RECLAMATION

Managing Water in the West

Yellow-Billed Cuckoo (*Coccyzus Americanus*) Biological Assessment for Bureau of Reclamation Operations and Maintenance in the Snake River Basin Above Brownlee Reservoir

U.S. Department of the Interior
Bureau of Reclamation
Pacific Northwest Region

June 30, 2017

Mission Statements

U.S. Department of Interior

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The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

Cover photograph: Riparian cottonwood gallery habitat on the South Fork of the Snake River (Photo credits Bureau of Land Management and U.S. Fish and Wildlife Service)

Acronyms and Abbreviations

Acronym or Abbreviation	Description
Act	Endangered Species Act of 1973
BA	Biological Assessment
BIA	Bureau of Indian Affairs
BiOp	Biological Opinion
BLM	Bureau of Land Management
Cfs	Cubic feet per second
CH	Critical Habitat
Corps	U.S. Army Corps of Engineers
DPS	Distinct Population Segment
EBSM	Ecologically Based System Management
ESA	Endangered Species Act
FERC	Federal Energy Regulatory Commission
GIS	Geographic Information System
ID	Irrigation District
IDFG	Idaho Department of Fish and Game
IFWIS	Idaho Fish and Wildlife Information System
NOAA	National Oceanic and Atmospheric Administration
O&M	Operations and Maintenance
PCE	Primary Constituent Elements
PCH	Proposed Critical Habitat
Reclamation	U.S. Bureau of Reclamation
RHJV	Riparian Habitat Joint Venture
RM	River Mile
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WMA	Wildlife Management Area
YBCU	Yellow-billed Cuckoo

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1. Overview of Document and Proposed Actions

1.1 How to Read This Document

This biological assessment (BA) has been written to:

- Document analysis of the effects of the proposed actions on Endangered Species Act (ESA)-listed species and proposed critical habitat.
- Request formal consultation for *May affect – not likely to adversely affect* conclusions.

The introductory section contains a list of acronyms and abbreviations and the table of contents.

Chapter 1 provides the preliminary information and background on this ESA Section 7 consultation, and descriptions of the action areas and proposed actions.

Chapter 2 provides an overview of the historic and present statuses of the yellow-billed cuckoo within the action areas, species biology and distribution, a description of the primary constituent elements (PCEs) of critical habitat, and discussion of proposed critical habitat units within the action areas.

Chapter 3 provides an overview of the environmental baseline, including hydrologic history and the current hydrologic and riparian habitat baseline conditions in the Snake River basin above Brownlee Reservoir.

Chapter 4 provides effect determinations for the proposed actions on the western distinct population segment (DPS) of the yellow-billed cuckoo, cumulative effects, a discussion of future conditions and climate change projections, and conclusions.

Chapter 5 contains a list of literature cited for this BA.

1.2 Purpose of the Biological Assessment

The ESA sets out a comprehensive program for the protection of threatened and endangered species and their habitats. Section 7 (a)(2) of the ESA requires Federal agencies to consult with either the U.S. Fish and Wildlife Service (USFWS) or National Marine Fisheries Service (NOAA Fisheries) on any Federal action that may affect listed species (50 CFR § 402.12; 16 USC § 1536 (a)(2)). The U.S. Bureau of Reclamation (Reclamation) has prepared this BA to assess the effects of the operation and maintenance (O&M) of Reclamation Projects in the upper Snake River basin above Brownlee Reservoir on the Western DPS of the yellow-billed cuckoo (YBCU) (*Coccyzus americanus occidentalis*).

This BA is a companion document to the *Biological Assessment for Bureau of Reclamation Operation and Maintenance in the Snake River Basin above Brownlee Reservoir* (2004

Upper Snake BA) and addresses impacts to the western YBCU due to the O&M of applicable Federal actions in the upper Snake River basin above Brownlee Reservoir. Generally, these operations remain unchanged from those considered in the 2004 Upper Snake BA (Reclamation 2004a).

This BA fulfills the requirements of 50 CFR 402.14(c) and the Endangered Species Consultation Handbook: Procedures for Conducting Consultation and Conference Activities under Section 7 of the Endangered Species Act (USFWS and NOAA Fisheries 1998).

1.3 Background and Consultation History

In October 2013, the USFWS proposed a status listing of Threatened for the Western DPS of the YBCU, and in October 2014, USFWS issued a determination of this proposal, assigning Threatened Status to the Western DPS of the YBCU and implementing the Federal protections provided by the Endangered Species Act of 1973 (Act) for this DPS of the species. YBCU had been determined in 2001 by USFWS to warrant listing, but listing was precluded by higher-priority listing actions until the 2014 determination (79 FR 59992). Critical habitat (CH) has been proposed for this species but has not been finalized as of the writing of this document. Three proposed CH areas fall within one of the action areas analyzed in this document. These proposed CH areas are discussed in Section 2.4 of this document.

The western YBCU nests exclusively in low- to moderate-elevation stands of dense riparian vegetation within arid to semiarid landscapes, making this species an obligate riparian nester. Preferred nesting habitat stands occur in broad floodplains along rivers and in areas where rivers and streams enter impoundments, and most often consist of mature cottonwood, willow-cottonwood, or mesquite forest. Suitable nesting habitat features a dense understory, dense canopy closure, high foliage volume, and sufficient humidity. Nesting pairs are thought to require a 50-acre (20 ha) minimum patch size of prime riparian habitat; smaller patches are rarely occupied (Hughes 1999).

Alteration of the natural hydrologic regime (e.g., dams/impoundment, out-of-stream diversions, and groundwater pumping) that results in changed vegetation stand structure and community composition, overgrazing, tamarisk and other nonnative vegetation invasion of riparian habitats, logging, development, and agricultural pesticide use have caused extensive loss, degradation, and fragmentation of riparian habitats in the western United States. The majority of verified detections of YBCU in Idaho have been in the southeastern part of the state, limited to reaches of the Snake River corridor above Minidoka Dam (at river mile [RM] 675.5). Because these occurrences are located in a watershed where the natural hydrograph is heavily influenced by the operation of Reclamation facilities, Reclamation's operations in the upper Snake River basin have the potential to affect the characteristics or extent of suitable nesting habitat essential for the persistence and recovery of the species.

In November 2004, Reclamation initiated consultation with USFWS and NOAA Fisheries on the effects of routine O&M of all Reclamation projects in the Snake River basin above

Brownlee Reservoir (Reclamation 2004a), in part to address changes in operations resulting from Reclamation's salmon flow augmentation commitments under the Nez Perce Water Rights Settlement. Reclamation received a Biological Opinion (BiOp) from NOAA Fisheries and USFWS in March 2005. After litigation, the 2005 NOAA Fisheries BiOp was remanded for additional analysis. After preparation of a second BA (2007 Upper Snake BA), Reclamation received a BiOp from NOAA Fisheries in May 2008. Each BiOp provided ESA coverage on Reclamation's upper Snake River operations for all species listed at the time, through 2034, the duration of the Nez Perce Water Rights Settlement.

Total system operations will be consistent with the 2004 and 2007 Upper Snake BAs and as described in the respective BiOps (USFWS 2005; NOAA Fisheries 2008). The general descriptions of the proposed actions in Chapter 2 of the 2004 Upper Snake BA also remain the same and are herein incorporated by reference (Reclamation 2004a, p 11-28.)

1.4 Action Areas

This BA is intended to cover all of Reclamation's 11 proposed actions, encompassing 12 separate Federal projects, in the Snake River basin above Brownlee Reservoir, where Reclamation owns and operates facilities (Figure 1). Although Reclamation's actions have no appreciable direct effect to the YBCU, long-term hydrologic alteration may have effects on the riparian habitat the species requires for nesting. Therefore, the specific action area analyzed in this BA has been limited to areas that both:

a) Are affected by Reclamation's operations, and

b) Include either proposed CH, known suitable nesting habitat, or, in the absence of ground survey verification, areas where GIS modeling indicates a reasonable expectation that such habitat may exist; and/or a recent (within the last 20 years) record of YBCU detections. GIS habitat modeling has been completed for the eastern part of Idaho, where literature and the historic record of detections suggest the species' limited use of nesting habitat in the state occurs. Future refinement and expansion of this model throughout the western part of the state, where breeding habitat for the species is not currently known to exist, would inform any future consideration of additional areas found to contain potentially suitable YBCU habitat.

The current known occupied range of the YBCU within Reclamation's greater area of operations for these 11 proposed actions is based on the historic record of YBCU detections in riparian areas along both the Snake and Henrys Fork Rivers in eastern Idaho, and along the Boise River in the western part of the state. Current and historic detection data limit the species' nesting range primarily to suitable habitat patches located along the Henrys Fork from below Island Park Dam at RM 91.7 to the confluence with the Snake River, and the Snake River from below Palisades Dam at RM 901.6 downstream to Minidoka Dam at RM 674.5. Sporadic detections of the species have occurred as far west along the Snake River as the confluence with the Boise River, at RM 392.3. However, habitat in much of this region largely fails to meet the minimum patch-size requirement to be considered suitable for

YBCU nesting habitat (discussed in Section 2.4 of this document), and no instances of confirmed nesting activity have been reported in this region. It is therefore thought that these detections likely represent transient birds moving along a migratory path, rather than populations utilizing nesting habitat.

Thus, the three proposed actions further analyzed in this document include:

- Future O&M in the Snake River System above Milner Dam,
- Future O&M in the Boise River System, and
- Future Provision of Salmon Flow Augmentation from Rental or Acquisition of Natural Flow Rights

An additional eight proposed actions, including Future O&M in the Little Wood River System, Future O&M in the Owyhee River System, Future O&M in the Payette River System, Future O&M in the Malheur River System, Future O&M in the Mann Creek System, Future O&M in the Burnt River System, and Future O&M in the Upper Powder River System, are expected to have no effect to this species due to the absence of species detections and/or suitable habitat in these action areas. Therefore, analysis of these eight proposed actions is not included in this document.

Detailed descriptions of all 11 proposed actions and their associated action areas can be found in both the 2004 Upper Snake BA (Reclamation 2004a) and USFWS's 2005 Biological Opinion (USFWS 2005) for Bureau of Reclamation Operations and Maintenance in the Snake River Basin Above Brownlee Reservoir.

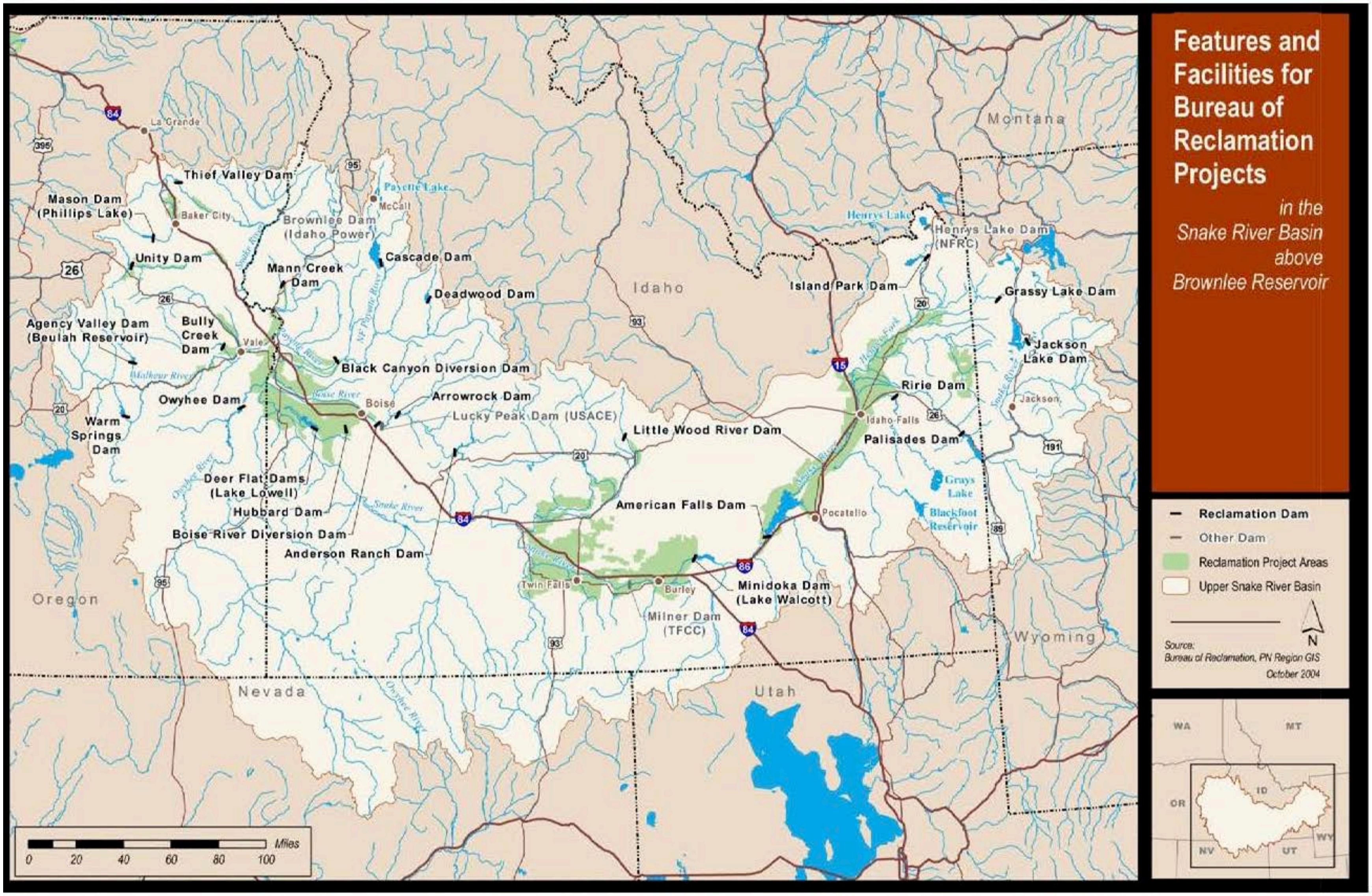

Figure 1. Reclamation facilities located in the upper Snake River basin

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1.5 Description of the Proposed Actions

