Trend

Enter the code that best describes the observed, estimated, inferred, suspected, or projected short-term trend in population size and/or area of occupancy, whichever most significantly affects the rank. Consider short-term historical trend within 25 years or 5 bull trout generations (consistent with the oldest data sets and with timeframes identified in the Draft bull trout recovery plan). Place the greatest emphasis in the ranking on trend information since the time of listing (1999 or later).

The trend may be recent, current, or projected (based on recent past), and the trend may or may not be known to be continuing. Trends may be smooth, irregular or sporadic. Fluctuations will not normally count as trends, but an observed change should not be considered as merely a fluctuation rather than a trend unless there is evidence for this. Specifics known about various pertinent trends, including trend information for particular factors, more precise information, regional trends, etc. are typically described in the accompanying template for the core area. Also, comments on whether the causes of decline, if any, are understood, reversible, and/or ceased will be found in the templates. If the trend is known not to be continuing, that is specified in template comments as well.

Assumptions:

1) Trend was estimated over the whole short-term time period when data were available. For example, recent population increases or decreases were put in context with past population abundances within the time period to determine final scoring.

Short-term Trend –Scoring

Select from the following values:

A = Severely Declining. Decline of >70% in population, range, area occupied, and/or number or condition of occurrences
B = Very Rapidly Declining. Decline of 50-70% in population, range, area occupied, and/or number or condition of occurrences
C = Rapidly Declining. Decline of 30-50% in population, range, area occupied, and/or number or condition of occurrences
D = Declining. Decline of 10-30% in population, range, area occupied, and/or number or condition of occurrences
E = Stable. Population, range, area occupied, and/or number or condition of occurrences unchanged or remaining within +/-10% fluctuation
F = Increasing. Increase of >10% in population, range, area occupied, and/or number or condition of occurrences
U = Unknown. Short-term trend in population, range, area occupied, and number and condition of occurrences are unknown.

Threats (Severity, Scope, and Immediacy)

Indicate the degree to which bull trout in this core area are observed, inferred, or suspected to be directly or indirectly threatened. Use this field to evaluate the impact of extrinsic threats, which typically are anthropogenic but may be natural. The impact of human activity may be direct (e.g., destruction of habitat) or indirect (e.g., invasive species introduction). Effects of natural phenomena (e.g., fire, hurricane, flooding) may be especially important when the species is concentrated in few locations.

Threats considerations apply to the present and the future. Effects of past threats (whether or not continuing) should be addressed instead under the short-term trend factors. Threats may be observed, inferred, or projected to occur in the near term. They should be characterized in terms of severity (how badly and irreversibly the species population is affected), scope (what proportion of it is affected), and degree of imminence (how likely the threat is and when it will occur). "Magnitude" is sometimes used to refer to scope and severity collectively.

Consider threats collectively, and for the foreseeable threat(s) with the greatest magnitude (severity and scope combined), individually rate the severity, scope, and immediacy as High, Moderate, Low, Insignificant, or Unknown, as briefly defined below. The threat(s) to which severity, scope, and immediacy pertains should be identified in the draft recovery plans and/or more recent template exercise. Additional threats will also be identified in recovery plans or templates, or interactions among threats discussed, including any high-magnitude threats considered insignificant in immediacy. For each core area, categorization of severity, scope and immediacy of threats will be documented so that we may determine now and in the future how the ultimate scoring category was determined.

Severity

High: Loss of species population (all individuals) or destruction of species habitat in area affected, with effects essentially irreversible or requiring long-term recovery (>100 years).

Moderate: Major reduction of species population or long-term degradation or reduction of habitat in the core area, requiring 50-100 years for recovery.

Low: Low but nontrivial reduction of species population or reversible degradation or reduction of habitat in area affected, with recovery expected in 10-50 years.

Insignificant: Essentially no reduction of population or degradation of habitat or ecological community due to threats, or populations, habitats, able to recover quickly (within10 years) from minor temporary loss. Note that effects of locally sustainable levels of hunting, fishing, logging, collecting, or other harvest from wild populations are generally considered Insignificant as defined here.

Scope

High: > 60% of total population or area affected

Moderate: 20-60% of total population or area affected

Low: 5-20% of total population or area affected

Insignificant: < 5% of total population or area affected

Immediacy

High: Threat is operational (happening now) or imminent (within a year).

Moderate: Threat is likely to be operational within 2-5 years.

Low: Threat is likely to be operational within 5-20 years.

Insignificant: Threat not likely to be operational within 20 years.

The system will calculate a rank factor value of A, B, C, D, E, F, or G, as shown in Table 2 below. If two of the three parameters are known, the rank factor value will be calculated by treating the unknown (or not assessed [null]) parameter as "Low." If only one of the rank factors is rated (as High, Moderate, or Low), the resulting rank factor value will be "U" (unknown). If any of the three factors are considered "Insignificant," the resulting rank factor will be "H" (unthreatened)."

Threats – Scoring Threat values, calculated from scope, severity, and immediacy, or unknown, may be considered as follows.

A = Substantial, imminent threat. Threat is moderate to severe and imminent for most (> 60%) of the population or area.

B = Moderate and imminent threat. Threat is moderate to severe and imminent for a significant proportion (20-60%) of the population or area.

C = Substantial, non-imminent threat. Threat is moderate to severe but not imminent (> 10 years) for most of the population or area.

D = Moderate, non-imminent threat. Threat is moderate to severe but not imminent for a significant portion of the population or area.

E = Localized substantial threat. Threat is moderate to severe for a small but significant proportion of the population or area.

F = Widespread, low-severity threat. Threat is of low severity but affects (or would affect) most or a significant portion of the population or area.

G = Slightly threatened. Threats, while recognizable, are of low severity, or affecting only a small portion of the population or area.

H = Unthreatened. Threats if any, when considered in comparison with natural fluctuation and change, are minimal or very localized, not leading to significant loss or degradation of populations or area even over a few decades' time. (Severity, scope, and/or immediacy of threat considered Insignificant.)

U = Unknown. The available information is not sufficient to assign degree of threat as above. (Severity, scope, and immediacy are all unknown, or mostly [two of three] unknown or not assessed [null].)

Table 1. Calculation of Threats factor values from values for Severity, Scope, and Immediacy subfactors.

SEVERITY	SCOPE	IMMEDIACY	VALUE	DESCRIPTION
High High Moderate Moderate	High High High High	High Moderate High Moderate	= A	Moderate to severe, imminent threat for most (>60%) of population, occurrences, or area
High High Moderate Moderate	Moderate Moderate Moderate Moderate	High Moderate High Moderate	= B	Moderate to severe imminent threat for a significant proportion (20-60%) of population, occurrences, or area
High Moderate	High High	Low Low	= C	Moderate to severe, non-imminent threat for significant proportion of population, occurrences, or area
High Moderate	Moderate Moderate	Low Low	= D	Moderate to severe, non-imminent threat for a significant proportion of population, occurrences, or area
High High High Moderate Moderate Moderate	Low Low Low Low Low Low	High Moderate Low High Moderate Low	= E	Moderate to severe threat for small proportion of population, occurrences, or area
Low Low Low Low Low Low	High High High Moderate Moderate Moderate	High Moderate Low High Moderate Low	= F	Low severity threat for most or significant proportion of population, occurrences, or area
Low Low Low	Low Low Low	High Moderate Low	= G	Low severity threat for a small proportion of population, occurrences, or area

Intrinsic Vulnerability
Enter the appropriate letter code for the observed, inferred, or suspected degree to which intrinsic or inherent factors of the species (such as life history or behavior characteristics of species) make bull trout vulnerable or resilient to natural or anthropogenic stresses or catastrophes. Examples of such factors include reproductive rates and requirements, time to maturity, dormancy requirements, and dispersal patterns.

Since geographically or ecologically disjunct or peripheral populations may show additional vulnerabilities not generally characteristic of the species, these factors are to be assessed for the species throughout the area of interest, or at least for its better populations. Do not consider here such topics as population size, number of occurrences, area of occupancy, extent of occurrence, or environmental specificity; these are addressed as other ranking factors.

Note that the intrinsic vulnerability factors exist independent of human influence, but may make the species more susceptible to disturbance by human activities. The extent and effects of current or projected extrinsic influences themselves should be addressed in the Threat comments field.

Assumptions: The reasons for our selection of the Intrinsic Vulnerability Factor for bull trout are well described in the Draft recovery plan, Chapter 1. Although some aspects of bull trout biology would support an A ranking, we have determined that the rangewide ranking of bull trout under the category of intrinsic vulnerability is B = Moderately Vulnerable. This B ranking is due mainly to the relatively high potential reproductive rate and fecundity. Admittedly, rates of recolonization and reestablishment of bull trout are speculative, given the infrequency with which they have been documented to occur.

For comparative purposes, here are the categories from which we selected:

A = Highly Vulnerable. Species is slow to mature, reproduces infrequently, and/or has low fecundity such that populations are very slow (> 20 years or 5 generations) to recover from decreases in abundance; or species has low dispersal capability such that extirpated populations are unlikely to become reestablished through natural recolonization (unaided by humans).

B = Moderately Vulnerable. Species exhibits moderate age of maturity, frequency of reproduction, and/or fecundity such that populations generally tend to recover from decreases in abundance over a period of several years (on the order of 5-20 years or 2-5 generations); or species has moderate dispersal capability such that extirpated populations generally become reestablished through natural recolonization (unaided by humans).

C = Not Intrinsically Vulnerable. Species matures quickly, reproduces frequently, and/or has high fecundity such that populations recover quickly « 5 years or 2 generations) from decreases in abundance; or species has high dispersal capability such that extirpated populations soon become reestablished through natural

recolonization (unaided by humans).

Environmental Specificity
Enter the appropriate letter code for the observed, inferred, or suspected vulnerability or resilience of bull trout due to habitat preferences or restrictions or other environmental specificity or generality. The reasons for the selection in the Environmental Specificity field are well documented in the Draft recovery plan and templates. This factor is most important when the number of populations and the range extent or area of occupancy is largely unknown.

Assumptions: The reasons for our selection of the Environmental Specificity Factor for bull trout are well-described in the Draft recovery plan, Chapter 1. Although some aspects of bull trout biology would again support an A ranking, we have determined that the rangewide ranking of bull trout under the category of Environmental Specificity is B = Narrow. This B ranking is due mainly to the widespread historical range of the species, and the generally common occurrence of many bull trout habitat parameters within the remaining distribution.

For comparative purposes, here are the categories from which we selected:

A = Very Narrow. Specialist. Specific habitat(s), substrate(s), food type(s), hosts, breeding/non breeding microhabitats, or other abiotic and/or biotic factor(s) are used or required by the Element in the area of interest, with these habitat(s) and/or other requirements furthermore being scarce within the generalized range of the species within the area of interest, and, the population (or the number of breeding attempts) expected to decline significantly if any of these key requirements become unavailable.

B = Narrow. Specialist. Specific habitat(s) or other abiotic and/or biotic factors (see above) are used or required by the Element, but these key requirements are common and within the generalized range of the species within the area of interest.

C = Moderate. Generalist. Broad-scale or diverse (general) habitat(s) or other abiotic and/or biotic factors are used or required by the species but some key requirements are scarce in the generalized range of the species within the area of interest.

D = Broad. Generalist. Broad-scale or diverse (general) habitat(s) or abiotic and/or biotic factors are used or required by the species, with all key requirements common in the generalized range of the species in the area of interest. If the preferred food(s) or breeding/nonbreeding microhabitat(s) become unavailable, the species switches to an alternative with no resulting decline in numbers of individuals or number of breeding attempts.

