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DRAFT
FISH AND WILDLIFE COORDINATION ACT REPORT
FOR THE
ODESSA SUBAREA SPECIAL STUDY

September 16, 2010

FOR THE
U. S. BUREAU OF RECLAMATION
PACIFIC NORTHWEST REGION
YAKIMA, WASHINGTON

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EXECUTIVE SUMMARY

The Odessa Subarea Special Study (Project) is a technical investigation of options to provide a replacement surface water supply for current irrigation that uses groundwater in the Odessa Groundwater Management Subarea (Odessa Subarea) of Adams, Franklin, Grant, and Lincoln Counties, Washington. The Project Area is generally defined by the area bounded on the west by the Project's East Low Canal, on the east by the City of Lind, on the north by the north end of Lake Billy Clapp and on the south to the town of Connell. The Project is jointly undertaken by the U.S. Bureau of Reclamation (Reclamation) and the Washington Department of Ecology (WDOE). The Project is considered part of the continued phased development of the Columbia Basin Project (CBP) which originally authorized water development to irrigate a total of 1,029,000 acres, of which 671,000 acres are currently irrigated in the entire CBP area. An estimated 170,000 acres within the Odessa Subarea are now being irrigated with groundwater with an estimated 140,000 of these acres eligible to receive Project surface water. Reclamation is considering alternatives that would provide a replacement surface water supply for up to 140,000 groundwater irrigated acres within the Project Area. No increase in agricultural acreage is expected as a result of the Project.

This document constitutes the Secretary of the Interior's report for the Odessa Subarea, in accordance with section 2(b) of the Fish and Wildlife Coordination Act, as amended (16 U.S.C 661-667e), and the 2008 and 2010 Interagency Agreements between the U.S. Fish and Wildlife Service (Service) and Reclamation. The purpose of this report is to identify and evaluate anticipated impacts of implementing each Project alternative on fish and wildlife resources, to recommend conservation and mitigation measures for the protection of those resources during construction, and recommended a mitigation plan for impacts within the Project Area. The Service produced this report in coordination with Reclamation and the Washington Department of Fish and Wildlife (WDFW). This report is to be included in Reclamation's draft and final Environmental Impact Statement for the Project. Separate comments and recommendations from WDFW can be found as an attachment to the final report.

The purpose of the Project is to avoid potential economic loss, in the near term, to the region's agricultural sector as a result of continued declines in the quantity and quality of water in Odessa Subarea aquifers. Groundwater in the Odessa Subarea is currently being depleted to such an extent that water must be pumped from depths as great as 750 feet. Domestic, commercial, municipal, and industrial uses are also affected by decreasing water supplies. The Project is intended to replace well water use with surface water use by constructing a variety of conveyance and storage facilities to move water from the Columbia River, southeast to the Project Area.

The Project consists of various combinations of two water conveyance options and three water supply components, totaling nine alternatives, including the No Action Alternative (Table 1). The full replacement or full implementation option of the Project would provide surface water to 102,614 eligible acres in the Project Area. The partial replacement or partial implementation option would provide surface water to 45,545 acres north of I-90 and east of the East Low Canal. Water will be delivered through a system of pumping plants, pipe laterals, new and existing canals and reservoirs to irrigate land within the Odessa Subarea in Adams, Franklin, Grant and Lincoln Counties.

Table 1. Key Features of the Study Alternatives

Key Features of the Study Alternatives

Delivery Alternative (see also Map 3)	Letter and Symbol*	Supply Alternative: Additional Drawdowns of Existing Reservoirs: Banks Lake	Supply Alternative: Additional Drawdowns of Existing Reservoirs: Lake Roosevelt (FDR)	Supply Alternative: New Rocky Coulee Reservoir
1 No Action • No CBP surface water provided to any additional groundwater-irrigated lands in the Odessa Subarea • No facility construction required • Current and ongoing Columbia River and CBP programs, commitments, and operations continue		Not Applicable		
2 Partial Groundwater Irrigation Replacement • Approximately 58,000 acres of groundwater-irrigated lands provided with CBP surface water • All lands supplied with surface water replacement would be south of I-90 • Water delivered by enlargement and extension of the existing East Low Canal and construction of a pressurized pipeline system • Current and ongoing Columbia River and CBP programs, commitments, and operations continue	2A	Yes	No	No
	2B	Yes	Yes	No
	2C	Yes	No	Yes
	2D	Yes	Yes	Yes
3 Full Groundwater Irrigation Replacement • Most groundwater-irrigated lands in the Study Area (102,614 acres) provided with CBP surface water (both north and south of I-90) • Water delivered south of I-90 by enlargement and extension of the existing East Low Canal and construction of a pressurized pipeline system • Water delivered north of I-90 by construction of a new East High Canal system, with an associated pressurized pipeline system • Current and ongoing Columbia River and CBP programs, commitments and operations continue	3A	Yes	No	No
	3B	Yes	Yes	No
	3C	Yes	No	Yes
	3D	Yes	Yes	Yes

*The symbol system shown on this table is used as an aid in identifying the alternatives. The center area shows the delivery alternative: partially or fully shaded to indicate partial or full replacement. The band surrounding the center shows the supply option. If a reservoir name is shown in black with white text, it is included in that alternative; the white, grayed-out reservoir is not included.

The Service believes alternative 2A has the least negative impacts to fish and wildlife. WDFW has not chosen a preferred alternative at this time. Action Alternative 2A is expected to have a moderate level of negative impacts to aquatic and riparian resources and a low level of negative impacts to shrub-steppe and grassland habitats. Alternatives with the least disturbance to shrub-steppe, riparian and grassland habitats were determined best for wildlife and fish.

1.0 PURPOSE, SCOPE, AND AUTHORITY

Pursuant to the Fish and Wildlife Coordination Act, as amended (16 U.S.C 661-667e) and the 2008 and 2010 Interagency Agreements between the U.S. Fish and Wildlife Service (Service) and the Bureau of Reclamation (Reclamation), the Service has prepared this Coordination Act Report for Reclamation's Odessa Subarea Special Study (Project). The purpose of this report is to:

- Describe the baseline condition of fish and wildlife resources within a defined geographic area likely to be affected by the Project alternatives, referred to as the "Affected Area". The Affected Area may be larger than the Project Area or project footprint as impacts may extend beyond the borders of the area directly impacted by construction;
- Generally describe the effects of the Project alternatives on fish and wildlife resources in the Affected Area, and;
- Provide recommendations to avoid, minimize, and/or compensate for adverse impacts to fish and wildlife resources associated with the Project alternatives.

The Project is a technical investigation of options to provide surface water for current irrigation that utilizes groundwater in the Odessa Groundwater Management Subarea (Odessa Subarea) of Adams, Franklin, Grant, and Lincoln Counties, Washington.

The Project Area is generally defined by the area bounded on the west by the Project's East Low Canal, on the east by the City of Lind, on the north by the town of Wilson Creek and on the south to the town of Connell. Reclamation is considering alternatives that would provide a replacement surface water supply for up to 140,000 groundwater irrigated acres within the Project Area. This is a water replacement project and an increase in agricultural acreage is not an expected result of the Project. However, if this project contributes to an increase in the conversion of lands to agricultural development Reclamation and the Washington Department of Ecology (Ecology) will be required to consult with the Service to identify potential impacts not contemplated in this CAR. Any changes in project scope not described in the EIS will need to be evaluated by the Service, in coordination with WDFW to further protect resources in the Project Area.

The Project is jointly undertaken by Reclamation and Ecology under a December 2004 Memorandum of Agreement between the State of Washington and the Columbia Basin Project (CBP) irrigation districts, to cooperatively explore opportunities for delivery of surface water to existing groundwater-irrigated lands within the Subarea. The Project is being planned under the authority of the Columbia Basin Project Act of 1943, as amended, and the Reclamation Act of 1939. The Project is considered part of the continued phased development of the Columbia Basin Project which originally authorized water development to irrigate a total of 1,029,000 acres, of which 671,000 acres are currently irrigated in the entire CBP area. An estimated 170,000 acres within the Odessa Subarea are now being irrigated with groundwater from many private and a few municipal wells, of which approximately 140,000 acres are eligible to receive surface water through this Project.

2.0 COORDINATION WITH AND CONCURRENCE OF WASHINGTON DEPARTMENT OF FISH AND WILDLIFE

WDFW and the Service have collaborated to identify data needs and gaps, discussed species surveys, and jointly investigated the potential level of project impacts to fish, wildlife, and habitat. WDFW performed wildlife surveys and habitat surveys during 2009 and 2010 and provided the results to the Service for analysis. WDFW has reviewed and provided information to assist with the production of this report; however, WDFW's official comments are attached as Appendix E, in the final report.

3.0 RELEVANT STUDIES, REPORTS USED and REQUESTED INFORMATION

Reclamation and WDFW have engaged in fish, wildlife, and habitat studies and investigations that provide information used in this report to determine the effects of the project on species and habitats. The following studies and investigations conducted by WDFW were used in this report:

- Habitat surveys conducted in 2009 (WDFW 2009a, p.1) and 2010,
- Wildlife surveys conducted in 2009 (WDFW 2009c, p.1)and 2010,
- Habitat Evaluation Procedures (HEP) Analysis for 13 species listed in Table 5 (WDFW 2009c, p.1),
- Banks Lake Productivity and Water Quality Study to be completed in 2010 and, Banks Lake Fish Entrainment Study to be completed in 2010

HEP Analysis is a scientific model used to calculate the relative impacts of project alternatives on a species and its habitat. Our analytical design used Habitat Suitability Indices (HSI) for each species that contained a suite of variables, designed for each species under consideration. These impacts include, but are not limited to, foraging areas, migration areas, amount of escape cover, nesting cover and others. HEP has a long history and was agreed upon by the Service, Reclamation, and WDFW.

Project planning documents used for this report are general in nature, since the available information on the project is from early planning phases and does not identify the preferred alternative, exact locations, or engineered designs of constructed features. The Project scoping documents used for this report include a Federal Notice of Intent to prepare an EIS that was published in the *Federal Register* on August 21, 2008 (Reclamation 2008a), the Determination of Significance, the Odessa Special Study Update, and the Odessa Subarea Special Study, Columbia Basin Project issued by Washington Department of Ecology in November 2008. (WDOE, et al 2008, p.1) Consequently, we analyzed the Project's terrestrial impacts, including all eight alternatives and the No-Action Alternative, using two different sets of data as described in Section VI of this report. These data were the results of the wildlife surveys conducted by WDFW (WDFW 2009c, p.1) and the data provided by Reclamation (2010, p. 1).

In March, 2010, Reclamation provided the Service with a project description, analysis of impacts, and the environmental consequences of the alternatives in the form of an internal draft of the Environmental Impact Statement for the Odessa Subarea Special Study (EIS). In this document, Reclamation (2010, p. 3-121) determined that no impacts to listed terrestrial species would result from the Project. The Service, in considering indirect effects, and temporary effects such as noise, disagreed with Reclamation's effects determination (2010, p.1) and has determined that the Affected Area is significantly larger than that described by Reclamation in the Environmental Impact Statement (Reclamation 2010, p.1). For this reason, the Service decided to use both Affected Areas to compare the proposed alternatives.

Information requested, and not received, from Reclamation to complete our analysis included:

- Designation of the Preferred Alternative;
- Location of planned facilities;
- Habitats and their size at the location of each planned facility;
- A description of Best Management Practices used to minimize fish and wildlife impacts in construction and maintenance of facilities and roads, and;
- The type, amount, and location of proposed mitigation areas for fish and wildlife habitat impacts.

The Service has produced a Fish and Wildlife Coordination Act Reports on the proposed Banks Lake Drawdown (USFWS 2003) and the Potholes Reservoir Alternate Feedroute in 2007. These projects move Columbia River water from Lake Roosevelt to irrigated lands west and south of the Project, through existing facilities that are also proposed for use in this Project.

4.0 DESCRIPTION OF THE PROJECT AREA

The Project Area is located in Adams, Grant, and portions of Franklin and Lincoln Counties. The Project Area is within the CBP boundary and is generally defined by the area bounded on the west by the Project's East Low Canal, on the east by the City of Lind, on the north to Wilson Creek and south to the Connell area (Reclamation 2006a, p. 4).

For the purpose of this CAR, the "Affected Area" is identical to the Project Area defined above, whereas the Project Area as described by Reclamation is the area where actual ground disturbing activities will take place (i.e. the project footprint). The Affected Area is not the same as the Project Area or the Project footprint but is much larger as impacts will likely occur outside of the Project Area as described by Reclamation.

In this report, the "Project Area" (shown in tan and identified in the map legend as the Odessa Special Study Area in Figure 1**)** contains lands determined to have development potential by previous Reclamation investigations, are part of the Odessa ground water management subarea that is authorized to receive water from the Columbia River Basin, and coincides with the Odessa Subarea boundary defined by Ecology.

Each of the four partial replacement alternatives (2A thru 2D) would provide CBP surface water supply to approximately 58,000 acres of lands south of I-90. The four partial-replacement sub-alternatives differ only in the combination of reservoirs used to provide the necessary water supply (Figure 2).

Each of the four full replacement alternatives (3A thru 3D) would provide CBP surface water supply to replace existing groundwater supply for most lands in the Study Area now irrigated with groundwater (102,614 acres), both north and south of I-90. The four full-replacement sub-alternatives differ only in the combination of reservoirs used to provide the necessary water supply (Figure 2). Potential water sources are shown by red circles on Figure 2.

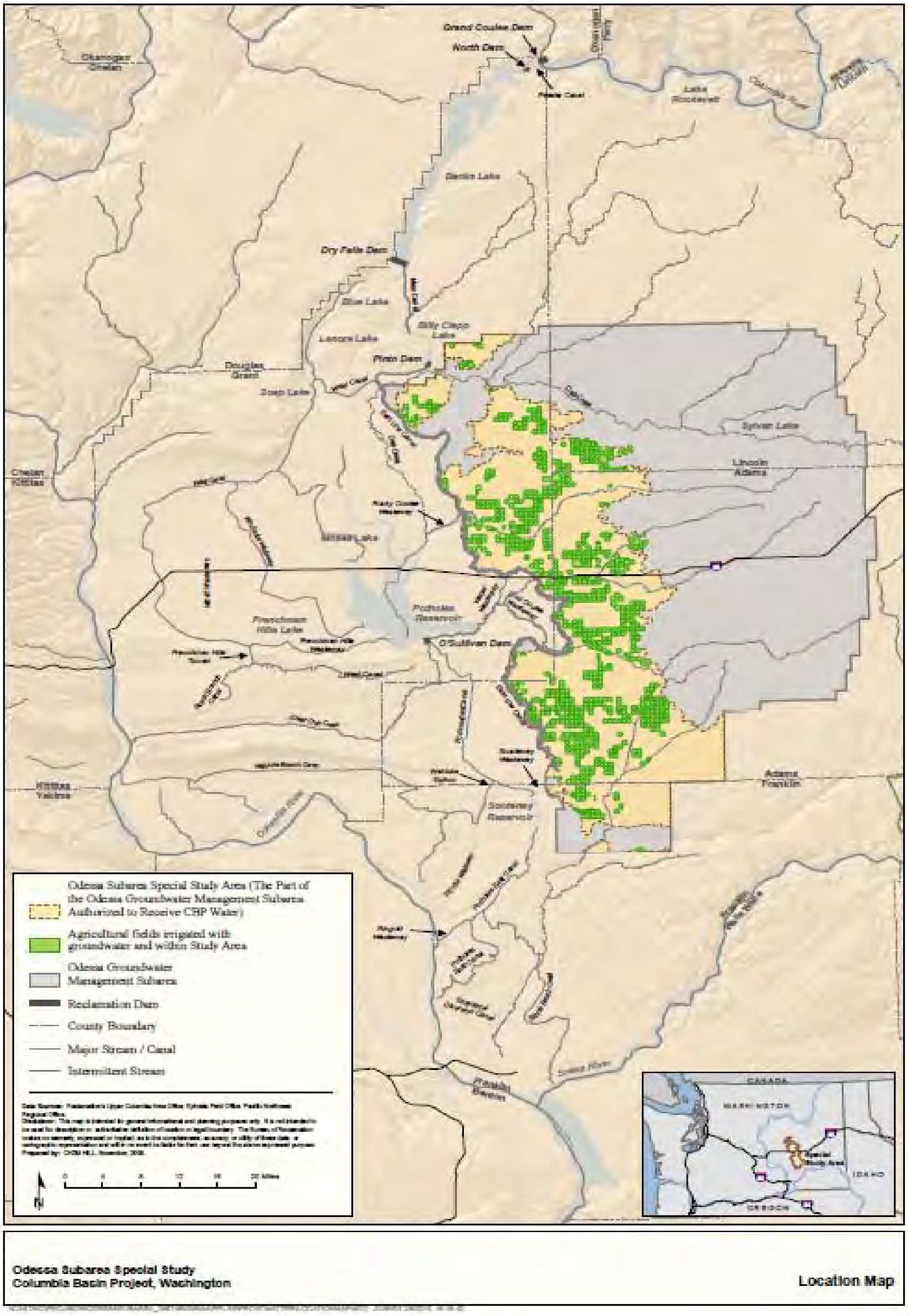

Figure 1. Project Area Map (Reclamation 2010, p. 4)

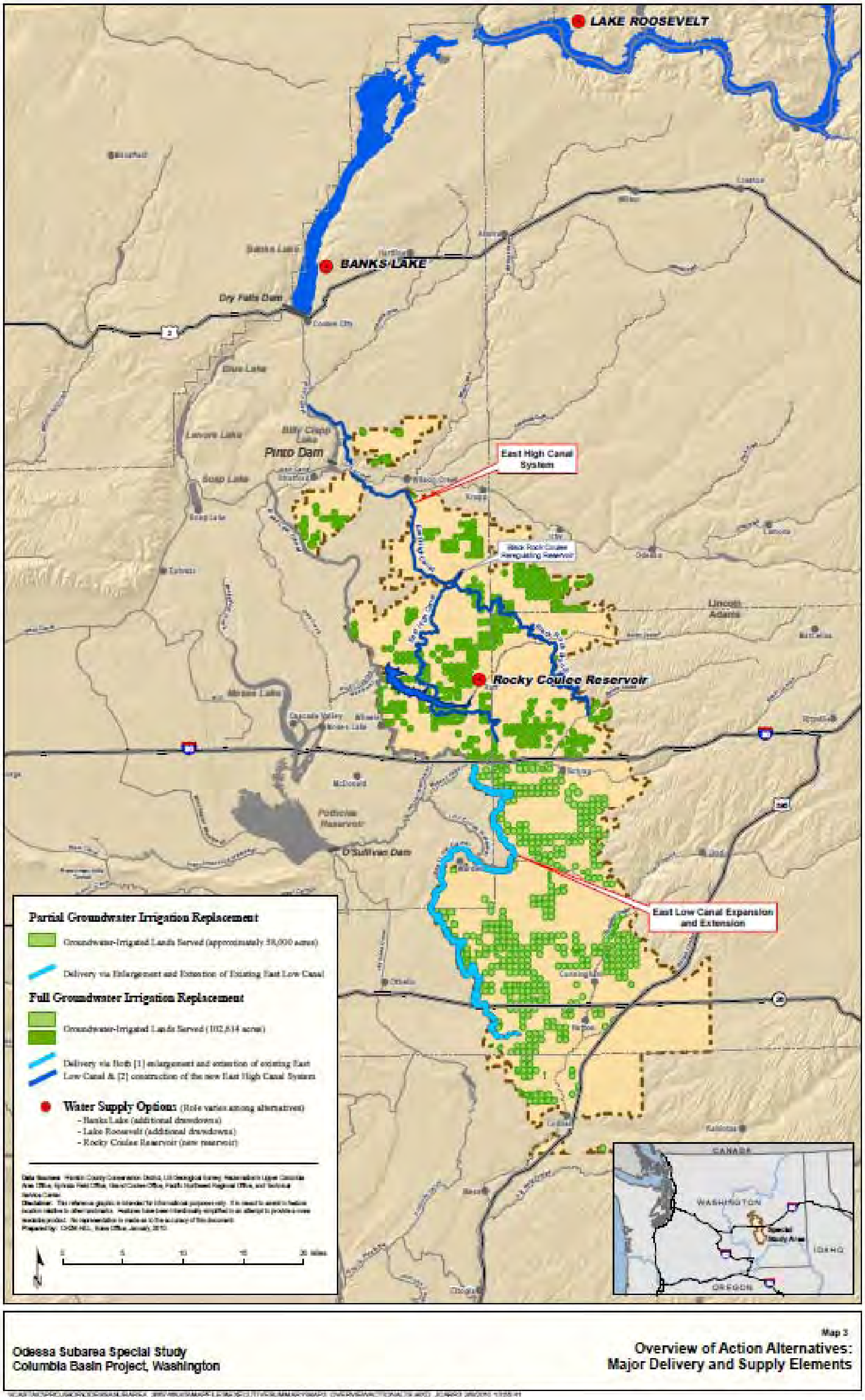

Figure 2. Map of Action Alternatives

5.0 FISH AND WILDLIFE RESOURCE CONCERNS

The term "wildlife resources" as used herein includes birds, fish, mammals, and all other classes of wild animals and all types of aquatic and land vegetation upon which fish and wildlife are dependent, pursuant to the Fish and Wildlife Coordination Act (16 USC § 666(b)). Shrub-steppe habitat, native grasslands, and riparian corridors are of primary importance to the Service and to WDFW because these habitats are limited in availability, rich in species, and support some of the rarest species in the Columbia Basin. However, all fish and wildlife resources were considered in this report.

Wildlife resources within the Project Area are briefly described below. More details about these resources can be found in the draft environmental analysis, section IV.

5.1 Aquatic Habitats

Major water bodies within the Project Area include Banks Lake, Lake Roosevelt, Billy Clapp Lake, and Potholes Reservoir, all of which are part of the existing surface water conveyance operated by Reclamation (Figure 1). Many smaller water bodies also exist within the Affected Area. The major water bodies, from North to South are described as follows:

- Lake Roosevelt National Recreation Area is located in northeastern Washington, along the mainstem of the Columbia River. Grand Coulee Dam was completed in 1942 and is operated by Reclamation in Grand Coulee, Washington. The dam creates 154 mile-long Lake Roosevelt, which includes 29 mile-long Spokane Arm. At 81,389 acres, it is the sixth largest reservoir in the U.S. and is managed cooperatively with the National Park Service and local Native American tribes. Most of the water in Lake Roosevelt originates as glacial ice, lakes, and snow high in the Canadian Rockies.

- Billy Clapp Lake is a 1,000 acre equalizing reservoir located 10.5 miles downstream from Banks Lake and maintains equilibrium in the distribution system between the primary water supply and the consumer. The lake is basically a wide spot in the main canal with an average inflow/outflow rate of 6500 cfs of water during normal irrigation demand periods. This results in a rather rapid turnover rate for the reservoir, less retention of nutrients, and a more lotic environment than Banks Lake. These characteristics complicate intensive management of this water body. Irrigation water provides the continuous recruitment and entrainment from Banks Lake of the fish species present in the lake.

- Banks Lake is a re-regulation reservoir for the CBP which is located in the upper Grand Coulee in central Washington. Banks receives its water supply from Grand Coulee Dam and was developed by Reclamation primarily to receive and store water from the Columbia River via pumps at Grand Coulee Dam. It then provides the irrigation water supply for the Columbia Basin Irrigation Project through a system of canals and laterals starting at the southern end of Banks Lake at the Main Canal. This reservoir's regulating function is to temporarily store excess water from rainfall, water delivery loss and inflow from the rivers, on the upstream side of another dam, so that it can be put back into the system and used further downstream. Banks Lake holds over one million acre/feet (ac-ft.) of water, but supplies over 2.4 million ac-ft. to the Project Area each year.