The 2004 Upper Snake BA documented 11 proposed actions, comprising the O&M of 12 Reclamation projects in the upper Snake River basin. Some of these projects consist of multiple divisions on separate rivers. Reclamation does not coordinate operation among all 12 projects, but rather operates divisions, projects, or groups of projects independently of each other. Therefore, some actions reflect the operations of only a single project, and other actions encompass the integrated operation of multiple divisions of a project or multiple projects. Reclamation has determined that eight of the 11 proposed actions will have no effect on this species or to proposed CH.

The following three proposed actions were determined to be specifically relevant to consultation for this species, and have been analyzed for their effects to YBCU and its proposed CH in this document.

1.5.1 Future O&M in the Snake River System above Milner Dam

This proposed action includes storage in and release of water from facilities that are part of the Minidoka, Palisades, and Ririe Projects (Jackson Lake Dam and Lake, Palisades Dam and Reservoir, Island Park Dam and Reservoir, Ririe Dam and Reservoir, American Falls Dam and Reservoir, and Minidoka Dam and Lake Walcott). Project lands are located discontinuously along the Snake River, from the town of Ashton, Idaho, on the Henrys Fork and on the Snake River below Palisades Reservoir, to about 300 miles downstream near the town of Bliss in south-central Idaho. A detailed description of the projects, the proposed action, and the action area is included in the 2004 Upper Snake BA (Reclamation 2004a), pages 15-16.

Specific activities included in this proposed action are described in detail in Chapter 2 of the 2004 BA (Reclamation 2004a). Further detailed descriptions of Reclamation's operations are included in Reclamation's *Operation Description for Bureau of Reclamation Projects in the Snake River Basin Above Brownlee Reservoir* (Reclamation 2004b), and are herein incorporated into this document by reference.

The only operational changes to this proposed action from Reclamation's 2004 Upper Snake BA identified in this 2017 BA are specific to how water now passes through the recently constructed facilities at Minidoka Dam. These changes are the result of the 2015 completion of a modified spillway facility at Minidoka Dam, and only affect conditions in the spillway area. Specifics of this change are discussed in the USFWS's 2015 BiOp, issued following reconsultation for the effects of this change in operations on the endangered Snake River physa (USFWS 2015). Overall system management and accounting will remain consistent with Reclamation's current operations, as described in the 2004 Upper Snake BA.

1.5.2 Future O&M in the Boise River System

This proposed action includes storage in and release of water from facilities that are part of the Arrowrock Division of the Boise Project and the Lucky Peak Project (Anderson Ranch Dam and Reservoir and Arrowrock Dam and Reservoir). A detailed description of the projects, the proposed action, and the action area is included in the 2004 Upper Snake BA (Reclamation 2004a), pages 19-20.

Specific activities included in this proposed action are described in detail in Chapter 2 of the 2004 BA (Reclamation 2004a). Further detailed descriptions of Reclamation's operations are included in Reclamation's *Operation Description for Bureau of Reclamation Projects in the Snake River Basin Above Brownlee Reservoir* (Reclamation 2004b), and are herein incorporated into this document by reference.

1.5.3 Future Provision of Salmon Flow Augmentation

Reclamation provides up to 487,000 acre-feet annually for salmon flow augmentation from operations on four different river systems, primarily for juvenile salmon migration between April 20 and August 31. Reclamation generally assumes 487,000 acre-feet would be needed in July and August, with recession of natural flows and the beginning of storage draft for irrigation. In general, augmentation water releases begin by early July, but may begin as early as April or May in low-water years.

Sources and amounts of flow augmentation releases vary yearly, depending on the volume and timing of natural runoff, the volume of water available in each storage source, and the availability of rental water in each river system in any given year. Typically, Reclamation does not release augmentation water as long as natural flows are sufficient to meet the flow objectives at Lower Granite Dam. The state watermasters are responsible for the regulation of rental water delivery. Reclamation, the State of Idaho, spaceholders, and contract holders discuss and determine the timing and release of flow augmentation water each year.

Salmon flow augmentation entails varying operations that may occur in the same action areas as both of the above proposed actions further analyzed in this document (Future O&M in the Snake River System above Milner Dam and Future O&M in the Boise River System). However, salmon flow augmentation is analyzed as a separate proposed action since it is a component of coordinated actions in multiple river systems/action areas, including the Snake River above Milner Dam, the Boise River System, the Malheur River system, and the Payette River system.

Salmon flow augmentation is discussed in further detail in Appendix B of the 2004 BA (Reclamation 2004a).

1.5.4 Snake River and Boise River System Maintenance Activities

In general, all maintenance activities within the Snake River and Boise River systems are handled on a case-by-case basis. Annual maintenance activities typically occur within existing structures and outside of irrigation season, thereby resulting in no effect to ESA-listed species. Maintenance activities are typically scheduled to not coincide with annual water delivery or flood operations. Reclamation O&M and natural resources personnel coordinate prior to scheduling major maintenance activities to identify timing, sequencing, and other alternatives to avoid or minimize potential impacts to biological resources. Reclamation will confer with the USFWS to determine the appropriate level of consultation necessary if maintenance activities arise that may affect ESA-listed species.

1.6 Overview of Current System Management

For the purposes of this document, the upper Snake River basin is the Snake River basin located above Brownlee Dam, as described in the *Biological Opinion for Bureau of Reclamation Operations and Maintenance in the Snake River Basin above Brownlee Reservoir* (USFWS 2005). Reclamation features and facilities of the 12 Federal projects located in the upper Snake River basin are shown in Figure 1. Management of these projects is consistent with operations described in Reclamation 2004a, Reclamation 2007, and USFWS 2005. An extensive discussion of the historical flow conditions, including estimated unregulated flows and modeled current operations (the proposed actions), as they relate to the upper Snake River project facilities and action area, can be found in the 2004 BA (Reclamation 2004a).

1.7 Future O&M in the Proposed Actions

Future flow conditions associated with Reclamation facilities in the Snake River system and the Boise River system are expected to be consistent with those modeled for the 2004 Upper Snake BA and identified in USFWS 2005 BiOp. Overall, upper Snake River system and Boise River system management is anticipated to remain consistent with operations descriptions identified in Reclamation 2004b and USFWS 2005. The general descriptions of the proposed actions in Chapter 2 of the 2004 BA also remain the same and are herein incorporated by reference (Reclamation 2004a, p 11-28.)

1.8 Duration of the Proposed Action

The duration of the proposed action is 18 years (2017 through December 31, 2034). This is the period contemplated by Section III (the Snake River Flow Component) of the April 2004 Nez Perce Term Sheet (Term Sheet) for the settlement of the Federal water right claims of the Nez Perce Tribe in the Snake River Basin Adjudication (Nez Perce Tribe et al. 2004). The Term Sheet applies, in part, to those actions involving the operation of the Reclamation projects discussed in this document. This term is the same term evaluated in the 2004 BA and 2005 Opinion.

1.9 Limitations on Reclamation's Discretion

Palisades Dam (as part of the Palisades Project) was originally authorized under provisions of the Reclamation Project Act of 1939, and was reauthorized by the Act of September 30, 1950 (64 Stat. 1083, P.L. 93-206), for flood-control benefits. In addition, several flood control acts have essentially authorized flood control at all Reclamation reservoirs.

ESA regulations for any consultation are applicable to Reclamation's actions only to the extent that Reclamation has discretionary involvement in or control of them. Some aspects of the proposed actions discussed in this document are pursuant to State water law, Federal reclamation law, contracts with water users, and flood-control authorizations, and are non-discretionary on Reclamation's part. In particular, compliance with statutory obligations set forth by the Flood Control Act of 1944, and the flood control rule curves formulated and administered by the U.S. Army Corps of Engineers (Corps) for Palisades Dam pursuant to this authority, limits Reclamation's discretion to select peak releases from Palisade Dam that result in exceedances of the official flood stage downstream, except in the case of emergency flooding operations necessary for safety and preservation of the structural integrity of the dam.

Below Palisades Dam, the official flood stage at the Snake River near the Heise gauging station (USGS 13037500), according to the National Weather Service, is 24,500 cfs. However, some bank erosion occurs at flows less than the official flood stage; therefore the joint flood control rule curves for Jackson and Palisades Dams operations are based on limiting the Snake River flow at Heise to 20,000 cfs. Farther downstream, flooding (as indicated by high flows at the gauging stations at Shelley [USGS 13060000] and Blackfoot [USGS 13062500]) can still occur in the reach from Roberts upstream to near Firth downstream, even when the flow at Heise is well below flood stage. Avoiding flooding in this reach entails limiting release rates from Palisades Reservoir during flood control operations, particularly in April through June.

A more in-depth overview of the general limitations on Reclamation's discretion regarding the proposed actions (i.e., project authorizations, state water law and water rights, contracts, and tribal interests) is provided in the 2004 Upper Snake BA (Reclamation 2004a).

2. Western Yellow-Billed Cuckoo in the Snake River Basin

2.1 Status of the Western DPS of YBCU

In October 2013, the USFWS proposed a status listing of Threatened for the Western DPS of the YBCU, and in October 2014, USFWS issued a determination of this proposal, assigning Threatened Status to the Western DPS of the YBCU and implementing the Federal protections provided by the Endangered Species Act of 1973 (Act) for this DPS. This DPS had been determined in 2001 by USFWS to warrant listing, but listing was precluded by higher priority listing actions until the 2014 determination (79 FR 59992).

In November 2004, Reclamation initiated consultation with USFWS and NOAA Fisheries on the effects of routine O&M of all Reclamation projects in the Snake River basin above Brownlee Reservoir (Reclamation 2004a), in part to address changes in operations resulting from Reclamation's salmon flow augmentation commitments under the Nez Perce Water Rights Settlement. Reclamation received a BiOp from NOAA Fisheries and USFWS in March 2005. Following litigation, the 2005 NOAA Fisheries BiOp was remanded for additional analysis. After preparation of a second BA (2007 Upper Snake BA), Reclamation received a BiOp from NOAA Fisheries in May 2008. Each BiOp provided ESA coverage on Reclamation's upper Snake River operations for all species listed at the time, through 2034, which is the duration of the Nez Perce Water Rights Settlement.

This BA is a companion document to Reclamation's 2004 and 2007 Upper Snake BAs. Total system operations will be consistent with the 2004 and 2007 Upper Snake BAs and as described in the respective BiOps (USFWS 2005; NOAA Fisheries 2008). The general descriptions of the proposed actions in Chapter 2 of the 2004 Upper Snake BA also remain the same and are herein incorporated by reference (Reclamation 2004a, p 11-28.)

2.2 YBCU Distribution and the Action Areas

The YBCU is a migratory species. Therefore, identifying boundaries of the full range of habitat potentially occupied by the western YBCU with any certainty is difficult, and necessarily includes large amounts of largely unoccupied range through which the birds may sporadically migrate, but which cannot be considered to be suitable or regularly occupied habitat. The current summer nesting range known to be seasonally occupied by the YBCU includes portions of nine Western states: Arizona, California, Colorado, Idaho, Nevada, New Mexico, Texas, Utah, and Wyoming.

The action area for the proposed action Future O&M in the Snake River System above Milner Dam includes three of the four CH units proposed by the USFWS in the state of Idaho. These areas may be occupied by YBCU during the nesting season.