CONSERVATION STATUS FOR SPECIES:
A RULE- AND POINT -BASED PROCESS FOR RANK ASSIGNMENT

Adopted for bull trout from Montana Natural Heritage Program - 2004

A Quantitative approximation to assigning Heritage Ranks

The method for determining a C rank is a hybrid of rule based approaches and point scoring techniques. The method incorporates unknown data. To determine a C rank, we first determined what information was available for each core area. Using the following rationale, along with the Status Assessment Factors presented in this document and the method for point allocation for each of the factors presented below, we determined the classification.

? *Population size.* If the number of mature individuals is small, it may be appropriate to raise the priority by one-half rank or more. If there are many mature individuals, the priority may be lowered. [A = -l, B = -0.75, C = -0.5, D and E = -0.25, F = 0, U = 0]

? *Geographic distribution.* If the area of occupancy within the core area is relatively small, it is more vulnerable to negative effects from localized events. It may be appropriate to raise priority by one-quarter rank or more for narrow distribution and lower it by one-quarter to one-half rank for widespread distribution. Lower the score one rank if the population is adfluvial or anadromous and lentic habitat is sufficiently supportive. [A = -l, B = -0.75, C = -0.5, D = -.25, E = 0, U = 0]

? *Environmental specificity.* If a species requires highly specific habitat(s) or other abiotic or biotic factor(s), and if the number of populations and distribution is unknown, the rank may be raised or lowered. [A = -0.5, B and C = 0, D = +0.5, U = 0].

? *Short-term trends in population size, area of occupancy, extent of occurrence, or number or condition of occurrences.* A significant short term and non-cyclic negative trend may be reason to raise priority by one-quarter rank or more, or a significant positive trend may indicate that priority should be lowered by one-half rank. [A = -l, B = -0.75, C = -0.5, D = -0.25, E = 0, F = +0.25, U = O] In the absence of short-term trend data, the rank may be raised or lowered for *long-term trends.* [A = -0.5, B = -0.25, C and D and E = 0, F = +0.25, U = 0]

? *Threats.* Threats include habitat destruction or degradation, introduction of exotic species, overexploitation and direct human-caused mortality, and elimination of natural disturbance regimes, such as fire or flooding. Depending on the severity, scope, and immediacy of threats, the priority may be raised or lowered by one-half to one rank. [A = -l, B = -0.75, C = - 0.5, D = -0.25, E and F = 0, G = +0.75, H = + 1.0, U=O]

? *Intrinsic vulnerability*. If a species is intrinsically vulnerable because it is slow to mature, reproduces infrequently, and/or has low fecundity such that populations are very slow to recover from decreases in abundance, or if a species has low dispersal capability such that extirpated populations are unlikely to become reestablished through natural colonization, it may be appropriate to raise its priority. [A = -0.5, B = -0.25, C and U =0]

***Step* 1**: Determine the available data for the species. The following subheadings are indicative *of* the types *of* data useful for classification (Refer to Heritage Conservation Status Assessment Factors for definitions *of* the following factors as noted in this document.

Assumption: For bull trout core areas, in most cases, all categories were well represented in Draft bull trout recovery plan, templates, or both.

Population size
Geographic Distribution (Extent *of* Occurrence [EOO] or Area *of* Occupancy [AOO])
Environmental Specificity
Trends (short-term and long-term trends)
Threats (scope, severity, immediacy)
Management / Protection
Intrinsic Vulnerability

Step2*:* Determine which *of* the following combinations *of* the first five data requirements suits the available data (only choose one combination and the first to apply).

Assumption: For bull trout core areas the first category applies.

Pop size + Geographic Distribution (greatest value from EOO or *AOO)*
Pop size + Environmental Specificity
Population size
Geographic Distribution (EOO only; *AOO* unknown) and Environmental Specificity
Geographic Distribution (greatest value from EOO or *AOO)*
Environmental Specificity

***Step* 3**: Start point allocation at 3.5. Using the point allocation document below, determine a value for the combination you choose and add or subtract if appropriate. If all six factors are unknown: points = 3.5

***Step* 4**: Once a value has been determined for the first five data requirements, incorporate remaining data.

P = points (total from step 3) + trends (short term trend otherwise use Long term trend) + threats

The following Ranks correspond to the final point total.

Points (P)	C RANK
$P \leq 1.5$	C1
$1.5 < P \leq 2.5$	C2
$2.5 < P \leq 3.5$	C3
$3.5 < P \leq 4.5$	C4

FINAL BULL TROUT RANKING CATEGORIES

The following narrative descriptions are provided for each of the final bull trout ranking categories:

C1 – HIGH RISK - Core area at high risk because of extremely limited and/or rapidly declining numbers, range, and/or habitat, making the bull trout in this core area highly vulnerable to extirpation. (Map Color – Red)

C2 – AT RISK -Core area at risk because of very limited and/or declining numbers, range, and/or habitat, making the bull trout in this core area vulnerable to extirpation. (Map Color – Orange)

C3 – POTENTIAL RISK - Core area potentially at risk because of limited and/or declining numbers, range, and/or habitat even though bull trout may be locally abundant in some portions of the core area. (Map Color – Yellow)

C4 – LOW RISK - Bull trout common or uncommon, but not rare, and usually widespread through the core area. Apparently not vulnerable at this time, but may be cause for long-term concern. (Map Color – Green)

CU – UNRANKED - Core area currently unranked due to lack of information or due to substantially conflicting information about status and trends. (Map Color – Blue)

CX – EXTIRPATED - Core population extirpated; not a viable core area. (Map Color – Black)

Appendix B - Bull Trout Core Area Ranking Results

Table 1. Alphabetic scores assigned in each category by core area.

CORE AREA ALPHABETIC SCORING (FINAL - 3/1/05)									
Core Area	Environmental Specificity	Intrinsic Vulnerability	Population Size	Distribution	Trend	Threats	Severity	Scope	Immediacy
Sycan River	B	B	B	C	A	B	M	M	H
Upper Klamath Lake	B	B	B	D	F	D	M	H	M
Upper Sprague River	B	B	D	C	U	B	H	H	H
Akokala Lake	B	B	B	B	U	H	I	I	I
Arrow Lake	B	B	B	C	U	G	L	L	L
Big Salmon Lake	B	B	C	C	D	F	L	M	H
Bitterroot River	B	B	C	D	U	A	M	H	H
Blackfoot River	B	B	C	D	F	E	M	L	H
Bowman Lake	B	B	A	B	B	A	H	H	H
Cabinet Gorge Reservoir	B	B	B	C	E	B	M	M	H
Quartz Lake(s)	B	B	C	C	E	C	M	H	L
Clark Fork River (Section 1)	B	B	B	D	U	A	H	H	H
Clark Fork River (Section 2)	B	B	B	D	U	B	M	M	H
Clark Fork River (Section 3)	B	B	B	C	U	B	M	M	H
Clearwater River & Lakes	B	B	C	D	D	B	M	M	H
Cyclone Lake	B	B	A	B	B	D	M	M	L
Doctor Lake	B	B	B	C	U	G	L	L	L

CORE AREA ALPHABETIC SCORING (FINAL - 3/1/05)									
Core Area	Environmental Specificity	Intrinsic Vulnerability	Population Size	Distribution	Trend	Threats	Severity	Scope	Immediacy
Flathead Lake	B	B	D	E	D	A	M	H	H
Frozen Lake	B	B	B	C	U	G	L	L	L
Harrison Lake	B	B	A	D	U	B	M	M	H
Holland Lake	B	B	B	B	C	C	H	H	L
Hungry Horse Reservoir	B	B	E	E	F	F	L	M	L
Isabel Lakes	B	B	C	B	U	H	I	I	I
Kintla Lake	B	B	A	B	A	A	H	H	H
Lake McDonald	B	B	A	B	A	A	H	H	H
Lake Pend Oreille	B	B	E	E	E	D	M	M	L
Lincoln Lake	B	B	B	B	U	B	M	M	M
Lindbergh Lake	B	B	B	C	U	C	H	H	L
Logging Lake	B	B	B	B	A	A	M	H	M
Lower Flathead River	B	B	B	C	U	B	M	M	H
Lower Quartz Lake	B	B	B	B	U	A	M	H	H
Noxon Rapids Reservoir	B	B	B	C	U	B	M	M	H
Priest Lakes	B	B	B	C	C	A	H	H	H
Rock Creek	B	B	C	D	D	D	M	M	L
Swan Lake	B	B	D	E	E	B	M	M	H
Trout Lake	B	B	C	B	U	G	L	L	L
Upper Kintla Lake	B	B	C	C	U	H	I	I	I
Upper Stillwater Lake	B	B	B	C	U	A	M	H	H
Upper Whitefish Lake	B	B	A	C	U	A	H	H	M

CORE AREA ALPHABETIC SCORING (FINAL - 3/1/05)									
Core Area	**Environmental Specificity**	**Intrinsic Vulnerability**	**Population Size**	**Distribution**	**Trend**	**Threats**	**Severity**	**Scope**	**Immediacy**
West Fork Bitterroot River	B	B	B	C	U	D	M	M	L
Whitefish Lake	B	B	A	C	U	A	H	H	H
Bull Lake	B	B	C	C	E	D	M	M	L
Kootenai River	B	B	C	D	E	B	M	M	M
Lake Koocanusa	B	B	F	E	F	F	L	M	L
Sophie Lake	B	B	A	B	U	A	H	H	H
Upper Willamette River	B	B	B	D	E	A	H	H	H
Hood River	B	B	B	C	U	B	M	M	M
Lower Deschutes River	B	B	D	D	F	E	M	L	H
Odell Lake	B	B	A	B	U	A	H	H	H
Middle Fork John Day River	B	B	U	D	F	A	H	H	M
North Fork John Day River	B	B	U	D	F	A	M	H	M
Upper Mainstem John Day River	B	B	A	D	F	D	M	M	L
Touchet River	B	B	B	C	E	B	M	M	M
Umatilla River	B	B	B	D	U	B	M	M	M
Walla Walla River	B	B	D	C	E	B	H	M	M
Grande Ronde River	B	B	B	D	E	F	L	M	M
Little Minam River	B	B	C	B	E	G	L	L	L
Granite Creek	B	B	U	B	U	U	U	U	U
Imnaha River	B	B	C	D	E	F	L	M	L

CORE AREA ALPHABETIC SCORING (FINAL - 3/1/05)									
Core Area	Environmental Specificity	Intrinsic Vulnerability	Population Size	Distribution	Trend	Threats	Severity	Scope	Immediacy
Sheep Creek	B	B	U	B	U	U	U	U	U
Pine, Indian & Wildhorse Creeks	B	B	C	D	B	A	H	H	H
Powder River	B	B	C	D	B	A	H	H	H
Malheur River	B	B	B	D	D	A	H	H	H
Coeur d'Alene Lake	B	B	B	D	E	A	M	H	H
Fish Lake (Lochsa River)	B	B	A	B	U	F	L	H	L
Fish Lake (No. Fork Clearwater River)	B	B	A	D	D	B	H	M	H
Lochsa River	B	B	B	D	E	B	M	M	H
Middle-Lower Clearwater River	B	B	U	D	U	A	M	H	H
North Fork Clearwater River	B	B	C	D	D	B	M	M	M
Selway River	B	B	U	D	U	F	L	M	L
South Fork Clearwater River	B	B	D	D	U	A	M	H	H
Lake Creek	B	B	B	C	U	F	U	H	L
Lemhi River	B	B	C	D	U	A	M	H	H
Little-Lower Salmon River	B	B	B	D	U	A	M	H	H
Middle Fork Salmon River	B	B	D	E	U	G	L	L	L
Middle Salmon River-Chamberlain	B	B	U	D	U	F	L	M	M