- Potholes Reservoir is a 28,200-acre reservoir formed by the construction of O'Sullivan Dam across the Crab Creek Valley in 1949. Water flows into the reservoir from the outlet of Moses Lake via Crab Creek, and irrigation return water from Winchester Wasteway, Frenchman Hills Wasteway, and Lind Coulee. Water discharge occurs through O'Sullivan Dam to the Potholes Canal to irrigate farmlands in Adams and Franklin counties. Owned by Reclamation, with fish resources managed by WDFW, Potholes Reservoir is renowned for its warm water fishery and wetland habitat. Seepage from Potholes Reservoir and the elevated water table resulting from the CBP created many lakes, sloughs, streams, wet meadows, and marshes that provide diverse habitats for fish, waterfowl and other migratory birds in what is now the Columbia National Wildlife Refuge.

The Columbia Basin has four major watersheds: Crab, Douglas, and Foster creeks that flow to the Columbia River, and the Palouse River that flows to the Snake River. Only Crab Creek is within the Project Area. Upper Crab Creek begins above the Columbia River canyon in Spokane County and flows southwest to Wilson Creek in Grant County, then on to Moses Lake. Additional water is supplied to the watershed via a canal system from Banks Lake, Crab Creek that intersects below Billy Clapp Reservoir.

Wasteways are channels used to divert surplus flow from the main canal systems into a natural or constructed drainage channel. Wasteway channels have seasonal and daily flood patterns not typical of native streams. Several coulees that had intermittent streams prior to the CBP now support perennial flow, including Crab Creek, and Rocky, Lind, and Red Rock coulees.

Crab Creek flows through several lakes starting with Sylvan Lake in south-central Lincoln County, then Brook, Round, Willow, and Moses Lakes, as well as Potholes Reservoir in Grant County. Crab Creek is over 124 miles (200 km) in length and drains an area of some 5,097 square miles (13,200 square kilometers). The creek was created by the ancient floods of Lake Missoula, and it winds along in rocky channels for most of its length. The creek is separated into to three major reaches:

- Upper Crab Creek—from its source near Reardon, Washington downstream to Brook (Stratford) Lake;
- Middle Crab Creek— from Brook Lake to, and including, Potholes Reservoir;
- Lower Crab Creek— from below Potholes Reservoir to the Columbia River.

5.1.1 Declining Aquifer

The Plan of Study (Reclamation 2006a, p. 9) states that the Columbia Basin Development League has estimated that 170,000 acres are irrigated with groundwater from the Odessa Subarea; an area larger than described as the Project Area. Water use has diminished the aquifer to the extent that irrigators in the Odessa Subarea have had to drill their wells to a depth of over 2,000 feet at costs of over $4,000. Pumping water from that deep has increased costs to run the wells. As wells get deeper, water quality decreases. With less water in the aquifer, concentrations of impurities, such as sodium, in the water increase, increasing water density and decreasing water quality.

5.1.2 Wetlands

The number of wetlands in Washington has declined by 30 percent, with the loss of freshwater wetlands estimated at 25 percent from historic levels (USFWS 2003a, pp. 5-7). Losses have been attributed to agriculture conversion including grazing; filling for solid waste disposal; road construction and commercial, residential and urban development; construction of dikes, levees and dams for flood control, water supply and irrigation; discharges of materials; hydrologic alteration by canals, drains, spoil banks, roads and other structures; and groundwater withdrawal. Aside from direct losses in the quantity of wetlands, many wetlands have also been reduced in quality resulting from the above factors.

Wetlands in the Affected Area provide an array of functions, such as providing important habitat for fish and wildlife, groundwater recharge, floodwater storage, nutrient uptake, and recreational opportunities. Because both the Affected Area and the Project Area are mostly situated in a semi-arid environment, wetlands are extremely important to the survival of numerous wildlife species, as they provide some of the best vegetation for food and cover, invertebrate production, and water.

Several species of waterfowl dependent on riparian and wetland habitat may be found in the both the Affected Area and the Project Area. Appendix A lists representative birds and their current trends. Some common wetland plants found in both the Affected Area and the Project Area include common cattail (*Typha latifolia*), hardstem bulrush (*Scirpus acutus*), spikerush (*Eleocharis species.*), sedges (*Carex species*), scouring rush (*Equisetum hyemale*), reed canarygrass (*Phalaris arundinacea*), meadow foxtail (*Alopecurus pratensis*), common reed (*Phragmites australis*), as well as black cottonwood (*Populus trichocarpa)*, which is a dominant overstory species. Willows (*Salix* sp.) and Russian olive (Elaeagnus angustifolia L.) are typical understory species found in wetlands within both the Affected Area and the Project Area. Aquatic plants can include pondweeds (*Potamogeton* sp.), coontail (*Ceratophyllum demersum*), Eurasian milfoil (*Myriophyllum spicatum*) and duckweeds (*Lemna* sp.) (USFWS 2003, pp. 5-7).

5.2 Shrub-steppe Habitat

Current shrub-steppe conditions in the Columbia Basin are greatly altered from those existing prior to European-American entry into the area. Wooten (2003, p. 14) estimated that only 46.3 percent of previously existing shrub-steppe habitat remains in the Basin. Ninety-eight percent of this habitat loss is attributable to farmland development. Previously, Dobler *et al.* (1996, p. 10) reported that from 62 percent (Lincoln County) to 76 percent (Adams County) of the shrub-steppe habitat within the Project Area has been lost (Table 1). Dobler (1996, p.10) reported that almost 60% of the remaining shrub-steppe habitat is privately owned.

Table 2. Remaining shrub-steppe habitat by county (Wooten 2003, p.15)

County	Historical (acres)	Remaining (acres)	Percent Lost (%)
Adams	1,187,399	279,758	76
Franklin	753,716	230,778	69
Grant	1,614,555	571,830	65
Lincoln	1,260,032	473,674	62
Total	4,815,702	1,556,040	68

Undisturbed shrub-steppe habitat is dominated by big sagebrush (*Artemisia tridentata*) as the principal shrub and bluebunch wheatgrass (*Pseudoroegneria spicata*) as the principal grass (Dobler 1996, p. 10). Much smaller amounts of gray rabbitbrush (*Ericameria nauseosa*) and green rabbitbrush (E. *viscidiflorus*), spiny hopsage (*Grayia spinosa*), three-tip sage (*Artemisia tripartite*) and horsebrush (*Tetradymia canescens*) may occur in the shrub layer. Cheatgrass (*Bromus tectorum*), a nonnative annual grass, has become widespread throughout the region. In some areas it has replaced native grass species within the native shrubs and forbs. In other areas, shrubs are completely absent and cheatgrass is essentially the only species that occurs (Dobler 1996, p. 10).

5.3 Riparian Habitat

As used in this report, the term "riparian habitat" is defined as the area adjacent to flowing (i.e. streams, rivers) waters that contain elements of both aquatic and terrestrial ecosystems which mutually benefit each other (Crawford 2007, p. 7). They generally occur as relatively narrow linear units along rivers, creeks, lakes and ponds. Riparian areas also include forested and scrub-shrub habitats that are too dry to be classified as wetlands, gravel bars, and other stream related habitats and vegetation. Thus, palustrine, lacustrine, and riverine habitats would be considered a subset of the overall area described as riparian areas in this report.

In order to define habitat types in a workable manner, scrub shrub, mesic shrub, and riparian forest cover types were combined for mapping purposes. Mesic shrub and riparian forest were merged with scrub shrub to form the Scrub Shrub/Mesic Shrub/Riparian Forest cover type. The vegetation found in the riparian forest cover type is hydrophytic in nature, which lent further support to this classification (WDFW 2009d, p. 31).

Dispersed throughout the shrub-steppe habitat are areas of streamside or riparian habitat. Knutsen and Naef (1997, pp. 8-10) estimate between 50 and 90 percent of previously existing riparian areas on the Columbia Plateau have been destroyed or drastically altered. Since the early 1800s, the annual loss statewide averages 2,034 acres per year (Knutsen and Naef 1997, pp. 8-10). However, accurate estimates of annual riparian loss are not available for the Project Area.

Although irrigation and agricultural conversion may adversely impact riparian habitats, it is also true that seepage and leaks from irrigation systems may create riparian and wetland areas (Canning & Stevens 1990, p.2; Furnald & Guldan 2004, pp. 1-3). This is especially apparent along the East Low Canal. Reclamation reports that waterfowl, especially, often use the embayments that were created to control water flow (Dave Kaumheimer, USBR, 2010, *pers. comm*.)

Undisturbed riparian areas in the Project Area contain rose (*Rosa* spp.), serviceberry (*Amelanchior alnifolia*), and hawthorn (*Crataegus douglasii*). WDFW (2009d, p. 4) reports that "…. riparian vegetation found in scrub shrub wetlands includes, but is not limited to, willows (*Salix* spp.), rose (*Rosa* spp.), water birch (*Betula occidentalis*), black cottonwood (*Populus trichocarpa*), aspen (*P. tremuloides*), hawthorn (*Crataegus douglasii*), and serviceberry (*Amelanchier alnifolia*). Native and introduced herbaceous wetland species consist of cattail (*Typha latifolia*), common reed (*Phragmites* spp.), reed canary grass (*Phalaris arundinacea*), purple loose-strife (*Lythrum salicaria*), and various sedges (*Carex* spp.) and sedges (*Juncus* spp.)…"

5.4 Animals

5.4.1 Birds
A total of 151 species of birds were observed within the study area during the Service's studies for the Banks Lake Drawdown project; this total number of species is indicative of the total Project Area. A representative list of birds found in the Project Area is shown in Appendix A. A total of 104 species of birds were found within the Project Area during surveys conducted in 2009 (WDFW 2009c, p.7).

5.4.2 Raptors
Large amounts of excellent raptor nesting habitat in the basalt cliffs and the diversity of other habitat within the Banks Lake area have resulted in a high diversity of raptors using the study area, including nesting peregrine falcons and nesting bald eagles.

5.4.3 Colonial Nesting Birds
Nesting colonies of grebes occur within Osborne Bay and Devils Punch Bowl in Banks Lake, and are present in smaller numbers at other sites. Breeding colonies or concentrations of Grebes are of special concern to WDFW, as 54 nesting pairs have been reported for Banks Lake (Rich Finger, 2010, pers. comm.).

5.4.4 Waterfowl
Waterfowl use primarily occurred during the breeding seasons of March, April, and May, below Dry Falls Dam, Devils Punch Bowl (close to Steamboat Rock), and Osborne Bay. More scattered use occurs in the smaller bays and inlets on the main lake and other wetlands throughout the Affected Area as well as the Project footprint. Waterfowl use is heaviest and contains the highest diversity of species throughout the field season in the various wetlands and ponds below Dry Falls Dam.

5.4.5 Shorebirds
Shorebird use of the Banks Lake area is diverse; however, their numbers are low. It is likely that shorebirds are normally found in lower numbers, during migration and breeding seasons, because there is little suitable habitat. The area with the highest shorebird use is the area below Dry Falls Dam, although a diversity of shorebirds is found throughout the Affected Area. Shorebirds may also be found at Lake Billy Clapp, Potholes Reservoir, Gloyd Seeps, lower Crab Creek, Seeps Lake and along the Audubon Trail in Grant County.

5.4.6 Neotropical Migratory Birds
Neotropical migratory birds (NTMB) are species which breed in the United States and Canada and then migrate south to Mexico, Central or South America or the Caribbean to spend the winter. They do not include waterfowl, shorebirds, or herons and egrets, even though some species in these groups also winter south of the Mexico-United States border. There is widespread concern about the future of NTMB, since many of these species have experienced large population declines due to habitat destruction on the breeding grounds, wintering areas, and along migration routes (USFWS 2003, pp. 5-7). In addition to riparian and wetland habitats, which are important for two-thirds of the NTMB within that study area, mesic shrub and shrub-steppe habitats are also important to several of these species.

5.4.7 Mammals

Previous work has identified a minimum of thirty-four mammal species that are present in the Project Area (Appendix B). These mammals play an important part in maintaining the diversity of the Affected Area by providing multiple layers in the food web and maintaining stable habitat functions. WDFW (2009c, p. 7) reports 15 species of mammals were observed during the 2009 surveys.

5.4.8 Reptiles and Amphibians

At least eleven species of amphibians and reptiles have been documented within the study area. Appendix C is a checklist for reptiles and amphibians within the Project Area. The Service used this list as representative of the Project Area, and Project effects on these species are examined in this report. WDFW (2009c, p. 7) reports 5 species of reptiles and amphibians were observed during the 2009 surveys.

5.5 Fish

Lake Roosevelt, Banks Lake, Potholes Reservoir, and Billy Clapp Lake contain numerous fish species. These species include peamouth chub (*Mylochelius caurinus*), northern pikeminnow (*Ptychochelius oregonensis*), carp (*Cyprinus carpio*), longnose sucker *(Catostomus catostomus*), largescale sucker (*Catostomus macrocheilus*), bridgelip sucker (*Catostomus columbianus*), brown trout (*Salmo trutta*), mountain whitefish (*Prosopium williamsoni*), lake whitefish (*Coregonus clupeaformis*), brown bullhead (*Ictalurus nebulosis*), walleye (*Stizostedion vitreum*), bluegill sunfish (*Lepomis macrochirus*) and prickly sculpin (*Cottus asper*), yellow bullhead (*Ictalurus natalis*), white catfish (*I. catus*), channel catfish (*I. punctatus*) and smallmouth bass (*Micropterus dolomieui*).

The Crab Creek Sub-basin hosts a rather large assemblage of fish species. Much of this assemblage has developed over the past 100 years as human settlement in the region contributed to establishment of many nonnative species and stocks. However, trout were one of the native fishes of Crab Creek.

In summary, the primary species of commercial or recreational importance within the watershed are lake whitefish, steelhead and rainbow trout, brown trout, Lahontan cutthroat trout, Chinook salmon (summer/fall run), kokanee, brown bullhead, walleye, largemouth bass, smallmouth bass, bluegill, black crappie, yellow perch, and burbot.

5.6 Threatened and Endangered Species

5.6.1 Pygmy Rabbit

The pygmy rabbit (*Brachylagus idahoensis*) (USFWS 2003b) is the smallest native rabbit species in North America. It is distributed in patches of sagebrush-dominated areas of the Great Basin of Oregon, California, Nevada, Utah, Idaho, Montana, Wyoming, and Washington. Washington populations are isolated from the core of the species’ range, apparently having been separated for thousands of years. Today, the known Washington range of the pygmy rabbit is greatly restricted. Museum specimen records and reliable sight records show that pygmy rabbits formerly occupied sagebrush habitat in five Washington counties: Benton, Adams, Grant, Lincoln, and Douglas. Pygmy rabbit habitat occurs in the Project Area; although all known pygmy rabbits are currently in captivity, awaiting reintroduction.

The pygmy rabbit is the only rabbit native to North America that digs its own burrows. It is also uniquely dependent upon sagebrush, which comprises up to 99% of its winter diet. Dense sagebrush and relatively deep, loose soil are important characteristics of pygmy rabbit habitat. The primary factor contributing to the decline of the pygmy rabbit in Washington has been loss of habitat due to the conversion of habitat into agricultural areas.

In 1990, the pygmy rabbit was listed as a threatened species by the Washington Wildlife Commission. The Commission reclassified the species to Endangered in 1993. The species was listed federally as Endangered on March 5, 2003 (USFWS 2003b).

5.6.2 Bull Trout

The bull trout is a wide ranging, salmonid species that formerly inhabited most of the cold lakes, rivers and streams throughout the western states and British Columbia. It exhibits two life forms, resident and migratory. The resident form inhabits streams and grows to about twelve inches. The migratory form commonly exceeds twenty inches in length and spawns in streams, where juveniles live for some time before migrating to rivers and lakes. Bull trout are piscivorous and require an abundant supply of forage fish for vigorous populations.

Bull trout require cold water, with 7-8^{o}C appearing optimal for all their seasonal activities and 15^{o}C maximum. Spawning occurs in cooling water below 9^{o} C. Optimal incubating temperature seems to be 2-4^{o}C. Spawning occurs from August through November and eggs hatch in late winter or early spring. Emergence occurs in early April through May, commonly following spring peak flows. Because of extended time in the substrate, bull trout are susceptible to mortality in unstable conditions. Successful reproduction requires channel and substrate stability and adequate winter water flow to prevent the substrate from freezing. Bull trout require complex forms of instream cover. Adults use pools, large woody debris and undercut banks for resting and foraging. Juveniles also use side channels and smaller wood in the water. Freely flowing rivers and streams are necessary for bull trout to move between safe wintering areas and summer foraging areas are also necessary.

During the winter months, temperatures are cool enough for bull trout to use the reach and predate on small steelhead. Reclamation maintains temperature data for the lower Crab Creek. Although bull trout presence has not been confirmed, the instream habitat conditions of Crab Creek are conducive to seasonal use by bull trout. Also, migratory and resident populations of bull trout do occur above and below the project in the Columbia River. Using an upper growth-limit temperature of 15° C and Reclamation temperature data as shown in Appendix D (Gina Hoff 2007, *pers. comm.*), we presume bull trout occupy lower Crab Creek, especially during the winter months, for foraging purposes.

The coterminous United States population of the bull trout *(Salvelinus confluentus)* was listed as threatened on November 1, 1999 (USFWS 1999a). Bull trout in the Columbia River Distinct Population Segment were listed as threatened on June 10, 1998 (USFWS 1998). The bull trout occurs in the Klamath River Basin of south-central Oregon and in the Jarbidge River in Nevada, north to various coastal rivers of Washington to the Puget Sound and east throughout major rivers within the Columbia River Basin to the St. Mary-Belly River, east of the Continental Divide in northwestern Montana.

5.6.3 Steelhead

Steelhead (*Oncorhynchus mykiss*), an anadromous form of rainbow trout, inhabit lower Crab Creek to forage (KWA 2004, p. 39), Steelhead adults and juveniles use the Columbia River; however, the presence of steelhead (adults) have also been confirmed within Red Rock Coulee of the Crab Creek drainage. Steelhead may be able to ascend higher in Crab Creek, but potential passage barriers have not been thoroughly described for most of the reach, which is privately owned. A natural falls south of McManamon Road may pose a barrier about 35 miles (56 km) above the mouth. Documentation exists indicating steelhead were planted in both upper and lower Crab Creek in the past. However, we were unable to find specific planting information regarding dates, specific locations, numbers of fish, or origin.

NOAA Fisheries describes the end of the anadromous portion of Crab Creek as the base of O'Sullivan Dam. As with Chinook salmon, steelhead use of Crab Creek prior to irrigation development was probably very limited, and most certainly the stream would not have produced smolts, given its ephemeral character.

Spawning habitat within Crab Creek appears to be limited due to high silt loads, temperature and water quality. With present perennial flows, no information has yet been discovered that indicates steelhead produce smolts in lower Crab Creek. Conceivably, young parr may move out of Crab Creek and finish rearing in the Columbia. Due to the large presence of rainbow trout (stocked and naturally reproducing), it has been difficult to determine if steelhead par are migrating to the Columbia to rear. The presence of resident rainbows in Red Rock suggests that steelhead might well be successful in producing smolts in this tributary.

The lower 35 miles (56 kilometers) of Crab Creek are used by steelhead (O. mykiss) (KWA 2004, p.44) and are designated critical habit for the species (NOAA and NMFS 2006).

5.6.4 Spalding's Catchfly

Spalding's catchfly is a long-lived perennial in the carnation or pink family. The species is native to portions of Idaho, Montana, Oregon, Washington, and British Columbia, Canada, and is found predominantly in bunchgrass grasslands and sagebrush-steppe habitats, and occasionally in open pine habitats. The plant was listed as a federally threatened species in 2001 (USFWS 2001a). A final recovery plan for the species was published on October 12, 2007 (USFWS 2007a).

Spalding's catchfly blooms from mid-July through August, and occasionally into September, producing small white tubular flowers. It emerges in spring and dies back to below ground level in the fall. It can remain dormant for up to 6 consecutive years. Plants range from 8 to 24 inches in height, occasionally up to 30 inches tall. There is generally one distinctively yellow-green stem per plant; but it may have multiple stems. Each stem bears four to seven (up to 12 or more) pairs of leaves that are 2 to 3 inches in length, and has swollen nodes where the leaves are attached to the stem. All green portions of the plant are covered in dense sticky hairs that frequently trap dust and insects, hence the common name "catchfly". The plant's long taproot makes transplanting the species difficult. The species is typical of grasslands ranging from the Palouse Prairie and Northern Great Plains types, found in the Ponderosa biogeographic climatic zone. Exact locations of the species within the Project Area and the Project footprint are unknown.

5.6.5 Ute Ladies'-tresses

Ute ladies'-tresses (*Spiranthes diluvialis*) is a perennial, terrestrial orchid with 7 to 32-inch stems arising from tuberous thickened roots. The flowering stalk consists of few too many small white or ivory flowers clustered into a spiraling spike arrangement at the top of the stem. The species is characterized by whitish, stout flowers. It generally blooms from late July through August.

The orchid occurs along stable riparian edges, gravel bars, old oxbows, high flow channels, and moist to wet meadows along perennial streams. It typically occurs in stable wetland and seep areas associated with old landscape features within historical floodplains of major rivers, as well as in wetlands and seeps near freshwater lakes or springs. Ute ladies'-tresses ranges in elevation from 720 to 1,830 ft in Washington to 7,000 ft in northern Utah. Nearly all occupied sites have a high water table (usually within 5 to 18 inches of the surface) that is augmented by seasonal flooding, snowmelt, runoff and irrigation. The orchid is known in Colorado, Idaho, Montana, Nebraska, Nevada, Utah, Washington, and Wyoming. In Washington, it occurs in Okanogan and Chelan Counties. The Ute ladies' tresses is currently listed as a federally threatened species (USFWS 1992). A range-wide review was conducted in 2005. Exact locations of the species within the Project Area and the Project footprint are unknown.

5.7 Candidate Species

5.7.1 Greater Sage-Grouse

Sage-grouse in Washington belong to the western subspecies of greater sage-grouse (*Centrocercus urophasianus*). In 2010, the Service determined that listing the greater sage-grouse was warranted but precluded by higher priority listing actions; which resulted in the species, including those in Washington, becoming a federal candidate species (USFWS 2010). Greater sage-grouse occur within the Project Area.

In eastern Washington, the sage-grouse is found from 1,000 to 4,000 feet in elevation (the highest point on the Yakima Training Center). It is an omnivore, feeding on soft plants, primarily sagebrush a necessary component of its diet, and insects.

Agricultural conversion of shrub-steppe habitat is the primary cause of the decline of the grouse. Because the sage-grouse is so closely tied to sagebrush, conversion of shrub-steppe habitats destroys the species' food plants and cover. Intensive grazing of their habitat also reduces cover and forage for the grouse.

The historic range of the sage-grouse included Washington, Oregon, eastern California, Nevada, Idaho, Montana, Wyoming, western Colorado, Utah, South Dakota, North Dakota, Kansas, Oklahoma, Nebraska, New Mexico, Arizona and the Canadian provinces of British Columbia, Alberta and Saskatchewan. The distribution of greater sage-grouse has contracted, most notably along the northern and northwestern periphery and in the center of the historic range. The Columbia Basin population of the greater sage-grouse is isolated from remaining greater sage-grouse populations. Currently there are between 100,000 and 500,000 greater sage-grouse, with an estimated 1,292 Columbia Basin sage-grouse occurring in Washington as of spring 2010, primarily on private land (Sage-Grouse Working Group 2010). There are two Columbia Basin sage-grouse populations remaining in Washington, one in Douglas and Grant counties and one in Yakima and Kittitas Counties. Both populations are two small to be considered viable. Several attempts have been made to establish new populations, including one in Lincoln County.

Although sage-grouse remain in translocation areas, they are not yet considered viable populations.

The Project Area is located within (depending on final location of Project infrastructure) these five Sage-Grouse Management Units, which were designated in the *Washington State Recovery Plan for the Greater Sage-Grouse* (Stinson and Schroeder 2004, pp. 28-29):

- Crab Creek Sage-grouse Management Unit;
- Dry Falls Sage-grouse Management Unit;
- Saddle Mountain Sage-grouse Management Unit;
- Hanford Sage-grouse Management Unit, and;
- Potholes Sage-grouse Management Unit.