The action area for the proposed action Future O&M in the Boise River System does not include proposed CH, and it is currently undetermined whether suitable nesting habitat exists in this area. However, recent detections of YBCU in the action area suggest that the species is at least transiently present in the action area during migration. In terms of maintaining habitat connectivity within the greater Snake River basin, the additional potential migration/stopover habitat in this action area may also provide conservation value for the species, and therefore this proposed action is also analyzed for effects.

2.3 Life History of the Western Distinct Population Segment of the Yellow-Billed Cuckoo

2.3.1 Identification of Western Distinct Population Segment

The breeding and nesting range of the entire species historically included almost all of North America, extending from southeastern and western Canada through most of Mexico and the Caribbean islands. This range is effectively separated into distinct geographic sections by the crest of the Rocky Mountains at the Continental Divide, the watershed divide between the Rio Grande and the Pecos River, and the Chihuahuan Desert in Mexico. Though genetic research suggests that eastern and western YBCU populations may have diverged as much as 205,000 to 465,000 years ago (Pruett et al. 2001), USFWS determined in its listing that the two YBCU populations separated by these divides do not conclusively exhibit genetic divergence sufficient for classification into subspecies. However, documented differences in morphological data (Banks 1988, Banks 1990) and genetically controlled behavior, especially migration timing, between populations on the eastern and western sides of this east-west boundary indicate that division into two distinct population segments is warranted. Following an evaluation of its status, USFWS accordingly issued a determination of Threatened status for the Western DPS of the YBCU. This Western DPS is the focus of this document.

2.3.2 Biology

The YBCU is a Neotropical migrant bird that moves between wintering grounds in South America east of the Andes and primarily south of the Amazon Basin, and summertime nesting and breeding grounds in North America.

The YBCU is a member of the Cuculideae avian family, identified by zygodactyl feet (two toes pointing forward, two toes pointing backward), moderate to heavy bills, and eyes encircled by a ring of bare skin. The YBCU is a somewhat elongated bird that is approximately 12 inches in length, weighs approximately 2 ounces, and has plumage that is brownish-grey above and white below, with rufous primary flight feathers on its wings and tail feathers bearing a bold black and white pattern on the undersides. The YBCU’s common name originates from its yellow- to orange-colored lower mandible. Males have slightly smaller bills and more-distinct oval-shaped tail feather markings, but are otherwise similar to females in appearance. Juvenile YBCUs may have darker bills and fainter markings on the undertail (Hughes 1999).

YBCUs may consume a large variety of prey but are most often large-insect specialists, feeding primarily on large-insect prey, including sphinx moth larvae and other caterpillars, cicadas, katydids, grasshoppers, beetles, and dragonflies. They will opportunistically feed on tree frogs and small vertebrates such as lizards if high population densities of these prey are present. The availability of the foods primary to the YBCU's diet is highly influenced by the growth characteristics and health of local vegetation. The short-term abundance of such prey is known to have an effect on the timing of arrival and nesting by YBCUs, and likely also influences year-to-year variation in breeding site occupancy (Laymon et al. 1997, Hughes 1999). YBCUs do not exhibit strong nest-site fidelity, and nesting sites may periodically remain unoccupied in any given year, likely tied closely to factors including yearly variations in the abundance of certain food (Halterman 2009).

2.3.3 Migration, Breeding Chronology and Lifespan

In Idaho, the western YBCU generally begins to arrive from mid-June to early July at nesting sites. Breeding and nesting occurs from mid-June through mid-August, with individuals occasionally observed at nesting sites into mid-September (Halterman 2004). Both adults participate in nest building, incubation, and brood rearing. Nests are typically concealed in dense vegetation, in which pale blueish-green eggs are laid typically at an interval of every second day. Incubation lasts from 9 to 11 days, and hatchlings will fledge approximately 1 week after hatching. Adult cuckoos continue care of dependent fledglings for an additional 2 to 3 weeks (Hughes 1999). Typically, YBCUs raise one brood per year; however, in favorable years with abundant prey resources, cuckoos have been observed to fledge two and even three successful broods (Laymon 1998).

Little is known about the lifespan of the YBCU due to a scarcity of banding studies; the longest known lifespan is approximately 5 years (USGS Patuxent Wildlife Research Center 2016). Likewise, while the breeding range of the YBCU is addressed in detail in the USFWS designation, telemetry studies on the YBCU have been limited and little is conclusively known about the YBCU's migration route and winter range.

2.3.4 Habitat Requirements

The western YBCU is known to nest and rear young almost exclusively in low to moderate elevation stands of dense riparian vegetation within arid to semiarid landscapes, making this species an obligate riparian nester. Preferred nesting habitat stands most often consist of mature cottonwood, willow-cottonwood, or mesquite forest and occur in broad floodplains along rivers and in areas where rivers and streams enter impoundments. Suitable nesting habitat features a dense understory, dense canopy closure, high foliage volume, and sufficient humidity. Nesting pairs require a 50-acre-minimum patch size of prime riparian habitat; smaller patches are rarely occupied (Hughes 1999).

River management resulting in changed vegetation stand structure and community composition, overgrazing, tamarisk invasion of riparian habitats, logging, and agricultural pesticide use have contributed to the loss, degradation, and fragmentation of riparian habitats in the western United States. The majority of verifiable occurrences of the YBCU in Idaho have been in the southeastern part of the state, limited to reaches of the Snake River corridor above Minidoka Dam (at RM 675.5). Because these occurrences are located in a watershed where the natural hydrograph is heavily influenced by the operation of Reclamation facilities, Reclamation's operations in the upper Snake River basin above Minidoka Dam have the potential to alter the characteristics or extent of suitable nesting habitat necessary for the persistence and recovery of the species.

2.3.5 Factors Contributing to Species Decline

Approximately 90 percent of the YBCU's nesting habitat in the West has been lost or degraded. Numerous human activities have created threats to YBCU habitat in the West, including alteration of hydrology through the actions of dams, surface diversions, groundwater withdrawals, and fluctuating reservoir levels; floodplain encroachment, including agricultural development and other development; and other land management-related threats, including overgrazing, pesticide drift, woodcutting, invasion of nonnative vegetation, and recreational uses (RHJV 2004).

The land area containing potential YBCU habitat over which Reclamation exercises surface management is extremely limited. However, Reclamation's proposed actions have the potential to affect YBCU through changes to the riparian habitat caused by alteration to the hydrograph due to Reclamation's operations in the action areas. The nature and extent of these potential effects is discussed in more detail in Chapters 3 (Environmental Baseline) and 4 (Effects to the Yellow-Billed Cuckoo) of this document.

2.3.6 YBCU Distribution and Habitat Use in the Action Areas

YBCU have proved challenging to study, and combining comprehensive review of historic detection records with present surveys, quantifying either historic or extant population abundances, locations, and breeding status, is particularly difficult due to the species' migratory, transient nature and inconspicuous behavioral habits.

Historic population estimates in the Pacific Northwest have been characterized as drastically declined from as early as the 1850s (Roberson 1980, Gaines and Laymon 1984). Habitat in Idaho represents the far northeastern edge of the species' known summer range, and it has been suggested that most Idaho records of YBCU observations are likely indicative of isolated, non-breeding individuals (USFWS 1985).

It has been theorized in the past that breeding populations of YBCUs in Idaho had been extirpated, but according to a species assessment document prepared by USFWS (2004), "the yellow-billed cuckoo appears to be hanging on precariously in Idaho," and it was noted in the same document that YBCU "could easily become extirpated from the State in the near future." Though the YBCU population has significantly declined throughout the range of the Western DPS, suitable nesting habitat conditions exist in multiple locations along the Snake River in southeastern Idaho, where YBCU breeding and nesting could still occur.

When developing their Riparian Bird Conservation Plan, the Riparian Habitat Joint Venture (RHJV) performed simulation modeling of the more-abundant populations of YBCU in California, and concluded that populations of less than 10 breeding pairs anywhere would be highly unstable and susceptible to extirpation by stochastic, or random, events over a very short time period. RHJV's models recommended that for reasonable population stability, a minimum of 25 pairs in a subpopulation, with interchange between other subpopulations, would be necessary (RHJV 2004). Laymon and Halterman (1989) have identified that a minimum 1,000-acre tract size of intact riparian habitat at any site would be required to provide habitat for a minimum population of 10 breeding pairs of cuckoos. It has been theorized that from fewer than 10 to a maximum of a few dozen pairs of YBCU breed annually in Idaho (Taylor 2000). However, no reliable population trend data for the species in the state exist because the number of detections on record are insufficient to be used for valid statistical conclusions (ICDC 2005).

In the absence of conclusive abundance data, Reynolds and Hinckley (2005) concluded that any remaining "stronghold for YBCU [breeding habitat] in Idaho" would consist of the corridors along the South Fork of the Snake River from Heise, Idaho, to the U.S. Highway 20 bridge at Lorenzo, Idaho, along the mainstem of the Snake River upstream of American Falls, and at Deer Parks Wildlife Mitigation Unit near Menan Buttes. Much of this habitat identified as historic YBCU breeding habitat on the Deer Parks and above Henrys Fork confluence reaches exists on Bureau of Land Management (BLM) lands administered by the Idaho Falls BLM District, Tribal lands, and adjacent private lands.

A review of the complete historic record of YBCU detections from the early 20th century into the present shows that it is made up primarily of detections occurring during peak breeding season, which suggests that a small number of YBCU do still migrate to and utilize areas in southeast Idaho for breeding habitat.

Recent Detection Surveys

In anticipation of a future listing determination, both Reclamation and the Corps conducted presence/absence surveys for the YBCU to supplement available data on the birds' contemporary range, totaling 22 survey days during the summer of 2014 (18 days, Reclamation) and the summer of 2015 (4 days, Corps).

Reclamation's surveys included repeated survey visits to four areas in the Snake River corridor, including Cartier Slough WMA on the Henrys Fork, along the Snake River above and below the confluence with Henrys Fork, McTucker Bottoms Wildlife Management Area (WMA) above American Falls Reservoir, and Fort Boise WMA at the confluence of the Boise and Snake Rivers, west of the city of Boise. These locations were chosen based on the presence of potential YBCU nesting habitat, as it relates to Reclamation's operations, as well as accessibility related to land management.

The Corp's surveys occurred one time at five sites along the Boise River from Barber Park to Eagle Island, west of Boise. The Corp's survey locations were selected based on historic sightings and their applicability to an impact assessment for the proposed action of raising the crest of Arrowrock Dam (Corps 2015).

Collectively, five vocalization detections were made during these efforts in 2014-2015, believed to represent the detection of three individual birds. These recent detections are included in Figure 2, which shows the locations of all recorded YBCU detections in the Snake River Basin above Brownlee Reservoir from 1918 to 2015 (Cavallaro 2011, IFWIS 2013, Reclamation 2014, Corps 2015). Detections within the last 20 years are shown in yellow; records older than 20 years are shown in black.