CORE AREA ALPHABETIC SCORING (FINAL - 3/1/05)									
Core Area	**Environmental Specificity**	**Intrinsic Vulnerability**	**Population Size**	**Distribution**	**Trend**	**Threats**	**Severity**	**Scope**	**Immediacy**
Middle Salmon River-Panther	B	B	U	D	U	B	M	M	H
Opal Lake	B	B	U	B	U	F	L	H	L
Pahsimeroi River	B	B	U	D	U	A	H	H	H
South Fork Salmon River	B	B	U	D	U	B	M	M	H
Upper Salmon River	B	B	U	E	U	B	M	M	H
Anderson Ranch Reservoir	B	B	C	D	U	A	M	H	H
Arrowrock Reservoir	B	B	U	D	D	B	M	M	H
Deadwood River	B	B	C	C	U	A	M	H	H
Lucky Peak Reservoir	B	B	A	C	U	A	H	H	H
Middle Fork Payette River	B	B	U	C	U	A	M	H	H
North Fork Payette River	B	B	A	B	B	A	H	H	H
Squaw Creek	B	B	C	C	U	A	H	H	H
Upper South Fork Payette River	B	B	U	D	U	B	M	M	H
Weiser River	B	B	U	C	C	A	H	H	H
Little Lost River	B	B	U	C	U	A	M	H	H
Klickitat River	B	B	U	C	U	B	M	M	H
Lewis River	B	B	D	D	F	F	L	M	M
Yakima River	B	B	C	D	B	A	H	H	H
Entiat River	B	B	B	D	E	B	M	M	H

CORE AREA ALPHABETIC SCORING (FINAL - 3/1/05)									
Core Area	**Environmental Specificity**	**Intrinsic Vulnerability**	**Population Size**	**Distribution**	**Trend**	**Threats**	**Severity**	**Scope**	**Immediacy**
Methow River	B	B	B	D	D	B	M	M	H
Wenatchee River	B	B	C	E	E	F	L	M	H
Pend Oreille River	B	B	A	C	U	A	H	H	H
Asotin Creek	B	B	B	C	U	A	M	H	H
Tucannon River	B	B	D	D	E	F	L	M	M
Jarbidge River	B	B	B	D	U	A	H	H	H
Chester Morse Lake	B	B	D	C	F	F	L	H	L
Chilliwack River	B	B	D	C	U	F	L	M	H
Lower Skagit River	B	B	E	E	F	G	L	L	H
Nooksack River	B	B	U	E	U	B	M	M	H
Puyallup River	B	B	U	E	U	A	M	H	H
Snohomish & Skykomish Rivers	B	B	D	E	F	F	L	M	H
Stillaguamish River	B	B	C	E	U	B	M	M	H
Upper Skagit River	B	B	U	E	U	G	L	I	H
Dungeness River	B	B	B	C	U	A	M	H	H
Elwha River	B	B	U	C	U	A	H	H	H
Hoh River	B	B	C	D	F	A	H	H	H
Queets River	B	B	U	E	U	F	L	H	H
Quinault River	B	B	U	D	U	B	M	M	H
Skokomish River	B	B	B	D	C	A	M	H	H
Belly River	B	B	C	C	F	F	L	M	L
Cracker Lake	B	B	C	C	U	H	I	I	I
Lee Creek	B	B	B	B	U	A	M	H	M
Red Eagle Lake	B	B	B	B	U	F	L	H	L
Saint Mary River	B	B	C	C	E	B	M	M	M
Slide Lake	B	B	B	B	U	H	I	I	I

Appendix B - Bull Trout Core Area Ranking Results

Table 2. Numeric scores assigned in each category by core area.

CORE AREA NUMERIC SCORING (FINAL - 3/1/05)

Core Area	Environmental Specificity	Intrinsic Vulnerability	Population Size	Distribution	Trend	Threats	SUM 4	C RANK
Sycan River	0	-0.25	-0.75	-0.5	-1	-0.75	-3	1
Upper Klamath Lake	0	-0.25	-0.75	-0.25	0.25	-0.25	-1	2
Upper Sprague River	0	-0.25	-0.25	-0.5	0	-0.75	-1.5	2
Akokala Lake	0	-0.25	-0.75	-0.75	0	1	-0.5	3
Arrow Lake	0	-0.25	-0.75	-0.5	0	0.75	-0.5	3
Big Salmon Lake	0	-0.25	-0.5	-0.5	-0.25	0	-1.25	2
Bitterroot River	0	-0.25	-0.5	-0.25	0	-1	-1.75	2
Blackfoot River	0	-0.25	-0.5	-0.25	0.25	0	-0.5	3
Bowman Lake	0	-0.25	-1	-0.75	-0.75	-1	-3.5	1
Cabinet Gorge Reservoir	0	-0.25	-0.75	-0.5	0	-0.75	-2	1
Quartz Lake(s)	0	-0.25	-0.5	-0.5	0	-0.5	-1.5	2
Clark Fork River (Section 1)	0	-0.25	-0.75	-0.25	0	-1	-2	1
Clark Fork River (Section 2)	0	-0.25	-0.75	-0.25	0	-0.75	-1.75	2
Clark Fork River (Section 3)	0	-0.25	-0.75	-0.5	0	-0.75	-2	1
Clearwater River & Lakes	0	-0.25	-0.5	-0.25	-0.25	-0.75	-1.75	2
Cyclone Lake	0	-0.25	-1	-0.75	-0.75	-0.25	-2.75	1
Doctor Lake	0	-0.25	-0.75	-0.5	0	0.75	-0.5	3
Flathead Lake	0	-0.25	-0.25	0	-0.25	-1	-1.5	2
Frozen Lake	0	-0.25	-0.75	-0.5	0	0.75	-0.5	3
Harrison Lake	0	-0.25	-1	-0.25	0	-0.75	-2	1
Holland Lake	0	-0.25	-0.75	-0.75	-0.5	-0.5	-2.5	1
Hungry Horse Reservoir	0	-0.25	-0.25	0	0.25	0	0	3
Isabel Lakes	0	-0.25	-0.5	-0.75	0	1	-0.25	3
Kintla Lake	0	-0.25	-1	-0.75	-1	-1	-3.75	1
Lake McDonald	0	-0.25	-1	-0.75	-1	-1	-3.75	1
Lake Pend Oreille	0	-0.25	-0.25	0	0	-0.25	-0.5	3
Lincoln Lake	0	-0.25	-0.75	-0.75	0	-0.75	-2.25	1

CORE AREA NUMERIC SCORING (FINAL - 3/1/05)

Core Area	Environmental Specificity	Intrinsic Vulnerability	Population Size	Distribution	Trend	Threats	SUM 4	C RANK
Lindbergh Lake	0	-0.25	-0.75	-0.5	0	-0.5	-1.75	2
Logging Lake	0	-0.25	-0.75	-0.75	-1	-1	-3.5	1
Lower Flathead River	0	-0.25	-0.75	-0.5	0	-0.75	-2	1
Lower Quartz Lake	0	-0.25	-0.75	-0.75	0	-1	-2.5	1
Noxon Rapids Reservoir	0	-0.25	-0.75	-0.5	0	-0.75	-2	1
Priest Lakes	0	-0.25	-0.75	-0.5	-0.5	-1	-2.75	1
Rock Creek	0	-0.25	-0.5	-0.25	-0.25	-0.25	-1.25	2
Swan Lake	0	-0.25	-0.25	0	0	-0.75	-1	2
Trout Lake	0	-0.25	-0.5	-0.75	0	0.75	-0.5	3
Upper Kintla Lake	0	-0.25	-0.5	-0.5	0	1	0	3
Upper Stillwater Lake	0	-0.25	-0.75	-0.5	0	-1	-2.25	1
Upper Whitefish Lake	0	-0.25	-1	-0.5	0	-1	-2.5	1
West Fork Bitterroot River	0	-0.25	-0.75	-0.5	0	-0.25	-1.5	2
Whitefish Lake	0	-0.25	-1	-0.5	0	-1	-2.5	1
Bull Lake	0	-0.25	-0.5	-0.5	0	-0.25	-1.25	2
Kootenai River	0	-0.25	-0.5	-0.25	0	-0.75	-1.5	2
Lake Koocanusa	0	-0.25	0	0	0.25	0	0.25	4
Sophie Lake	0	-0.25	-1	-0.75	0	-1	-2.75	1
Upper Willamette River	0	-0.25	-0.75	-0.25	0	-1	-2	1
Hood River	0	-0.25	-0.75	-0.5	0	-0.75	-2	1
Lower Deschutes River	0	-0.25	-0.25	-0.25	0.25	0	-0.25	3
Odell Lake	0	-0.25	-1	-0.75	0	-1	-2.75	1
Middle Fork John Day River	0	-0.25	0	-0.25	0.25	-1	-1	2
North Fork John Day River	0	-0.25	0	-0.25	0.25	-1	-1	2
Upper Mainstem John Day River	0	-0.25	-1	-0.25	0.25	-0.25	-1.25	2
Touchet River	0	-0.25	-0.75	-0.5	0	-0.75	-2	1
Umatilla River	0	-0.25	-0.75	-0.25	0	-0.75	-1.75	2
Walla Walla River	0	-0.25	-0.25	-0.5	0	-0.75	-1.5	2
Grande Ronde River	0	-0.25	-0.75	-0.25	0	0	-1	2
Little Minam River	0	-0.25	-0.5	-0.75	0	0.75	-0.5	3
Granite Creek	0	-0.25	0	-0.75	0	0	-0.75	U
Imnaha River	0	-0.25	-0.5	-0.25	0	0	-0.75	3

CORE AREA NUMERIC SCORING (FINAL - 3/1/05)

Core Area	Environmental Specificity	Intrinsic Vulnerability	Population Size	Distribution	Trend	Threats	SUM 4	C RANK
Sheep Creek	0	-0.25	0	-0.75	0	0	-0.75	U
Pine, Indian & Wildhorse Creeks	0	-0.25	-0.5	-0.25	-0.75	-1	-2.5	1
Powder River	0	-0.25	-0.5	-0.25	-0.75	-1	-2.5	1
Malheur River	0	-0.25	-0.75	-0.25	-0.25	-1	-2.25	1
Coeur d'Alene Lake	0	-0.25	-0.75	-0.25	0	-1	-2	1
Fish Lake (Lochsa River)	0	-0.25	-1	-0.75	0	0	-1.75	2
Fish Lake (No. Fork Clearwater River)	0	-0.25	-1	-0.25	-0.25	-0.75	-2.25	1
Lochsa River	0	-0.25	-0.75	-0.25	0	-0.75	-1.75	2
Middle-Lower Clearwater River	0	-0.25	0	-0.25	0	-1	-1.25	2
North Fork Clearwater River	0	-0.25	-0.5	-0.25	-0.25	-0.75	-1.75	2
Selway River	0	-0.25	0	-0.25	0	0	-0.25	3
South Fork Clearwater River	0	-0.25	-0.25	-0.25	0	-1	-1.5	2
Lake Creek	0	-0.25	-0.75	-0.5	0	0	-1.25	2
Lemhi River	0	-0.25	-0.5	-0.25	0	-1	-1.75	2
Little-Lower Salmon River	0	-0.25	-0.75	-0.25	0	-1	-2	1
Middle Fork Salmon River	0	-0.25	-0.25	0	0	0.75	0.5	4
Middle Salmon River-Chamberlain	0	-0.25	0	-0.25	0	0	-0.25	3
Middle Salmon River-Panther	0	-0.25	0	-0.25	0	-0.75	-1	2
Opal Lake	0	-0.25	0	-0.75	0	0	-0.75	3
Pahsimeroi River	0	-0.25	0	-0.25	0	-1	-1.25	2
South Fork Salmon River	0	-0.25	0	-0.25	0	-0.75	-1	2
Upper Salmon River	0	-0.25	0	0	0	-0.75	-0.75	3
Anderson Ranch Reservoir	0	-0.25	-0.5	-0.25	0	-1	-1.75	2
Arrowrock Reservoir	0	-0.25	0	-0.25	-0.25	-0.75	-1.25	2
Deadwood River	0	-0.25	-0.5	-0.5	0	-1	-2	1
Lucky Peak Reservoir	0	-0.25	-1	-0.5	0	-1	-2.5	1