5.7.2 Washington Ground Squirrel

The Washington ground squirrel **(***Spermophilus washingtoni)* spends much of its time underground. Adults emerge from hibernation between January and early March, depending on elevation and microhabitat conditions. Males emerge before females. Their active time is spent in reproduction and feeding activities in preparation for their six-month or longer dormancy.

Although the species is associated with sagebrush-grasslands of the Columbia Plateau, recent studies indicate that silty soils in the Warden Soil series, are particularly favored by this squirrel for burrow locations. Soil type may be the most important habitat feature. Warden Soils not only have a high silt content, they are very deep, allowing for deeper burrows that maintain their structure compared to sandy or shallow soils. Warden Soils typically occur east and south of the Columbia River. The species occurs in scattered location throughout the Project Area.

Agricultural conversion of shrub-steppe habitat is the primary cause of the decline of the Washington ground squirrel. Tilling and other mechanisms involved in conversion of shrub-steppe habitats destroy the species' food plants and burrows. Intensive grazing of their habitat reduces cover and forage. Since they are often viewed as pests, these squirrels are also subject to illegal recreational shooting and poisoning.

The Washington ground squirrel became a candidate species in October 1999 (USFWS 1999b). An annual review of the species was last conducted in November 2009 (USFWS 2009).

5.7.3 Northern Wormwood

Northern wormwood (*Artemisia campestris ssp. borealis var. wormskioldii* [Bess. ex Hook.] Cronq.) is a low growing, tap rooted, biennial or perennial shrub in the Asteraceae (composite) plant family. Northern wormwood is 20 to 60 inches tall with greenish to red stems covered by stiff hairs. Leaves occur in crowded rosettes, are 1 to 4 inches long, divided into linear divisions, and are covered by dense silky hairs. Plants typically begin to flower in April, but individual plants occasionally flower throughout the growing season. The inflorescence is narrow and spike-like to diffuse and panicle-like. Flowers are pale yellow to yellow.

Northern wormwood generally grows in arid shrub steppe vegetation. Plants grow within the flood plain of the Columbia River and occasionally are flooded. Plants are generally sparsely distributed covering less than 1% of the suitable habitat at known sites. Northern wormwood is a narrow endemic species that has only two populations, which occur in Grant and Klickitat Counties.

In addition to direct loss of habitat as a result of dam construction, the manipulation of water flows by hydroelectric dams is a major threat to this variety. The severity of spring floods has been reduced or eliminated in most years. Altered water regimes, as well as recreational uses and grazing, have allowed nonnative plants to invade both sites. Threats that are increasingly significant in smaller populations are related to the loss of genetic variability due to random changes in gene frequencies (genetic drift). Loss of genetic variability can affect disease resistance, response to climatic change, and reproductively compatible gene combinations (genotypes) (USFWS 1999b).

5.7.4 Yellow-billed cuckoo

Yellow-billed cuckoos were known to occur statewide, but are considered extirpated in Washington, and the occasional sightings are vagrants. Historically, they nested along wooded rivers in eastern Washington, along the shores of Lake Washington (King County), in Tacoma (Pierce County), and in Whatcom County. A recent observation in Washington was a single bird near Elma at Vance Creek County Park (Grays Harbor County) in 1996. In 1997, the peregrines that nest in downtown Seattle were captured on video, feeding a Yellow-billed Cuckoo to their nestlings. In the latter half of the 20th Century, there were three sightings along forested stream-sides in eastern Washington. Other sightings in the past few decades were along historical breeding grounds on the shore of Lake Washington and in a cottonwood grove along the Snohomish River near Sultan (Snohomish County). Western yellow-billed cuckoos breed in dense willow and cottonwood stands in river floodplains.

In the western United States, the yellow-billed cuckoo was accorded candidate status in July 2001 (USFWS 2001b). An annual review was conducted in December 2009 (USFWS 2009).

5.8 Species of Concern

A “species of concern” is a species in need of concentrated conservation actions in order to keep them from becoming threatened by extinction. Such conservation actions vary depending on the health of the populations and degree and types of threats the species is subject to. “Species of concern” receive no legal protection under the federal Endangered Species Act or state law and may or may not be proposed for listing as a threatened or endangered species. However, it is prudent to be proactive regarding conservation actions for these species, since they are rare. Species of concern that may be found in the Project Area are shown in Appendix D.

6.0 EVALUATION METHODS

At this time, Reclamation has not chosen a Preferred Alternative; therefore, all nine proposed alternatives have been analyzed for this report, including the No-Action Alternative.

Since the greatest uncertainty lay with the placement of terrestrial elements of the Project and their effect on terrestrial communities the alternatives were analyzed to balance benefits and impacts to wildlife habitat using a general method. Habitat impacts were analyzed using several sets of information. First, WDFW performed wildlife surveys to determine the presence of species of interest. Secondly, Habitat Evaluation Procedures models for a representative set of wildlife species that occur in habitats within the Project Area were used to determine representative habitats and suitable Habitat Suitability Indices for the various portions of the Project footprint. Thirdly, the types of facilities and activities that Reclamation planned and their general location were used to determine habitat loss and degradation, as seen in the EIS maps. Alternatively, a second method, using the estimates of acres impacted that Reclamation estimated in the EIS were used. Using these data, predicted impacts to five selected terrestrial habitats were analyzed, by the two separate methods:

- Riparian and riparian/ mixed habitat;
- Shrub-steppe habitat;
- Grasslands;
- Emergent wetlands, and
- Agricultural lands.

Whether the Project would impact federal and state listed species, candidate species, and the species of concern was taken into consideration. However, impacts to listed species and species of concern were not weighted differently as consultation under section 7 of the Endangered Species Act of 1973, as amended, will be conducted at a later date. Impacts to listed and sensitive species were, however, given special consideration in determining priority habitats that were of concern, in identifying mitigation measures, and in selection of the Service's recommended alternative.

Values representing the degree of negative impact were assigned to each of the five terrestrial habitat types, from 1 (low impact), 2 (medium impact) to 3 (high impact). Determinations were made qualitatively. A low impact would produce minimal impacts. A rating of "1" could be due to small area, short temporal span, or minor degradation. A high impact ("3") would typically be permanent, highly destructive, or cover a large area.

Two impact analyses were conducted to determine the effects of each alternative. One used the acreages from the HEP surveys, while the other used the acreages provided by Reclamation and set forth in the EIS. A mean value was calculated for each alternative and the relative magnitude of impacts were compared to determine the alternative estimated to have the least impact to each habitat type. The results from each analytical method were compared to determine which alternative was the least destructive, overall.

Finally, a modified alternative was created using the least destructive alternative modified by incorporating the mitigation suggestions set forth later in this report. These mitigation suggestions were determined by specifically addressing expected impacts resulting from Project implementation.

6.1 Assumptions in the Effects Evaluation Methods

Natural processes, as well as predicted effects of the alternatives, will change conditions in the Project Area, such as climate change and water conservation measures. While future impacts associated with construction and implementation +are reasonably predictable, a measure of uncertainty exists as to the magnitude of their affect. For the purpose of our analysis, we assume that future natural impacts will occur equally under the No Action Alternative and the action alternatives.

Some reasonable assumptions were made in the analysis, due to the lack of specific information regarding the exact location of proposed facilities, existing habitat mapping, and construction methods for proposed facilities. These assumptions were consistently made, within each analysis, to evaluate project effects on wildlife resources:

- That the total area of each constructed facility is composed of the same amounts of habitat types as obtained by the WDFW surveys.

- Destruction of the living soil crust (biotic or cryptogrammic soil) will result in long-term destruction of the habitat, effectively equaling permanent destruction (Stinson 2004, pp. 41-43; Mike Gregg, USFWS, May 3, 2010, *pers. comm*.). Long-term impacts were presumed to occur throughout the easement areas, thus will require extensive rehabilitation efforts to avoid permanent impacts.

- A permanent increase in depredation by avian predators will result from construction of new transmission lines and fences. The area of predation will extend up to 4.3 miles (6.9 kilometers) on each side of the transmission lines (Connelly *et al* 2004, p. 13-21).

- Mitigation and replacement habitat will be of optimal quality. If mitigation areas of suitable quality cannot be found or acquired, further adjustments in the area needed will have to be made**.** Actual mitigation requirements will be calculated upon completion of final construction surveys.

6.2 Assessment of Aquatic Habitats and Species

To assess Project impacts on aquatic habitats and aquatic species, we evaluated different life-stage parameters and habitat elements necessary for aquatic vertebrate, invertebrate, and plant species. We evaluated changes to water quality, habitat access, channel conditions and dynamics, habitat elements, flow and hydrology, and watershed conditions.

6.3 Impacts of Noise

Temporary impacts from noise will result from Project construction. Impacts will vary seasonally. Avoidance has less impact on a species than nest or den abandonment, which would be likely to occur during the breeding season. Additional noise will result from operation and maintenance of the Project. These impacts will likely interfere with vital behavior (i.e. breeding) in mammals and birds. Fish are also likely to be affected by noise (Federal Highway Administration 2004, p. 7). Noise effects are less likely to occur in invertebrates, reptiles, and amphibians, but may still result (Federal Highway Administration 2004, p. 8).

Noise has been proven to have a disruptive effect on many types of animal life (Federal Highway Administration 2004, p. 10)**.** Effects vary from higher levels of stress through permanent hearing damage and loss to increased predation and reduced vigor and fitness (Federal Highway Administration 2004, p. 10)**.** As strength of the sound increases, so does the level of damage (New York 2000, p. 15). In general, adverse effects can be expected if Project noise is greater than 10 to 15 decibels Base A [dB (A)] above background noise. (EPA 1978, p. 17**)** Ambient, or background, noise in farmland is usually somewhere near 45 dB (A), whereas ambient wilderness noise can be expected to be about 35 dB (A). Windier areas, such as the Wyoming shrub-steppe, have a base level of approximately 39 dB (A) (K.C. Harvey 2009, p.1). Noise levels of 10 dB (A) above ambient have been shown to negatively affect sage-grouse by altering vital behavior in Wyoming (K.C. Harvey 2009, p.1).

Sound levels attenuate, or diminish, at a set rate. In general, sound attenuates at a rate of 6 dB (A) for every doubling of the distance after the first 50 feet (~15 meters) (New York 2000, p. 8). Table 3 shows noise levels for some common machinery used in construction. Table 4 shows the expected level of noise generated by common construction machinery at various distances. From this data, it is reasonable to expect construction noise levels to temporarily exceed the threshold of 10 dB(A) over ambient noise level a distances up to 1000 feet. The 10 dB(A) over ambient noise level threshold is widely used to determine disturbance and non-disturbance to sage-grouse (Freudenthal 2008 p. 1). Therefore, we feel it is prudent to assume that adverse impacts will occur at a distance of 800 feet or less from the center-line of the right-of-way, which creates a 1600-foot wide buffer. Therefore the buffer width needed to protect sage-grouse from noise disturbance is significantly greater than the 600-foot wide buffer areas used in the Project.

Table 3. Noise levels of common construction machinery (New York 2000, p. 15).

Situation	Noise Level
Farmland (Ambient)	45 dB(A)
Wilderness (Ambient)	35 dB(A)
Backhoe	83-86 dB(A)
Bulldozer	80 dB(A)
Grader	85 dB(A)
Rock drill	98 dB(A)

Table 4. Noise attenuation over distance (New York 2000, p. 15)

	dB(A) at Different Distances From The Source							
Source	0	100 ft	200 ft	400 ft	800 ft	1600 ft	3200 ft	6400 ft
Backhoe	86	80	74	68	62	56	50	44
Bulldozer	80	74	68	62	56	50	44	38
Grader	85	79	73	67	61	55	49	43
Rock drill	98	93	87	81	75	69	63	57

Since most construction work will take place within the 600-foot easement that exists along the canal right-of-ways, temporary noise impacts will occur over an additional 500 feet or more. Multiplying the length of the relevant sections of the Project where construction will occur by a *conservative* 200 feet (600 feet in two instances), then by 5280 feet (length of one mile) and lastly by two gives the additional area in square feet. An easy conversion gives the number of acres upon which mitigation may be computed, as set forth herein. This only provides a method for comparison of the relative impacts by alternative. Both the HEP analysis and the areal analysis are used only for comparing the relative impacts of each alternative. Due to the uncertainties present in the Project description, actual acreages of impact areas will need to be reassessed by actual construction location and method, as well as the habitat types present during construction, to further evaluate environmental compliance needs and mitigation.

Using the above assumptions, a series of calculations were done to estimate the area of the total Project footprint. These acreages, together with temporary impacts from construction, and temporary impacts from construction noise were identified as negative impacts for each alternative. The sum of these factors was used to evaluate potential habitat impacts resulting from each alternative; estimates of noise impacts are likely conservative. Without exact locations of Project infrastructure, terrestrial and HEP surveys may not have been completed for all lands potentially impacted by the Project thus mitigation requirements will need to be revisited when that information is provided.

6.3.1 Impact Analysis Method One: HEP Analysis

Our analytical design used Habitat Suitability Indices (HSI) for each species that contained a suite of variables, designed for each species under consideration. These variables include, but are not limited to, foraging areas, migration areas, amount of escape cover, nesting cover, and others. These variables are assessed to develop a ranking factor for each, ranging from 0.0 to 1.0, with 1.0 being of highest benefit to the species. Action alternatives that yield a value of 1 for a habitat variable means the action alternative is best for providing or maintaining that habitat variable.

The species used in the HEP analysis were decided by a HEP Policy Team which included members from WDFW and the Service.

Table 5. Species Used in HEP Analysis in FY2008

Species	Habitat
Red-winged blackbird (*Agelaius phoeniceus)*	Wetland >0.10 ha
Muskrat (*Ondatra zibethicus)*	Wetland
Brewer's sparrow (*Spizella breweri)*	Shrub-steppe > 0.20 ha
Ferruginous Hawk (*Buteo regalis)*	Shrub-steppe, grassland
California Quail (*Callipepla californica*)	Multiple
Mule deer (*Odocoileus hemionus*)	Shrub-steppe
Meadowlark (*Sturnella neglecta)*	Multiple
Black-capped chickadee (*Poecile atricapillus*)	Riparian
Pheasant (*Phasianus colchicus*)	Agriculture
Song sparrow (*Melospiza melodia***)**	Mixed shrub
Columbia spotted frog (*Rana luteiventris*),	Wetland
Yellow Warbler (*Dendroica petechia)*	Riparian > 0.15 ha
Gray partridge (*Perdix perdix)*	Grassland > 4.0 ha

The HEP Analysis consisted of using Habitat Suitability Indices (HSI) for each species selected as representative of general groups of species that utilize habitats found in the Project Area and has the same or similar requirements. For instance, mule deer was selected to represent ungulates. The HSI is a model for determining the value of existing habitat by comparing it with an idealized habitat and contains a suite of environmental parameters needed by each species to successfully live and reproduce. For example, the parameters for a species would include foraging areas, migration areas, amount of escape cover, and amount of nesting cover. Values, such as acres or percent cover, for these environmental parameters are assessed for each species to determine a ranking factor for each area that indicates the relative impact each action has on the species. The HSI values range from 0.0 (no value) to 1.0, the most benefit to the species. WDFW, in the survey report, categorized habitat as poor, marginal, fair, good, or optimum (WDFW 2009a, pp. 31-32). For example, the HSI for the Brewer's sparrow is based on the equation $\mathbf{[(V_1 \times V_2)(V_3 \times V_5 \times V_6)^{1/3} \times V_4]^{1/2}}$, where V_1 is the size of the habitat block, V_2 is the terrain characteristics of the habitat block, V_3 is the composition of the substrate, V_4 are the species of shrubs present, V_5 is present cover, and V_6 is the average height of the shrub cover. Instructions for quantifying habitat are contained in the model designed by the Service (Short 1984, pp. 9-12). Habitat variables are not the same for each species. For example, the equation for computing the HSI for the yellow warbler is $\mathbf{(V_1 \times V_2 \times V_3)^{1/2}}$**,** where V1 is percent cover, V_2 is average height, and V_3 is percent cover of hydrophytic species (Shroeder 1982, p. 6).

6.3.2 Presence/Absence Surveys

WDFW conducted a series of surveys to detect the presence of Federal and State species of concern, during 2009 (WDFWc 2009, p .5). Over 514 miles of transects were surveyed for a variety of species. Table 6 shows the results of these surveys. Surveys were conducted within a ½ mile corridor (1/4 mile on each side) along the proposed alignment of the East High Canal, the existing East Low Canal proposed expansion and extension, and all proposed reservoir sites. Each area was surveyed twice, once between March 6 to May 11 and another survey between May 12 to July 27, 2009. Surveys were adjusted for daily variation in sunrise. Some species (e.g. northern leopard frog) required specialized survey techniques and survey methodology was adapted as needed (e.g. call chorus surveys). Any indication of presence (sight, sound, or artifact) was recorded as an observation.

Table 6. Federal and State species of concern found during surveys (WDFW 2009c, p 8-12).

Species	Scientific Name	Federal Status	State Status
Grasshopper Sparrow	*Ammodramus savannarum*	none	SM
Loggerhead Shrike	*Lanius ludovicianus*	species of concern	SC
Long-billed Curlew	*Numenius americanus*	none	SM
Sage Thrasher	*Oreoscoptes montanus*	none	SC
Badger	*Taxidea taxus*	none	SM
Black-necked Stilt	*Himantopus mexicanus*	none	SM
American White Pelican	*Pelecanus erythrorhynchos*	none	SE
Bald Eagle	*Haliaeetus leucocephalus*	species of concern	SS
Great Egret	*Ardea alba*	none	SM
Great Blue Heron	*A. Herodias*	none	SM
Osprey	*Pandion haliaetus*	none	SM
Peregrine Falcon	*Falco peregrinus*	species of concern	SS

Table 6. Federal and State species of concern found during surveys (WDFW 2009c, p 8-12).

Species	Scientific Name	Federal Status	State Status
Black-crowned Night-Heron	*Nycticorax nycticorax*	none	SM
Burrowing Owl	*Athene cunicularia*	species of concern	SC
Prairie Falcon	*Falco mexicanus*	none	SM
Sandhill Crane	*Grus Canadensis*	none	SE
Turkey Vulture	*Cathartes aura*	none	SM
Pygmy Short-horned Lizard	*Phrynosoma douglasii*	none	SM
Sage Sparrow	*Amphispiza belli*	none	SC
Swainson's Hawk	*Buteo swainsoni*	none	SM
Washington ground squirrel	*Spermophilus washingtoni*	candidate	SC

6.3.3 Method Two: Areal Analysis using Reclamation's Figures

A second method of analyzing the project's effects to habitat was done by using preliminary acreages of habitat types impacted as provided by Reclamation. However, Reclamation's estimates do not reflect a complete picture of habitat impacts that will result to areas outside of the Project Area not do they consider temporary impacts. In order to adequately assess and compare habitat impacts, we must also consider the following:

- Shrub-steppe and attendant grasslands are a priority habitat for both the Service and WDFW. The U.S. Forest Service and Bureau of Land Management determined that shrub-steppe was of the highest priority for preservation and necessary for preservation of Neotropical migrant birds (Saab and Rich, 1997 p. 16).

- The predicted acreages do not include "…those from substations, transmission lines and pump stations because their location is not known at this time." (Reclamation 2010, p 4-60) The Service and WDFW expect an increase of impacts in the Project Area.

- Destruction of the soil (biotic or cryptogrammic) crust will result in long-term destruction of the habitat, may equate to permanent, irrevocable destruction (Stinson 2004, pp. 41-43). Therefore permanent impacts can be presumed to occur throughout the easements areas.

- Due to "issues related to weeds, the (in) ability to restore high quality shrub-steppe communities, and the long times required to mitigate the losses" (Reclamation 2010, p. 4-60), Temporary ("short-term") impacts may be considered as permanent impacts if implementation of restoration efforts fail. McClendon and Rodente (1990, pp. 298-299) and Samuel and Hart (1994, pp 183 & 190) report on the length of time required to achieve full restoration. Samuel and Hart (1994, p. 190) found that after 61 years, full restoration and complete ecological function had not been accomplished. Reclamation

(2010, p.4-60) states that it is likely that complete restoration of shrub-steppe habitat may never be accomplished. However, enhancement of current conditions may occur, although complete restoration may not.

- Construction noise will likely interfere with vital behavior (i.e. breeding) in mammals and birds. These impacts will extend beyond the Project footprint by several hundred yards (see previous analysis). We expect this will substantially increase the impacted area. Noise resulting from operations and maintenance will continue after construction is completed.

- Predation by raptors may occur up to 4.3 miles (6.9 km) from power and fence lines, such as are planned for the Project. Access roads will facilitate predation by terrestrial predators, including domestic pets.

Based on the above assumptions, the Service has determined that the area of impacts will be much greater than that reported by Reclamation in the acreage estimates we used in the second method of effects analysis. WDFW (2009a, Tables 2-8 and 2-9) reports that the Project Area contains 6,260 acres of shrub-steppe habitat (in Alternatives 3A-3D), of which 200 acres are contained within the area covered by the partial implementation alternatives (2A-2D). Grassland covers approximately 4,940 acres (in Alternatives 3A-3D) and the partial implementation alternatives (2A-2D) contain 1450 acres. Agricultural land totals 4,523 acres (in Alternatives 3A-3D) with 390 acres being contained within the area planned for the partial implementation alternatives (Alternatives 2A-2D). Additional areas of impact may occur in Black Rock Coulee and possibly the Black Rock flood easement. The above figures are not absolute but may change when Project infrastructure and locations are determined for Reclamation's Preferred Alternative. When temporary and off-site impacts (i.e. increased avian predation) are considered, the actual area of disturbance will be much larger than reported. Also, many of the impacts described by Reclamation as temporary are considered by the Service to be permanent in nature, because these impacts will either be long-term or of such duration (>10 years) as to consider them permanent.

By using the two methods of impact analysis, we now have two means of comparing impacts from the Project: comparing habitat impacts as reported by WDFW resulting from their HEP surveys and by comparing Reclamation's description of the Project impacts.

Final determination of the Service's recommended alternative was then made by comparing the results of the HEP analysis performing an aerial analysis using Reclamation's estimates, and then completing an analysis of the impacts on aquatic habitats, using the numerical scoring as described above.

7.0 FISH AND WILDLIFE RESOURCES

7.1 Future Resources without the Project (No Action Alternative)

The No Action Alterative represents the foreseeable future if no action is taken and groundwater levels continue to decline in Project Area aquifers. Under the No Action Alternative, no CBP facility expansion to serve the Project Area would occur and irrigated agriculture that currently relies on groundwater would continue using that source of water.

Based on current trends, it is estimated that declining conditions will result in failure of the groundwater supply for most groundwater-irrigated lands in the Project Area within 10 years. The loss of irrigated agriculture in the Project Area would have adverse economic consequences in the region, affecting local farm owners and operators, associated commodity processing industries, and other inter-connected and inter-dependent parts of the economy (Reclamation 2010, p. ES-1). Also likely to be affected would be domestic, commercial, municipal, and industrial users who rely on groundwater. Continued declines in well productivity and groundwater quality resulting from agricultural irrigation—the largest user of groundwater in the Project Area—would adversely affect the water supply for other users.

The No-Action Alternative includes possible future implementation of water conservation measures and water acquisitions authorized under Section 1203 of Title XII of the Act of October 31, 1994.