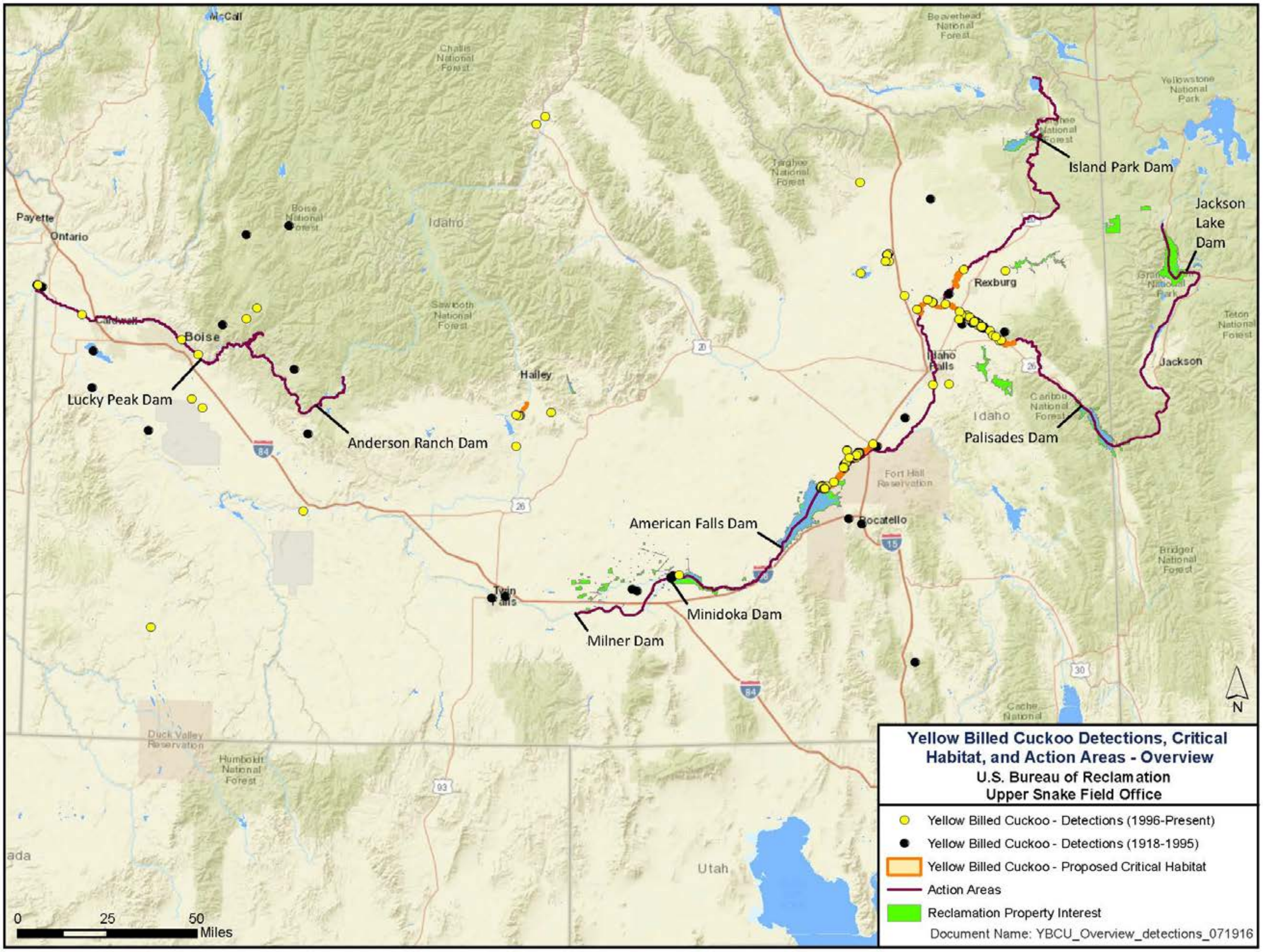

Figure 2. Overview map of the action areas, showing all YBCU detections included in the historic record from 1918-2015, and proposed CH units

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GIS Habitat Modeling Efforts

In anticipation of the USFWS listing status determination for the YBCU, in 2010 the Idaho Department of Fish and Game (IDFG), in partnership with the BLM Idaho Falls District, initiated a GIS modeling effort based on historic records, known attributes of suitable habitat (discussed in further detail in Section 2.4 of this document), and estimates of regional wildlife biologists, to comprehensively map all potentially suitable YBCU breeding and nesting habitat in eastern Idaho. Surveys of 72 of the resulting mapped forest stands, located along reaches of the Snake River, the Big Lost River, and the Salmon River, yielded five YBCU detections: three at sites on the Snake River above the Henrys Fork, and two at sites on the Snake River west of the Menan Buttes (IDFG 2013).

This GIS habitat modeling effort has only been completed for the eastern part of Idaho, where literature and the historic record of detections suggests the species' limited use of breeding habitat in the state occurs. Interest from multiple stakeholders, including Reclamation, exists in completing future refinement and expansion of this model for application throughout the western part of the state, where breeding habitat for the species is not currently thought to exist. If additional areas are found to contain as-yet unidentified suitable YBCU habitat, this would inform any future adaptive management considerations.

2.4 Proposed Critical Habitat for Yellow-Billed Cuckoo

The YBCU's life history requires certain essential physical and biological features of nesting habitat for successful individual and population growth. In developing the proposal for CH designation, USFWS identified three primary constituent elements (PCEs) of habitat suitable for YBCU breeding and foraging, focusing primarily on habitat requirements for breeding behavior and secondarily on habitat requirements for foraging behavior. Sections 2.4.1 through 2.4.3 of this document summarize these three PCEs; a more in-depth review of available information is included in the USFWS proposed rule for the designation of CH (79 FR 48548).

2.4.1 PCE 1: Riparian Woodlands

Contiguous patches of mixed willow-cottonwood riparian woodlands that are larger than 100 feet in width and 200 acres or more in extent are required for a single YBCU breeding pair's nesting needs. Although characteristics such as foliage volume and canopy structure also factor into habitat suitability, the overall size of a habitat patch serves as the greatest indicator of its suitability for nesting occupancy by the YBCU. Research has shown that in addition to patch size, the extent of habitat within a 5-mile section of river and the presence of low woody vegetation are the most important variables influencing occupancy by breeding pairs of YBCUs (Laymon and Halterman 1989). Recent modeling completed by researchers at Northern Arizona University has also shown that the type of habitat adjacent to suitable nesting habitat (e.g., developed, agricultural, or undeveloped natural) is also highly correlated with YBCU occupancy, suggesting an influential edge effect, as well (M. Johnson, personal communication, June 2016).

Suitable patches in this geographic part of the YBCU's range will typically have high foliage volume of willows (*Salix* spp.) in a moderately dense understory, and an overstory of cottonwoods (*Populus* spp.), with dense canopy closure and intermediate basal area (defined as the total summed cross-sectional area of a tree's trunk at chest height for a given area). A mean canopy height of 23 to 33 feet is optimal and most frequently selected by breeding pairs; sites with greater or smaller mean canopy heights are less-frequently occupied but are still suitable. However, mean canopy heights under 13 feet are not suitable. Invasive non-native shrubs and trees such as tamarisk (*Tamarix* spp) and Russian olive (*Elaeagnus angustifolia*) may be a component of the understory; however, monotypic stands of tamarisk are rejected by nesting YBCUs. Smaller habitat patches or patches whose overall characteristics are not adequate for nesting occupancy may still serve a critical role as stopover, resting, and foraging sites during migration (Haltermann et al. 2015).

Studies have closely linked the heterogeneity and system health of western riparian gallery forests with the diversity and abundance of Neotropical birds, amphibians, and terrestrial and aquatic insects. The narrowleaf cottonwood (*Populus angustifolia*) and its gallery forests are the dominant plant species and cover type of the floodplain corridor in the Snake River system above Milner Dam, particularly along the lower reach of the Henrys Fork, and reaches on the mainstem Snake River between Palisades Dam downstream to American Falls Reservoir. On the Boise River system, black cottonwood (*Populus trichocarpa*) galleries dominate the riparian cover type.

2.4.2 PCE 2: Adequate Prey Base

YBCUs eat a variety of prey but are primarily large-insect specialists. The cuckoo's diet relies heavily on large insects such as cicadas, grasshoppers, katydids, large beetles, and caterpillars, particularly the sphinx moth caterpillar. Cuckoos may also opportunistically prey on small lizards and frogs, if they are available. Studies suggest that at the landscape level, population levels may be tied to the abundance of certain types of prey; at a temporal level, occupancy of nesting habitat from year to year may also be dependent upon the year-to-year fluctuations in abundance of these prey species (Laymon 1980). Fluctuations in cuckoo populations among sites and between years suggests that the species is likely adapted to locating and utilizing resources whose availability is highly varied, both spatially and temporally (Halterman 2001). YBCUs forage by perching inconspicuously and visually scanning for moving prey in nearby vegetation. This foraging behavior may lead cuckoos to venture out of riparian habitat into surrounding low vegetation such as flooded fields and younger, non-nesting habitat after observed prey (McNeil et al. 2013).

Insects that hibernate underground (katydid and sphinx moth larvae) are primary to the cuckoo's diet, and may not be available in lowland floodplains during late-spring flooding and high-water years. Therefore, it may also be important that upland refugia adjacent to suitable riparian patches occupied for nesting are included as a component of habitat protection and restoration projects (RHJV 2004).

2.4.3 PCE 3: Dynamic Riverine Processes

The natural hydrographic regime plays an essential role in the biodiversity and productivity of the river floodplain system as various vegetation species (e.g. cottonwood, willow) evolved life-cycle strategies of seed dispersal timing and germination requirements that are specific to the conditions present under natural flow regimes.

Seasonal flooding that drives geomorphic changes, such as the regular disturbance and redeposition of fine sediments, is a key factor in the succession of floodplain vegetation. The alteration of the natural hydrograph that occurs with changed flow regimes as a result of water storage and release operations throughout the year is well known to result in changes to riparian vegetation communities.

Cottonwood and, to a lesser degree, willows, both of which are key elements of the YBCU's nesting habitat, are dependent upon hydrologic processes that result in dynamic sediment movement and deposition processes that produce new sites characterized by uncolonized deposits of moist, fine, bare substrate available for seedling germination, and that promote riparian plant growth, maintenance, health, and vigor. Specifically, lower-gradient streams with broad floodplains, an elevated subsurface groundwater table, and perennial rivers and streams create the conditions that allow for the recruitment, development, and persistence of sufficiently sized patches of riparian vegetation, such as the mixed-age willow-cottonwood complexes required by the YBCU for nesting in this part of its range.

These organisms are well adapted to pulse disturbance; however, regulated flow that attenuates peak flows and repeatedly produces press- and ramp-disturbance, as observed in the historic record on the Snake River following the completion of Palisades Dam in 1956, interferes with this life-cycle adaptation (Rood and Mahoney 1990). This has been well documented in other regulated rivers throughout the northern Rocky Mountains (Hauer and Stanford 1991, Stanford and Hauer 1992). Life-cycle interference may take the form of direct lethal impact (e.g., winter freezing, summer desiccation) or long-term impact (e.g., shifting community age-structure if aging and age-related losses are not balanced by seedling recruitment, up to eventual loss of riparian cottonwood galleries due to lack of seedling recruitment).

Long-term hydrological alteration of this type can result in changes not only to vegetation community composition, as the success of competing nonnative vegetation such as tamarisk may be attributed in part to these effects of altered hydrology, but also to changes in vegetation age structure, as reduced germination and seedling recruitment leads to fewer young trees reaching maturity. Several studies from across western North America have revealed progressive declines in the extent and health of riparian cottonwood ecosystems in connection with upstream river management (Reily and Johnson 1982, Rood and Mahoney

1990, Braatne et al. 1996, Mahoney and Rood 1998, Merritt and Cooper 2000, Rood et al. 2003).

The primary causes of these declines have been impacts related to damming, water diversions, the clearing of floodplain habitats for agricultural use, and livestock grazing (Rood and Mahoney 1990, Braatne et al. 1996). Studies conducted in the 1990s on vegetation of the Snake River floodplains within the study area concluded that declines in riparian cottonwoods are related to the suppression of seedling recruitment (Merigliano 1996). A more-recent study linked a spike in cottonwood and willow seedling recruitment to the exceptionally large flooding event experienced on this area of the Snake River in 1997, further contrasting natural recruitment rates following uncontrolled flooding to those experienced under the suppressed peak flow regimes inherent to flood control operations (Merigliano 2005). Since cottonwoods are a relatively short-lived tree (100 to 200 years), declines in seedling recruitment in the years since the construction of Palisades Dam in 1956 until the early 21st century would be expected to lead to a widespread shift in the age structure of these riparian communities to old, decadent stands which, if left unchecked, could eventually lead to loss of the riparian cottonwood ecosystems along the alluvial floodplain reaches of the Snake River in the action area.

2.4.4 Locations of Proposed Critical Habitat in the Action Area

Three areas of proposed CH exist within the action area covered by this document, comprising 24,182 acres, of which 10,398 acres exist on Federal and state lands. These areas are known to be semi-consistently occupied during the breeding season, and represent the far northeastern limit of the cuckoo's summer nesting range. These proposed CH areas are summarized below, and also are shown in Figures 3 through 5. All of the PCH units are described in further detail in the Federal Register Designation of Critical Habitat, Proposed Rule (79 FR 48548).

Proposed CH Unit ID-1

Proposed CH Unit ID-1 consists of 9,294 acres in a 22-mile-long continuous stretch, from the upstream end of American Falls Reservoir to a point on the Snake River approximately 2 miles west of the town of Blackfoot, Idaho. Within this unit, approximately 3,343 acres, or 36 percent, of proposed CH Unit ID–1 are privately owned; 2 acres, or less than 1 percent, are in State ownership managed by the Idaho Department of Lands; 2,257 acres, or 24 percent, are Tribal lands located on the Fort Hall Indian Reservation; and 3,692 acres, or 40 percent, are in Federal ownership (Bureau of Indian Affairs: 117 acres, BLM: 3,260 acres, and Reclamation: 1,598 acres. Proposed CH Unit ID-1 is shown in Figure 3; the area over which Reclamation exercises land management authority within the proposed CH unit is delineated.