CORE AREA NUMERIC SCORING (FINAL - 3/1/05)

Core Area	Environmental Specificity	Intrinsic Vulnerability	Population Size	Distribution	Trend	Threats	SUM 4	C RANK
Middle Fork Payette River	0	-0.25	0	-0.5	0	-1	-1.5	2
North Fork Payette River	0	-0.25	-1	-0.75	-0.75	-1	-3.5	1
Squaw Creek	0	-0.25	-0.5	-0.5	0	-1	-2	1
Upper South Fork Payette River	0	-0.25	0	-0.25	0	-0.75	-1	2
Weiser River	0	-0.25	0	-1	-0.5	-1	-2.5	1
Little Lost River	0	-0.25	0	-0.5	0	-1	-1.5	2
Klickitat River	0	-0.25	0	-0.5	0	-0.75	-1.25	2
Lewis River	0	-0.25	-0.25	-0.25	0.25	0	-0.25	3
Yakima River	0	-0.25	-0.5	-0.25	-0.75	-1	-2.5	1
Entiat River	0	-0.25	-0.75	-0.25	0	-0.75	-1.75	2
Methow River	0	-0.25	-0.75	-0.25	-0.25	-0.75	-2	1
Wenatchee River	0	-0.25	-0.5	0	0	0	-0.5	3
Pend Oreille River	0	-0.25	-1	-0.5	0	-1	-2.5	1
Asotin Creek	0	-0.25	-0.75	-0.5	0	-1	-2.25	1
Tucannon River	0	-0.25	-0.25	-0.25	0	0	-0.5	3
Jarbidge River	0	-0.25	-0.75	-0.25	0	-1	-2	1
Chester Morse Lake	0	-0.25	-0.25	-0.5	0.25	0	-0.5	3
Chilliwack River	0	-0.25	-0.25	-0.5	0	0	-0.75	3
Lower Skagit River	0	-0.25	-0.25	0	0.25	0.75	0.75	4
Nooksack River	0	-0.25	0	0	0	-0.75	-0.75	3
Puyallup River	0	-0.25	0	0	0	-1	-1	2
Snohomish & Skykomish Rivers	0	-0.25	-0.25	0	0.25	0	0	3
Stillaguamish River	0	-0.25	-0.5	0	0	-0.75	-1.25	2
Upper Skagit River	0	-0.25	0	0	0	0.75	0.75	4
Dungeness River	0	-0.25	-0.75	-0.5	0	-1	-2.25	1
Elwha River	0	-0.25	0	-0.5	0	-1	-1.5	2
Hoh River	0	-0.25	-0.5	-0.25	0.25	-1	-1.5	2
Queets River	0	-0.25	0	0	0	0	0	3
Quinault River	0	-0.25	0	-0.25	0	-0.75	-1	2
Skokomish River	0	-0.25	-0.75	-0.25	-0.5	-1	-2.5	1
Belly River	0	-0.25	-0.5	-0.5	0.25	0	-0.75	3
Cracker Lake	0	-0.25	-0.5	-0.5	0	1	0	3
Lee Creek	0	-0.25	-0.75	-0.75	0	-1	-2.5	1
Red Eagle Lake	0	-0.25	-0.75	-0.75	0	0	-1.5	2
Saint Mary River	0	-0.25	-0.5	-0.5	0	-0.75	-1.75	2
Slide Lake	0	-0.25	-0.75	-0.75	0	1	-0.5	3

Appendix B - Bull Trout Core Area Ranking Results

Table 3. Final core area C-Ranking, sorted by point value (P).

CORE AREA RANKINGS (FINAL - 3/1/05)								
Core Area	**Population Size**	**Distribution**	**Trend**	**Threats**	**SUM**		**C-RANK**	**P**
Kintla Lake	-1	-0.75	-1	-1	-3.75		1	-0.25
Lake McDonald	-1	-0.75	-1	-1	-3.75		1	-0.25
Bowman Lake	-1	-0.75	-0.75	-1	-3.5		1	0
Logging Lake	-0.75	-0.75	-1	-1	-3.5		1	0
North Fork Payette River	-1	-0.75	-0.75	-1	-3.5		1	0
Sycan River	-0.75	-0.5	-1	-0.75	-3		1	0.5
Cyclone Lake	-1	-0.75	-0.75	-0.25	-2.75		1	0.75
Priest Lakes	-0.75	-0.5	-0.5	-1	-2.75		1	0.75
Sophie Lake	-1	-0.75	0	-1	-2.75		1	0.75
Odell Lake	-1	-0.75	0	-1	-2.75		1	0.75
Holland Lake	-0.75	-0.75	-0.5	-0.5	-2.5		1	1
Lower Quartz Lake	-0.75	-0.75	0	-1	-2.5		1	1
Upper Whitefish Lake	-1	-0.5	0	-1	-2.5		1	1
Whitefish Lake	-1	-0.5	0	-1	-2.5		1	1
Pine, Indian & Wildhorse Creeks	-0.5	-0.25	-0.75	-1	-2.5		1	1
Powder River	-0.5	-0.25	-0.75	-1	-2.5		1	1
Lucky Peak Reservoir	-1	-0.5	0	-1	-2.5		1	1
Weiser River	0	-1	-0.5	-1	-2.5		1	1
Yakima River	-0.5	-0.25	-0.75	-1	-2.5		1	1
Pend Oreille River	-1	-0.5	0	-1	-2.5		1	1
Skokomish River	-0.75	-0.25	-0.5	-1	-2.5		1	1
Lee Creek	-0.75	-0.75	0	-1	-2.5		1	1
Lincoln Lake	-0.75	-0.75	0	-0.75	-2.25		1	1.25
Upper Stillwater Lake	-0.75	-0.5	0	-1	-2.25		1	1.25
Malheur River	-0.75	-0.25	-0.25	-1	-2.25		1	1.25
Fish Lake (No. Fork Clearwater River)	-1	-0.25	-0.25	-0.75	-2.25		1	1.25
Asotin Creek	-0.75	-0.5	0	-1	-2.25		1	1.25
Dungeness River	-0.75	-0.5	0	-1	-2.25		1	1.25
Upper Willamette River	-0.75	-0.25	0	-1	-2		1	1.5
Cabinet Gorge Reservoir	-0.75	-0.5	0	-0.75	-2		1	1.5
Clark Fork River (Section 1)	-0.75	-0.25	0	-1	-2		1	1.5
Clark Fork River (Section 3)	-0.75	-0.5	0	-0.75	-2		1	1.5
Harrison Lake	-1	-0.25	0	-0.75	-2		1	1.5
Lower Flathead River	-0.75	-0.5	0	-0.75	-2		1	1.5
Noxon Rapids Reservoir	-0.75	-0.5	0	-0.75	-2		1	1.5
Hood River	-0.75	-0.5	0	-0.75	-2		1	1.5
Touchet River	-0.75	-0.5	0	-0.75	-2		1	1.5

CORE AREA RANKINGS (FINAL - 3/1/05)								
Core Area	**Population Size**	**Distribution**	**Trend**	**Threats**	**SUM**		**C-RANK**	**P**
Little-Lower Salmon River	-0.75	-0.25	0	-1	-2		1	1.5
Deadwood River	-0.5	-0.5	0	-1	-2		1	1.5
Jarbidge River	-0.75	-0.25	0	-1	-2		1	1.5
Methow River	-0.75	-0.25	-0.25	-0.75	-2		1	1.5
Coeur d'Alene Lake	-0.75	-0.25	0	-1	-2		1	1.5
Squaw Creek	-0.5	-0.5	0	-1	-2		1	1.5
Bitterroot River	-0.5	-0.25	0	-1	-1.75		2	1.75
Clark Fork River (Section 2)	-0.75	-0.25	0	-0.75	-1.75		2	1.75
Clearwater River & Lakes	-0.5	-0.25	-0.25	-0.75	-1.75		2	1.75
Lindbergh Lake	-0.75	-0.5	0	-0.5	-1.75		2	1.75
Umatilla River	-0.75	-0.25	0	-0.75	-1.75		2	1.75
Fish Lake (Lochsa River)	-1	-0.75	0	0	-1.75		2	1.75
Lochsa River	-0.75	-0.25	0	-0.75	-1.75		2	1.75
North Fork Clearwater River	-0.5	-0.25	-0.25	-0.75	-1.75		2	1.75
Lemhi River	-0.5	-0.25	0	-1	-1.75		2	1.75
Anderson Ranch Reservoir	-0.5	-0.25	0	-1	-1.75		2	1.75
Entiat River	-0.75	-0.25	0	-0.75	-1.75		2	1.75
Saint Mary River	-0.5	-0.5	0	-0.75	-1.75		2	1.75
Flathead Lake	-0.25	0	-0.25	-1	-1.5		2	2
Upper Sprague River	-0.25	-0.5	0	-0.75	-1.5		2	2
Quartz Lake(s)	-0.5	-0.5	0	-0.5	-1.5		2	2
West Fork Bitterroot River	-0.75	-0.5	0	-0.25	-1.5		2	2
Kootenai River	-0.5	-0.25	0	-0.75	-1.5		2	2
Walla Walla River	-0.25	-0.5	0	-0.75	-1.5		2	2
South Fork Clearwater River	-0.25	-0.25	0	-1	-1.5		2	2
Middle Fork Payette River	0	-0.5	0	-1	-1.5		2	2
Little Lost River	0	-0.5	0	-1	-1.5		2	2
Elwha River	0	-0.5	0	-1	-1.5		2	2
Hoh River	-0.5	-0.25	0.25	-1	-1.5		2	2
Red Eagle Lake	-0.75	-0.75	0	0	-1.5		2	2
Stillaguamish River	-0.5	0	0	-0.75	-1.25		2	2.25
Big Salmon Lake	-0.5	-0.5	-0.25	0	-1.25		2	2.25
Rock Creek	-0.5	-0.25	-0.25	-0.25	-1.25		2	2.25
Bull Lake	-0.5	-0.5	0	-0.25	-1.25		2	2.25
Upper Mainstem John Day River	-1	-0.25	0.25	-0.25	-1.25		2	2.25
Middle-Lower Clearwater River	0	-0.25	0	-1	-1.25		2	2.25
Lake Creek	-0.75	-0.5	0	0	-1.25		2	2.25
Pahsimeroi River	0	-0.25	0	-1	-1.25		2	2.25
Arrowrock Reservoir	0	-0.25	-0.25	-0.75	-1.25		2	2.25