7.2 Climate Change and the Foreseeable Future

In order for the Service to analyze future climate impacts, we must first determine how far into the future (foreseeable future) we feel we can make projections, with a reasonable certainty. The climate in eastern Washington is arid, with an average of 7.4 inches of precipitation and 17.4 inches of annual snowfall at Ephrata, and 10.9 inches of precipitation and 16.3 inches of snowfall at Odessa (Washington State Climatologist, 2009). Figure 3 shows the predicted increase in mean global temperature for three diverse and equally likely scenarios. This predicted increase is a composite of numerous scenarios. These scenarios are labeled the A2 (high emissions), A1B (moderate emissions), and B1 (low emissions) models. The A2 scenario predicts a 3.4 ^{o}C increase in ambient temperature (with a projected range: 2.0 to 5.4 ^{o}C), the A1B predicts 2.8 ^{o}C increase (with a projected range of 1.7 to 4.4 ^{o}C) and the B1 predicts 1.8 ^{o}C increase (with a projected range of 1.1 to 2.9 ^{o}C) (IPCC 2007, p.13). In Figure 3, at about year 2050, these three projections quickly begin to diverge. Since economic and political impacts and responses are linked to climate change, become harder to predict, and confidence in the prediction decreases the further into the future they are made, the more divergent the scenarios become into the future (Hall and Behl 2006, p. 443). We believe the limits of our "foreseeable future" condition will occur between 2040 and 2060. We used year 2050 as an end point of our analysis and predict that, under the three climate change scenarios, no substantial difference in habitat, resource management, laws, and land-use will occur before year 2050. Therefore, using these projections, we feel that our effects analysis should remain valid until at least the year 2050.

Based on climate trend projections by the Intergovernmental Panel on Climate Change (IPCC) (IPCC 2007, p.12) and the Climates Impact Group of the University of Washington (CICG), in general, habitats and species will tend to migrate further north or higher in elevation in response to global climate change (Shafer *et al* 2001, p. 18; Chambers and Pellant 2008, p.30). However, migration may not result from heat stress, *per se* but will more likely occur through such mechanisms as competition between species with similar requirements or limitations resulting from unsuitable habitat (Shafer *et al* 2001, p. 18; Chambers and Pellant 2008, p.30). This projection is further supported by surveys conducted by WDFW which indicate no North-South variations in habitat suitability for the 14 species chosen to represent several assemblages of wildlife found in the Project Area (WDFW 2009a, Chapter 5, p.3).

For the Pacific Northwest, increases are projected in precipitation, temperature, and the length of droughts. However, increased precipitation is projected to come more in the form of rain rather than snow which will result in decreased groundwater recharge and less spring moisture, due to more run off (CICG 2009, p.198). Projections for Lind show that, although annual rainfall will increase by 10 to 14 per cent by 2080, seasonal rainfall (spring and summer) will only increase by 10 to 12 per cent while non-seasonal (fall and winter) rainfall will increase by 12 to 16 per cent (CICG 2009, p. 198). Increased drought will harden surface soil and prevent absorption of rainwater. These factors are projected to equate to less *effective* precipitation. Forest and grass land cover is predicted to likely increase (Wooten 2003, p. 9). A net decrease of shrub steppe habitat in the Project Area will likely result, as the boundaries of shrub steppe habitat shift northward (Shafer *et al* 2001, p. 18; Chambers and Pellant 2008, p.30).

The changes described above are general and present a broad picture of predicted future change. Their magnitude will, largely, be dependent on actions taken in political, private, and economic arenas and so they remain unquantifiable. These general predictions are expected to occur regardless of which alternative is implemented and are based on projections of current data.

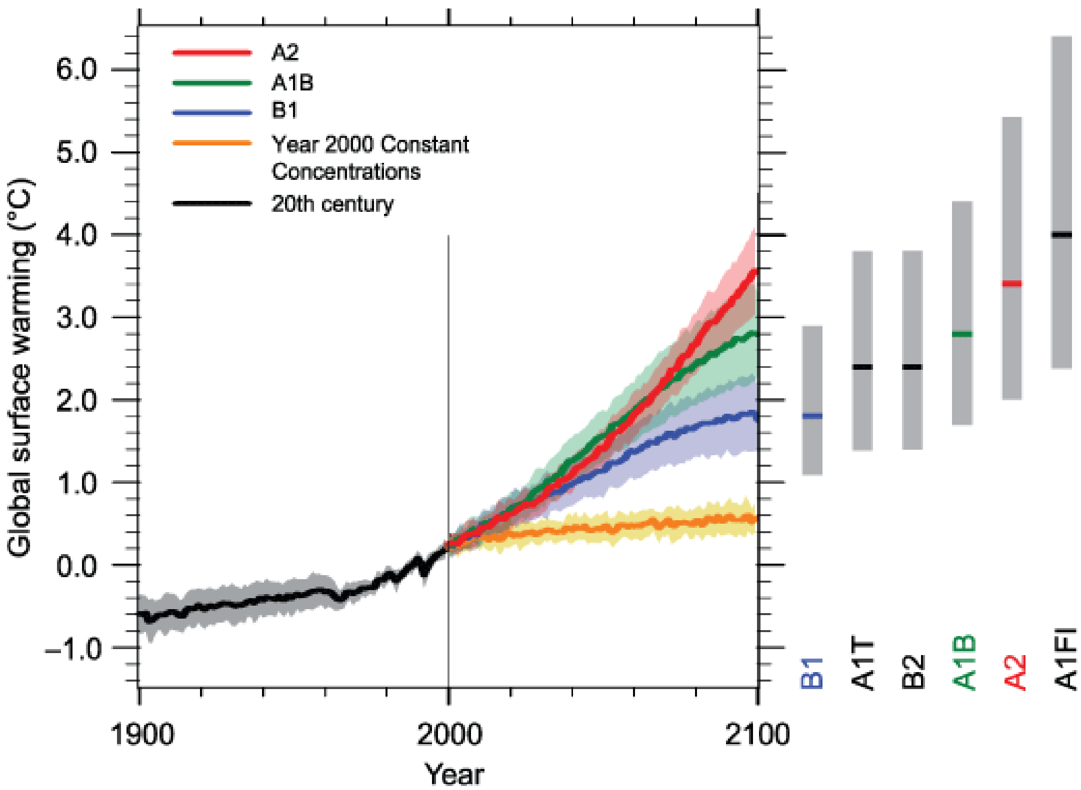

Figure 3. Predicted increases in mean global temperature under A2, A1B, and B1 scenarios (IPCC 2007, p. 12)

7.3 Effects to Wildlife Resources under the No Action Alternative

The No Action Alterative represents the foreseeable future if no action is taken and groundwater levels continue to decline in Project Area aquifers. Under the No Action Alternative, no CBP facility expansion to serve the Project Area would occur and irrigated agriculture that currently relies on groundwater would continue using that source of water. Based on current trends, it is estimated that groundwater supply for most groundwater-irrigated lands in the Project Area will fail within 10 years. The No-Action Alternative does include future implementation of water conservation measures and water acquisitions authorized under Section 1203 of Title XII of the

Act of October 31, 1994. For more information on the effects of the No Action Alternative, please refer to the DEIS.

7.3.1 Water Quality and Quantity under the No-Action Alternative

Changes in water temperature and turbidity, as well as their associated effects to biotic and abiotic components of the lakes are anticipated to continue in Billy Clapp Lake and Potholes Reservoir, as part of the No Action Alternative. Allison Aldous (2008, slide 12) points out that changes may be expected, as a result of climate change, in the form of higher water temperatures, increased pollutants, increased turbidity and increased salinity. For example, water quality and quantity indicators, such as temperature and turbidity, can have a wide range of impacts on abiotic and biotic aspects of any body of water. Turbidity can lead to increased temperatures, indicate algal blooms, and dictate the limits of the photic zone for plant growth. WDFW's study of Banks Lake primary productivity, fish bioenergetics, and fish entrainment revealed data which suggests that water temperatures in this lake can be stressful for fish; however, turbidity data demonstrated limited dynamic variability.

Current manipulation of water quantity in the Columbia Basin Irrigation Project is likely to result in impacts to local fish communities in the bodies of water within the Project. Fisheries within Banks Lake, Billy Clapp Lake, and Potholes Reservoir will likely continue to decline at a rate similar to that of recent years. The current hydrograph and water operations of these water bodies limit the establishment of a stable fishery. Water elevations at water bodies such as Banks Lake fluctuate quickly with the onset and termination of irrigation flows. Typical water operations on Banks Lake include a 5-foot drawdown in August with refill occurring usually by late September. These fluctuations in water levels can have negative effects on aquatic communities by reducing habitat availability, stranding benthic organisms, decreasing water retention times which cause increases in entrainment, and congregating predators with their prey (Ploskey 1986). It is our understanding that water quality data, along with primary and secondary bio-production data, do not exist for Billy Clapp Lake. However, high volumes of water entering the lake from Banks Lake most likely transport nutrients and plankton that are susceptible to flow. The low relative abundance of walleye in Billy Clapp Lake is most likely indicative of low natural production and high water clarity, which are sub-optimal for walleye forage success. Water originating from Billy Clapp Lake through Pinto Dam likely experiences less negative effects from Total Dissolved Gas due to the installation of an energy dissipater within the stilling basin of this dam, which reduces the level of dissolved gases.

The lack of perennial flows will also continue to limit the establishment of an effective fishery in most of Crab Creek. Flows from springs throughout the system will remain perennial and vary with the irrigation season and the resulting re-charge of local groundwater. Trout fisheries will remain where perennial flows exist, while other areas will continue to provide warm water fisheries. It is likely the springs that feed this system will continue to have good water quality. However, in some areas, low flows and aquatic weed growth may contribute to diminished fingerling survival. The introduction and expansion of carp populations through this system is likely and may decrease habitat conditions for other more desirable fish species. As a result, species composition is anticipated to change in Crab Creek. These changes in fish community structure will likely result in changes to spawning behavior of steelhead which may utilize Crab Creek or bull trout which may reside in the Columbia River.

Finally, the No Action Alternative would also mean continued reliance on the Odessa aquifer. As the water table lowers, pumping costs for obtaining this groundwater water will increase.

Water quality will continue to deteriorate unless, as Reclamation predicts, a reduced number of agronomists continue using the Odessa aquifer. However, there is some potential environmental benefits that may result due to a reduced reliance on groundwater. Since pumping water from a depth of 2000 feet increases the amount of dissolved solids, less of these solids will drain back into the canals and waterways. This could result in fewer pollutants to affect aquatic life.

7.3.2 Habitat Access under the No-Action Alternative

In general, it is reasonable to presume that water supplies will experience reductions due to predicted climate change and an increase in seasonal water demand, therefore resulting in a reduction of both aquatic habitat and habitat access under this alternative. Entrainment rates such as those discussed in these studies will likely continue with the No Action alternative.

7.3.3 Habitat Elements under the No-Action Alternative

This alternative would continue to impact habitat for resident fish and bull trout from hydrographic variation and the impoundment of water by the Columbia Basin Irrigation Project. The overall effect of the No Action Alternative on resident fish and bull trout habitat will continue and effort should be made to maintain and improve degraded habitat elements in the Columbia Basin Irrigation Project.

7.3.4 Channel Condition and Dynamics under the No-Action Alternative

Effects to the channel condition and dynamics of Crab Creek are likely to continue with the implementation of the No Action Alternative. The overall effect of the alternative is likely to maintain degraded channel conditions and dynamics in Crab Creek.

7.3.5 Flow/Hydrology under the No-Action Alternative

Effects to the flow/hydrology habitat indicator will continue to be most pronounced in the Crab Creek drainage through the implementation of the No Action Alternative. Hydrographic variation has resulted in a moderation of the amplitude of hydrographic change. Further dependence on sub-surface water would also reduce both surface and sub-surface flows and further alter hydrologic regimes.

7.3.6 Watershed Conditions under the No-Action Alternative

Although it is anticipated that watershed conditions will not change dramatically in Banks Lake, Billy Clapp Lake, Potholes Reservoir, and Crab Creek, watershed conditions will likely continue to deteriorate at a low level, exacerbated by climate change conditions.

7.3.7 Riparian and Riparian-mixed Habitat under the No-Action Alternative

It is likely that the agricultural use of lands in the Project Area will increase and the presence of shrub/riparian, scrub shrub/mesic forest mix will likely diminish, based on land use trends for the basin (USDA 2003, Table 1; Rural Policy Research Institute 2006, p. 2, 10, & 12) Agricultural land use increase is most likely to occur in the form of dry-land farming and will likely include a shift in the composition and timing of crops.

7.3.8 Shrub-steppe Habitat under the No-Action Alternative

Climate change, without implementation of any alternative described herein, will continue to negatively impact shrub-steppe habitats in the Project Area. This will happen through two general mechanisms: changes in plant communities and changes in the soil communities.

7.3.9 Grassland Habitat under the No-Action Alternative
In light of changes predicted to occur resulting from global climate change, it is likely that the agricultural use of lands in the Project Area will increase and the presence of grasslands will diminish. This increase is will occur in the form of dry-land farming and include a shift in the nature, composition, and timing of crops. Changes resulting from climate change may, conversely, increase the extent of grassland habitat as shrub-steppe habitat decreases, if there is no widespread conversion of shrub-steppe to agricultural use. This increase will, however, be facilitated by an increase on invasive species such as cheat grass, which are better adapted to predicted drought conditions (Chambers and Pellant 2008, pp. 30-31).

7.3.10 Emergent Wetland Habitat under the No-Action Alternative
In light of changes predicted to occur from global climate change, the agricultural use of lands in the Project Area will increase and the presence of emergent wetland will likely diminish. Longer droughts in the summer months and less snowpack available will impact the Odessa area by providing less water reserves. If the Project is not implemented, the Odessa area wetlands habitat will receive less water runoff.

7.3.11 Agricultural Habitat under the No-Action Alternative
In light of changes predicted to occur in land use, it is likely that the agricultural use of lands in the Project Area will follow current trends. USDA (2008) reports that Adams County had a 9 per cent increase in the number of farms, Grant County had an increase of 3 per cent, and Lincoln County had an increase of 7 per cent in the number of farms. Only Franklin County had a decrease (-6 percent) and the amount of land under agriculture increased in all of the above listed counties except Franklin. With limited water resources available in the Project Area, farming has largely been dryland farming of wheat. However, with the availability of Columbia River water in the area, shifts in the nature, composition, and timing of crops are expected. For instance, yield of dryland wheat will likely increase by 35 percent in Lind and 36 percent in Odessa by the year 2080, without any changes in land use, merely due to increased rainfall and increased carbon dioxide in the atmosphere (CICG 2009, p. 203-204). Rainfall is expected to increase by 25 millimeters (~ 1 inch) for the same period (CICG 2009, p.198).

7.3.12 Federally Listed Threatened and Endangered Species, Candidate Species and Species of Concern under the No-Action Alternative
As noted above, operations and flow regimes in the Odessa Subarea would be maintained without the implementation of any of the alternatives. Regardless of whether any of the proposed alternatives are implemented, it is expected that conditions will continue to degrade in parts of the Odessa Subarea. Further loss or degradation of important habitats will continue to impact sensitive species.

8.0 ALTERNATIVE SELECTION PROCESS

No preferred alternative has been selected. The process and timeline for selection of the preferred alternative is set out in the DEIS and incorporated herein by reference (Reclamation 2010, p. 2-18)

9.0 DESCRIPTION OF EFFECTS

Without more specific information regarding infrastructure location, timing of construction and other variables, we cannot fully assess the type and magnitude of Project impacts on fish, wildlife and their habitats. However, aquatic impacts will largely be the same among the alternatives, depending on water source. Terrestrial impacts will be larger and more severe under the full implementation (full replacement) alternative since there is a significantly larger amount of non-agricultural habitat with the Project Area. The full implementation alternatives will result in more extensive habitat impacts because of the larger footprint. We, therefore, will analyze the effects typical for each group of alternatives, the partial implementation or full implementation. Similarly, we will examine each alternative's effect on the aquatic resources within the Affected Area. Ultimately, our recommendation will result from a comparison of these alternative's effects.

9.1 Aquatic Resources under the Partial Implementation Alternatives (2A thru 2D)

Under these alternatives, it is our understanding that water from Lake Roosevelt and the Banks Lake Reservoir will be utilized to convey water in Reclamation's existing East Low Canal and proposed extension for the purpose of providing surface water to the Project Area. The Lake Roosevelt Drawdown proposes new diversions of water from behind the Grand Coulee Dam for agricultural, municipal, industrial, and instream uses. All water supplied by these projects will come from water stored behind Grand Coulee Dam. Drawdown of water from Lake Roosevelt is contemplated in the proposed action.

We will discuss resident fish impacts resulting from water releases at Lake Roosevelt, designed to be distributed throughout the CBP. None of the partial implementation alternatives will produce significant impacts to mainstem Columbia River flows. We will use the habitat indicators as we did in the analysis of the No Action Alternative, including water quality and quantity, habitat access, habitat elements, channel condition and dynamics, flow/hydrology, and watershed conditions, to assess these alternatives:

- 2A: Partial replacement of ground water use with water from Banks Lake. Water delivery options include an expanded East Low Canal (ELC) with a 2.5-mile extension together with an additional drawdown of Banks Lake (up to 18 feet);
- 2B: Partial replacement of ground water use with water from Banks Lake and Lake Roosevelt. Water delivery options include an expanded ELC with a 2.5-mile extension together with an additional drawdown of Banks Lake and use of additional water from Lake Roosevelt;
- 2C: Partial replacement of ground water use with water from Banks Lake and Rocky Coulee. Water delivery options include an expanded ELC with a 2.5-mile extension together with an additional drawdown of Banks Lake and construction of a reservoir in Rocky Coulee (117,900 acre-feet active storage), and;
- 2D: Partial replacement of ground water use with water from Banks Lake, Rocky Coulee, and Lake Roosevelt. Water delivery options include an expanded ELC with a 2.5-mile extension together with an additional drawdown of Banks Lake and construction of a reservoir in Rocky Coulee and use of additional water from Lake Roosevelt.

9.1.1 Effects to Water Quality and Quantity under the Partial Implementation Alternatives
Lake Roosevelt is contaminated with trace elements that were discharged as a result of mining, smelting, pulp mill effluents and other industrial processes occurring upstream within the watershed. Numerous studies conducted over several decades have documented contamination in Lake Roosevelt sediments, surface water and biota (Serdar, *et al.* 1993, p.1; Majewski, *et al.* 2003, p. 1; WDOH, 2010, p. 9). A potential effect of the action alternatives on water quality is an increase in contaminated water released from Lake Roosevelt into Banks Lake, Billy Clapp Lake, Potholes Reservoir, and Crab Creek. These contaminants may be suspended in the water or lie in sediments within Lake Roosevelt that are flushed back into the system when water is released. Data related to trace metals and organic contaminants in the water column, either in dissolved or suspended particulate form, are limited; therefore, it is uncertain to what degree contaminants would be distributed to downstream areas. However, conveyance of contaminated water to downstream areas is considered a resulting effect of the action alternatives unless it can be demonstrated that contaminant concentrations are below levels of ecological concern. One could argue that the water being pumped into Banks Lake from the Columbia River at Lake Roosevelt does not contain a high level of contaminants since the intakes at Lake Roosevelt are located at a significant height in the water column which would prevent mobilization of existing contaminants in this body of water. The Service is unaware of information of substantial information that would lead to this conclusion. Further information leads the Service to conclude that conveyance of contaminants in the CBIP may be a resource issue concern related to the implementation of the partial implementation alternatives. An assessment of water quality, bottom sediment, and biota explains how the CBIP, in general, does not have an adverse effect on biota, however, irrigation drainage from the CBIP does contribute to elevated levels of trace elements which may affect aquatic vegetation and associated wildlife species that feed upon this aquatic vegetation (Embrey and Blok 1995, pp. 70-73). Conveyance of other contaminants such as pesticides has also been demonstrated to occur throughout the CBIP (Wagner *et al.* 2006, p. 1). We would expect continued conveyance of contaminants through the implementation of the alternatives.

Other water quality effects will include temperature increases due to the continued impoundment of water in reservoirs and water velocity reduction; increased sediment suspension in the water due to fluctuating river levels and bank erosion (which is also related to higher temperatures); and the increased occurrence of gas supersaturation due to spillway operations at the associated reservoirs. Water quality effects associated with temperature will also include those described under water quality and quantity for the No Action Alternative, in addition to any minor effects resulting from global climate change. The overall effect of the action is likely to maintain or further degrade water quality in water bodies associated with the CB P.

Contaminants have been documented to have detrimental direct and indirect effects on bull trout (Cuffney *et al.* 1997, p.1). Lethal impacts may occur from accidental spills of contaminants during construction and facility maintenance activities associated with the action alternatives; whereas sub lethal impacts may occur from agriculture, residential/urban, mining, grazing, and forestry activities. Reductions in aquatic invertebrate numbers and aquatic community structure were documented in the upper as well as the lower Columbia Basin ecoregion due to water quality issues related to contaminants (Cuffney *et al*. 1997, p.1). Specifically, both the presence of stoneflies, mayflies and caddis flies and total species richness were lower in the mainstem Yakima River, below the storage dams, largely as the result of water contamination, especially heavy metals (Cuffney *et al.* 1997, p.1).

Water temperature in Middle Crab Creek, is expected to improve with the implementation of this alternative. Currently, the operation of the CBP does not result in return flow to the CBP below the areas south of Moses Lake, specifically Lower Crab Creek. It is our understanding that bull trout and steelhead would have the potential to use Lower Crab Creek, when water temperatures are within 4-9°C range during the winter timeframe. In general, current flow regimes in Crab Creek exclude use of Lower Crab Creek by bull trout and steelhead outside the winter timeframe. Therefore, implementation of the action alternatives is not anticipated to lengthen the seasonal timeframe significantly in which bull trout and steelhead could use Lower Crab Creek.

Action alternatives 2B and 2C would impact water quality the greatest by increasing the distribution of contaminants within the Columbia Basin. Even though the fluctuations of water levels within existing reservoirs and the Columbia River would likely result in increased erosion in some instances, water temperature in the Columbia River is likely to improve moderately with the additional water flow. It is also our understanding that Banks Lake would experience a lower frequency and magnitude of elevation changes through the implementation of all eight action alternatives as compared to Lake Roosevelt. At this time, it is not clear how the proposed Rocky Coulee Reservoir and the Black Rock Coulee Reservoir (a totally new reservoir) would serve to re-regulate additional flows for these alternatives. It is our understanding that Rocky Coulee Reservoir would be filled in fall/winter and drained progressively in the spring/summer of each respective year, until it is empty in fall. The depth in which water is drafted from these bodies of water may affect water quality and quantity in outflow streams. For example, water from Banks Lake is drafted within the top 20 feet of the reservoir whereas Billy Clapp Lake water is drafted solely from the bottom section of this reservoir resulting in different water temperature regimes downstream. Water drafted from Billy Clapp Lake will likely be cooler than water drafted from Banks Lake. Therefore, when these effects to resident fish are considered collectively, it is likely that current degraded water temperature conditions in the CBP will continue with any of the partial implementation action alternatives. A comparison of the impacts is shown in section 9.1.6 and Table 7, therein.

9.1.2 Effects to Habitat Access Under the Partial Implementation Alternatives

Habitat access is the ability for wildlife and fish to freely move between areas of suitable habitat, whether nesting, foraging, breeding, or other necessary life-functions. Chief Joseph, Dry Falls, O'Sullivan, and Pinto Dams currently have outlet works that cause fish to be entrained downstream. We understand that these dams and associated outlet works have general trash racks intended to capture debris that allow entrainment of resident fish. For example, the Banks Lake outlet structure is comprised of a 4-inch bar screen and barrier net, and the associated hydropower bypass valve has no screening mechanism. We anticipate that fish will continue to be entrained in water moving from Lake Roosevelt, Banks Lake, Billy Clapp Lake, and Potholes Reservoir to its destined use. Currently, fish entrainment at Lake Roosevelt has affected the harvest of kokanee and rainbow trout in the reservoir (Olson *et al*. 2010, p. 19). Entrainment of fish at Banks Lake (Dry Falls Dam) has been shown to be a significant resource concern (Olson *et al.* 2010, p. 35; Polacek 2009, p. 28). Entrainment rates at Banks Lake will likely continue at a higher level with the action alternatives; since, significant water withdrawals from Lake Roosevelt (i.e., action alternatives 2B and 2D) will result in more water distributed through Banks Lake and surrounding water conveyance structures. We anticipate that entrainment levels will continue to occur at moderate levels through the proposed implementation of the remaining alternatives. Primary effects to resident fish that are entrained will likely include effects associated with changes in pressure differentials within the water column and injury/mortality when fish come in contact with structures associated with hydropower facilities (i.e., Banks Lake).