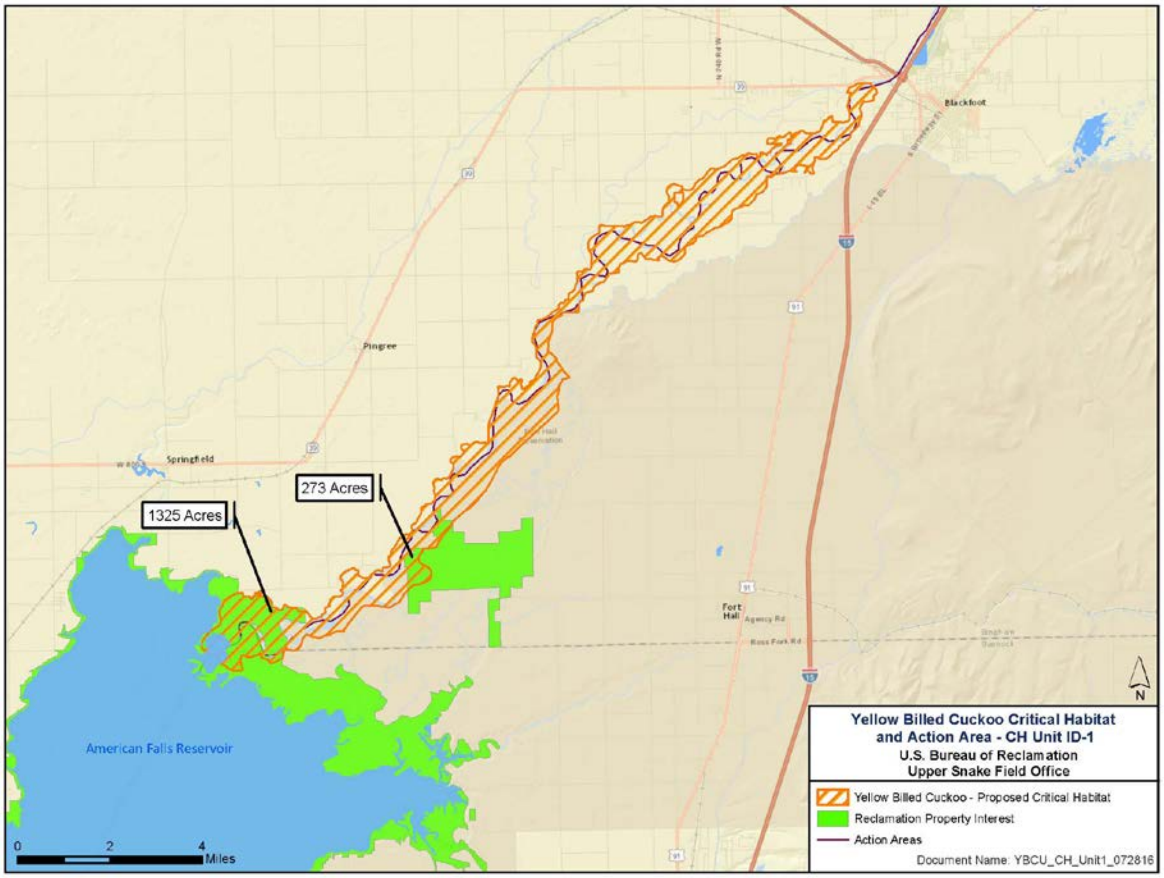

Figure 3. Proposed CH Unit ID-1 on the Snake River above American Falls Reservoir, Bannock and Bingham Counties, Idaho. Reclamation property interest is shown in green.

Proposed CH Unit ID-2

Proposed CH Unit ID-2 consists of 11,439 acres and extends along a 40-mile-long continuous segment of the Snake River from the bridge crossing on the Snake River 2 mi east of the town of Roberts, through Jefferson County, and upstream to the vicinity of the mouth of Table Rock Canyon in Bonneville County, Idaho. Approximately 5,472 acres, or 48 percent, of proposed CH Unit ID– 2 are privately owned; 106 acres, or 1 percent, are in State ownership and managed by the Idaho Department of Lands; and 5,861 acres, or 51 percent, are in Federal ownership, which includes lands managed by BLM and lands located in the Caribou-Targhee National Forest managed by the U.S. Forest Service. Reclamation does not own or exercise surface management of land in any part of this proposed CH unit; however, the water management operations of upstream Jackson Lake and Palisades Dams have significant impact on the hydrograph in this reach of the river. These operations are discussed in more detail in Chapter 3 of this document. CH Unit ID-2 is shown in Figure 4.

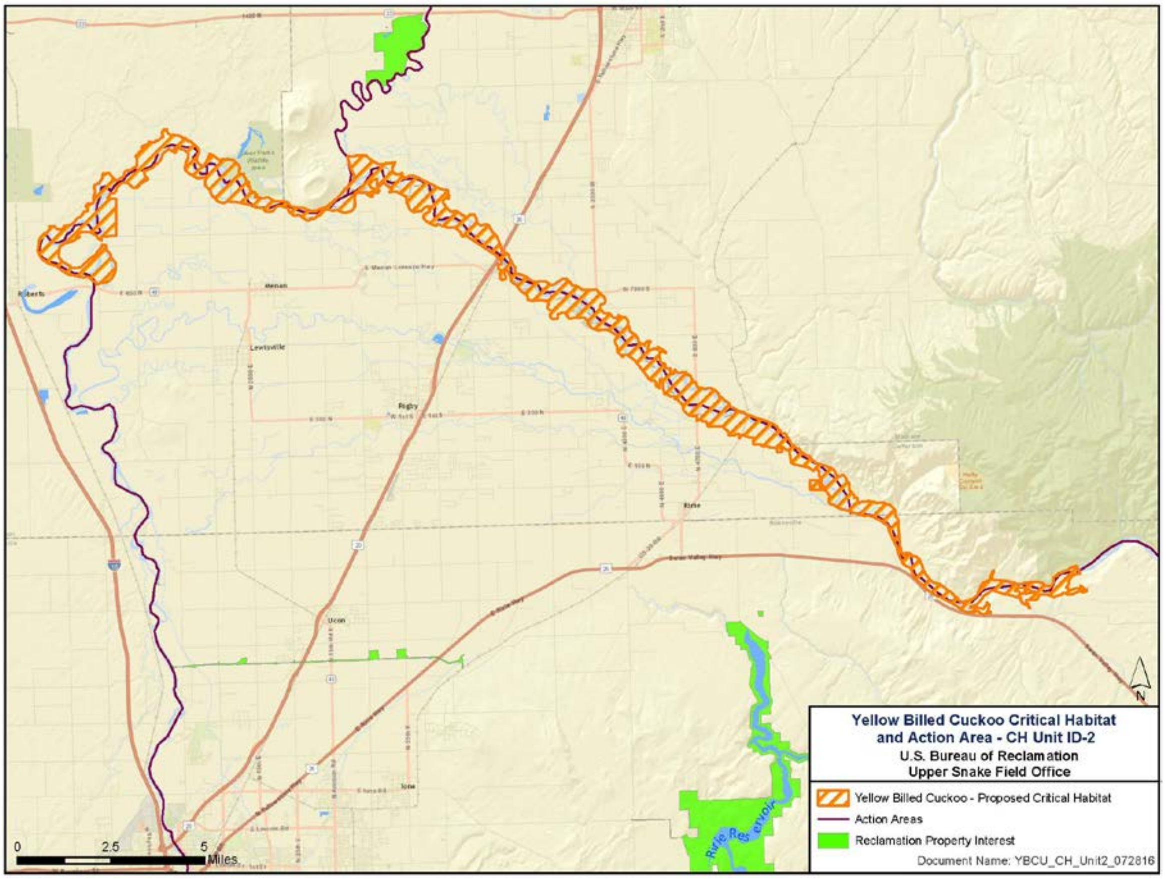

Figure 4. Proposed CH Unit ID-2 on the Upper Snake River corridor, Madison, Jefferson, and Bonneville Counties, Idaho. Reclamation does not manage any surface area in this CH unit.

Proposed CH Unit ID-4

Proposed CH Unit ID-4 consists of 3,449 acres, and extends along a 6-mi-long continuous segment of the Henrys Fork in Madison County from just upstream of the confluence with the Snake River to a point approximately 1 mi upstream of the Madison County line in Fremont County, Idaho (Figure 5). Approximately 2,712 acres, or 79 percent, of proposed CH Unit ID–4 are privately owned; 341 acres, or 10 percent, are in State ownership and managed by the Idaho Department of Lands; and 396 acres, or 11 percent, are in Federal ownership managed by BLM. Within this proposed CH unit, Reclamation's surface management is limited to a 0.75-acre parcel on the north edge of the proposed CH unit, where a 2.5-acre observation well site overlaps the proposed CH boundary. The potential impacts to riparian habitat of water management operations at upstream Island Park Dam are discussed in more detail in Chapter 3 of this document.

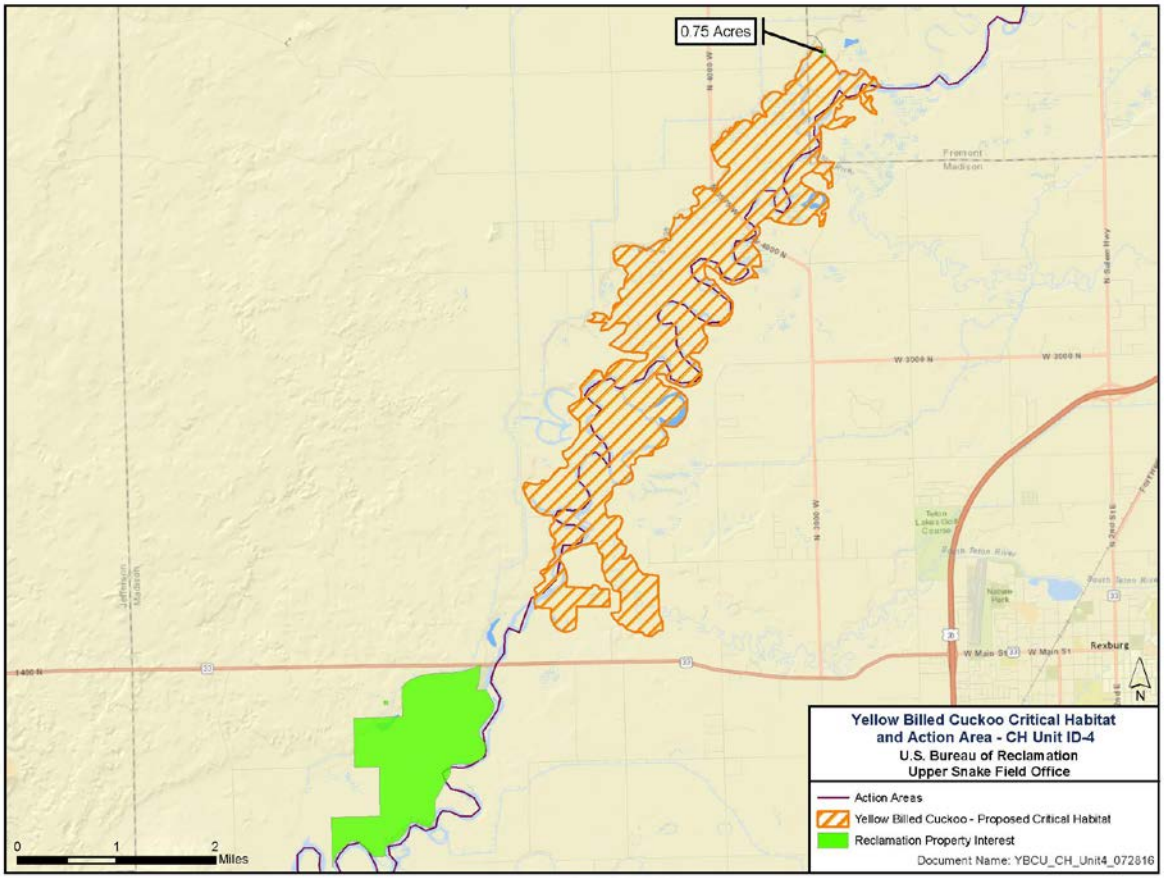

Figure 5. Proposed CH Unit ID-4 on the Henrys Fork, Madison and Fremont Counties, Idaho. Reclamation surface management is limited to 0.75 acres, at the overlapping edge of a 2.5-acre observation well site on the northern edge of the CH unit.

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3. Environmental Baseline

Hydrology affects many of the physical and biological features essential to the conservation and recovery of nesting habitat of the YBCU. Flow rates, such as minimum base or peak flows, are discussed in terms of limiting factors for the growth and maintenance of the vegetation communities necessary for the persistence of nesting habitat suitable for the YBCU. System management by Reclamation Actions and the resulting changes in flows on the Henrys Fork, the Snake River, and the Boise River systems are described below. The hydrologic information used in this BA comes from the historical (observed) record and expected conditions based on historical record and continued operation of Reclamation facilities.