CORE AREA RANKINGS (FINAL - 3/1/05)								
Core Area	**Population Size**	**Distribution**	**Trend**	**Threats**	**SUM**		**C-RANK**	**P**
Klickitat River	0	-0.5	0	-0.75	-1.25		2	2.25
Swan Lake	-0.25	0	0	-0.75	-1		2	2.5
Puyallup River	0	0	0	-1	-1		2	2.5
Upper Klamath Lake	-0.75	-0.25	0.25	-0.25	-1		2	2.5
Middle Fork John Day River	0	-0.25	0.25	-1	-1		2	2.5
North Fork John Day River	0	-0.25	0.25	-1	-1		2	2.5
Grande Ronde River	-0.75	-0.25	0	0	-1		2	2.5
Granite Creek	0	-0.75	0	-0.25	-1		U	2.5
Sheep Creek	0	-0.75	0	-0.25	-1		U	2.5
Middle Salmon River-Panther	0	-0.25	0	-0.75	-1		2	2.5
South Fork Salmon River	0	-0.25	0	-0.75	-1		2	2.5
Upper South Fork Payette River	0	-0.25	0	-0.75	-1		2	2.5
Quinault River	0	-0.25	0	-0.75	-1		2	2.5
Upper Salmon River	0	0	0	-0.75	-0.75		3	2.75
Nooksack River	0	0	0	-0.75	-0.75		3	2.75
Imnaha River	-0.5	-0.25	0	0	-0.75		3	2.75
Opal Lake	0	-0.75	0	0	-0.75		3	2.75
Chilliwack River	-0.25	-0.5	0	0	-0.75		3	2.75
Belly River	-0.5	-0.5	0.25	0	-0.75		3	2.75
Lake Pend Oreille	-0.25	0	0	-0.25	-0.5		3	3
Little Minam River	-0.5	-0.75	0	0.75	-0.5		3	3
Wenatchee River	-0.5	0	0	0	-0.5		3	3
Akokala Lake	-0.75	-0.75	0	1	-0.5		3	3
Arrow Lake	-0.75	-0.5	0	0.75	-0.5		3	3
Blackfoot River	-0.5	-0.25	0.25	0	-0.5		3	3
Doctor Lake	-0.75	-0.5	0	0.75	-0.5		3	3
Frozen Lake	-0.75	-0.5	0	0.75	-0.5		3	3
Trout Lake	-0.5	-0.75	0	0.75	-0.5		3	3
Tucannon River	-0.25	-0.25	0	0	-0.5		3	3
Chester Morse Lake	-0.25	-0.5	0.25	0	-0.5		3	3
Slide Lake	-0.75	-0.75	0	1	-0.5		3	3
Middle Salmon River-Chamberlain	0	-0.25	0	0	-0.25		3	3.25
Isabel Lakes	-0.5	-0.75	0	1	-0.25		3	3.25
Lower Deschutes River	-0.25	-0.25	0.25	0	-0.25		3	3.25
Selway River	0	-0.25	0	0	-0.25		3	3.25
Lewis River	-0.25	-0.25	0.25	0	-0.25		3	3.25
Hungry Horse Reservoir	-0.25	0	0.25	0	0		3	3.5
Snohomish & Skykomish Rivers	-0.25	0	0.25	0	0		3	3.5
Queets River	0	0	0	0	0		3	3.5

CORE AREA RANKINGS (FINAL - 3/1/05)								
Core Area	**Population Size**	**Distribution**	**Trend**	**Threats**	**SUM**		**C-RANK**	**P**
Upper Kintla Lake	-0.5	-0.5	0	1	0		3	3.5
Cracker Lake	-0.5	-0.5	0	1	0		3	3.5
Lake Koocanusa	0	0	0.25	0	0.25		4	3.75
Middle Fork Salmon River	-0.25	0	0	0.75	0.5		4	4
Lower Skagit River	-0.25	0	0.25	0.75	0.75		4	4.25
Upper Skagit River	0	0	0	0.75	0.75		4	4.25

Appendix B - Bull Trout Core Area Ranking Results

Table 4. Saturation of key recovery habitat as a proportion of total stream habitat in bull trout core areas (sorted from lowest to highest).

CORE AREA NAME	CORE AREA (Acres)	ALL STREAMS (Stream Miles)	KEY HABITAT (Stream Miles)	% SATURATION (Key H / Total)
Lake McDonald	105,004	172	2	0.9%
Belly River	57,233	98	1	1.5%
Lake Koocanusa	781,200	1,373	45	3.2%
Logging Lake	19,908	34	1	3.3%
Red Eagle Lake	22,324	36	1	3.3%
Lower Deschutes River	2,577,637	4,974	173	3.5%
Lower Flathead River	1,276,896	3,150	128	4.1%
Holland Lake	7,228	9	0.4	4.1%
Umatilla River	1,606,383	3,062	149	4.9%
Lewis River	530,692	905	44	4.9%
Weiser River	604,885	1,076	54	5.0%
Klickitat River	862,151	1,636	84	5.1%
Middle-Lower Clearwater River	1,636,927	3,446	181	5.2%
Yakima River	3,923,888	9,467	519	5.5%
Big Salmon Lake	49,950	82	5	5.6%
North Fork Payette River	394,080	740	42	5.7%
Lucky Peak Reservoir	301,318	626	38	6.1%
Noxon Rapids Reservoir	372,451	476	32	6.6%
Malheur River	1,569,670	3,210	214	6.7%
Entiat River	336,980	698	52	7.4%
Touchet River	483,086	1,058	82	7.8%
Upper Willamette River	1,701,994	2,530	200	7.9%
Clark Fork River (Section 1)	1,789,937	3,778	301	8.0%
Clark Fork River (Section 3)	760,512	1,272	105	8.2%
Blackfoot River	1,269,541	3,244	270	8.3%
Walla Walla River	640,210	1,354	117	8.6%
Upper Mainstem John Day River	1,096,433	2,143	189	8.8%
Coeur d'Alene Lake	2,533,688	4,497	403	9.0%
Little Lost River	608,846	1,224	110	9.0%
Kootenai River	1,759,878	3,276	297	9.1%
Lincoln Lake	1,658	5	0.5	9.1%
Bull Lake	126,544	232	23	9.9%
North Fork John Day River	1,179,652	2,378	239	10.0%
Lake Pend Oreille	1,138,674	1,757	177	10.1%
Powder River	1,089,957	2,626	266	10.1%
Methow River	1,374,174	2,749	299	10.9%
Flathead Lake	2,195,814	3,817	424	11.1%

Little-Lower Salmon River	1,121,342	2,365	265	11.2%
Bitterroot River	1,624,046	3,348	379	11.3%
Cabinet Gorge Reservoir	233,275	371	43	11.5%
Hungry Horse Reservoir	1,000,768	1,701	201	11.8%
Upper Skagit River	464,089	694	84	12.1%
Chilliwack River	152,819	231	29	12.5%
Hood River	217,297	528	69	13.1%
Wenatchee River	877,172	1,692	227	13.4%
Anderson Ranch Reservoir	636,139	1,490	201	13.5%
Middle Fork John Day River	505,543	997	135	13.6%
Harrison Lake	13,794	31	4	14.0%
Sheep Creek	25,867	42	6	14.0%
Snohomish & Skykomish Rivers	1,171,243	1,986	281	14.2%
Grande Ronde River	2,240,402	4,223	612	14.5%
Swan Lake	435,854	867	126	14.6%
Sycan River	202,046	391	58	14.8%
Middle Fork Payette River	217,958	450	68	15.0%
Dungeness River	130,823	209	32	15.1%
Asotin Creek	249,504	557	85	15.3%
Saint Mary River	229,913	441	68	15.4%
Tucannon River	321,286	674	104	15.4%
Lindbergh Lake	25,761	33	5	15.5%
Whitefish Lake	81,477	160	25	15.6%
Upper Stillwater Lake	82,085	176	28	15.8%
Selway River	1,280,732	2,533	407	16.1%
North Fork Clearwater River	1,556,190	2,837	465	16.4%
Clark Fork River (Section 2)	1,265,458	2,305	386	16.8%
Trout Lake	5,285	8	1	17.1%
South Fork Clearwater River	753,739	1,668	288	17.3%
Lee Creek	17,700	54	10	17.8%
Middle Salmon -Chamberlain	864,399	1,637	293	17.9%
Bowman Lake	27,746	36	7	18.3%
Kintla Lake	15,471	9	2	18.4%
Pend Oreille River	674,638	1,250	232	18.6%
Imnaha River	543,015	958	178	18.6%
Lemhi River	806,932	1,391	267	19.2%
Chester Morse Lake	52,308	82	17	20.2%
Elwha River	205,548	285	60	21.0%
Upper Salmon River	1,551,743	3,273	691	21.1%
Pahsimeroi River	535,757	968	205	21.2%
Squaw Creek	217,640	428	91	21.3%
Slide Lake	5,190	8	2	21.4%
Upper Sprague River	206,801	420	90	21.5%
Doctor Lake	9,388	15	3	22.4%
Lochsa River	749,991	1,364	306	22.4%
Lower Skagit River	1,377,327	2,110	493	23.3%
Quinault River	279,477	435	102	23.5%
Arrowrock Reservoir	779,063	1,551	366	23.6%

Stillaguamish River	450,856	793	192	24.2%
Granite Creek	21,364	28	7	24.4%
Clearwater River & Lakes	211,102	390	97	25.0%
Rock Creek	568,290	1,196	302	25.3%
Nooksack River	499,300	908	231	25.4%
Jarbidge River	308,399	519	132	25.4%
Skokomish River	152,816	242	62	25.4%
Upper Klamath Lake	420,665	508	131	25.8%
Middle Salmon River-Panther	1,374,368	2,335	609	26.1%
Upper South Fork Payette River	428,330	856	225	26.3%
Priest Lakes	376,561	621	166	26.7%
Puyallup River	663,537	1,050	286	27.2%
Middle Fork Salmon River	1,835,118	3,548	1,011	28.5%
Upper Kintla Lake	15,606	20	6	28.8%
Quartz Lake(s)	15,089	21	6	29.2%
South Fork Salmon River	833,448	1,626	488	30.0%
Upper Whitefish Lake	10,045	19	6	30.3%
Queets River	288,115	460	147	31.9%
West Fork Bitterroot River	201,288	368	117	31.9%
Pine, Indian & Wildhorse Cr.	423,330	731	242	33.1%
Isabel Lakes	1,273	1	0.5	33.9%
Akokala Lake	1,424	3	1	34.2%
Odell Lake	59,431	38	13	34.5%
Lake Creek	11,221	15	5	35.7%
Lower Quartz Lake	3,163	2	1	37.0%
Arrow Lake	5,092	6	3	39.7%
Hoh River	190,938	272	108	39.7%
Cyclone Lake	6,619	13	5	42.5%
Little Minam River	18,990	26	13	50.8%
Deadwood River	70,067	119	67	55.7%
Frozen Lake	1,911	4	3	63.1%
Fish Lake (Lochsa River)	5,093	8	5	64.8%
Sophie Lake	5,231	5	3	68.2%
Fish Lake (No. Fk. Clearwater)	3,581	5	4	70.0%
Cracker Lake	5,224	7	5	71.3%
Opal Lake	1,275	2	2	92.6%

Appendix C - Core Area Life History & Connectivity Rule Set & Tables

Rule Set for Life History and Connectivity Characterization Definitions

March 22, 2005 (Bull Trout 5-Year Review)

NOTE: Where additional explanation is necessary for any entry in the excel spreadsheet, right click and use "insert comment" to attach additional explanation to the specific cell where the code is provided.

Life History Form(s) Present

(1)

Dominant Migratory Form
Fluvial = F Adfluvial = AD Anadromous = AN No Longer Present = NP

Enter code for the current dominant migratory form within the core area ("F", "AD", or "AN"). If all historic migratory forms have been lost within the core area, enter "NP" and proceed to (3). Note, even if there is a very small remnant migratory component within the core area, still enter a form type. Their remnant status will be addressed under (3), the Resident Form column. If migratory forms never existed within the core area, leave blank.

(2)

Secondary Migratory Form(s) (if present)
Fluvial = F Adfluvial = AD Anadromous = AN No Longer Present = NP

Enter code for a secondary migratory form within the core area if one exists ("F", "AD", or "AN"). If the secondary migratory form has been lost within the core area, enter "NP". If migratory forms never existed within the core area, leave blank. In rare cases, where all three migratory forms maybe present, enter both secondary forms.