Entrainment effects may not be limited solely to resident fish, but may include fish forage resources as well. For example, entrainment of zooplankton from Banks Lake into the system may affect the survivability of the fish populations in this lake, since the forage base for fish in Banks Lake is being continually reduced while canals are being fed water (Polacek 2009, p. 1). Alternatives 2B and 2D would have the highest risk to these forage resources.

Access to spawning and rearing habitats within close proximity to the shorelines of these bodies of water will also decrease significantly due to the higher frequency and duration of water fluctuations. Effects to spawning and rearing habitats are explained in more detail in the habitat elements discussion below.

In addition, existing smaller-scaled water control structures and natural barriers to fish movement located in the Project Area have not been subjected to altered flow regimes as anticipated by the action alternatives. The scope and nature of these proposed flow modifications are not well understood at this time, since Reclamation has not established designated flow regimes for each of the alternatives. However, significant drawdowns such as those proposed at Lake Roosevelt and/or Banks Lake will likely translate into effects to the local resident fish community within the Project.

Effects on the habitat access indicator may not be limited solely to the aforementioned bodies of water. One could surmise that the further withdrawl of water from the mid-Columbia River would detract from the safe, timely, and effective upstream and downstream passage of fish species inherent to this aquatic ecosystem. An analysis of fisheries and aquatic resources potentially affected by the alternatives concludes that this type of further water withdrawl from the mid-Columbia River to the Banks Lake Reservoir would have minimal effect on these resources. The alternatives would result in a small reduction of discharge in the Columbia River on an annual basis and would slightly alter the seasonal flow regime as well (Olson *et al.* 2010, p. 1). This analysis further concludes that the alternatives would have no adverse effects on the downstream survival of spring-migrant salmonid smolts in addition to the upstream migration of salmon and steelhead (Olson *et al*. 2010, p. 59). A comparison of the impacts is shown in section 9.1.6 and Table 7, therein.

9.1.3 Effects to Habitat Structural Elements under the Partial Implementation Alternatives
Implementation of the partial implementation action alternatives is likely to increase the effects to structural elements of streams, rivers and reservoirs associated with current reservoir operations. Water level fluctuations currently experienced at reservoirs, such as Banks Lake, likely affects spawning and rearing conditions for fish species in this reservoirs. The additive loss of littoral habitats in Banks Lake due to the implementation of the alternatives will further reduce the low abundance of fish species in Banks Lake. Significant lake drawdowns such as those proposed in the alternatives can alter the structure and dynamics of aquatic macrophyte communities through several avenues, including changes in distribution, density, and species composition of these communities due to desiccation from water level reductions, wave damage, and alteration of substrate conditions.

A number of habitat elements were evaluated and are currently negatively impacted by hydrographic variation and impoundment of water bodies associated throughout the CBP, including:

- Increased levels of sediment from fluctuating water levels and bank erosion have increased substrate embeddedness in rivers (i.e., Middle Crab Creek) and reservoirs affected by the Project;

- Large woody debris has decreased due to the fluctuations in river levels, altering riparian vegetation composition and vigor, and has caused mortality of some riparian species. In addition, large woody debris that is mobilized is typically captured at log booms or trash racks and removed from the river as part of Project and recreation maintenance activities;

- Pool frequency and quality, especially primary pools that have been flooded by the CBP, experience variation from the normal and historic flow regimes and are maintained by hydrologic variation caused by CBP operations.

- Off-channel habitat has been reduced in quality and fish have less access to off-channel habitat due to fluctuating river levels and overall channel simplification; and,

- Refugia within the river and lakes have likely been eliminated in most cases; although, the Columbia River and Crab Creek may have thermal refugia created from cold water sources (e.g., very deep pools, upwelling, large groundwater influences).

Alternatives 2B and 2D are anticipated to have the most significant impacts on spawning and rearing habitats for resident fish in Lake Roosevelt because they result in the most significant changes in water elevation. Although the habitat access effects will be smaller in scope and magnitude, all of the action alternatives will affect spawning and rearing habitats for resident fish within Banks Lake. The overall effect of all the partial implementation action alternatives is to likely continue to and may increase degraded aquatic habitat elements within the CBP. A comparison of these impacts is shown in section 9.1.6 and Table 7.

9.1.4 Effects to Channel Condition and Dynamics Under the Partial Implementation Alternatives

Currently, hydrographic variation has resulted in an overall change in wetted width/maximum depth ratio, increasing this ratio and overall water depth (i.e., Crab Creek). While increased water depth is generally beneficial to the bull trout and other resident fish, in this case it is also accompanied with slower water, warmer temperatures, simplified habitat conditions, and other habitat degradation. Stream bank condition and near-shore reservoir habitats would also be impacted, primarily by the fluctuations in pool/river levels for bodies of water associated with the Project. Effects can stem from direct bank erosion to indirect impacts to the condition and extent of riparian vegetation, which if degraded, can lead to additional stream bank and near-shore instability. Floodplain connectivity is also impacted by hydrographic variation, reducing hydrologic connectivity between off-channel habitat, wetlands, and riparian areas. In addition, the extent of wetlands has likely been reduced and riparian vegetation and succession have been altered significantly. The overall effect of any of the partial implementation alternatives is likely to continue degraded channel conditions and dynamics in water bodies associated with the Columbia River Basin Irrigation Project such as Middle Crab Creek.

Alternatives 2B and 2D will likely demonstrate the highest level of channel condition and water level impacts as these alternatives entail the most significant water withdrawals from Lake Roosevelt. Water withdrawals from Lake Roosevelt under these alternatives would be distributed to Banks Lake for further distribution in the CBP. It is anticipated that alternatives 2A and 2C, will have moderate (M) to high (H) impacts on the channel condition and habitat dynamics; since, water withdrawals from Lake Roosevelt and Banks Lake are lower in magnitude under these alternatives. A comparison of the impacts is shown in section 9.1.6 and Table 7, therein.

9.1.5 Effects to Flow/Hydrology Under the Partial Implementation Alternatives
Under the existing CBP operations, hydrographic variation has resulted in lower proportional change in peak flows and higher base flows from water impoundment in existing reservoirs. As a result of any of the partial implementation alternatives, a highly modified hydrograph with altered peak and base flows, and fluctuating reservoir levels will be continued in Lake Roosevelt, Banks Lake, Billy Clapp Lake, and Potholes Reservoir. These flow alterations are in addition to those anticipated as a result of the No Action Alternative and the anticipated effects of global climate change. Flow alterations will impair a number of natural ecosystem processes, including accumulation and deposition of sediment and large woody debris. Since details of flow alterations resulting from reservoir operations and instream flow releases is not yet well-defined under the proposed alternatives, it is our assumption that the effects discussed above will continue in the near future or increase.

Action alternatives 2B and 2D entail the most significant water withdrawals from Lake Roosevelt. The effects of these alternatives would have the highest level of negative impact on the hydrology of the natural water systems in the Project. Water withdrawn from Lake Roosevelt under these alternatives would then be pumped to Banks Lake for further distribution. The effects to the hydrology of Lake Roosevelt are not as significant as the effects of the drawdown of Banks Lake, which occurs in all eight action alternatives. For example, action Alternative 2C most closely mimics conditions for current Banks Lake water withdrawals. A moderate (M) to high (H) level of hydrologic impact to Banks Lake is expected to result. A comparison of the impacts is shown in section 9.1.6 and Table 7, therein.

9.1.6 Effects to Watershed Conditions Under the Partial Implementation Alternatives
Hydrographic variation has resulted in substantial effects to the watershed conditions within the CBP. The overall effect of the partial implementation action alternatives is likely to further degrade watershed conditions in the CB P. The action area has been altered by substantial changes to the hydrograph due to irrigation demands and hydropower generation, degraded riparian areas, and agricultural development. This has lead to the impairment of a number of ecosystem processes that support fish habitats. In addition, the natural disturbance regime for floods and fires has departed substantially from its historic properly functioning interval and effects. Therefore, the overall watershed condition is currently characterized as being of poor quality, with little resiliency, and limited (L) ability to provide habitat for salmon and trout in the long term.

Implementation of the partial implementation action alternatives is likely to contribute towards currently degraded watershed conditions in the CBP. Significant drawdowns at Lake Roosevelt, such as those contemplated in action alternatives 2B and 2D will likely produce a high level (3) of negative impact on the ecological function of the watershed within the Project Area.

Based on predicted impacts described above for each of the six aquatic habitat indicators, Table 7 summarizes estimated impacts to aquatic habitat indicators, using high (3), medium (2), or low (1).

Table 7. Evaluation and Benefit Ratings of Aquatic Habitat Indicators for Aquatic Species by Alternative. Assigned level of impact (i.e., 3=high impact; 2=moderate impact; 1=low impact) was derived by assessing the amount, frequency, and duration of water releases from Lake Roosevelt and/or Banks Lake in accordance with the proposed alternatives

Project Alternative	Aquatic Habitat Indicators					
	Water Quality & Quantity	Habitat Access	Habitat Elements	Channel Condition and Dynamics	Flow/ Hydrology	Watershed Conditions
No Action	3	3	3	3	3	3
Action 2A	2	2	2	2	2	2
Action 2B	3	3	3	3	3	3
Action 2C	2	2	2	2	2	2
Action 2D	3	3	3	3	3	3
Action 3A	2	2	2	2	2	2
Action 3B	3	3	3	3	3	3
Action 3C	2	2	2	2	2	2
Action 3D	3	3	3	3	3	3
3 = High Impact, 2 = Moderate Impact, 1 = Low Impact						

9.1.7 Effects to Riparian and Riparian-mixed Habitat Under the Partial Implementation Alternatives

The WDFW HEP analysis (WDFW 2009a, p. 28) indicate that a habitat loss equivalent to 21 acres of optimal riparian habitat will be lost under any of the partial implementation alternatives. Riparian-mixed habitat is heterogeneous in nature and contains some of the features and qualities of riparian habitat as well as the features and qualities of other habitat types. However, the Service has determined that an additional 148 acres of varying quality riparian habitat will be subject to temporary disturbance under Alternatives 2C and 2D. Based on our estimated levels of impact, Alternatives 2A and 2B are the second-most destructive to riparian and riparian-mixed habitat, as compared to the full implementation Alternatives 3B and 3D. These impacts are summarized in Table 9, along with impacts to terrestrial habitats. It is possible that some of the existing riparian habitat could, through proper management, be useful as seasonal habitat for such species as geese and other migratory waterfowl.

9.2 Effects to Terrestrial Habitats Under the Partial Implementation Alternatives

9.2.1 Effects to Shrub-steppe Habitat Under the Partial Implementation Alternatives
Shrub-steppe is a priority habitat for both the Service and WDFW. Therefore, the Service is concerned about the impacts expected to result from any of the partial implementation alternatives (2A, 2B, 2C, or 2D), as they all will impact shrub-steppe habitat to some extent.

According to the WDFW 2009 HEP analysis (WDFW 2009a, p. 28), a direct loss of the equivalent of over 4,000 acres shrub-steppe habitat will occur under any of the partial implementation alternatives. However, up to a total of 15,448 acres of shrub-steppe habitat may be subject to temporary noise disturbances. Similarly, the Service expects several thousand acres (exact amount unknown) to be impacted per the second analytical method. Duration of the impacts may vary from a few seconds after cessation of activities to permanent avoidance.

9.2.2 Effects to Grassland Habitat Under the Partial Implementation Alternatives
The WDFW HEP analysis (WDFW 2009a, p. 28) indicated that a loss of the equivalent of up to 3,183 acres of grassland habitat will be lost under any partial implementation alternative. However, up to a total of 2,287 additional acres of grassland habitat may be lost when temporary and noise disturbances are included. Temporary disturbance, or short-term loss, could result from construction noise or maintenance activities of short duration (i.e. one day to one month). Long term loss could result from crust-disturbing activities, such as trenching canals in shrub-steppe habitat or noise of such magnitude as to cause permanent hearing loss.

9.2.3 Effects to Agricultural Under the Partial Implementation Alternatives
We expect that minimal impacts to agricultural land will result from implementation of any of the partial implementation alternatives. Wildlife often uses the borders of agricultural land for foraging and agricultural land itself may provide sheltering and nesting areas. Conservation Reserve Program lands and lands with conservation easements on them may provide foraging, sheltering, and nesting habitat for sage-grouse (Schroeder 2006, p. 1)

9.2.4 Effects to Federally listed Threatened and Endangered Species Under the Partial Implementation Alternatives

Columbia Basin Pygmy Rabbit
The further loss of shrub-steppe habitat will have a detrimental effect on recovery of the pygmy rabbit. Since many areas of potential habitat have never been surveyed, the potential also exists for disturbing, injuring or killing undiscovered individuals or small surviving populations. Any remaining populations that exist would likely be further isolated, genetically and physically by the Project (WDFW 2009b, pp .13-15). Loss of suitable habitat and habitat connectivity will also hamper long term recovery of the species. A possible recent sighting of a Columbia Basin pygmy rabbit was reported within the Affected Area by a consultant in March, 2010. Attempts were made to confirm the sighting; however, they were unsuccessful. Based on the information gathered, no further investigation of the sighting was recommended (Rich Finger, WDFW 2010, *pers. comm.*).

Bull trout
Bull trout have not been reported in lower Crab Creek; although, surveys to detect bull trout have not been conducted there (Dave Kaumheimer, Reclamation, November 2, 2006, *pers. comm.*). Water temperatures, provided by Reclamation in Appendix E and Figure 4 indicate that water temperatures are well within the optimum range for bull trout for several months of the year.

Bull trout likely could use lower Crab Creek for foraging, wintering and over-wintering in the fall, winter, and spring. Suitable water temperatures together with the presence of steelhead, a food source, compel the Service to determine that bull trout may be present in lower Crab Creek, at least during the months of October through March. Bull trout residing in the mainstem of the Columbia River may use Crab Creek for foraging all year long (U.S. Environmental Protection Agency. 2003, Table 2). Implementation of the alternatives is likely to have a low level of impact on bull trout since the alternatives will not result in inputs of irrigation return water to Lower Crab Creek.

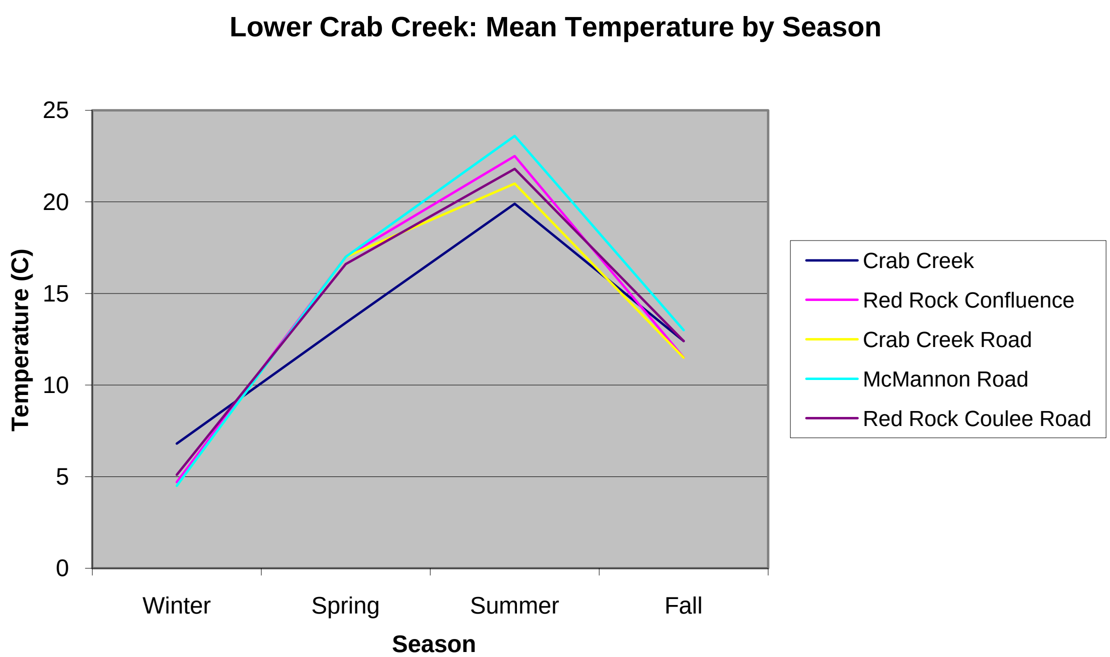

Figure 4. Mean seasonal temperatures in lower Crab Creek (Gina Holt 2009, pers. comm.)

<u>Steelhead</u>

Over the past several decades, populations of steelhead throughout the West Coast have declined to dangerously low levels. These population declines and extinctions are the result of numerous habitat-affecting factors (such as economic development, resource extraction, and other land uses), harvest practices, hatchery production, and other factors similar in scope and magnitude to the action alternatives. Human actions that depress population abundance have also caused steelhead to be more susceptible to natural environmental fluctuations such as poor ocean conditions and drought. Implementation of the action alternatives is anticipated to lengthen the seasonal timeframe in which steelhead could use Crab Creek. Conversely, the action alternatives may negatively change the structure and hydrology of Lower Crab Creek instream habitat through increased flows. Implementation of the alternatives is likely to have a low level of impact on steelhead, since the alternatives will not change irrigation return water to Lower Crab Creek substantially, if at all.

As previously discussed, steelhead use of Crab Creek, prior to the CBP, was probably very limited and the creek would likely not have produced smolts, given its ephemeral character. With present perennial flows, no information has yet been discovered that indicates lower Crab

Creek produces smolts. Spawning habitat within Crab Creek appears to be limited due to high silt loads, temperature and water quality. Conceivably, young parr may move out of Crab Creek and finish rearing in the Columbia River. Due to the large presence of rainbow trout (stocked and naturally reproducing), it has been difficult to determine if steelhead par are migrating to the Columbia to rear. The presence of resident rainbows in Red Rock suggests that steelhead might well be successful in producing smolts in this tributary. Therefore, implementation of the action alternatives may influence future steelhead smolt production by increasing silt load and moderately benefiting water temperature and water quality.

Spalding's Silene

The further loss of grassland habitat especially at elevations of 1900-3050 feet will have a detrimental effect on Spalding's silene. The potential also exists for the removal or disturbance of individuals of the species. There are 49 populations known in Washington, many within or around the Project Area (USFWS 2005, pp. 5-6). Any remaining populations that exist could likely be genetically isolated further by the Project.

Ute's ladies' tresses

The further loss of emergent wetland habitat, especially streamside habitats that are periodically grazed, will have a detrimental effect on the Ute's ladies' tresses. The potential also will be present for the removal or disturbance of individuals of the species. Occurrences of the ladies' tresses are reported near to the Project in Chelan County, within the Chief Joseph watershed (USFWS 2005c, p. 20). It is unknown if the species occurs within the Project Area. Any remaining populations that exist would likely be genetically isolated by the Project (WDFW 2009b, pp .13-15).

9.3 Candidate Species

Greater sage-grouse, Washington ground squirrel, Northern wormwood, yellow-billed cuckoo, and Suksdorf's monkey-flower will be adversely affected by further loss of shrub-steppe and riparian habitat, as well as possible direct or indirect mortality. Any remaining populations of greater sage-grouse, Washington ground squirrel, Northern wormwood, yellow-billed cuckoo, and Suksdorf's monkey-flower that exist would likely be genetically and physically isolated by the Project (WDFW 2009b, pp. 13-15).

Much of the sage-grouse habitat within the Project Area is likely unoccupied. There are, however, recent and historical records of sage-grouse occurrence in all the management units and much of the habitat is suitable (Stinson 2004, pp. 28-29). A translocated sage-grouse population does occur in the Crab Creek Sage-grouse Management Unit. The three units in the Project Area south of I-90 are occupied but do not support functional populations of sage-grouse. Sage-grouse likely migrate from Moss Coulee east to surrounding sage steppe habitats within Dry Falls Sage-grouse Management Unit; therefore, the suitable habitat within the Project Area, particularly north of I-90, is very important for recovery of the sage-grouse.

Sage-grouse management units affected by the Project can be seen in Figure 5. Five management units are within the Project Area, including Dry Falls, Crab Creek, Potholes, Saddle Mountain and Hanford.

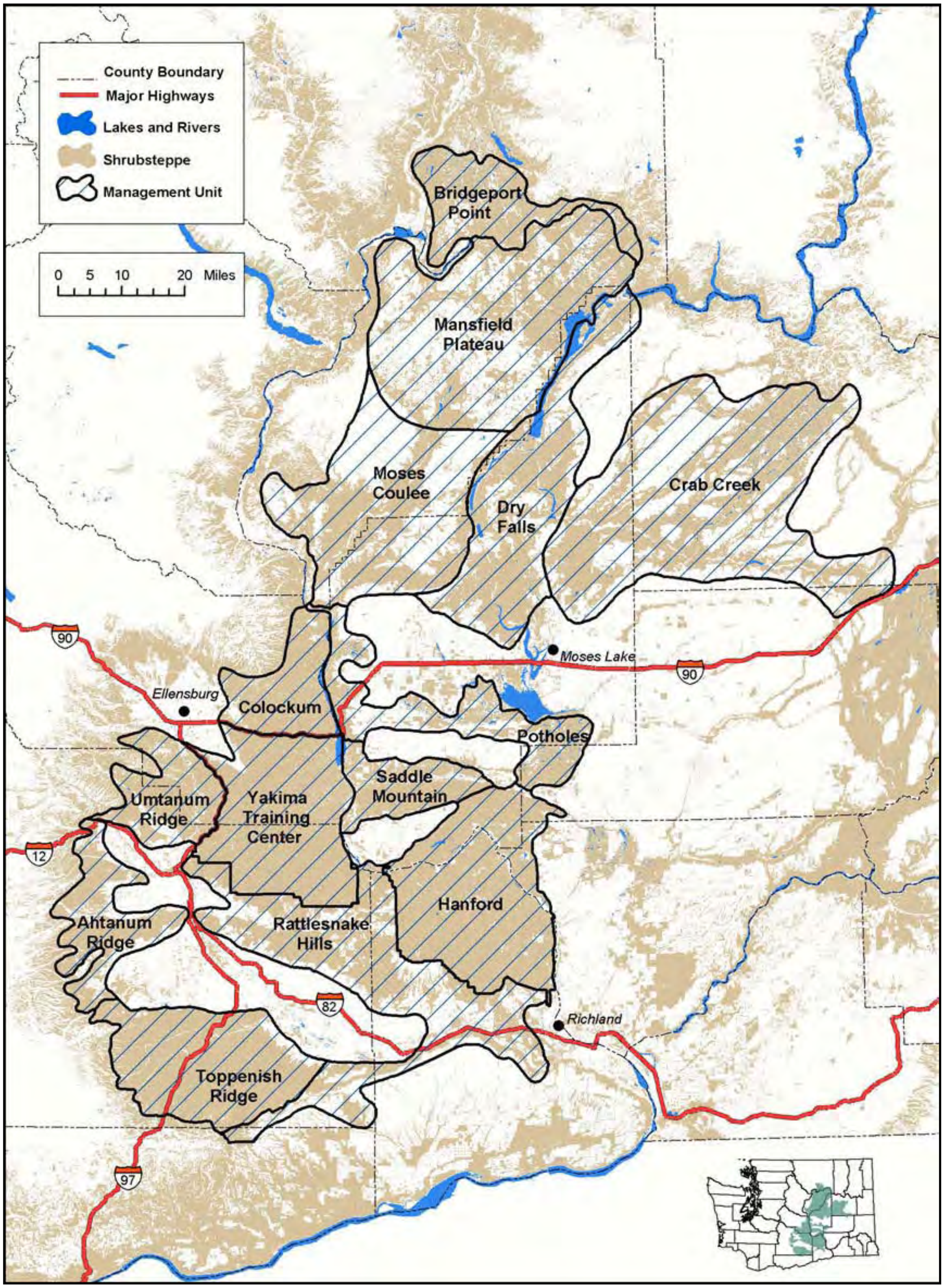

Figure 5. Sage-grouse Management Units (Stinson 2004, p. 30)

9.3.1 Effects to Species of Concern Under the Partial Implementation Alternatives
Species of Concern that may be present are also expected to be adversely affected by all of the alternatives. Loss of shrub-steppe and grassland habitat will negatively impact bald eagle *(Haliaeetus leucocephalus)*, burrowing owl (*Athene cunicularia)*, Columbian sharp-tailed grouse *(Tympanuchus phasianellus columbianus)*, ferruginous hawk (*Buteo regalis*), loggerhead shrike (*Lanius ludovicianus*), long-eared myotis (*Myotis evotis*), northern goshawk *(Accipiter gentilis)*, olive-sided flycatcher *(Contopus cooperi)*, possibly northern leopard frog (*Rana pipiens)*, pallid Townsend's big-eared bat (*Corynorhinus townsendii pallescens*), and sagebrush lizard (*Sceloporus graciosus*). Depending on location, habitat present, season, and species present, these impacts may include loss of nesting and rearing habitat, loss of roosting and perching disturbance at hibernation sites, avoidance of foraging habitat, and direct mortality through stress and increased predation. Effects may occur directly or through disturbance of vital behavior patterns or through avoidance behavior. Populations may be separated from food sources. Any remaining populations that are isolated by project infrastructure could potentially suffer from lack of gene flow, inbreeding depression, and genetic drift, rendering these isolated populations more susceptible to stochastic events. Construction noise could cause adverse impacts including increased predation due to hearing damage, flight, nest abandonment, and interference with vital behaviors, such as breeding. The project will affect many habitats in many areas and, therefore, may directly or indirectly impact any of the species present. Infrastructure, such as pole lines, fences, and access roads may facilitate predation from avian predators that use them for hunting and make prey more vulnerable and by domestic animals that use access roads to move between areas. Competition among predators, especially avian predators, may reduce food resources and decrease available food resources for species of concern.