Reclamation's 2004 Upper Snake BA describes historical hydrologic environmental baseline conditions, including changes that occurred as a result of Reclamation's past operations, as well as private upstream water development activities. In 2014, Reclamation completed a supplemental BA to assess changes to the operations of the Minidoka Dam spillway as a result of the construction of a new spillway (completed in March 2015). As discussed, Reclamation's proposed actions for upper Snake River operations will be consistent with the 2004 Upper Snake BA, except for the partition of flows between Minidoka Dam's power facility and spillway (addressed in the 2014 BA). That change in flow partitioning will not alter the current system management, including the volume or shape of water releases from Minidoka Dam; it is also of minimal relevance to this BA, as all proposed CH units are located upstream of American Falls Reservoir, and are not affected by downstream changes at Minidoka Dam.

This chapter covers water supply, historical flows, and current (baseline) hydrologic conditions in the Henrys Fork from Island Park Dam to the confluence with the Snake River, the Snake River from Jackson Lake Dam downstream to above Milner Dam, and the Boise River system from Anderson Ranch Dam on the South Fork Boise River downstream to the confluence of the Boise River with the Snake River.

Hydrologic conditions in the Snake River system from below Milner Dam to above Brownlee Reservoir are not analyzed in this document. Although there are continuing downstream hydrologic effects of Reclamation's actions, they are minor relative to many other cumulative contributing factors beyond Reclamation's control. Due to the absence of species detections and/or suitable habitat in this reach of the Snake River, hydrologic alterations from Reclamation's actions would be expected to have no effect on the YBCU.

Reclamation's actions in other tributaries of the Snake River were also not analyzed, as suitable habitat is not known to exist in these river systems, and YBCU detections are rare to nonexistent throughout the historic record. Therefore, Reclamation actions on these tributaries are also expected to have no effect on the YBCU.

3.1 Snake River Basin Hydrologic History

The Snake River basin upstream from Brownlee Dam drains about 72,590 square miles, with an annual average flow of about 14 million acre-feet per year into Brownlee Reservoir. This area includes 31 dams and reservoirs. Reclamation, Idaho Power, the Corps, and a host of other organizations own and operate various facilities that have substantial influence on water resources, supplies, and the movement of surface and ground water through the region. The total storage capacity of these reservoirs is more than 9.7 million acre-feet. In addition, there are numerous smaller state, local, and privately owned and operated dams and reservoirs throughout the upper Snake River basin.

Consumptive use of Snake River water is primarily for agriculture. However, less than one-half of the irrigated land in the upper Snake River basin above Milner was developed under Federal authorities. The majority of the irrigation development is private and relies on natural flow rights, groundwater pumping, and Federal storage for a supplemental water supply. Federal irrigation development, in contrast, includes lands that were mostly privately developed but rely on storage rights for a full water supply.

Unregulated flow is the estimated amount of water that would pass a point if there were no storage reservoirs and no irrigation or other diversion of the water basin supply. Estimates of unregulated flow can be derived by adjusting observed runoff for the effects of upstream storage, diversions, and return flows. The most difficult part of making this estimate is the determination of return flow and reuse, which are affected by a complex relationship between surface flows and groundwater flows. The Snake River Plain Aquifer intersects the river and provides significant water; however, timing of the groundwater influence is difficult to assess, and data on groundwater movement does not provide exact results. Estimated unregulated flows for the upper Snake River near Milner are discussed and contrasted with the observed flow past Milner for the period 1928 to 2000 in the 2004 BA (Reclamation 2004a, Chapter 3), highlighting the effect of multiple Federal, state, and private operations in the area, including water storage and water diversion out-of-stream, on flows in the Snake River.

An extensive discussion of the historical flow conditions as it relates to the upper Snake River project facilities and action area can be found in the 2004 Upper Snake BA (Reclamation 2004a, Chapter 3). Modeling and discussion of historic, current, and future flow conditions, with analysis of the potential impacts of climate change on flows, is also presented and discussed in-depth in the 2013 Upper Snake River Bull Trout Critical Habitat Biological Assessment (Reclamation 2013, Chapter 2).

3.2 Snake River Basin Riparian Habitat

In general, floodplains are modified by erosional deposition and channel avulsion, which lead to destruction and development of habitats both temporally and spatially; this is described as a shifting habitat mosaic within the floodplain (Hauer et al. 2004, Lytle and Merritt 2004).

This constant creation and destruction of habitats is the basis for the biological diversity within riparian habitats. Historic maps and photographs, coupled with analysis of hydrographic regimes, indicate that these riparian habitats are affected by many different anthropogenic actions, such as agricultural, industrial, and residential development, woodcutting, overgrazing, floodplain encroachment and bank stabilization (including levees and riprap placement), and the alteration of hydrologic flow regimes resulting in geomorphic modification of the floodplains.

The hydrologic regime of the upper Snake River basin from 1917 to 2004 was characterized by theoretical average unregulated peak flows (theoretical flows without damming/diversion operations) of 32,081 cfs in the uppermost reach, as would be presently measured at the Heise gage (USGS 13037500) near Heise, Idaho, resulting from spring snowmelt in late May or June. These natural discharge regimes supported extensive surface water and groundwater exchange, as well as the erosion and avulsion processes necessary to sustain a dynamic shifting habitat mosaic of cottonwood gallery forest with an attendant high diversity of riparian plants and animals on the expansive unconfined alluvial floodplains. Historically, Reclamation’s water management operations on the Snake River have significantly reduced the high annual scouring flows associated with uncontrolled spring runoff. The actual average regulated peak flow from 1956 (when the construction of Palisades Dam was completed) to 2004 measured at Heise, as affected by operations at Palisades Dam, as well as upstream Jackson Lake Dam and irrigation in Wyoming, was around 21,000 cfs.

In studies specific to the Snake River basin, Hauer et al. (2004) determined that a minimum flow of 15,000 cfs is the average threshold flow needed to initiate sediment mobilization within the active river channel (parafluvial flow). The erosion and avulsion processes that create and destroy habitats begin at this flow. Merigliano (1995) theorized that in order to maintain the existing habitat mosaic below Palisades Dam, including the cottonwood galleries critical for the conservation and recovery of the YBCU, flows in excess of 30,000 cfs are needed to cause erosion and avulsion of the floodplain (orthofluvial flows); however Hauer et al (2004) concluded, after extensive modeling specific to the Snake River below Palisades Dam, that flows of 28,000 cfs in this reach would be sufficient to initiate orthofluvial avulsion events. Because cottonwoods are phreatophytic (organisms that must maintain connectivity to the water table to meet their water needs), Hauer et al. (2004) also noted that the ramping-down rate from these higher flows is influential to the longer-term success rate of seedlings that do establish, with a ramping-down rate not to exceed 5 percent per day most conducive to survival.

Historic records of discharge patterns also illustrate how temporally modified the hydrographic regime of the Snake River was during the early part of the 20th century. Prior to the construction of Palisades Dam, the rising limb of the spring snowmelt typically began in late March and early April. Peak in discharge typically occurred in late May or in June. Discharge patterns in the Snake River (measured at the gage at Heise, Idaho) since construction of Palisades Dam changed dramatically, particularly among high-discharge years, with increased discharge typical of the onset of spring snowmelt initiated in late

February and early March. In contrast with the natural discharge regime in which the ascending limb of the hydrograph begins in late March and April, this earlier spilling of water is a result of operator anticipation of high discharge coming from the upper basin, and is part of the attempt to maximize potential water storage in Palisades Reservoir, while still balancing the contrary need of reducing flooding risks, to the extent possible, in light of each year's water forecast. When compared to high discharge years prior to Palisades Dam, the early discharge represents a 30- to 45-day earlier initiation of a rising spring hydrograph; the overall timing of peak flows, however, remains generally unchanged. Figure 6 shows a comparison of the average pre- and post-dam completion yearly hydrograph for wet hydrologic year types. Hydrographic patterns among low discharge years remain similar before and after dam construction (Reclamation 2004a).

Cottonwoods are prolific seed producers, but their seeds only remain viable for 2 to 4 weeks following release, and do not create persistent seed banks. Therefore, the brief spring timeframe in which cottonwoods release their seeds must be synchronized with a spring flooding event of sufficient size to create suitable germination sites. Once germinated, phreatophytic cottonwood seedlings' root growth must keep pace with the dropping water table. Seedlings that are unable to maintain this connection due to a water table that drops too rapidly following germination commonly desiccate and die. Thus, the establishment and subsequent survival of cottonwood seedlings is the result of a favorable combination of a suite of variable factors, including a specific timed sequence of hydrologic events in any one season. This combination of conditions essential for cottonwood establishment does not naturally occur on an annual basis, but rather may coincide only at irregular intervals of 2 to 10 years (Rood and Mahoney 1990). Even at long recurrence intervals, if seedling establishment occurs with enough frequency to adequately replenish and compensate for general mortality in other age classes of cottonwoods, gallery forests can successfully persist.

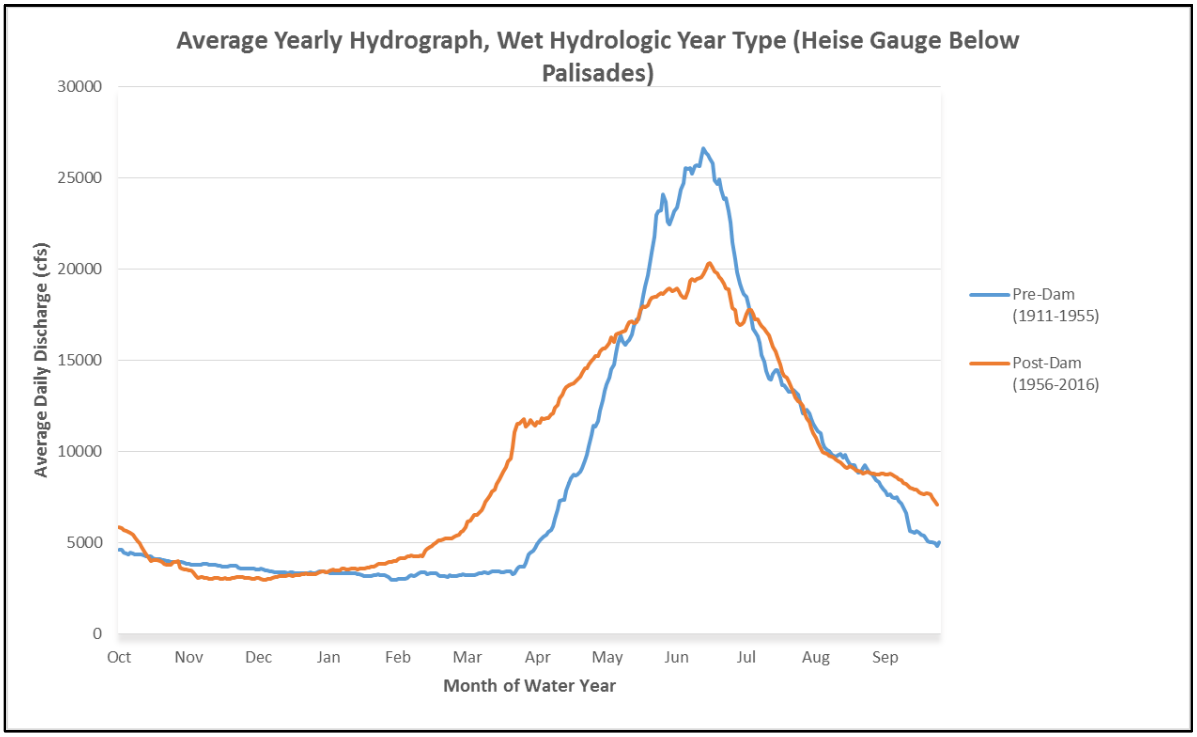

Figure 6. Average yearly hydrograph for wet-type hydrologic water years, before and after construction of Palisades Dam. This graph shows flow data from Heise gage (USGS 13037500) below Palisades from 1911 to 2016.

3.3 Hydrologic Baseline (Current Ongoing Operations and Maintenance)

The following subsections of this document discuss the environmental baseline in the action areas for each of the two proposed actions analyzed in this document (Current O&M in the Snake River System above Milner Dam, and Current O&M in the Boise River System). The environmental baseline of the Snake River system is further broken into three geographic areas for discussion, while the Boise River system is considered one geographic area. These four separate areas are each discussed in terms of environmental baseline and the effects of proposed actions:

The following O&M activities currently take place in the following sections of the Snake River system above Milner Dam:

- The Snake River from the top of Jackson Lake above Jackson Lake Dam (RM 988.9) to the Henrys Fork confluence, and continuing below the mouth of Henrys Fork to below Milner Dam, including American Falls Reservoir and American Falls Dam (RM 714), and Lake Walcott and Minidoka Dam (RM 674.5),
- Henrys Fork from below Island Park Dam (RM 91.7) to the confluence with the Snake River, and

- The Snake River from below Milner Dam (RM674.5) to above Brownlee Reservoir

The following O&M activities currently take place in the following sections of the Boise River system:

- The South Fork Boise River from Anderson Ranch Dam (RM 43.5) to the confluence with the mainstem Boise River, and downstream to the Boise River's confluence with the Snake River, including Arrowrock Dam and Reservoir on the Boise River (RM 75.4) and Lucky Peak Dam and Reservoir (RM 64). (Lucky Peak Dam is owned and operated by the Corps).