(3)

Resident Form
Dominant = D Present = P Absent = A Unknown = U

Enter the status of the resident form within the core area. "D" indicates that it is historically the only life history form, or currently the primary life history form within the core area. "P" indicates that although it exists within the core area, it is not the dominant life history. "A" indicates that the resident life history form is absent within the core area. "U" indicates that it is unknown whether the resident form exists within the core area.

Core Area Extent / Connectivity

(4)

Upper Bound

Headwaters = HW Watershed boundary = WB Dam/Artificial Barrier = AB Natural Barrier = NB

Enter the delineation of the current "upstream" extent (upper bound) of the core area where it abuts a watershed divide or another core area. For core areas situated furthest upstream within a basin, only "HW" or "NB" should apply. Note that although core areas are typically defined around watershed boundaries, "NB" should be used in cases where a natural barrier actually precludes migratory access to the majority of headwater habitat within the core area. For core areas where the upstream boundaries of major portions of the watershed are complex and defined by multiple aspects, such as both a dam (or dams) on one major fork of the drainage and headwaters on another, use multiple codes in their relative order of importance (e.g., "WB/AB" would indicate the boundaries are mostly headwaters but a bull trout core area also exists above a dam upstream).

Degree of Connectivity To Upstream Cores No Passage = NP Restricted Passage = RP Unrestricted Passage = UP

Enter the level of upstream connectivity to other core areas relative to the upper bound selected above. Note that connectivity within the boundaries of the core area is dealt with in a separate column entry (see #6). This column only addresses the ability for fish to migrate from this core area to other upstream core areas. "NP" applies to natural waterfalls and dams/diversions without upstream passage facilities; "RP" applies to dams/diversions with upstream passage facilities; and "UP" applies to intact migratory corridors. For core areas situated most upstream within a basin (i.e., upper bound coded as "HW" or "NB" in some cases), leave this column blank, as passage to other upstream core areas is not applicable.

(5)

Lower Bound Watershed boundary = WB Dam/Artificial Barrier = AB Natural Barrier = NB

Enter the delineation of the current "downstream" extent (lower bound) of the core area. Where a core area extends to the mainstem Columbia River or marine waters, enter "WB", unless this happens to be coincident with a dam/artificial barrier.

Degree of Connectivity to Downstream Cores No Passage = NP Restricted Passage = RP Unrestricted Passage = UP

Enter the level of downstream connectivity to other core areas relative to the lower bound selected above. "NP" applies to longstanding natural habitat conditions that preclude downstream migration (e.g., Jarbidge) or dams/diversion that prevent any passage; "RP" applies to dams/diversions with one- or two-way passage, or anthropogenic habitat conditions that significantly impair downstream migration (e.g., Yakima); and "UP" applies to intact migratory corridors. Note that connectivity within the boundaries of the core area is dealt with in the next entry (see #6) – this entry only applies to ability for fish to migrate from this core area to other downstream core areas. It is assumed that adfluvial populations typically do not migrate downstream (in part a behavior, but also because water downstream of lakes is typically

warmer than bull trout preference in the summer). Thus, for adfluvial populations downstream passage is considered "RP" by default, unless demonstrated otherwise.

(6)

Degree of Connectivity within Core Area
Low (significantly impaired) = L Moderate (partially impaired) = M High (unimpaired) = H

Enter the level of connectivity within the core area (i.e., between local populations, within local populations, between local populations and FMO habitats, and within FMO habitats). "L" (Low) applies to core areas where the majority of local populations are artificially separated from one another, or migratory or resident forms (if dominant) have impaired access (year round or seasonally) to a majority of the habitat within the core area. Access may be impaired by degraded habitat conditions or by artificial barriers (e.g., diversions, culverts, etc.). "M" (Moderate) applies to core areas where a minority of local populations are artificially separated from the others, or migratory or resident forms (if dominant) have impaired access to smaller portions of habitat within the core area, but are still considered significant. "H" (High) applies to core areas where connectivity between local populations is generally unimpaired, or where only minor or insignificant portions of usable habitat are currently inaccessible. Where "M" or "L" applies attach descriptive comments, if appropriate.

Appendix C - Core Area Life History and Connectivity Tables

Table 1. Life history form(s) and internal and external connectivity status by core area.

ID #	Core Area	Life History Form(s) Present			Core Area Extent / Connectivity					"External Connectivity" Scoring		
		Dominant Migratory Form	Secondary Migratory Form(s) (if present)	Resident Form	Upper Bound	Degree of Connectivity to Upstream Cores	Lower Bound	Degree of Connectivity to Downstream Cores	Degree of Connectivity within Core Area	UP-STREAM SCORE	DOWN-STREAM SCORE	TOTAL SCORE
		Fluvial = F Adfluvial = AD Anadromous = AN No Longer Present = NP	Fluvial = F Adfluvial = AD Anadromous = AN No Longer Present = NP	Dominant = D Present = P Absent = A Unknown = U	Headwaters = HW Watershed boundary = WB Dam/Artificial Barrier = AB Natural Barrier = NB	No Passage = NP Restricted Passage = RP Unrestricted Passage = UP	Watershed boundary = WB Dam/Artificial Barrier = AB Natural Barrier = NB	No Passage = NP Restricted Passage = RP Unrestricted Passage = UP	Low (significantly impaired) = L Moderate (partially impaired) = M High (unimpaired) = H			
1	Chester Morse Lake	AD		A	HW		NB	RP	H	-1	0	-1
2	Chilliwack River	F	AD, AN?	U	HW		WB	UP	H	-1	+1	0
3	Dungeness River	F	AN	U	NB		WB	UP	H	-1	+1	0
4	Elwha River	F	AD, AN?	U	HW		WB	RP	L	-1	0	-1
5	Hoh River	AN	F	U	HW		WB	UP	H	-1	+1	0
6	Lower Skagit River	AN	F, AD	P	AB	NP	WB	UP	M	-1	+1	0
7	Nooksack River	AN	F	U	HW/NB		WB	UP	M	-1	+1	0
8	Puyallup River	F	AN	P	HW		WB	UP	M	-1	+1	0
9	Queets River	AN	F	U	HW		WB	UP	H	-1	+1	0
10	Quinault River	AD	F	U	HW		WB	UP	H	-1	+1	0
11	Skokomish River	AD	F	U	NB		WB	UP	L	-1	+1	0

ID #	Core Area	Life History Form(s) Present			Core Area Extent / Connectivity					"External Connectivity" Scoring		
		Dominant Migratory Form	Secondary Migratory Form(s) (if present)	Resident Form	Upper Bound	Degree of Connectivity to Upstream Cores	Lower Bound	Degree of Connectivity to Downstream Cores	Degree of Connectivity within Core Area	UP-STREAM SCORE	DOWN-STREAM SCORE	TOTAL SCORE
12	Snohomish & Skykomish R.	AN	F	P	HW		WB	UP	H	-1	+1	0
13	Stillaguamish River	AN	F	P	HW		WB	UP	H	-1	+1	0
14	Upper Skagit River	AD	F	U	HW		AB	RP	M	-1	0	-1
15	Akokala Lake	AD		A	HW		WB	RP	H	-1	0	-1
16	Anderson Ranch Res.	AD		P	HW		AB	NP	M	-1	-1	-2
17	Arrow Lake	AD		A	HW		WB	RP	H	-1	0	-1
18	Arrowrock Reservoir	AD	F	P	HW		AB	RP	L	-1	0	-1
19	Asotin Creek	F		D	HW		WB	RP	L	-1	0	-1
20	Big Salmon Lake	AD		A	HW		WB	RP	H	-1	0	-1
21	Bitterroot River	F		D	HW/AB	NP	WB	UP	L	-1	+1	0
22	Blackfoot River	F		U	HW		AB	RP	M	-1	0	-1
23	Bowman Lake	AD		A	HW		WB	RP	M	-1	0	-1
24	Bull Lake	AD		A	HW		AB	RP	H	-1	0	-1
25	Cabinet Gorge Reservoir	AD		U	AB	RP	AB	RP	L	0	0	0
26	Quartz Lake(s)	AD		A	HW		WB	RP	H	-1	0	-1
27	Clark Fork River (Sec. 1)	F	AD	U	HW		AB	RP	L	-1	0	-1
28	Clark Fork River (Sec. 2)	F	AD	U	AB	NP	WB	UP	M	-1	+1	0

ID #	Core Area	Life History Form(s) Present			Core Area Extent / Connectivity					"External Connectivity" Scoring		
		Dominant Migratory Form	Secondary Migratory Form(s) (if present)	Resident Form	Upper Bound	Degree of Connectivity to Upstream Cores	Lower Bound	Degree of Connectivity to Downstream Cores	Degree of Connectivity within Core Area	UP-STREAM SCORE	DOWN-STREAM SCORE	TOTAL SCORE
29	Clark Fork River (Sec. 3)	F	AD	U	WB	UP	WB	UP	M	+1	+1	+2
30	Clearwater River & Lakes	AD		U	HW		WB	RP	L	-1	0	-1
31	Coeur d'Alene Lake	AD	F	P	HW		NB/AB	NP	M	-1	-1	-2
32	Cyclone Lake	AD		A	HW		WB	RP	H	-1	0	-1
33	Deadwood River	AD		D	HW		AB	NP	H	-1	-1	-2
34	Doctor Lake	AD		A	HW		NB	RP	H	-1	0	-1
35	Entiat River	F		U	NB/HW		WB	RP	H	-1	0	-1
36	Fish Lake (Lochsa River)	AD		U	HW		NB	RP	H	-1	0	-1
37	Fish Lake (NF Clearwater)	AD		U	HW		NB	RP	H	-1	0	-1
38	Flathead Lake	AD	F	A	AB/WB	NP/RP	AB	RP	H	-1	0	-1
39	Frozen Lake	AD			HW		WB	RP	H	-1	0	-1
40	Grande Ronde River	F	NP	D	HW		WB	RP	L	-1	0	-1
41	Granite Creek	F		P	AB/HW		WB	UP	H	-1	+1	0
42	Harrison Lake	AD		A	HW		WB	RP	H	-1	0	-1
43	Holland Lake	AD		A	HW		WB	RP	M	-1	0	-1
44	Hood River	AD	F	U	AB/HW		WB	RP	L	-1	0	-1
45	Hungry Horse Reservoir	AD		A	WB	RP	AB	RP	H	0	0	0
46	Imnaha River	F		P	HW/AB		WB	UP	M	-1	+1	0
47	Isabel Lakes	AD		A	HW		NB	RP	H	-1	0	-1
48	Kintla Lake	AD		A	NB	NP	WB	RP	M	-1	0	-1
49	Klickitat River	F		D	HW		WB	UP	M	-1	+1	0