Similarly, plant species such as gray cryptantha (*Cryptantha leucophaea*), Hoover's desert-parsley (*Lomatium tuberosum*), prairie lupine (*Lupinus cusickii*), Washington polemonium (*Polemonium pectinatum*), basalt daisy (*Erigeron basalticus*), and Wanapum crazyweed (*Oxytropis campestris* var. *wanapum*) will be susceptible to ground disturbance impacts. Pollutants leaking from construction equipment or treated construction materials (i.e., treated wooden poles) may impact plant species, especially those near construction staging areas or near pole lines and fences. Construction activities can introduce invasive species into new areas, resulting in increased competition for resources.

9.4 Effects to Aquatic Resources under the Full Implementation Alternatives (3A-3D)
Under these alternatives, it is our understanding that water from Lake Roosevelt and the Banks Lake Reservoir will be utilized to supplement water in Reclamation's East Low Canal for purpose of providing additional instream flows in the CBP. Reclamation has also identified the Weber Siphon expansion as a federal project to expand the water delivery capacity of the CBP in the East Low Canal. This would entail the construction of a new East High Canal system north of Interstate 90 in phases. The alternatives discussed in this section are described below:

- <u>3A: Full replacement of ground water use with water from Banks Lake.</u> Water delivery options include an expanded East Low Canal with a 2.5-mile extension together with construction of the East High Canal from above Billy Clapp Lake to a point about 15 miles east of Moses Lake, construction of the Black Rock reregulation reservoir, and construction of the Black Rock Branch Canal from the proposed Black

Rock reregulating reservoir to about 21 miles east of Moses Lake, Washington. Water supply options include an additional drawdown of Banks Lake (up to 18 feet);

- <u>3B: Full implementation with water from Banks Lake and Lake Roosevelt.</u> Full replacement of ground water use with water from Banks Lake. Water delivery options include an expanded East Low Canal with a 2.5-mile extension together with construction of the East High Canal from above Billy Clapp Lake to a point about 15 miles east of Moses Lake, construction of the Black Rock reregulation reservoir, and construction of the Black Rock Branch Canal from the proposed Black Rock reregulating reservoir to about 21 miles east of Moses Lake, Washington. Water supply options include an additional drawdown of Banks Lake and use of additional water from Lake Roosevelt;

- <u>3C: Full implementation with water from Banks Lake and Rocky Coulee.</u> Water delivery options include an expanded East Low Canal with a 2.5-mile extension together with construction of the East High Canal from above Billy Clapp Lake to a point about 15 miles east of Moses Lake, construction of the Black Rock reregulation reservoir, and construction of the Black Rock Branch Canal from the proposed Black Rock reregulating reservoir to about 21 miles east of Moses Lake, Washington. Water supply options include an additional drawdown of Banks Lake and construction of a reservoir in Rocky Coulee (117,900 acre-feet active storage);

- <u>3D: Full implementation with water from Banks Lake, Rocky Coulee, and Lake Roosevelt.</u> Water delivery options include an expanded East Low Canal with a 2.5-mile extension together with construction of the East High Canal from above Billy Clapp Lake to a point about 15 miles east of Moses Lake, construction of the Black Rock reregulation reservoir, and construction of the Black Rock Branch Canal from the proposed Black Rock reregulating reservoir to about 21 miles east of Moses Lake, Washington. Water supply options include an additional drawdown of Banks Lake, construction of a reservoir in Rocky Coulee, and use of additional water from Lake Roosevelt.

9.4.1 Effects to Water Quality and Quantity Under the Full Implementation Alternatives

As with the partial implementation alternatives, the primary effect of the full implementation action alternatives on water quality and quantity is related to increasing the distribution of contaminants from Lake Roosevelt through water releases to Banks Lake Reservoir, Billy Clapp Lake, Potholes Reservoir, and Crab Creek. The overall effect of the action is likely to maintain or further degrade water quality in water bodies associated with the CBP. This effect is estimated to be of a moderate (M) to high (H) level of impact.

Full implementation will produce similar impacts to those resulting from the partial implementation alternatives; but effects will occur over a greater area due to the increase in the water distribution area and the increased amount of contaminated water and sediment moved through the CBP. At this time, it is unclear whether or not full implementation will improve water quantity in a meaningful manner.

9.4.2 Effects to Habitat Access Under the Full Implementation Alternatives

The action alternatives do not include the construction of upstream fish passage facilities at Chief Joseph, Dry Falls, O'Sullivan, or Pinto dams. Upstream fish passage facilities may provide an alternative for fish to return to bodies of water above these dams. These structures currently have outlet works that cause fish to be entrained downstream. We expect that fish will continue to be entrained at Lake Roosevelt, Banks Lake, Billy Clapp Lake, and Potholes Reservoir based upon current operational regimes at these locations. Information regarding the rates of entrainment for these bodies of water is limited, but most likely determines the success of annual fisheries with sport seasons. The Service analyzed entrainment data collected from WDFW at Dry Fall Dam (Banks Lake). Entrainment of fish from Banks Lake appears to be at its highest level during the daytime period of this study. Sculpin, smallmouth bass, and largemouth bass were the highest proportion of fish species sampled during entrainment studies at Banks Lake. Entrainment rates at Banks Lake will likely increase with all the action alternatives, since significant water withdrawals from Lake Roosevelt (i.e., action alternatives 3B and 3D) will result in more water available for distribution through Banks Lake and surrounding water conveyance structures. Since bull trout have been documented to reside in Lake Roosevelt, we are not able to discount the potential effect of bull trout entrainment at this facility. We also anticipate that entrainment levels will continue to occur at moderate levels through the proposed implementation of the remaining alternatives, specifically 3A and 3C.

Full implementation will produce impacts similar to those resulting from the partial implementation alternatives; but again the effects will occur over a greater area due to the increase in project size. The Affected Area includes the area impacted by the partial implementation alternatives (2A-2D). This effect would be of a moderate (M)) level of impact.

9.4.3 Effects to Habitat Elements Under the Full Implementation Alternatives
Implementation of the Full Implementation Alternatives is likely to increase the effects associated with the current reservoir operations of the CBP.

For example, alternatives 3B and 3D are anticipated to have the most significant impacts on spawning and rearing habitats for resident fish in Lake Roosevelt. Depending on the water amount available and the time of year, these alternatives will result in the most significant changes in water elevation. Although the habitat access effects will be larger in scope and magnitudes, all of the action alternatives will affect spawning and rearing habitats for resident fish within Banks Lake. The overall effect of the action alternatives is likely to continue to degrade aquatic habitat elements within the CBP.

Full implementation will produce impacts similar to those resulting from the partial implementation alternatives; but again the effects will occur over a greater area due to the increase in project size. The Affected Area includes the area impacted by the partial implementation alternatives (2A-2D). This effect would be of a moderate (M)) level of impact.

9.4.4 Effects to Channel Condition and Dynamics Under the Full Implementation Alternatives
Implementation of any of the full implementation alternatives will likely have the most pronounced effects to the channel conditions within the Middle Crab Creek drainage of the CBP. The overall effect of any of the full implementation alternatives is likely to maintain degraded channel conditions and dynamics in water bodies associated with the Columbia River Basin Irrigation Project. Channels throughout the CBP have suffered from truncated flow regimes,

altered water levels, channelization and resulting impacts to other dynamics as described in this report.

Alternatives 3B and 3D, will likely demonstrate the highest level of impacts as these alternatives entail the most significant water withdrawals from Lake Roosevelt. Water withdrawals from Lake Roosevelt under the full implementation alternatives would be distributed to Banks Lake for further distribution in the CBP. It is anticipated that alternatives 3A and 3C, will have moderate impacts on the channel condition and dynamics habitat indicator since water withdrawals from Lake Roosevelt and Banks Lake are lower in magnitude under these alternatives.

Full implementation will produce impacts of the same nature as the partial implementation alternatives but will produce these effects over a greater area due to project size, which includes the area impacted by the partial implementation alternatives (2A-2D). The effect is estimated be of moderate (M) level of impact.

9.4.5 Effects to Flow/Hydrology Under the Full Implementation Alternatives

The full implementation alternatives require extensive construction, which would include expanding the capacity of existing facilities and constructing new canals, siphons, tunnels, pumping plants, piped laterals, and new re-regulating reservoirs. We anticipate that these types of activities will alter the flow/hydrology of the affected water bodies. For example, the new proposed re-regulating reservoirs at Black Rock Coulee and Rocky Coulee would offer a higher level of active storage capacity for disseminating flows in the CBP. However, at this time, it is unclear how this water would be allocated and released to other infrastructure within the CBP once it leaves Banks Lake. It is our understanding that the Rocky Coulee Reservoir would be filled in fall/winter and drained progressively in the spring/summer of each respective year. The exact timing, number and seasonal incremental flows released from Lake Roosevelt down the Columbia River are also not known at this time.

Hydrographic variation has resulted in lower proportional change in peak flows, higher base flows have resulted from water impoundment in bodies of water such as Lake Roosevelt, Banks Lake, Billy Clapp Lake, Potholes Reservoir, and Crab Creek. A natural hydrograph would have the ability to support possible bull trout occurrences in Crab Creek by minimizing daily and day-to-day fluctuations and minimizing departures from the natural cycle of flow levels corresponding with seasonal variation. As a result of the proposed action, a highly modified hydrograph with altered peak and base flows, and reservoir levels will be continued in Lake Roosevelt, Banks Lake, Billy Clapp Lake, Potholes Reservoir, and Crab Creek.

Specifically, action alternatives 3B and 3D entail the most significant water withdrawals from Lake Roosevelt. The effects of these alternatives would appear to have the highest level of negative impact on the flow/hydrology indicator. Water withdrawn from Lake Roosevelt under these alternatives would then be pumped and transported via canal to Banks Lake for further distribution in the CBP. The effects to the flow/hydrology indicator are not as significant to the drawdown of Banks Lake for all eight action alternatives. For example, action alternative 3C closely mimics existing Banks Lake water withdrawals and would result in only moderate changes from current levels. The overall effect of any of the full implementation alternatives is likely to increase degraded flow and hydrology conditions in water bodies associated with the CBP. These effects are estimated to be of moderate (M) level of impact.

9.4.6 Effects to Watershed Conditions Under the Full Implementation Alternatives

Full implementation will produce the same types of impacts as the partial implementation alternatives but will produce a much greater range and magnitude of effects due to increased project size and habitat differences. A greater proportion of the Project Area under the full implementation alternatives is currently composed of suitable and good quality habitats. Hydrographic variation has resulted in substantial effects to the watershed conditions within the CBP. The overall effect of the full implementation action alternatives is likely to further degrade watershed conditions in the CB P. The disturbance history in the action area has been altered by substantial changes to the hydrograph due to water withdrawal for irrigation, operational needs for hydropower generation, degraded riparian areas, and nearly a century of fire suppression. This has lead to the impairment of a number of ecosystem processes that support habitats used by fish. Analysis of the riparian conservation area indictor in particular suggests a condition that is fragmented, poorly connected, and provides limited protection to aquatic species within the Project Area. In addition, the natural disturbance regime, in terms of floods and fires, has departed substantially from its historic properly functioning condition and frequency. This will likely translate to overall watershed conditions of poor quality habitats, little resiliency, and limited ability to provide habitat for the fish in the long term.

Implementation of any of the alternatives is likely to contribute to degrade watershed conditions in the CBP. Significant drawdowns at Lake Roosevelt, such as those contemplated in alternatives 3B and 3D will likely produce a high level of negative impact on the ecological function of the watershed within the Project Area. Table 8 summarizes these impacts to aquatic habitats. Low impacts could be detected but would be unlikely to trigger adverse reactions in aquatic life. Moderate (M) impacts would likely trigger avoidance behavior or would cause modification of, but not preclude, vital functions in aquatic life, and high impacts would cause significant damage up to and including mortality or interference with vital life functions or life stages.

Table 8. Overall evaluation of impacts to habitat indicators for the No Action and Alternatives 2A-3D

Project Alternative	Aquatic Habitat Indicators					
	Water Quality	Habitat Access	Habitat Elements	Channel Condition and Dynamics	Flow/ hydrology	Watershed Conditions
No Action	3	3	3	3	3	3
Action 2A	2	2	2	2	2	2
Action 2B	3	3	3	3	3	3
Action 2C	2	2	2	2	2	2
Action 2D	3	3	3	3	3	3
Action 3A	2	2	2	2	2	2
Action 3B	3	3	3	3	3	3
Action 3C	2	2	2	2	2	2
Action 3D	3	3	3	3	3	3
3 = High Impact, 2 = Moderate Impact, 1 = Low Impact						

Figures 6-11.
Figures 6 through 11 below show visually how each aquatic habitat indicator was impacted by each alternative on a scale of high, medium and low, where 3 is equal to high impact, 2 is equal to moderate impact, and 1 is equal to low impact.

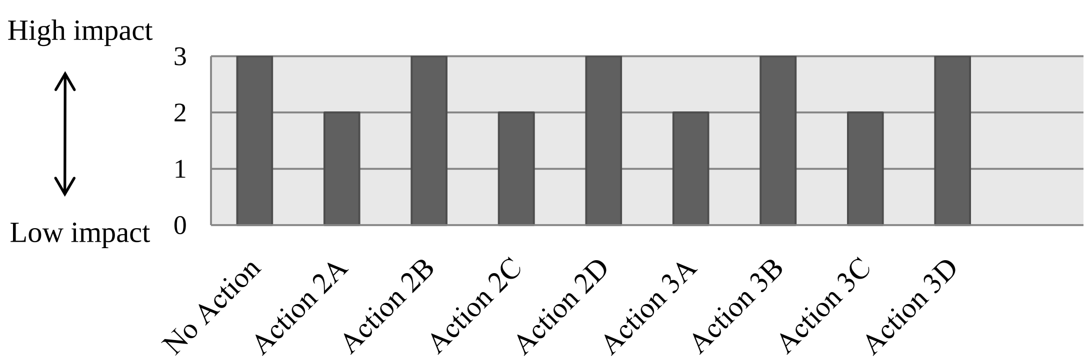

Figure 6. Water Quality

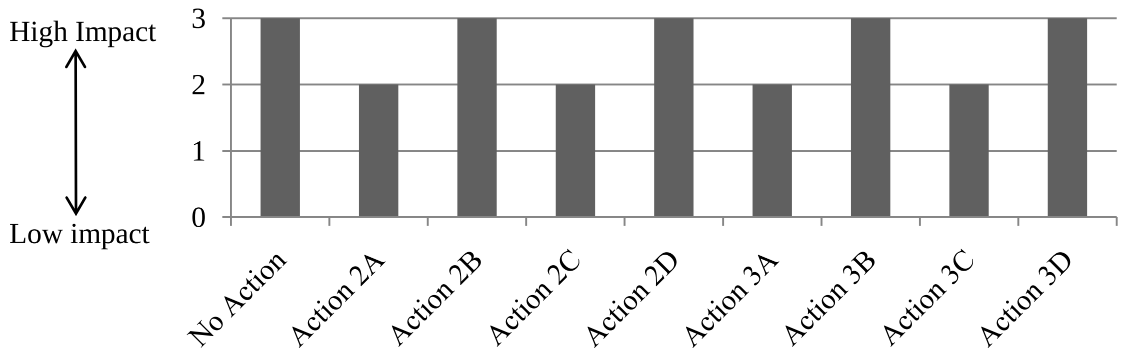

Figure 7. Habitat Access

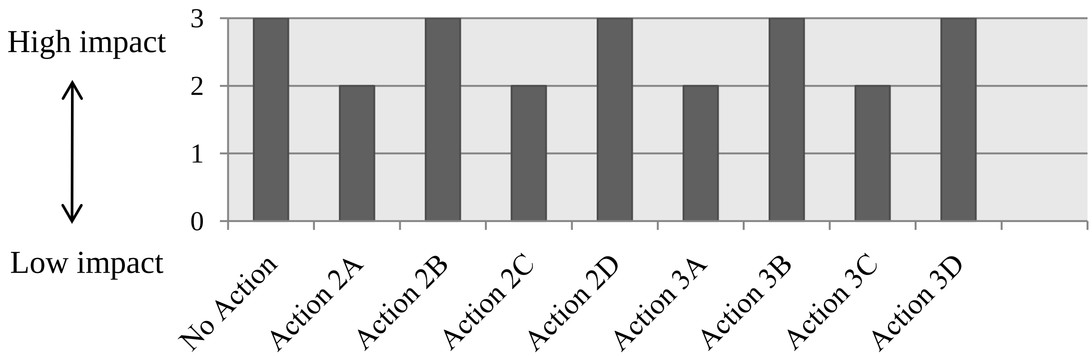

Figure 8. Habitat Elements

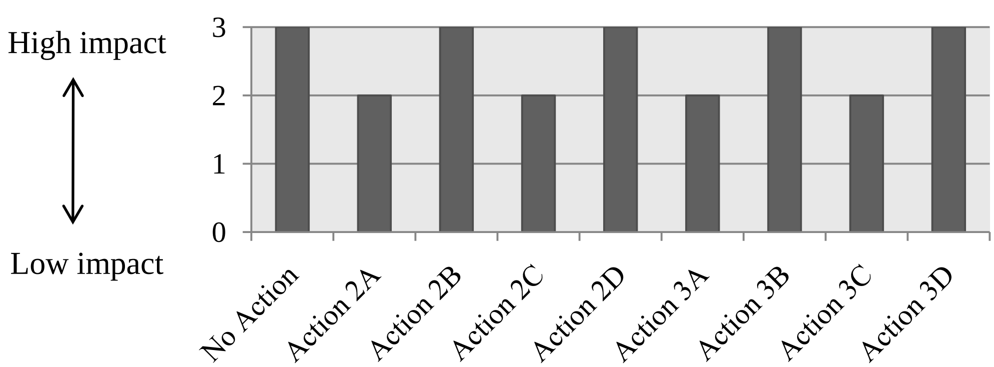

Figure 9. Channel Condition and Dynamics

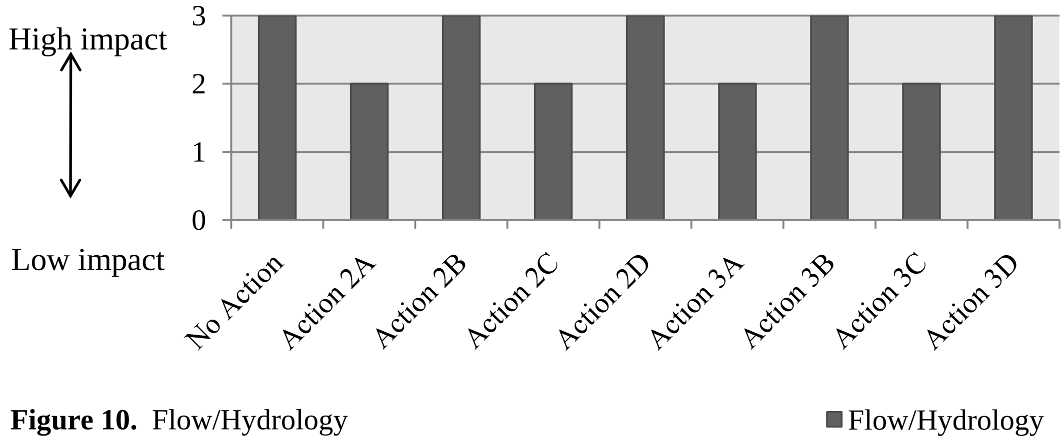

Figure 10. Flow/Hydrology

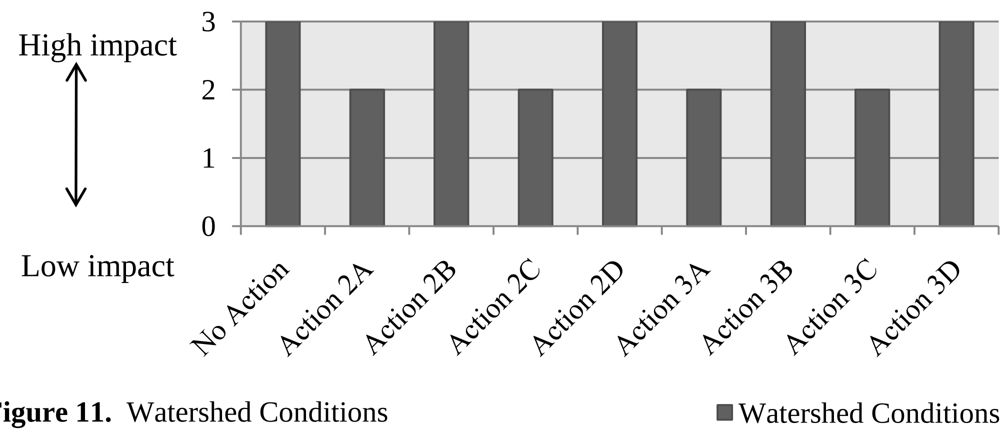

Figure 11. Watershed Conditions

9.4.7 Effects to Riparian and Riparian-mixed Habitat Under the Full Implementation Alternatives

The analyses indicate that the greatest loss of riparian and riparian-mixed habitats will occur under Alternatives 3C and 3D. However, Alternatives 3A and 3B are the second-most destructive to these habitats. Habitat loss will occur primarily through construction of the East High Canal, Rocky Coulee Reservoir and the reservoir in Black Rock Coulee, along with attendant structures such as pumping plants. Exact locations and designs for many of these structures have not been determined at this preliminary stage of the project; therefore, our assessment is qualitative.

Under Alternatives 3A, 3B, 3C, and 3D, significant and irreplaceable impacts are expected to occur to unique upland and riparian habitats located within the Black Rock Coulee flood easement area. These effects are predicted to be of moderate (M) to high (H) levels of impact.