3.3.1 Current O&M in the Snake River System above Milner Dam

Snake River System – Jackson Lake Dam to below Milner Dam – Ecologically Based System Management

Reclamation's influence on the hydrology in this part of the action area begins at Jackson Lake Dam below Jackson Lake, at RM 988.9 on the Snake River. Jackson Lake Dam has an active storage capacity of 847,000 acre-feet (the preexisting natural lake has a large unmeasured volume below the dam outlet), and is surrounded by Grand Teton National Park. The dam is operated for flood control, in conjunction with Palisades Dam under Section 7, Flood Control Act of 1944 (33 USC Ch. 15). Palisades Reservoir, above Palisades Dam at RM 901.6 on the Snake River, has a storage capacity of 1,401,500 acre-feet, including 157,500 acre feet of inactive storage (below the minimum elevation necessary for power generation) and 44,000 acre feet of dead capacity (below the lowest water outlet).

In 2000, Reclamation initiated a research and modeling effort to analyze the effects of its water management operations from an ecological perspective in large part to address conservation concerns for the Yellowstone cutthroat trout. Rather than focusing on a single species or minimum seasonal flows, the Ecologically Based Systems Management (EBSM) project identified annual and inter-annual operation guidelines that would sustain long-term riverine and riparian ecological functions in the Snake River below Palisades Dam, including the geomorphic processes necessary for maintenance and restoration of the cottonwood gallery habitats that had experienced decline since the construction of Palisades Dam. A statistical analysis and modeling of a long-term regulated hydrograph and a long-term unregulated hydrograph for the Snake River below Palisades Dam was performed, examining the relationship between discharge and total cumulative power applied to the floodplain (i.e., the ability of the river to do geomorphic work on the floodplain). These results were then used to estimate the river's power to achieve geomorphic work, indicated by within-channel (parafluvial) and within-floodplain (orthofluvial) mobilization and redeposition of sediment, including channel avulsion, at different flows. The EBSM project findings were corroborated by a parallel research effort completed by the Idaho Department of Fish and Game (IDFG) and Idaho State University assessing flows needed to sustain and protect the cutthroat trout fishery, and were presented in 2003. The presentation identified operational recommendations under a variety of hydrologic year types (i.e., ultra-wet, wet, moderate, and dry) that would allow the Snake River below Palisades Dam to meet geomorphic thresholds.

Both the EBSM and cutthroat trout studies suggested that the ecological functions supporting species that evolved under flow conditions in high-energy Rocky Mountain streams benefit from regulated flow regimes that mimic naturally occurring hydrographs. Flows great enough to cause sediment mobilization beneficial to cutthroat trout also provide the mechanisms for channel erosion and avulsion processes that maintain the existing shifting habitat mosaic, including cottonwood habitats, on the Snake River below Palisades Dam. The findings of this EBSM study were applied to develop minimum discharge-level operational guidelines for Palisades Dam to target these ecological goals.

The research linking system management and ecological conditions are analyzed and discussed extensively in the University of Montana's Flathead Lake Biological Station Division of Biological Sciences' 2004 final report to Reclamation titled *Ecologically Based Systems Management (EBSM) – The Snake River – Palisades Dam to Henrys Fork*. Methods, results, and how the EBSM approach informs system operations are discussed in detail in that document. This comprehensive analysis and the resulting guidance under which Reclamation's operations are currently carried out in the action area, to the extent feasible, is herein incorporated by reference into this document (Hauer et al. 2004).

The EBSM study produced operational recommendations from a purely ecological framework. However, some of the EBSM recommendations cannot be feasibly practiced, due to conflicting flood control storage regulations. A summary of EBSM operational recommendations to meet ecological goals applicable to the conservation and recovery of the YBCU is included below, and conflicts with other guidelines and regulations are noted in footnotes:

Maximum Annual Discharge, Spring Freshet – to scour and reshape river channel and to meet healthy river dynamics:

- Ultra-wet years (total annual discharge ≥7 million acre-feet) exceed 30,000 cfs for as long as possible with more than 25,000 cfs for 12 to 15 days[1]
- Wet years (5.8 to 6.9 million acre-feet) exceed 25,000 cfs for 8 to 12 days
- Dry years stay with the previously existing water release protocols

[1] These recommendations directly conflict with other governing authorities, and cannot be practiced due to statutory limits on discretionary releases. Formal flood regulations in this reach of the Snake River are formulated for Heise, ID, in accordance with Section 7 of the Flood Control Act of 1944. Release objectives for Palisades Dam formulated pursuant to this Congressional Policy are required to target maintenance of flows at or below 20,000 cfs. Water-year scenario-based flow objectives are presented in a formal flood control curve diagram in the Palisades SOP. Flood stage at Heise results from flows between 24,000 cfs and 26,000 cfs. Because of tributary inputs between gages at Irwin and Heise which may range from 400-600 cfs in low water years up to 2,000 cfs in high water years, flows at Irwin must be maintained at lower levels than those measured at Heise to avoid flood stage at Heise.

Descending Limb and Summer Flow – for riparian recruitment:

- Ultra-wet and wet years, reduce discharge from maximum at a rate not to exceed 5 to 15 percent a day for 2 to 3 weeks; maintain descending discharge throughout July and August to meet irrigation demand driven operations by late August
- Moderate to dry years, stay with existing protocols; maintain descending discharge throughout July and August

These operational principles are general guidelines, not rules. There are two key points considered in the application of these EBSM principles in any given year:

- The goal of EBSM is to reintroduce operational variability into the system, rather than new operational set-points. Therefore, working with prevailing hydrologic conditions, operators should vary flow ranges within high-, average-, and low-water years.
- All the seasonal operation principles should work together. To meet requirements for overall ecological benefits, it is ineffective to adhere to one seasonal operating principle but disregard others.

Flows below Palisades Dam have exceeded the 15,000 cfs flow thresholds identified by Hauer et al. (2004) as the minimum flows necessary to mobilize sediment within the active river channel (parafluvial flows, which initiate the erosion and avulsion processes required for cottonwood habitat maintenance), in 10 out of 12 years, as measured at the Irwin gage (USGS 13032500) just below Palisades, from 2005 (when implementation of EBSM began) to 2016. Because of basin inputs, flows at the downstream Heise gage (USGS 13037500) are higher than at Irwin, and exceeded this 15,000 cfs threshold in all 12 years from 2005 to 2016.

The higher discharge thresholds identified in the EBSM models as necessary for orthofluvial work (i.e., flows greater than 28,000 cfs capable of causing erosion and avulsion of the broader floodplain) were recorded at Heise gage, located below Palisades Dam, in 16 out of 46 years (35 percent) of flow data recorded prior to the construction of the dam (1910-1955). This same 28,000 cfs flow threshold has been recorded in 2 out of 60 years (4 percent) since the completion of Palisades Dam (1956-2015). However, one of these years was 1956, before Palisades was fully available for fill and water storage operations.

The range of variation in water yield that Rocky Mountain watersheds are capable of generating should be noted in any review of the hydrologic record; even prior to dam construction, the unregulated hydrograph did not attain the 28,000 cfs flow threshold in naturally occurring low-volume water years. The influence of total annual discharge (i.e., characterization of the water year) on peak flows in any given year (i.e., ultra-wet, wet, moderate, or dry characterization of the water year) should be considered when analyzing flows. The historic record shows that peak flows greater than 28,000 cfs were most often recorded in wet or ultra-wet years (total annual discharge more than 5.8 million acre-feet), as compared to significantly lower occurrence in moderate or dry years (total annual discharge less than 5.8 million acre-feet), both prior to and after construction of Palisades Dam.

Table 1 summarizes this information on water year classifications, the occurrence of threshold flows, and the number of days these flow thresholds were exceeded for each of the last 12 years following implementation of EBSM guidance principles, representative of current operations (environmental baseline).

Table 1. Summary of water year classifications and threshold flow exceedances under EBSM (2005-2016). Flows measured at Heise gage (USGS 13037500) below Palisades Dam

Year	Water Year Type	Days discharge >15,000 cfs (parafluvial threshold)	Days discharge >28,000 cfs (orthofluvial threshold)
2005	Dry	2	0
2006	Dry	23	0
2007	Dry	0	0
2008	Dry	11	0
2009	Dry	52	0
2010	Dry	30	0
2011	Wet	113	0
2012	Dry	0	0
2013	Dry	9	0
2014	Dry	12	0
2015	Dry	15	0
2016	Dry	7	0

Discharges from Palisades Dam are closely mirrored in timing and magnitude in the management of, and resulting discharges from, downstream American Falls and Minidoka Dams, as shown in Figure 7. Reclamation's linked management of discharges from these three successive dams results in a downstream continuation of the EBSM flow regime, with similarly beneficial effects to downstream habitat throughout the action area.

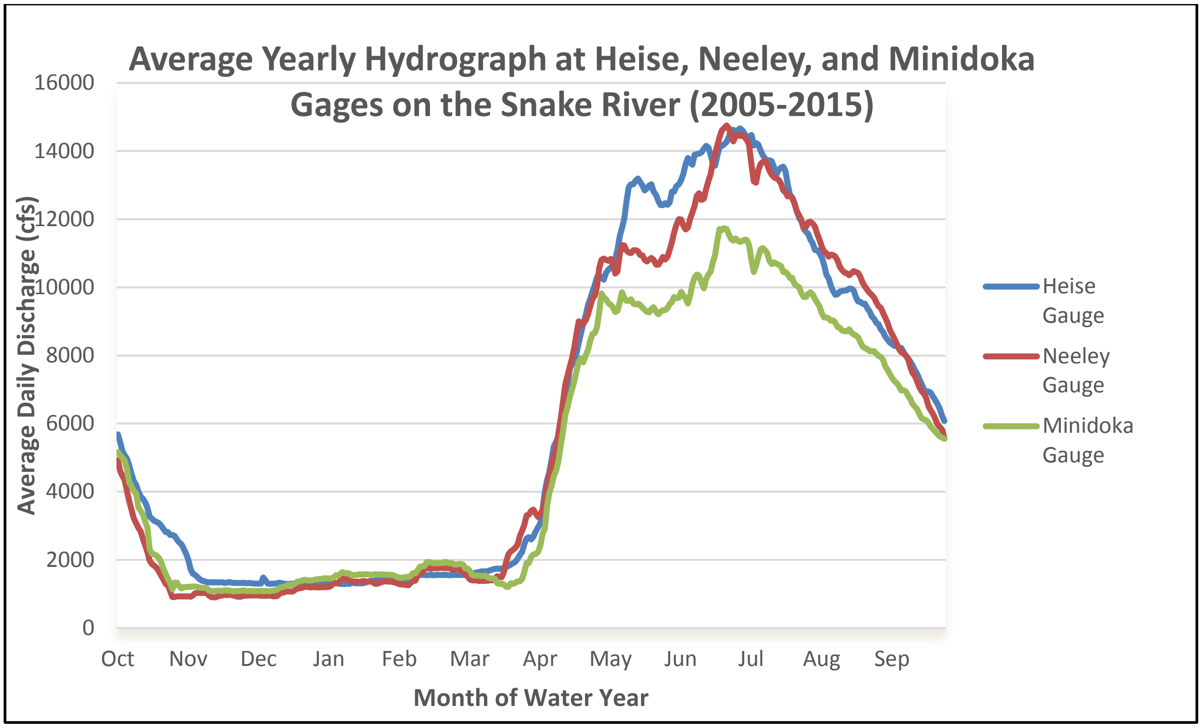

Figure 7. Comparison of average yearly hydrographs below Palisades, American Falls, and Minidoka Dams, showing mean monthly flows for WY 2005-2015. Flow data is from the Heise gage (USGS 13037500) below Palisades Dam, the Neeley gage (USGS 13077000) below American Falls Dam, and the Minidoka gage (USGS 13081500) below Minidoka Dam.

A survey-based evaluation of the specific riparian habitats in question has not yet been performed. Habitat surveys in areas of concern that identify cottonwood recruitment events through sapling aging and correlate these events with historic flow conditions could provide more predictive insight into the effectiveness of EBSM river management practices toward the long-term goal of sustaining riparian cottonwood galleries necessary for the protection and recovery of YBCU populations.