ID #	Core Area	Life History Form(s) Present			Core Area Extent / Connectivity					"External Connectivity" Scoring		
		Dominant Migratory Form	Secondary Migratory Form(s) (if present)	Resident Form	Upper Bound	Degree of Connectivity to Upstream Cores	Lower Bound	Degree of Connectivity to Downstream Cores	Degree of Connectivity within Core Area	UP-STREAM SCORE	DOWN-STREAM SCORE	TOTAL SCORE
50	Kootenai River	F	AD	A	AB/NB	NP	WB	UP	M	-1	+1	0
51	Lake Creek	AD		U	HW		NB	NP	H	-1	-1	-2
52	Lake Koocanusa	AD		A	HW		AB	RP	H	-1	0	-1
53	Lake McDonald	AD		A	NB	NP	WB	RP	L	-1	0	-1
54	Lake Pend Oreille	AD		P	AB	RP	AB	RP	M	0	0	0
55	Lemhi River	F		D	HW		WB	RP	L	-1	0	-1
56	Lewis River	AD		A	HW		AB/WB	RP	L	-1	0	-1
57	Lincoln Lake	AD		A	HW		WB	RP	H	-1	0	-1
58	Lindbergh Lake	AD		U	HW		WB	RP	H	-1	0	-1
59	Little Lost River	F		P	HW	NP	NB	NP	M	-1	-1	-2
60	Little Minam River			D	HW		NB	RP	H	-1	0	-1
61	Little-Lower Salmon River	F		P	NB	NP	WB	UP	M	-1	+1	0
62	Lochsa River	F		P	HW		WB	UP	H	-1	+1	0
63	Logging Lake	AD		A	HW		WB	RP	H	-1	0	-1
64	Lower Deschutes R.	AD	F	U	HW/NB/AB		WB	RP	L	-1	0	-1
65	Lower Flathead River	F	AD	U	HW		WB	RP	M	-1	0	-1
66	Lower Quartz Lake	AD		A	WB	RP	WB	RP	H	0	0	0

ID #	Core Area	Life History Form(s) Present			Core Area Extent / Connectivity					"External Connectivity" Scoring		
		Dominant Migratory Form	Secondary Migratory Form(s) (if present)	Resident Form	Upper Bound	Degree of Connectivity to Upstream Cores	Lower Bound	Degree of Connectivity to Downstream Cores	Degree of Connectivity within Core Area	UP-STREAM SCORE	DOWN-STREAM SCORE	TOTAL SCORE
67	Lucky Peak Reservoir	NP		U	AB	NP	AB	NP	L	-1	-1	-2
68	Malheur River	F	NP	P	WB		AB	NP	L	-1	-1	-2
69	Methow River	F	AD	P	NB/HW		WB	RP	M	-1	0	-1
70	Middle Fork John Day R.	F		D	HW		WB	UP	M	-1	+1	0
71	Middle Fork Payette River	NP		D	HW/WB	UP	WB	RP	M	+1	0	+1
72	Middle Fork Salmon River	F		P	HW		WB	UP	H	-1	+1	0
73	Middle Salmon River-Chamberlain	F		P	WB		WB	UP	H	-1	+1	0
74	Middle Salmon River-Panther	F		P	WB		WB	UP	M	-1	+1	0
75	Middle-Lower Clearwater R.	F		P	WB/AB	NP	WB	RP	M	-1	0	-1
76	North Fork Clearwater R.	AD		P	HW		AB	NP	H	-1	-1	-2
77	North Fork John Day R.	F		D	HW		WB	UP	M	-1	+1	0
78	North Fork Payette River	NP		A	HW		AB	NP	L	-1	-1	-2
79	Noxon Rapids Reservoir	AD		U	AB	RP	AB	RP	M	0	0	0
80	Odell Lake	AD		U	NB/HW		NB	NP	M	-1	-1	-2
81	Opal Lake	AD		U	HW		NB	NP	H	-1	-1	-2

ID #	Core Area	Life History Form(s) Present			Core Area Extent / Connectivity					"External Connectivity" Scoring		
		Dominant Migratory Form	Secondary Migratory Form(s) (if present)	Resident Form	Upper Bound	Degree of Connectivity to Upstream Cores	Lower Bound	Degree of Connectivity to Downstream Cores	Degree of Connectivity within Core Area	UP-STREAM SCORE	DOWN-STREAM SCORE	TOTAL SCORE
82	Pahsimeroi River	F		P	HW		WB	UP	L	-1	+1	0
83	Pend Oreille River	AD	F	U	AB	NP	NB/AB	NP	L	-1	-1	-2
84	Pine, Indian & Wildhorse Cr.	AD		D	HW		WB	UP	M	-1	+1	0
85	Powder River	NP		D	HW		AB	NP	L	-1	-1	-2
86	Priest Lakes	AD		U	HW		AB/WB	RP	M	-1	0	-1
87	Rock Creek	F		P	HW		WB	UP	H	-1	+1	0
88	Selway River	F		P	HW		WB	UP	H	-1	+1	0
89	Sheep Creek	F		P	AB/HW		WB	UP	H	-1	+1	0
90	Sophie Lake	AD		A	HW		NB	NP	L	-1	-1	-2
91	South Fork Clearwater R.	F		P	HW		WB	UP	M	-1	+1	0
92	South Fork Salmon River	F		P	HW		WB	UP	H	-1	+1	0
93	Squaw Creek	NP		D	HW		WB	NP	L	-1	-1	-2
94	Swan Lake	AD		A	WB	UP	AB	RP	H	+1	0	+1
95	Touchet River	F		P	HW		WB	RP	M	-1	0	-1
96	Trout Lake	AD		A	WB	UP	WB	RP	H	+1	0	+1
97	Tucannon River	F		P	HW		WB	UP	H	-1	+1	0
98	Umatilla River	F		P	HW/NB		WB	RP	L	-1	0	-1
99	Upper Kintla Lake	AD		A	HW		NB	RP	H	-1	0	-1
100	Upper Mainstem John Day R.	F		P	HW		WB	UP	M	-1	+1	0

ID #	Core Area	Life History Form(s) Present			Core Area Extent / Connectivity					"External Connectivity" Scoring		
		Dominant Migratory Form	Secondary Migratory Form(s) (if present)	Resident Form	Upper Bound	Degree of Connectivity to Upstream Cores	Lower Bound	Degree of Connectivity to Downstream Cores	Degree of Connectivity within Core Area	UP-STREAM SCORE	DOWN-STREAM SCORE	TOTAL SCORE
101	Upper Salmon River	F		P	HW		WB	UP	M	-1	+1	0
102	Upper South Fork Payette River	F		D	HW		WB	RP	H	-1	0	-1
103	Upper Stillwater Lake	AD		U	HW		WB	RP	H	-1	0	-1
104	Upper Whitefish Lk.	AD		A	HW		WB	RP	L	-1	0	-1
105	Upper Willamette R.	F	AD	A	AB/NB/HW		WB	UP	L	-1	+1	0
106	Walla Walla River	F		P	HW		AB/WB	RP	L	-1	0	-1
107	Weiser River	NP		D	HW		WB	RP	L	-1	0	-1
108	Wenatchee River	AD	F	P	NB/HW		WB	RP	H	-1	0	-1
109	West Fork Bitterroot R.	AD		U	HW		AB	RP	M	-1	0	-1
110	Whitefish Lake	AD		A	WB	UP	WB	RP	H	+1	0	+1
111	Yakima River	AD	F	P	AB/NB/HW		AB/WB	RP/NP	L	-1	0	-1
112	Sycan River	F		D	HW		AB	RP	L	-1	0	-1
113	Upper Klamath Lake	NP		D	HW		AB	RP	L	-1	0	-1
114	Upper Sprague River	F		D	HW		NB	RP	M	-1	0	-1
115	Belly River	F		U	NB		WB	UP	M	-1	+1	0
116	Cracker Lake	AD		A	HW		AB	RP	H	-1	0	-1
117	Lee Creek	F	AD	U	HW		WB	UP	M	-1	+1	0

ID #	Core Area	Life History Form(s) Present			Core Area Extent / Connectivity					"External Connectivity" Scoring		
		Dominant Migratory Form	Secondary Migratory Form(s) (if present)	Resident Form	Upper Bound	Degree of Connectivity to Upstream Cores	Lower Bound	Degree of Connectivity to Downstream Cores	Degree of Connectivity within Core Area	UP-STREAM SCORE	DOWN-STREAM SCORE	TOTAL SCORE
118	Red Eagle Lake	AD		A	HW		WB	RP	H	-1	0	-1
119	Saint Mary River	F	AD	U	HW		WB	UP	M	-1	+1	0
120	Slide Lake	AD		A	HW		NB	RP	H	-1	0	-1
121	Jarbidge River	F		D	HW		WB	NP	M	-1	-1	-2

Appendix D – Supplemental Threats Information

Table 1. Federal and Tribal Land Ownership by Core Area.

This information is displayed in a separate attachment.

Appendix D – Supplemental Threats Information

Table 2. Land Use by Core Area.

This information is displayed in a separate attachment.

Appendix I: PCE's for Bull Trout Critical Habitat and Associated Matrix Habitat Indicators

DRAFT

13. Rationale, baseline and determination for Proposed Critical Habitat *(insert this section following part 12 of the existing bull trout BA format, bumping References Cited to #14)*

A. Rationale Federally authorized funded or carried out activities require consultation, to ensure that they are not likely to destroy or adversely modify bull trout critical habitat. The Forest Service in Region 1 in western Montana uses the Matrix of Pathway Indicators (matrix; USFWS 1998a) for bull trout to evaluate and document baseline conditions and to determine the likelihood of ”take” of bull trout. Matrix analysis incorporates four biological indicators and 19 physical habitat indicators. The majority of the matrix analysis consists of specific consideration of the 19 habitat indicators. Analysis of the matrix habitat indicators provides a thorough analysis of the existing baseline condition and potential impacts to bull trout habitat.

Therefore, when assessing potential effects to bull trout as a species, through use of the matrix, agency biologists concurrently provide an analysis of effects to the primary constituent elements (PCEs) for bull trout critical habitat and related habitat indicators. Table 13-1 below describes the eight PCEs and the related matrix indicators.

Table 13-1 PCEs for bull trout critical habitat and associated matrix habitat indicators.

PCE #	PCE description	Associated matrix indicators
1	Water temperatures that support bull trout use. Bull trout have been documented in streams with temperatures from 32 to 72 [deg]F (0 to 22 [deg]C) but are found more frequently in temperatures ranging from 36 to 59 [deg]F (2 to 15 [deg]C). These temperature ranges may vary depending on bull trout life history stage and form, geography, elevation, diurnal and seasonal variation, shade, such as that provided by riparian habitat, and local groundwater influence. Stream reaches with temperatures that preclude any bull trout use are specifically excluded from designation.	- Temperature - Refugia - Average wetted width/maximum depth ratio in scour pools in a reach - Streambank condition - Change in peak/base flows - Riparian conservation areas - Floodplain connectivity
2	Complex stream channels with features such as woody debris, side channels, pools, and undercut banks to provide a variety of depths, velocities, and instream structures;	- Large woody debris - Pool frequency and quality - Large pools - Off channel habitat - Refugia - Average wetted width/maximum depth ratio in scour pools in a reach - Streambank condition - Floodplain connectivity - Riparian conservation areas

PCE #	PCE description	Associated habitat indicators
3	Substrates of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. This should include a minimal amount of fine substrate less than 0.25 inch (0.63 centimeter) in diameter.	- Sediment - Substrate embeddedness - Large woody debris - Pool frequency and quality
4	A natural hydrograph, including peak, high, low, and base flows within historic ranges or, if regulated, currently operate under a biological opinion that addresses bull trout**,** or a hydrograph that demonstrates the ability to support bull trout populations by minimizing daily and day-to-day fluctuations and minimizing departures from the natural cycle of flow levels corresponding with seasonal variation.	- Change in peak/base flows - Increase in drainage network - Disturbance history - Disturbance regime
5	Springs, seeps, groundwater sources, and subsurface water to contribute to water quality and quantity as a cold water source.	- Floodplain connectivity - Change in peak/base flows - Increase in drainage network - Riparian conservation areas - Chemical contamination/nutrients
6	Migratory corridors with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and foraging habitats, including intermittent or seasonal barriers induced by high water temperatures or low flows.	- Life history diversity and isolation - Persistence and genetic integrity - Temperature - Chemical contamination/nutrients - Physical barriers - Average wetted width/maximum depth ratio in scour pools in a reach - Change in peak/base flows - Refugia
7	An abundant food base including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish.	- Growth and survival - Life history diversity and isolation - Riparian conservation areas - Floodplain connectivity (importance of aquatic habitat condition-indirectly covered by previous 6 PCEs)
8	Permanent water of sufficient quantity and quality such that normal reproduction, growth, and survival are not inhibited.	- Sediment - Chemical contamination/nutrients - Change in peak/base flows

The crosswalk provides rationale supporting that the PCEs for bull trout critical habitat are thoroughly addressed in the current matrix analysis and that environmental baseline and determination for effects to the species consists of a biological and habitat component addressing in total the PCEs listed in final rule for Critical Habitat (USFWS 2005). Below are the eight PCEs and the sporting rationale

1. Water temperatures that support bull trout use. Bull trout have been documented in streams with temperatures from 32 to 72 [deg]F (0 to 22 [deg]C) but are found more frequently in temperatures ranging from 36 to 59 [deg]F (2 to 15 [deg]C). These temperature ranges may vary depending on bull trout life history stage and form, geography, elevation, diurnal and seasonal variation, shade, such as that provided by riparian habitat, and local groundwater influence. Stream reaches with temperatures that preclude any bull trout use are specifically excluded from designation.