9.5 Effects to Terrestrial Habitats Under the Full Implementation Alternatives

The difference in the impacts to terrestrial habitats resulting from each alternative is merely a matter of magnitude. We have the same concerns under full implementation as we do under partial implementation. With a larger footprint for the construction of the EHC, the larger the degree of uncertainty becomes without a detailed description of the Project. We do not, for instance, have details concerning type, amount, and location of Project features nor do we have information concerning type, amount, and location of habitats. We are aware that native habitats North of I-90 is more contiguous than habitat South of I-90. Also, land North of I-90 contains a greater proportion of native habitat within the Project Area. We are confident, therefore, that impacts of the full implementation alternatives (3A-3D) will be significantly greater.

9.5.1 Effects to Shrub-steppe Habitat Under the Full Implementation Alternatives

The conservation and protection of shrub-steppe habitat is a priority for both the Service and WDFW. Therefore, we have numerous concerns about the impacts we expect to result from any of the full implementation alternatives (3A, 3B, 3C, or 3D). Alternatives 3C and 3D will have greater impacts due to construction of the EHC canal, and a new reservoir in Rocky Coulee.

According to the WDFW HEP analysis (WDFW 2009a, p. 28) a direct loss of the equivalent of over 4,000 acres of shrub-steppe habitat will occur. This is out of an estimated 6,260 acres of available habitat within the Project footprint (WDFW 2009d, p.4). However, up to a total of 19,448 acres of shrub-steppe habitat may be loss due to temporary impacts and noise disturbances. This habitat loss will extend beyond the perimeters of the Project footprint. This figure is based on our assumptions concerning noise and the Project description provided by Reclamation. Impact area may change when construction surveys are completed and project infrastructure is determined.

9.5.2 Effects to Grassland Habitat Under the Full Implementation Alternatives

The WDFW HEP analysis (WDFW 2009a, p. 28) shows that a loss of an undetermined amount of grassland habitat will occur. This is out of an estimated 4,938 acres of available habitat within the Project footprint (WDFW 2009d, p. 4). However, up to a total of 5,500 acres of additional grassland habitat may be lost when temporary and noise disturbances are included. This habitat loss will extend beyond the perimeters of the Project footprint. This figure is based on our assumptions concerning noise and the Project description provided by Reclamation. Impact area may change when construction surveys are completed and project infrastructure is determined.

9.5.3 Effects to Agricultural Habitat Under the Full Implementation Alternatives

Regardless of which alternative is chosen, agricultural lands are expected to increase. The extent of this increase will be influenced by socio-economic influences and from political influences. It is expected that an increase in agricultural habitat will occur and will benefit some wildlife, such as pheasant and possibly sage-grouse, depending on the agricultural practices, crop, and their proximity to native habitats. Conversely, those species that rely on native habitat, such as Washington ground squirrel and mule deer, will likely decrease in numbers.

9.5.4 Effects to Federally listed Threatened and Endangered Species Under the Full Implementation Alternatives

<u>Columbia Basin Pygmy Rabbit</u>

Construction of the EHC will transect several areas of possible pygmy rabbit habitat. The further loss of actual or potential pygmy rabbit habitat may have a detrimental effect on the pygmy rabbit. Since many areas of potential habitat have never been surveyed, the potential exists for the take of individuals of the species.

Bull trout

Bull trout originating from the mainstem Columbia River are assumed to occur infrequently in Lower Crab Creek. Therefore, we assume impacts to bull trout will occur at a low level under any of the full implementation alternatives. It is anticipated that the most significant effects related to flow/hydrology and instream habitat components would occur in Middle Crab Creek based on the description of the full implementation alternatives. Likewise, effects to bull trout upstream and downstream passage, foraging, and migration in the mainstem Columbia River are anticipated to be low due to the relative small amount of water proposed to be withdrawn from the Columbia River for the full implementation alternatives. Effects to aquatic species are more completely described under the *Effects to Aquatic Resources* section above.

Steelhead

Steelhead are anticipated to experience similar impacts under any of the full implementation alternatives and the partial implementation alternatives. Steelhead have been documented to occur infrequently in lower Crab Creek; however, effects of the full implementation alternatives will likely extend only to middle Crab Creek. A natural falls located 56 kilometers above the mouth of Crab Creek likely limits further use upstream into middle Crab Creek. Effects to steelhead instream habitat components associated with spawning and potential rearing in lower Crab Creek are anticipated to be low. With present perennial flows, no information has yet been discovered that indicates lower Crab Creek produces smolts.

Spalding's Silene

The further loss of actual or potential Spalding's silene habitat will have a detrimental effect on Spalding's silene. The potential also exists for the removal/destruction or disturbance of individuals of the species. Any remaining populations that exist could be genetically isolated by the Project (WDFW 2009b, pp. 13-15). Appropriate pre-construction surveys could reduce but not preclude destruction on individuals.

Ute's ladies' tresses

The further loss of actual or potential Ute's ladies' tresses habitat will have a detrimental effect on this species. The potential exists for the removal/destruction or disturbance of individual plants. Any remaining populations that exist could be genetically isolated by the Project (WDFW 2009b, pp. 13-15). Appropriate pre-construction surveys could reduce but not preclude destruction of individuals.

9.5.5 Effects to Candidate Species

Washington ground squirrel will be adversely affected by further loss of habitat, as well as possible direct or indirect mortality. Any remaining populations that exist would likely be genetically and physically isolated by the Project (WDFW 2009b, pp. 13-15) by the creation of habitat barriers. Alternatives 3C and 3D will require construction of a new reservoir in Black Rock Coulee that will inundate areas of suitable habitat for the Washington ground squirrel and may cause any local colonies to become genetically isolated, if they are present.

Sage-grouse are a species of high concern to the Service. Currently, there are records of sage-grouse observations in all sage-grouse management units in the Project Area and the Affected

Area (Stinson and Schroeder, 2004, p. 3). Negative impacts, such as vegetation removal, to habitat in these areas will impede re-establishment and recovery of sage-grouse.

The Affected Area either lies within or may lie within (depending on final location of Project infrastructure) within five Sage-grouse Management Units as set forth in the Washington State Recovery Plan for the Greater Sage-grouse (Stinson and Schroeder 2004, pp. 28-29). State sage-grouse management units potentially affected by the project include:

- Saddle Mountain Sage-grouse Management Unit;
- Crab Creek Sage-grouse Management Unit;
- Dry Falls Sage-grouse Management Unit;
- Hanford Sage-grouse Management Unit, and;
- Potholes Sage-grouse Management Unit.

10.0 EVALUATION AND COMPARISON OF ALTERNATIVES

In review, we examined the No-Action Alternative, partial implementation Alternatives 2A, 2B, 2C, 2D, and full implementation Alternatives 3A, 3B, 3C, and 3D. Potential effects on aquatic habitats and fish were qualitatively examined. Effects on terrestrial resources, including wildlife, were examined using two methods: WDFW's HEP analysis using estimated acreages for canals and reservoirs and HEP analysis using Reclamation's preliminary acreage estimates of the Projects' features and facilities. Ultimately, final effects and their magnitude cannot be fully determined without final designs, on-site surveys, and a completely detailed Project description. Final analysis will occur once a preferred alternative has been identified by Reclamation.

Our evaluation and analyses indicate that none of the action alternatives will benefit fish, wildlife, or their habitats, to the degree that negative effects will be outweighed by positive effects, without the added benefits of mitigation and wildlife habitat improvements. Mitigation and wildlife habitat improvements could and may be done, but are not currently proposed as part of the Project. Overall, no alternative in either water replacement group of Alternative 2 (A thru D) nor Alternative 3 (A thru D) was considered better for wildlife resources than the other, except that the *degree* of impact to terrestrial resources was greater under full replacement alternatives. The greatest potential for negative impacts to aquatic species will result from Alternatives 2B, 2D, 3B, and 3D. The impacts that result from Alternatives 2A, 2C, 3A, and 3D will be smaller in magnitude than the remaining alternatives. The primary negative factor between the alternatives appeared to be the water source. If the alternative's water source was Banks Lake, it appeared to negatively influence the alternative's effects to wildlife and fish resources. This was due to the greater effects to the aquatic resources from water drawdown in Banks Lake. Note that all of the proposed alternatives will negatively impact terrestrial habitats.

Specifically, we find that Alternative 2A, 2B, 2C, and 2D do not meet fish and wildlife needs for the following reasons:

1. Long-term and potential permanent loss of shrub-steppe habitat. This habitat is necessary for the conservation of sage-grouse, sharp-tail grouse, Columbia Basin pygmy rabbit, and other species of wildlife.

2. Sage-grouse, sharp-tail grouse, and other species of concern could be wounded, killed, or disturbed.

3. Predation on sage-grouse, sharp-tail grouse, Columbia Basin pygmy rabbit, and other species of wildlife may increase.

4. Long-term and permanent loss of high-priority habitats as designated by WDFW. Besides shrub-steppe, these include freshwater wetlands, aspen groves and riparian areas, in stream, prairie-steppe, and talus and cliffs.

5. Canal, roads and reservoirs create barriers to wildlife movement. Wildlife crossings, as planned, over canals and waste ways may not be as effective as anticipated.

6. Small isolated populations of sage-grouse, Washington ground squirrel, reptiles and amphibians, and plants that are impacted by Project facilities may experience loss of genetic variability and increased vulnerability to stochastic events and genetic drift, brought about by their isolation from other populations.

7. Grebes may be negatively impacted during nesting season at Banks Lake, due to water level reductions associated with agriculture. As water is stored, fluctuating levels may inundate nests or elevate nests to a level such that adults may not re-enter nests successfully. Fluctuating water levels may also affect other nesting shorebirds, most likely by inundating nests.

8. Northern leopard frog habitat could be negatively impacted by changes in hydrology.

9. Increased potential of the introduction and spread of invasive species.

10. Bull trout and steelhead in lower Crab Creek could be negatively impacted, especially if Potholes Reservoir operations are altered in a manner as to negatively impact the flow regimes or to elevate water temperature or water levels. However, effects to aquatic resources in lower Crab Creek are anticipated to be low; since wasteway water entering lower Crab Creek will change little. Water return from the alternatives will only occur in the upper portion of Crab Creek, that is, the portion of the creek located above Moses Lake.

11. Alternatives 2C and 2D will significantly impact Washington ground squirrel populations in Rocky Coulee by inundating habitat.

12. Alternatives 2A and 2C will have moderate impacts to aquatic resources.

13. Alternatives 2B and 2D will have highly significant impacts to aquatic resources.

Also, we find that the impacts from Alternatives 3A thru 3D do not meet fish and wildlife needs for the same reasons stated above for Alternatives 2A-2D (items 1 – 10) and the following reasons:

1. Alternative 3A will significantly affect aquatic life in Banks Lake through more significant seasonal draw downs.

2. Alternatives 3C and 3D will significantly impact Washington ground squirrels in Black Rock Coulee by inundation, loss of nesting and nursery habitat, loss of foraging habitat, and isolation from adjacent colonies, thereby restricting gene flow and maintaining genetic variability.

3. Alternatives 3A, 3B, 3C, and 3D have the potential to significantly impact high priority wildlife habitats, through flooding of Black Rock Coulee.

4. Black Rock Coulee Reservoir will significantly impact wildlife habitat of high quality, impact Washington State Sensitive Species, rare plants, and wetlands. This impact may not be adequately mitigated within the Project Area because of the scarcity and uniqueness of these habitats.

All alternatives will have signification impacts to mule deer, as well as other mammals, reptiles, and amphibians, as they make attempts to cross the East High Canal and are killed, injured or impeded. Escape ramps and wildlife crossings are not expected to eliminate the problem, but could reduce it.

In all alternatives burrowing owls could be displaced, disturbed or injured and their habitat will likely be lost as a result of Canal expansion and extension and the flooding of Rocky Coulee Reservoir.

By ranking impacts as “high”, “medium” or “low” and comparing the level of impacts, our analysis has determined that alternative 2A will have the least negative effects to fish and wildlife resources. This conclusion was derived at by assigning a numeric value to each impact level (L=1, M=2, H=3) and determining a mean score for each alternative, as seen in Table 9. A low average score for an alternative means the negative impacts to fish and wildlife resources for that alternative are low. We have also determined that the most limited and imperiled habitat type in the Project Area is shrub-steppe. This Project, if implemented, would significantly and adversely impact shrub-steppe habitat.

Table 9. Comparison of Impacts from Project Alternatives Using Evaluation Factors

Alternative	Habitat Types or Evaluation Factors				Mean Evaluation Score
	Aquatic	Shrub-steppe	Grassland	Riparian	
No Action	3	1	1	1	1.50
2A	2	1	1	2	1.50
2B	3	1	1	2	1.75
2C	2	2	3	3	2.50
2D	3	2	3	3	2.75
3A	2	2	2	1	1.75

Table 9. Comparison of Impacts from Project Alternatives Using Evaluation Factors

Alternative	Habitat Types or Evaluation Factors				Mean Evaluation Score
	Aquatic	Shrub-steppe	Grassland	Riparian	
3B	3	2	2	1	2.0
3C	2	3	2	3	2.50
3D	3	3	2	2	2.50
3 = High Impact, 2 = Moderate Impact, 1 = Low Impact					

Based on our review and evaluation of the information acquired during preparation of this report, particularly the significant loss and/or fragmentation of shrub-steppe habitat, we recommend alternative 2A as the Service's preferred alternative. The Service further recommends that water conservation measures continue to be explored and implemented as a means to increase the availability of water in the Odessa Subarea, reduce the further fragmentation of shrub-steppe habitat, and reduce the need for moving and using water from the Columbia River.

We also recognize that some negative effects of implementing any preferred alternative can be reduced or eliminated, if proper amelioration and mitigation measures are implemented as part of the project. Alternative 2A can have little adverse and some positive effects on the fish and wildlife resources within the Affected Area, if conservation measures are adopted and mitigation for habitat impacts are implemented. The following conservation measures will be necessary to prevent adverse impacts to the natural resources within the Project Area.

11.0 FISH AND WILDLIFE MITIGATION RECOMMENDATIONS

The Service's mitigation policy (FWS Manual, 501 FW 2) was used to formulate recommendations to mitigate for potential negative impacts associated with the Project's alternatives. In accordance with this policy, attempts were made to (a) avoid the impact altogether by not taking a certain action or parts of an action; (b) minimize impacts by limiting the degree or magnitude of the action and its implementation; (c) rectify the impact by repairing, rehabilitating, or restoring the affected environment; (d) reduce or eliminate the impact over time by preservation and maintenance operations during the life of the action; and (e) compensate for the impact by replacing or providing substitute resources or environments (40 **CFR** Part 1508.20(a-e)), in that order. The Service has considered its responsibilities under the Endangered Species Act, Migratory Bird Treaty Act, Bald Eagle and Golden Eagle Protection Act, and the National Environmental Policy Act (USFWS 1981) in formulation of our recommendations. Our recommendations are also based on the ecological value and relative abundance of the affected habitats.

The Service's Mitigation Policy includes four Resource categories that were used to provide a consistent value rating for wildlife habitats. Based on the HSI values used in our analysis of project effects to fish and wildlife in the Project Area, the Service has designated a Resource Category for each terrestrial habitat in the Project Area.

11.1 Resource Category 1

Resource Category 1 habitats are of high value for evaluation species and is unique and irreplaceable on a national basis or in the ecoregion. The mitigation goal for habitat in Resource Category 1 is to experience no loss of existing habitat value. No such areas were designated within the Project Area.

11.2 Resource Category 2

Resource Category 2 habitats are of high value for evaluation species and are relatively scarce or becoming scarce on a national basis or in the ecoregion. The mitigation goal for habitat in Resource Category 2 is to experience no net loss of in-kind habitat value. Resource Category 2 habitats within the Project Area are shrub-steppe habitat, native grasslands, wetlands, and native riparian areas. Other Resource Category 2 habitats within the Project Area include the Washington State Priority Habitats previously described, areas containing known sage-grouse leks, and Black Rock Coulee.

11.3 Resource Category 3

Resource Category 3 habitats are of high to medium value for evaluation species. The mitigation goal for habitat in Resource Category 3 is to experience no net loss of habitat value.. Examples of this resource category include low to medium quality shrub-steppe habitat, native grasslands, and native riparian areas.

11.4 Resource Category 4

Resource Category 4 habitats are of medium to low value for evaluation species. The mitigation goal for habitat in Resource Category 4 is to minimize loss of habitat value for wildlife species. Examples of this resource category include active and fallow agricultural lands, actively grazed and ungrazed pasture, and currently or previously disturbed lands.

In formulating these mitigation and minimization recommendations, we also used Washington State's *Wind Power Guidelines* (WDFW, 2009b, p. 1), *Wetland Mitigation in Washington State – Part 1: Agency Policies and Guidance,* and various species recovery plans, both State and Federal. Recovery plans included those for the pygmy rabbit (USFWS 2007b, p. 1), Spalding's catchfly (USFWS 2005b, p.1), Ute's ladies' tresses (USFWS 1995, p. 1) and sage-grouse (Connelly 2005, p. 1).

Several of these mitigation measures were developed in coordination with WDFW. The Project will impact several areas of Washington State Priority Habitat; however, the exact number and location cannot be determined until a preferred alternative is selected. Although the DEIS (Reclamation 2010, pp. 3-70) lists six Priority habitat Areas, impacts to others may be determined after final construction surveys are completed.

Mitigation measures recommended below do not fully negate Reclamation's responsibilities under the Endangered Species Act (ESA) (16 U.S.C. §§ 1531–1544; 50 **C.F.R**. **§** 17.31(a).), Migratory Bird Treaty Act (16 U.S.C. **§** 703–712), Bald and Golden Eagle Protection Act (16 U.S.C. **§** 668–668d), and the National Environmental Policy Act (NEPA) (USFWS 1981). The Project possesses the possibility for the take of state or federally listed species. "Take" is defined under the ESA as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or to attempt to engage in any such conduct or any activity significantly impairing essential wildlife behavioral patterns, including breeding, feeding, or sheltering. ESA does not prohibit incidental take of listed plants; however it does prohibit certain deliberate disturbance, removal and possession of Federally listed plants or the malicious damage of such plants on areas under Federal jurisdiction, or the destruction of federally listed plants on non-Federal areas in violation of State law or regulation or in the course of any violation of State criminal trespass law. Under the Migratory Bird Treaty Act, "take" is defined as to pursue, hunt, take, capture, kill, attempt to take, capture, or kill, any migratory bird, any part, nest, or eggs of any such bird, or any product thereof, composed in whole or in part, of any such bird or any part, nest, or egg thereof. The Bald and Golden Eagle Protection Act defines "take" as pursuing, shooting, shooting at, poisoning, wounding, killing, capturing, trapping, collecting, molesting, or disturbing bald or golden eagles, but it does not cover habitat damage.

This report does not complete consultation under section 7 of the ESA; therefore, the Service recommends that Reclamation complete consultation with the Service on this project, if Reclamation moves forward to implement a preferred alternative.

The following Service recommendations to avoid or mitigate potential adverse impacts or enhance fish and wildlife resources are based on current information about the proposed alternatives. If the alternatives are modified in planning or implementation, the mitigation recommendations may need to be modified. If Reclamation proceeds with any of the alternatives as described in the DEIS, we recommend the following mitigation measures be implemented.

11.4.1 Mitigation of Effects to Fish and Aquatic Habitats Common to All Alternatives

1. Ensure Crab Creek flows are compatible with migration, spawning, and rearing of resident and migratory fish that utilize the Crab Creek Watershed by monitoring flow regime and temperatures.

2. If the Black Rock re-regulation reservoir is constructed, Reclamation should monitor flow augmentation releases from the reservoir and resulting effects on riparian and wetland habitats in the Project Area.

3. In coordination with WDFW, investigate the installation of alternative barrier systems at Dry Falls Dam on Banks Lake and Pinto Dam on Billy Clapp Lake to reduce fish entrainment out of both reservoirs.

4. Provide adequate fish screens that meet NOAA and WDFW compliance standards in all facilities that have the potential to entrain or kill fish, while moving water within Reclamation facilities.

5. Engineer facilities within water withdrawal, conveyance and impoundment structures that provide opportunity to identify and collect entrained fish during maintenance and operations, so that entrained fish can be documented and/or released unharmed. Also document and report fish entrainment by species, age, size, and life stage.

6. In coordination with the Washington Department of Ecology and WDFW, develop and implement a site-specific and site appropriate plan to monitor water quality within the CBP that is compatible with existing BOR water quality monitoring efforts; including:

a. Continue to fund water quality monitoring in Banks Lake and Moses Lake, using established protocols for a minimum of 10 years;

b. Initiate annual water quality monitoring in Potholes Reservoir, for a minimum of 10 years, using protocols established for Banks Lake and Moses Lake.

c. Monitor potential transport of potential contaminants from Lake Roosevelt to downstream areas, in the Columbia River between Lake Roosevelt and Hanford Reach National Monument and/or through conveyance structures to areas within the Project Area.

7. In coordination with WDFW, provide spawning habitat access for kokanee beginning in October each year at the bank at the mouth of Northrup Creek, near Banks Lake, and/or cove.

8. Assist WDFW to develop and implement a hatchery supplementation program, primarily targeted at kokanee and rainbow trout, within Banks Lake to compensate for the loss of fish and recreational fishery opportunity created by reduced primary and secondary productivity as a consequence of elevation fluctuations and increased flushing rates, as well as loss of access to spawning habitat, and uncertainty associated with water chemistry (note: entrainment should be resolved with measures identified above);

11.4.2 Mitigation of the Effects to Vegetation

9. In coordination with WDFW, locate construction staging areas that would avoid or minimize disturbance to wildlife and damage to priority habitats, including aquatic resources. Locate all staging areas in such a manner as to preclude water and soil contamination from solvents, fuels, and lubricants. Also all staging areas should be adequately equipped to deal with hazardous material spills, spill prevention, and clean-up.

10. All contracts awarded should require that workers comply with Best Management Procedures (Reclamation 2008b) to prevent the introduction of non-native plant and animal species in terrestrial and aquatic habitats. Monitor and manage disturbed areas post-construction to prevent the introduction and spread of non-native plants.

11. In consideration of Executive Order 13112, dated February 3, 1999, pertaining to invasive plant species, the Corps should develop a weed management plan that will include clear goals for the control and eradication of invasive exotic plants, as well as methods and a timeline for meeting those goals in areas those areas affected by the selected action alterative.

12. In consultation with Service and WDFW develop and implement a Native Plant Restoration and Conservation Management and Monitoring Plan for detailing performance criteria, clear goals and objectives, a schedule, and annual reports to evaluate the success of Reclamation's efforts to avoid permanent impacts to native vegetation. This plan should address Federal and State listed species, Species of Concern, and should cover all areas impacted by construction activities. We recommend that monitoring occur for 7 years following restoration efforts. The determination of adequate replacement ratios/locations for impacted wetland habitats should occur in consultation with Ecology and WDFW. Mitigation for affected riparian areas should be done according to the ratios for mitigation set forth below.

Due to the time frame required to restore shrub-steppe with biotic soil crust and the uncertainty of successful restoration, any disturbance to the biotic crust should be considered long-term and replacement lands should be provided as mitigation for their destruction.

13. Bury pipelines underground and restore native vegetation along the pipeline corridor and other construction areas. Consult with the Service for a list of native plants for this purpose. These plantings, to the extent possible, should be of local genetic stock or adapted to this area's climate.

14. To compensate for the loss of habitat, Reclamation should develop, in association with the Service and WDFW, a mitigation plan containing a provision for monitoring restoration efforts for a minimum of 7 years. If, after 7 years, restoration has not been adequately successful (does not meet the goals of the plan), mitigation lands should be acquired at established mitigation ratios (WDOE 2004, Appendix 8-D, pp. 17-20; WDFW 2009a, p. 20) Wetland mitigation is based on a variety of variables and should be determined in consultation with Ecology and WDFW. The ratios shown below are suggested starting points for further discussion and may change based on final project impacts and further negotiations. Shrub-steppe, grassland, and riparian habitats have established mitigation ratios as shown below:

Table 10. Recommended Habitat Mitigation Ratios

Habitat Type	Permanent Disturbance	Temporary Disturbance
Shrub-steppe[1]	2:1	0.5:1
Grassland[1]	1:1	0.1:1
Riparian[2]	20:1	10:1

[1] (WDFW 2009a, p. 20)
[2] (WDOE 2004, Appendix 8-D, pp.17-20)

15. If suitable areas for shrub-steppe mitigation are not present in the immediate Project Area, then another location will need to be selected in the Affected Area and evaluated for use as mitigation. If a suitable area for restoration cannot be found in the Affected Area, then Reclamation should work with the Service to find mitigation lands that are mutually agreeable in the mid-Columbia area.

16. Any mitigation land acquisitions will require maintenance or transfer to a land management agency for management and maintenance of resource goals and must include adequate funding to attain those goals.

17. Work cooperatively with the South Central Washington Shrub Steppe and Rangeland Partnership, as well as WDFW regional wildlife and habitat staff, to identify areas of shrub-steppe habitat that could be protected or restored as mitigation for any shrub-steppe habitat lost during the implementation of the Project.

11.4.3 Mitigation for the Effects to Wildlife

18. Reclamation should work with the Service and WDFW to identify and protect any existing Federal and state endangered, threatened, candidate, species of concern, and state sensitive plant species and their associated habitats that may occur within the Affected Area. Surveys should be conducted at the appropriate time and frequency in areas of permanent or temporary disturbance to detect the presence of any state or federally listed species, candidate species or species of concern.

19. To avoid impacts to any remaining pygmy rabbits, survey all areas of suitable habitat prior to beginning construction.

20. During construction, minimize or avoid all vegetation removal during the avian nesting season, to minimize the effect of the action on federally protected migratory birds. Typically the nesting season in this part of Washington occurs between March and August annually.

21. To avoid displacement of wildlife from high value habitats to less suitable habitat by human activities, any future recreation facilities should be located away from important wildlife use areas, including wildlife mitigation lands. The Service, in coordination with WDFW, would be willing to work with Reclamation to plan new recreation facilities on any new reservoirs, at the appropriate time.

22. Locate any above ground structures in areas that would cause the least disturbance to wildlife and loss or degradation of wildlife habitats. Creation of any barriers to or fragmentation of travel corridors for wildlife should also be avoided. Barriers to wildlife movement would include fences, roads, power lines, pipelines, canals, and large water bodies.

23. If reservoirs (storage and re-regulation) are created, design them to include wetland and riparian habitats if it would not replace existing shrub-steppe habitat. The Service could assist Reclamation in identifying suitable sites, as well as provide a list of native plants for this purpose.

24. Based on the significant loss of wildlife habitat that would occur with the creation of new reservoirs, we recommend that Reclamation consult with WDFW to establish a wildlife management area adjacent to the reservoirs, in areas that would be able to provide suitable wildlife habitat for waterfowl and shorebirds and that a wildlife management plan be developed to guide the management of that area.

25. Design and implement measures to maintain the connectivity of wildlife habitats and provide for the movement of wildlife within the Project Area. Mitigation measures should include wildlife crossings and escape mechanisms for canals, roads, pipelines and other structures, to minimize wildlife mortality and to maximize potential gene flow between populations.

26. The status of northern leopard frog is currently under review by the Service. In an attempt to avoid the future listing of northern leopard frogs and reduce impacts to other amphibians, and their habitats the Reclamation should work cooperatively with WDFW to assist them in developing and implementing, in consultation with USFWS, a Northern Leopard Frog Monitoring and Habitat Enhancement Plan for northern leopard frog habitat within the Project Area. The plan should

a. Develop the means to investigate whether water level fluctuations within the project's canals and reservoirs are impacting northern leopard frog habitat and reproductive success.
b. Identify areas to enhance, maintain and protect habitat within the Affected Area.
c. Monitor frog occurrence and reproduction for a minimum of 7 years after the operational changes for this project take effect. The plan should monitor project effects on frog occurrence, population trends of northern leopard frogs and other amphibian species (including invasive amphibian species, such as bull frogs), existing habitat, and habitat changes.
d. Include ways to adaptively manage the project so as to increase frog populations found in the Project Area.

27. Ensure that treated power distribution and transmission poles are not installed in areas that have potential to leach into irrigation canals, ponds, creeks, wetlands, groundwater or any waters of the state.

28. All transmission lines and guy wires should be constructed to ensure birds coming in contact with them avoid electrocution and collisions. Implement techniques set forth in the Service's *Avian Protection Plan Guidelines* (USFWS 2005a) to protect birds using project facilities.

29. Provide artificial burrowing owl nesting structures in areas where their populations may decline as a result of the Project. Coordinate with WDFW on the placement, design, and installation of the nesting structures. Examine use of the right of way (i.e., expansion dirt piles) along the East Low Canal as potential nesting habitat for this species. Protect nesting areas with "Soil Removal Prohibited" signs.

30. Install reflective tape or other reflective devices at 4-foot intervals along all wire fencing to reduce bird collisions. Wire fence construction specifications should comply with designs recommended by WDFW for sage-grouse protection. Reflective devices on the top fence wire should be installed for sage-grouse protection on all fences constructed within state sage-grouse management units.

31. Where applicable, implement Reclamation's best management procedures as set forth in the *Integrated Pest Management Manual for Effective Management on Reclamation Facilities* (2008a); and to protect sage-grouse and its habitat, incorporate the Natural Resources Conservation Service's sage grouse conservation measures set forth in the *Conference Report for the Natural Resources Conservation Service Sage-grouse Initiative* as best management practices for the Project (NRCS 2010).

12.0 SUMMARY AND CONCLUSION

Under authority of the Columbia Basin Project Act of 1943, as amended, and the Reclamation Act of 1939, the Bureau of Reclamation has proposed substituting Columbia River water for groundwater currently used for agriculture. This proposal contains eight possible alternatives; no Preferred Alternative has been chosen. Four alternatives (2A thru 2D) would primarily use the existing infrastructure to supply water to areas South of I-90, whereas the other four alternatives (3A thru 3D) would use existing infrastructure to supply those areas South of I-90 and construct new infrastructure to supply areas North of I-90. Water would be supplied via either Banks Lake, Lake Roosevelt, a new reservoir to be constructed at Rocky Coulee or a combination.

The Service and WDFW have collaborated to examine possible impacts resulting from the Project. WDFW's comments and recommendations are attached as an integral part of this report (to be attached by Reclamation for release in the final EIS).

Pursuant to the Fish and Wildlife Coordination Act, as amended (16 U.S.C 661-667e) and the 2008 and 2010 Interagency Agreements between the U.S. Fish and Wildlife Service (Service) and the Bureau of Reclamation (Reclamation), the Service has prepared a coordination act report (CAR) examining the impacts of all eight proposed alternatives, as well as a No Action Alternative. Based upon information contained in the draft Environmental Impact Statement, surveys conducted by Washington Department of Fish and Wildlife (WDFW) as reported in the Odessa Subarea Special Study Habitat Evaluation Procedures Project and the Odessa Subarea Special Study 2009 Wildlife Surveys Annual Report, other information in this office, and various previous studies and reports on record, the Service has determined that none of the proposed alternatives will be beneficial to fish, wildlife and their habitats but will produce adverse impacts to the area in varying degrees. The Service has further determined that Alternative 2A will be least deleterious to fish, wildlife and their habitats. However, the Service has recommended measures to mitigate and minimize these impacts. By incorporating these mitigation measures, any of the proposed alternatives could be implemented while significantly reducing harm to fish, wildlife and their habitats.

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Appendix A

Bird Species Potentially Found in the Project Area and Their Population Trends

Common Name	Scientific Name	Population Trend[1]	Habitat Association[2]			
			SS	GR	RP	JM
Turkey vulture	*Cathartes aura*	3	x	x	x	x
Osprey	*Pandion haliaetus*	3			x	
Bald eagle	*Haliaeetus leucocephalus*	3			x	
Sharp-shinned hawk	*Accipiter stratus*	2				x
Cooper's hawk	*A. cooperii*	3			x	
Northern harrier	*Circus cyaneus*	2	x	x		
Swainson's hawk	*Buteo swainsoni*	3	x	x		
Red-tailed hawk	*B. jamaicensis*	5	x	x	x	x
Ferruginous hawk	*B. regalis*	4	x	x		
Golden eagle	*Aquila chrysaetos*	4	x	x	x	x
American kestrel	*Falco sparverius*	5	x	x	x	x
Prairie falcon	*F. mexicanus*	3	x	x		x
Peregrine falcon	*F. perigrinus*	3	x	x	x	x
Barn owl	*Tyta alba*	3	x	x	x	
Western screech owl	*Otis kennicotti*	2			x	x
Great-horned owl	*Bubo virginianus*	3	x	x	x	x
Northern pygmy owl	*Glaucinium gnoma*	3			x	x
Northern saw-whet owl	*Aegolius arcadicus*	3				x
Burrowing owl	*Athene cunicularia*	1	x	x		
Long-eared owl	*Asio otis*	3	x	x	x	x
Short-eared owl	*A. flammeus*	3	x	x		
Great-blue heron	*Ardea herodias*	2			x	
Sage-grouse	*Centrocercus urophasianus*	3	x	x		
Sharp-tailed grouse	*Tympanuchus phasianellus*	3	x	x	x	
California quail	*Callipepla californica*	2	x	x	x	x
Sandhill crane	*Grus canadensis*	3		x	x	
Killdeer	*Charadrius vociferus*	3	x	x	x	
Long-billed curlew	*Numenius americanus*	1	x	x		
Rock dove	*Columba livia*	1	x			
Mourning dove	*Zenaida macroura*	5	x	x	x	x
Common poorwill	*Phalaenoptilus nuttalli*	3	x	x		x
Common nighthawk	*Chordelles minor*	2	x	x	x	x
Black swift	*Cypseloides niger*	3				
White-throated swift	*Aeronautes saxatalis*	3			x	
Black-chinned hummingbird	*Archilochus alexanri*	3	x		x	
Calliope hummingbird	*Stellula calliope*	3			x	
Rufous hummingbird	*S. rufus*	3			x	
Belted kingfisher	*Ceryle alcyon*	3			x	

Common Name	Scientific Name	Population Trend[1]	Habitat Association[2]			
			SS	GR	RP	JM
Lewis' woodpecker	*Melanerpes lewisi*	3			x	
Red-naped sapsucker	*Sphyrapicus nuchalis*	3			x	
Downy woodpecker	*Picoides pubescens*	3			x	
Hairy woodpecker	*P. villosus*	3			x	
Northern flicker	*Colaptes auratus*	2			x	x
Western wood-pewee	*Contupus sordidulus*	1			x	
Willow flycatcher	*Epidonax traillii*	3			x	
Least flycatcher	*E. minimus*	unknown			x	
Dusky flycatcher	*E. oberholseri*	3			x	x
Gray flycatcher	*E. wrightii*	2	x			x
Say's phoebe	*Sayornis saya*	2	x	x	x	x
Western kingbird	*Tyrannus verticallis*	2	x	x	x	x
Eastern kingbird	*T. tyrannus*	3	x	x	x	
Horned lark	*Eremophila alpestris*	5	x	x		
Tree swallow	*Tachycineta bicolor*	2			x	
Violet-green swallow	*T. thalassina*	3			x	x
Northern rough-winged swallow	*Stelgidopterix serripennis*	3	x	x	x	x
Bank swallow	*Riparia Riparia*	2	x	x	x	x
American robin	*Turdus migratorius*	3	x	x	x	x
Cliff swallow	*Petrochilodon pyrrhonota*	1	x	x	x	x
Loggerhead shrike	*Lanius ludovicianus*	5	x	x		x
Cedar waxwing	*Bombycilla cedrorum*	3			x	x
American dipper	*Cinclus mexicanus*	3			x	
Rock wren	*Salpinctus obsoletus*	3	x	x		x
Canyon wren	*Catherpes mexicanus*	3			x	x
House wren	*Troglodytes aedon*	1			x	
Sage thrasher	*Oreoscoptes montanus*	2	x			
Gray catbird	*Dumetella carolinensis*	Unknown			x	
Townsend's solitaire	*Myadestes townsendi*	3				x
Western bluebird	*Sialia mexicana*	3	x	x	x	x
Veery	*Catharus fuscescens*	3			x	
Black-capped chickadee	*Poecile atricapilla*	3			x	
White-breasted nuthatch	*Sitta carolinensis*	3			x	
Brown creeper	*Certhia americana*	3			x	
Song sparrow	*Melospizo melodia*	3			x	
White-crowned sparrow	*Zonotrichia leucophrys*	3			x	
Savannah sparrow	*Passerculus sandwichensis*	3	x	x	x	x
Grasshopper sparrow	*Ammodramus savannarum*	2	x	x		

Common Name	Scientific Name	Population Trend[1]	Habitat Association[2]			
			SS	GR	RP	JM
Brewers sparrow	*Spizella breweri*	5	x	x		x
Vesper sparrow	*Pooecetes gramineus*	2	x	x		x
Lark sparrow	*Chondestes grammacus*	5		x		x
Black-throated sparrow	*Amphispiza bileata*	4	x			
Sage sparrow	*A. belli*	3	x			
Chipping sparrow	*Spizelia passerina*	5			x	x
Dark-eyed junco	*Junco hyemalis*	2			x	x
Spotted towhee	*Pipilo maculatus*	2			x	x
Black-headed grosbeak	*Pheucticus melanocephalus*	1			x	
Lazuli bunting	*Passerina amoena*	1	x		x	x
Western tanager	*Piranga ludoviciana*	3			x	
Orange-crowned warbler	*Vermivora celata*	3			x	x
Nashville warbler	*V. ruficapilla*	3			x	x
Yellow warbler	*Dendroica petechia*	3			x	
Common yellowthroat	*Geothlypis trichas*	2			x	
MacGillivary's warbler	*Oporornis tolmieri*	3			x	
Wilson's warbler	*Wilsonia pusilla*	3			x	
Yellow-breasted chat	*Icteria virens*	2			x	
Cassin's vireo	*Vireo cassenni*	3			x	
Red-eyed vireo	*V. olivaceous*	3			x	
Warbling vireo	*V. gilvus*	3			x	
Bullock's oriole	*Icterus bullocki*	2			x	
Western meadowlark	*Sturnella neglecta*	2	x	x		
Red-winged blackbird	*Aeelaius phoeniceus*	4	x	x	x	x
Brewer's blackbird	*Euphagus cyanocephalus*	5	x	x	x	x
Brown-headed cowbird	*Molothrus ater*	2	x	x	x	x
American goldfinch	*Carduelis tristis*	2			x	
Cassin's finch	*Carpodacus cassinni*	2			x	x
House finch	*C. mexicanus*	2			x	x
Black-billed magpie	*Pica hudsonia*	2	x	x	x	x
American crow	*Corvus brachyrhynchos*	1	x	x	x	x
Common raven	*Corvus corax*	4	x	x	x	x

APPENDIX B

Mammals Found in the Columbia Basin

	Source of Information			
Mammal Species	*ASM (2006)*	*Banks Lake Study (2002-03)*	*Shrub-Steppe Project (Dobler, 2006)*	*Crab Creek Summary (2001)*
Merriam's shrew *(Sorex trowbridgii)*	X			X
Water shrew (*Sorex palustris)*	X			
Wandering shrew (*S. vagrans*)	X			
Northern grasshopper mouse (*Onychomys leucogaster*)	X			X
Sagebrush vole (*Lagurus curtatus*)	X		X	X
Montane vole (*Microtus montanus)*	X			
Columbian ground squirrel (*Citellus columbianus*)	X			X
Deer mouse *(Peromyscus maniculatus*)	X		X	
Forest deer mouse (*P. keenii*)	X			
Western jumping mouse (*Zapus princesp*)	X			
Porcupine (*Erethizon dorsatum*)	X		X	
Western harvest mouse (*Reithrodontomys megalotis*)	X		X	
Least chipmunk (*Eutamias minimus*)	X			
Yellow-bellied marmot (*Marmota flaviventris*)	X	X	X	
Yellow-pine chipmunk (*Tamias amoenus*)	X		X	
Ord's kangaroo rat (*Dipodomys ordii*)	X		X	
Northern pocket gopher (*Thomomys talpoides*)	X		X	X
Beaver (*Castor*	X			X

	Source of Information			
Mammal Species	*ASM (2006)*	*Banks Lake Study (2002-03)*	*Shrub-Steppe Project (Dobler, 2006)*	*Crab Creek Summary (2001)*
canadensis)				
Muskrat (*Onadontra zibethica*)	X			X
Washington ground squirrel (*Spermophilus washingtoni*)	X	X		X
Townsend's ground squirrel (*S. townsendii*)	X			
California ground squirrel (*S. beecheyii*)	X			
Columbia Basin pygmy rabbit (*Brachylagus idahoensis*)	X	X		X
White-tailed jackrabbit (*Lepus townsendii*)	X			X
Black tailed jackrabbit (*L. californicus)*	X		X	X
Nuttall's cottontail (*Sylvilagus nuttalli*)	X		X	X
Bushy-tail woodrat (*Neotomys cinerea*)			X	
Badger (*Taxidea taxus*)			X	X
Mink (*Mustela vison*)				X
River otter (*lutra canadensis)*				X
Long-tailed weasel (*Mustela frenata*)	X			
Short-tailed weasel (*M. erminea*)	X			
Bobcat *(Lyns rufus*)	X			X
Cougar (*Felis concolor*)				X
Raccoon (*Procyon lotor*)	X			X
Black bear (*Ursus americanus*)	X			X
Gray wolf				X
Coyote (*Canis latrans*)	X		X	
Muledeer (*Odocoileus hemionus*)	X		X	X
Whitetail deer (*O. virginianus*)	X			X
Elk (*Cervus elaphe*)			X	X

	Source of Information			
Mammal Species	*ASM (2006)*	*Banks Lake Study (2002-03)*	*Shrub-Steppe Project (Dobler, 2006)*	*Crab Creek Summary (2001)*
Yuma myotis (*Myotis yumanensis*)	X	X		X
Small-footed myotis (*M. ciliolabrum*)		X		X
Pale Townsend's big-eared bat (*Plecotus townsendii pallescens*)	X	X		
Long-eared myotis (*M. evotis*)	X	X		X
Fringed myotis (*M. thysanodes*)	X	X		X
Little brown bat (*M. lucifigis*)	X			X
Keen's myotis *(M. keenii*)	X			X
Long-legged myotis (*M. volans*)				X
California myotis (*M. californicus*)	X			X
Silver-haired bat (*Lasionycterus noctivagans*)	X			X
Western pipistrelle (*Pipistrellus Hesperus*)	X			X
Big brown bat (*Eptesicus fuscus*)	X			X
Pallid bat (*Antrozous pallidus*)	X			X
Hoary bat (*lasiurus cineurus*)				X
Townsend's big-eared bat (*Corynorhinus townsendii*)				X
Spotted bat (*Euderma maculata*)	X			X
Western small-footed myotis (*Myotis coopabari*)	X			

APPENDIX C

Reptiles and Amphibians Potentially in the Project Area

Species	Source of Information			
	Banks Lake Study (2002-03)	*Shrub-Steppe Project (Dobler, 2006)*	*Crab Creek Summary (2001)*	*UPS Slater Museum List (2006)*
REPTILES				
Common garter snake (*Thamnophis sirtalis*)		X		X
Short-horned lizard (*Phrynosoma douglassi*)		X	X	X
Sagebrush lizard *(Sceloporus graciosus)*			X	X
Side-blotched lizard (*Uta stansburiana*)				X
Western skink (*Eumeces skiltonianus*)				X
Racer (*Coluber constrictor)*				X
Striped whipsnake (*Masticophis taeniatus*)			X	X
Sharptail snake (*Contia tenius*)				X
Gopher snake (*Pituophis catenifer*)				X
Western rattlesnake (*Crotalus viridis*)			X	X
Night snake *(Hypsiglena torquata*)			X	X
AMPHIBIANS				
Long-toed salamander (*Ambystoma macrodactylum)*				X
Tiger salamander (*A. tiginum*)				X
Pacific treefrog (*Pseudacris regilla*)				X
Bullfrog (*Rana catesbiana*)				X
Columbia spotted frog (*R. luteiventris*)	X		X	X
Northern leopard frog (*R. pipiens*)			X	X

Species	Source of Information			
	Banks Lake Study (2002-03)	*Shrub-Steppe Project (Dobler, 2006)*	*Crab Creek Summary (2001)*	*UPS Slater Museum List (2006)*
Woodhouse's toad (*B. woodhousei*)				X

APPENDIX D

Species of Concern

These species of concern potentially occur in the Project Area, based on their known occurrence in habitats similar to those found in the Project Area. This list contains federally designated species of concern. Species of concern are species whose conservation standing is of concern to the Service, but for which status information is still needed.

<u>ANIMALS</u>
Burrowing owl (*Athene cunicularia)*
California floater (*Anodonta californiensis*) (mussel)
Columbia clubtail (*Gomphus lynnae*) (dragonfly)
Ferruginous hawk (*Buteo regalis*)
Giant Columbia spire snail (*Fluminicola Columbiana*)
Loggerhead shrike (*Lanius ludovicianus*)
Long-eared myotis (*Myotis evotis*)
Margined sculpin (*Cottus marginatus*)
Pacific lamprey (*Lampetra tridentate*)
River lamprey (*L. ayresi*)
Western brook lamprey (*L. richardsoni*)
Pallid Townsend’s big-eared bat (*Corynorhinus townsendii pallescens*)
Sagebrush lizard (*Sceloporus graciosus*)
Townsend’s ground squirrel (*Spermophilus townsendii*)
Black swift (*Cypseloides niger*)
Larch mountain salamander (*Plethodon larselli*)
Northern goshawk (*Accipiter gentilis*)
Olive-sided flycatcher (*Contopus cooperi*)
Peregrine falcon (*Falco peregrinus*)
Sharptail snake (*Contia tenius*)
Western gray squirrel (*Sciurus griseus griseus*)
Wolverine (*Gulo gulo*)
Redband trout (*Oncorhynchus mykiss*)
Westslope cutthroat trout (*O. clarki lewisii*)
Pygmy whitefish (*Prosopium coulteri*)

<u>PLANTS</u>
Columbia milk-vetch (*Astragalus columbianus*)
Suksdorf’s monkey-flower (*Mimulus suksdorfii*)
Liverwort monkey-flower (*M.us jungermannioides*)
Gray cryptantha (*Cryptantha leucophaea*)
Palouse goldenweed (*Haplopappus liatriformis*)
Hoover’s desert-parsley (*Lomatium tuberosum*)
Persistent sepal yellowcress (*Rorippa columbiae*)
Clustered lady’s slipper (*Cypripedium fasciculatum*)
Wenatchee larkspur (*Delphinium viridescens*)
Least phacelia (*Phacelia minutissima*)

whitebark pine (*Pinus albicaulis*)
Seely's silene (*Silene seelyi*)
Hoover's tauschia (*Tauschia hooveri*)
Long-bearded sego lily (*Calochortus longebarbatus* var. *longebarbatus*)
Obscure Indian-paintbrush (*Castilleja cryptantha*)
Pale blue-eyed grass (*Sisyrinchium sarmentosum*)

APPENDIX E

Mean Water Temperatures in Lower Crab Creek

Site	*n* =	Mean Temperature			
		Winter	*Spring*	*Summer*	*Fall*
Crab Creek Lateral	42	6.8	13.4	19.9	12.4
Red Rock Confluence	42	4.7	17.0	22.5	11.5
Crab Creek Road	41	4.5	17.0	21.1	11.5
McMannon Road	39	4.5	17.0	23.6	13.0
Red Rock Coulee Road	39	5.1	16.6	21.8	12.4
RBC Wasteway	40	4.6	14.8	22.5	15.5

(Gina Hoff, *pers. comm*. USBR, 2007)