This PCE is addressed directly by the analysis of *temperature*. It is addressed indirectly through consideration of *refugia*, which by definition is high quality habitat of appropriate temperature. Important components of refugia include pool frequency and quality and large pools. *Average wetted width/maximum depth ratio in scour pools* is an indication of water volume, which indirectly indicates water temperature, (i.e., low ratios indicate deeper water, which in turn indicates possible refugia). This indicator in conjunction with *change in peak/base flows* is an indicator of potential temperature and refugia concerns particularly during low flow periods. *Streambank condition*, *floodplain connectivity* and *riparian conservation areas* address the components of shade and groundwater influence, both of which are important factors of water temperature. Stable streambanks and intact riparian areas, which include part of the floodplain, typically support adequate vegetation to maintain thermal cover to streams during low flow periods.

2. Complex stream channels with features such as woody debris, side channels, pools, and undercut banks to provide a variety of depths, velocities, and instream structure.

The analysis of *large woody debris*, such as current values and sources available for recruitment, directly addresses this PCE. Large woody debris increases channel complexity and creates pools and undercut banks. *Pool frequency and quality* would also directly address this PCE, showing the number of pools per mile as well as the amount of cover and temperature of water in the pools. *Average wetted width/maximum depth ratio in scour pools in a reach* is an indicator of channel shape and pool quality. Low ratios suggest deeper, higher quality pools. *Large pools*, consisting of a wide range of water depths, velocities, substrates and cover, are typical of high quality habitat and are a key component of channel complexity (USFWS 1998). An analysis of *off-channel habitat* would describe side-channels and other off-channel areas. *Streambank condition* would analyze the stability of the banks, including such features as undercut banks. The analysis of both *riparian conservation areas* and *floodplain connectivity* would directly address this PCE. Floodplain and riparian functions include the maintenance of habitat and channel complexity, the recruitment of large woody debris and the connectivity to off-channel habitats or side channels (USFWS 1998). Complex habitats provide refugia for bull trout and in

turn, *refugia* analysis would assess complex stream channels. All of these habitat indicators consider the numerous characteristics of instream bull trout habitat and quantify critical components that are fundamental to creating and maintaining complex instream habitat over time.

3. Substrates of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. This should include a minimal amount of fine substrate less than 0.25 inch (0.63 centimeter) in diameter.

This PCE is addressed directly by analysis of *sediment* in areas of spawning and incubation and considers directly the size class composition of instream sediments, particularly fine sediments ≤63 mm. This PCE is also addressed directly by analysis of *substrate embeddedness* in rearing areas, which is a function of sediment size class and bedload transport. Both of these indicators would assess substrate composition and stability in relation to the various life stages of the bull trout as well as the sediment transportation and deposition. *Large woody debris* and *pool frequency and quality* affect sediment transport and redistribution within a stream and would indirectly assess substrate composition and amounts.

4. A natural hydrograph, including peak, high, low, and base flows within historic ranges or, if regulated, currently operate under a biological opinion that addresses bull trout, or a hydrograph that demonstrates the ability to support bull trout populations by minimizing daily and day-to-day fluctuations and minimizing departures from the natural cycle of flow levels corresponding with seasonal variation.

This PCE is addressed by analysis of *change in peak/base flows*, which considers changes in hydrograph amplitude or timing with respect to watershed size, geology, and geography. Considering *increase in drainage network* and *disturbance history* provides further information. Roads and vegetation management both have effects strongly linked to a stream's hydrograph. *Disturbance regime* ties this information together to consider how a watershed reacts to disturbance and the time required to recover back to pre-disturbance conditions.

5. Springs, seeps, groundwater sources, and subsurface water to contribute to water quality and quantity as a cold water source.

This PCE is addressed by analysis of *floodplain connectivity* and *riparian conservation areas*. *Floodplain connectivity* considers hydrologic linkage of off-channel areas with the main channel and overbank flow maintenance of wetland function and riparian vegetation and succession. Floodplain and riparian areas provide hydrologic connectivity for springs, seeps, groundwater upwelling and wetlands and contribute to the maintenance of the water table (USFWS 1998b). The analysis of *changes in peak/base flows* would address subsurface water connectivity. I*ncrease in drainage network* would address potential changes to groundwater sources and subsurface water connectivity. C*hemical contamination/nutrients* would address concerns regarding groundwater water quality.

6. Migratory corridors with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and foraging habitats, including intermittent or seasonal barriers induced by high water temperatures or low flows.

The biological indicator *life history diversity and isolation* addresses the function of migration and/or subsequent isolation with respect to the population. The biological indicator *persistence and genetic integrity* indirectly reflects the status of migratory corridors. Physical, biological or chemical barriers to migration are addressed directly through water quality habitat indicators, including *temperature*, *chemical contamination/nutrients* and *physical barriers*. The analysis of these indicators would assess if barriers have been created due to impacts such as high temperatures, high concentrations of contaminants or physical barriers. Analysis of *change in peak/base flows* and *average wetted width/maximum depth ratio in scour pools in a reach* would assess whether changes in flow might create a seasonal barrier to migration. An analysis of *refugia*, which considers the habitat's ability to support strong, well distributed, and connected populations for all life stages and forms of bull trout, would also be pertinent to this PCE.

7. An abundant food base including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish.

An analysis of *floodplain connectivity* and *riparian conservation areas* would assess these contributions to the food base. Floodplain and riparian areas provide habitat to aquatic invertebrates, which in turn provides a forage base to bull trout (USFWS 1998). This PCE is indirectly addressed through the biological indicator of *growth and survival* and *life history diversity and isolation*. Both of these indicators look at habitat quality and subpopulation condition, which provides information on food base. This PCE is a synthesis of the previous PCEs. It is addressed through the analysis of biological and habitat indicators in that, if a bull trout population either exists or could exist in a watershed, then there is an adequate forage base. A healthy habitat provides a forage base for the target species. Any potential impairment to the forage base has been addressed by way of summarizing the biological and habitat indicators.

8. Permanent water having low levels of contaminants such that normal reproduction, growth and survival are not inhibited.

Flow conditions, such as perennial or ephemeral would be analyzed through *changes in peak/base flows*, and addressed in consideration of current base flows. Changes in hydrograph amplitude or timing with respect to watershed size, geology, and geography would be considered. The level of contaminants is addressed directly by the analysis of *chemical contamination/nutrients* and *sediment*. Current listing under 303(d) status should be considered, as well as the causes for that listing. *Sediment* is considered a contaminant especially in spawning and rearing habitat and analysis would apply to this PCE.

B. Summary of environmental baseline for proposed critical habitat

Sample narrative 1: Based on the results of the bull trout matrix analysis and this crosswalk, <u>all</u> associated habitat indicators listed for one or more of the eight PCEs in Table 1 were identified as "functioning appropriately."

Based on the site specific environmental baseline of bull trout habitat conditions and their relationship to the PCEs associated with those habitat indicators described in Table 1, as well as other factors deemed necessary, PCE(s) __ is(are) functioning appropriately. The remaining PCEs are in less than optimal condition.

Sample narrative 2: Based on the results of the bull trout matrix analysis and this crosswalk, at least one associated habitat indicator listed for each of the eight PCEs in Table 1 is identified as "functioning at risk" or "functioning at unacceptable risk."

Based on the site specific environmental baseline of bull trout habitat conditions and their relationship to the PCEs associated with those habitat indicators described in Table 1, as well as other factors deemed necessary, all PCEs are in less than optimal condition.

C. Determination- Summary narrative of matrix indicator(s) and relationship to PCEs

The following examples link site specific project impacts to bull trout habitat to the PCEs. PCE determinations should consider those habitat indicators described in Table 13-1 and any other factors pertinent to the project analysis. Action agencies are required to determine if actions are likely to adversely affect critical habitat.

Sample narrative 1: Not Likely to adversely affect bull trout.

Analysis for the proposed Yahoo Timber Sale found that activities associated with this sale were likely to impact the Habitat Indicators **Sediment** and **Substrate Embeddedness**, as described in section 8 of this biological assessment. This impact is anticipated to result in a minor degrade to these habitat elements and subsequently PCEs 3 and 8 (Table 13-1). The impact associated with the proposed action is expected to be discountable or insignificant. As such, the proposed Yahoo Timber Sale is not likely to adversely affect critical habitat for bull trout in Trout Creek.

Sample narrative 2: Likely to adversely affect bull trout on projects with actions occurring entirely after September 26, 2005.

Analysis for the proposed Way Out Restoration Project found that activities associated with this project were likely to impact the Habitat Indicators **Sediment** and **Substrate Embeddedness**, as described in section 8 of this biological assessment. This impact is anticipated to result in degradation to these habitat elements and subsequently PCEs 3 and 8 (Table 13-1). The impacts associated with the proposed action are not discountable, insignificant or entirely beneficial. As such, the proposed Way Out Restoration Project is likely to adversely affect proposed critical habitat for bull trout in the Clark Fork River.

Sample Narrative 3: Likely to adversely affect bull trout when "other factors" must be considered to relate impacts to PCEs.

Analysis for the proposed Massive Habitat Enhancement Project found that associated activities (noxious weed treatment) were likely to impact the matrix indicator **Water Quality** as described in section 8 of this biological assessment. Impacts to water quality would subsequently impact

PCEs 1 and 8 (Table 13-1). However, analysis indicates that noxious weed treatment has the potential to deliver herbicides to flowing water, and consequently could adversely impact the macroinvertebrate community (forage base) of Easy Creek. As such, PCE 7 may be impacted by implementation of the proposed action. The impacts associated with the proposed action are not discountable, insignificant or entirely beneficial. Consequently, the proposed Massive Habitat Enhancement Project is likely to adversely affect proposed critical habitat for bull trout in the Kootenai River.

The Montana Field Office recommends that we delete references to ***destruction/adverse modification of proposed/designated critical habitat*** found in section 11, item 4 of the standard 15 part Fisheries Biological Assessment currently in use in western Montana.

References Cited

U.S. Fish and Wildlife Service. 1998a. A framework in making endangered species act determinations of effects for individual or grouped action at the bull trout subpopulation watershed scale. Prepared by the USFWS.

U.S. Fish and Wildlife Service. 1998b. Bull Trout Interim Conservation Guidance. Prepared by the USFWS.

U.S. Fish and Wildlife Service. 2005. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Bull Trout; Final Rule. Federal Register/ Vol. 70, No. 185: 56212-56311.