Flood Control-Based Limitations on Reclamation's Discretion

Below Palisades Dam, the official flood stage at the Snake River near the Heise gauging station (USGS 13037500), according to the National Weather Service, is 24,500 cfs. However, some bank erosion occurs at flows less than the official flood stage; therefore, the joint flood control rule curves for Jackson and Palisades Dams operations are based on limiting the Snake River flow at Heise to 20,000 cfs. Farther downstream, flooding as indicated by high flows at the gauging stations at Shelley (USGS 13060000) and Blackfoot (USGS 13062500) can still occur in the reach from Roberts upstream to near Firth downstream, even when the flow at Heise is well below flood stage. Avoiding flooding in this reach entails limiting release rates from Palisades Reservoir during flood control operations, particularly in April through June.

Henrys Fork below Island Park Dam

Reclamation's influence on the hydrograph in this part of the action area begins at Island Park Dam and Reservoir, located at RM 91.7 on the Henrys Fork. Island Park Reservoir has an active storage volume of 135,205 acre-feet. It is operated and maintained by the Fremont-Madison Irrigation District (FMID) for irrigation water supply for lands in the Ashton to Rexburg area, and on Henrys Fork tributaries by exchange or by delivery through the Cross Cut Canal. Releases are determined in collaborative consultation with the FMID, Idaho Water District 1, Fall River Rural Electric Cooperative (the Federal Energy Regulatory Commission [FERC] licensee for this facility), and the Henry's Fork Foundation. Short-term operating target flows are established for the Henrys Fork at the St. Anthony gage (RM 32.4) and Henrys Fork at the Rexburg gage (RM 9.2), based primarily on irrigation demand during the delivery season (reservoir carryover drives target flows in the winter; snowmelt forecast generally factors heavily into the establishment of target flows in the spring). Historically, Reclamation has generally tried to maintain flows of about 1,200 cfs at the Henrys Fork at St. Anthony gage. In years of poor runoff, when unregulated system inflow was decreased, the operating target was 1,000 cfs at the Rexburg gage.

Proposed CH Unit ID-4 is located in the lowest reach of the Henrys Fork, just above its confluence with the Snake River. Island Park Dam, 91.7 river miles upstream of the confluence, has limited ability to reduce overall flows on the lower Henrys Fork because much of the inflow to Island Park emits from springs with little seasonal variation, while much of the runoff of the basin originates downstream from Island Park Reservoir and is unregulated. Thus, irrigation diversions below the Fall River confluence with the Henrys Fork have a greater influence on Henrys Fork flows. These result in lowered late summer flows, but not in a substantial alteration of peak flow (Burnett and VanKirk 2004b). Burnett and VanKirk (2004a) further note that Reclamation's operational control of the Henrys Fork only minimally alters the hydrograph.

Snake River from below Milner Dam to above Brownlee Reservoir

On the Snake River downstream from Minidoka Dam, non-Federal and private dams alter the water operations and riparian habitat. These dams include Milner Dam and the Idaho Power dams (Idaho Power's Mid-Snake Projects, C.J. Strike and Swan Falls Dams) that are subject to ESA consultation through the FERC relicensing process. The Idaho Power Dams are operated to optimize power generation and meet customer demand; however, this opportunity is limited by the small storage capacity of these projects. Irrigation activities store or remove much of the surface water in the river upstream from Milner Dam. Streamflow is replenished by tributaries, return flows, and springs (including those in the Thousand Springs area). The only Reclamation facilities located below Milner Dam on the Snake River are four pumps located near Marsing, Idaho. Neither a record of YBCU detections nor potentially suitable habitat for the species occur in or within this area.

The Snake River Plain Aquifer is located north of the Snake River, extending from the vicinity of Bliss, Idaho, upstream (northeast) to the vicinity of Ashton, Idaho. It is one of the most productive aquifers in the continental United States. Since the early 1950s, groundwater levels have shown a net decline, caused primarily by increased groundwater pumping for irrigation and increased water conservation by irrigators on the plain, reducing incidental recharge. These factors, combined with periodic drought, have caused dramatic declines in groundwater levels. The condition of the Snake River Plain Aquifer is critical to Snake River flows below Milner, as most of the inflow to the river in the reach below Milner and King Hill is due to the discharge of the aquifer at Thousand Springs. The spring flow has been recorded by the USGS since 1902; the volume of spring flow is related to the Snake River Plain Aquifer level, although there is a lag between recharge changes and spring flow changes. In general, the annual mean spring discharge has shown a declining trend since 1951 (Reclamation 2004b).

The 92.1-mile reach downstream of Milner Dam to the King Hill gage (USGS gage #13154500, Snake River at King Hill, Idaho, at RM 546.6) experiences a large increase in flow as a result of groundwater and irrigation return flows and is minimally impacted by Milner Dam operations, with the exception of flood control releases. Because flows at King Hill are comprised almost entirely of aquifer discharges and irrigation returns, the Snake River at King Hill remains stable throughout the year, resulting in little change to stage or inundated area, with the exception of flood conditions. A comparison of the Milner Dam and King Hill hydrographs shows that for 50 percent of the years, releases from Milner Dam are fairly small compared to the Snake River flows at King Hill and do not have a major impact on the flow in the lower section of the Snake River. The only exception to this observation, outside of flood operations, is during the release of water for flow augmentation from the Snake River above Milner Dam. Reclamation annually provides up to 487,000 acre-feet of water from the Snake River above Brownlee Reservoir, intended to benefit ESA-listed anadromous fish species in the lower Snake and Columbia Rivers. The amount that is provided from above Milner Dam is variable each year, depending on water year type, amounts available from the Water District 01 rental pool, and hydrologic conditions in other source basins (Reclamation 2004b).

Due to this combination of factors, Reclamation's historic and current water management actions upstream of Milner Dam do not have a measurable impact on the overall hydrologic conditions in the Snake River system below Milner Dam.

3.3.2 Current O&M in the Boise River System

The Boise River system includes three major storage dams, a diversion dam, and one major and one minor off-stream storage reservoir. Anderson Ranch Dam and Arrowrock Dam are facilities maintained and operated by Reclamation in the Boise River System.

Reclamation's influence on the hydrograph in this action area begins at Anderson Ranch Dam and Reservoir, located at RM 43.5 on the South Fork Boise River. Below Anderson Ranch Dam, the South Fork and mainstem Boise River flow into Arrowrock Reservoir above Arrowrock Dam (RM 75.4 on the mainstem Boise River). Below Arrowrock Dam on the Boise River, the Corps owns and operates Lucky Peak Dam (RM 64). Downstream from

Lucky Peak, the Boise River Diversion Dam fills the New York Canal, operated by the Boise Project Board of Control. The remaining downstream canals, laterals, and off-stream reservoirs are operated and maintained by the irrigation districts.

The historic hydrograph (the timing and magnitude of streamflows) in the Boise River basin has been changed over the past century as a result of numerous water development projects involving hydropower generation, water withdrawals, reservoir storage, and return flows. Reclamation facilities have contributed to these hydrologic changes and the present hydrologic baseline conditions in the Boise River basin. The operation of Anderson Ranch and Arrowrock Reservoirs affects the downstream South Fork and mainstem Boise River hydrograph because, in general, reservoir operations regulate the hydrograph with flows that are lower in the winter and spring, lower during the spring peak, and higher in the summer. Further discussion of this change in conditions is presented in the 2004 BA (Reclamation 2004a, Chapter 3, pages 29-33).

The Corps and Reclamation jointly control the Boise River under formal flood control rules; however, the Corps has the ultimate flood control authority. A Water Control Manual for the Boise River was jointly developed by Reclamation and the Corps under the authority of Section 7 of the 1944 Flood Control Act, providing flood control operations guidance and including formal flood control rule curves.

3.4 Salmon Flow Augmentation

3.4.1 Snake River System (Snake River System above the Milner Dam Action Area)

In the Snake River System, storage releases past Milner Dam, the lowest point of regulation within the Minidoka and Palisades storage system on the Snake River, begin in May and are usually complete by August 20. Milner Pool has a modest volume of storage, so releases from upriver storage reservoirs are necessary to provide the water needed for augmentation and to sustain Milner Pool storage volumes at adequate levels. Augmentation releases begin after the maximum reservoir fills are achieved, and after flood releases past Milner Dam are over. In order to maintain a constant pool elevation at Milner Pool, gradual changes in releases at American Falls and Minidoka Dams are necessary. Use of water from the Palisades Reservoir powerhead space for provision of augmentation flows is a last resort.

Because of these timing, size, and source restrictions to augmentation releases, historic salmon flow augmentation operations have not significantly affected the timing or magnitude of the spring peak of the hydrograph in this river system.

3.4.2 Boise River System (Boise River System Action Area)

In the Boise River system, Reclamation typically requests that releases to meet a portion of Reclamation’s requirement for salmon flow augmentation occur during the summer irrigation period. Releases past Lucky Peak Dam are usually 400 cfs above the volume of stored water released for irrigation. Flows are usually about 1,500 cfs below the Boise River Diversion Dam just downstream from Lucky Peak Dam; the Ada County Parks and Waterways Department considers flows above 1,500 cfs unsafe for recreational floaters in the lower Boise River, and flows above 1,500 cfs damage gravel pushup dams. Therefore, flows are artificially maintained at or below these levels when possible.

Because of the later timing and limited size of augmentation releases, historic salmon flow augmentation operations have not significantly affected the timing or magnitude of the spring peak of the hydrograph in this river system.

4. Effects to the Yellow-Billed Cuckoo

4.1 Effects of the Proposed Action

Guidance in the Endangered Species Consultation Handbook explicitly states that when determining the effect of ongoing water projects, “the total effects of all past activities, including effects of the past operation of the project, current non-Federal activities, and Federal projects with completed section 7 consultations, form the environmental baseline.” (USFWS and NOAA Fisheries 1998, Chapter 4, page 4-29).

The proposed actions represent a continuation of the current O&M as described in Chapter 3 – Environmental Baseline. Therefore, the effects to YBCU and its proposed CH from Reclamation’s current operations are expected to continue as a result of the proposed action.

4.2 Effect Determinations of the Proposed Actions for Yellow-Billed Cuckoo (Western DPS) and Proposed Critical Habitat

This BA analyzes the effects of the included proposed actions on the Western DPS of the YBCU and its proposed CH, taking into account new information that has become available since the 2004 Upper Snake BA. Effects conclusions for each of the proposed actions are summarized in Table 2, and are discussed in the paragraphs that follow.

In accordance with the provisions of the ESA-implementing regulations and the USFWS and NMFS Section 7 Handbook (USFWS and NOAA Fisheries 1998), Reclamation used the following definitions to make its effects determinations:

- **No effect (NE) –** The appropriate conclusion when no effects on the listed species are expected.
- **May affect (MA) –** The appropriate conclusion if the Federal agency determines its proposed action may have effects on listed species or designated CH. The Federal agency must also determine whether the effects constitute an adverse effect as defined below.
    - **Not likely to adversely affect (NLAA) –** The appropriate conclusion when effects on listed species are expected to be discountable, insignificant, or completely beneficial. Beneficial effects are contemporaneous positive effects without any adverse effects to the species. Insignificant effects relate to the size of the impact and should never reach the scale where take occurs. Discountable effects are those extremely unlikely to occur. Based on best judgment, a reasonably informed person would not: (1) be able to meaningfully measure, detect, or evaluate insignificant effects; or (2) expect effects to occur.

- **Likely to adversely affect (LAA) –** The appropriate conclusion if any adverse effect to listed species that may occur as a direct or indirect result of the proposed action or its interrelated or interdependent actions, and the effect is not discountable, insignificant, or beneficial. In the event the overall effect of the proposed action is beneficial to the listed species, but is also likely to cause some adverse effects, then the proposed action is likely to adversely affect the listed species. If incidental take is anticipated to occur as a result of the proposed action, an *Is likely to adversely affect* determination should be made. This determination of *Is likely to adversely affect* would require the initiation of formal Section 7 consultation.

Table 2. Effects summary for YBCU (Western DPS) and PCH in each of the proposed action areas in the Snake River basin

Proposed Action	Effect Conclusion – YBCU	Effect Conclusion – Proposed CH
Future O&M in the Snake River System above Milner	MA-NLAA	MA-NLAA
Future O&M in the Little Wood River System	NE	NE
Future O&M in the Owyhee River System	NE	NE
Future O&M in the Boise River System	MA-NLAA	MA-NLAA
Future O&M in the Payette River System	NE	NE
Future O&M in the Malheur River System	NE	NE
Future O&M in the Mann Creek System	NE	NE
Future O&M in the Burnt River System	NE	NE
Future O&M in the Upper Powder River System	NE	NE
Future O&M in the Lower Powder River System	NE	NE
Future Provision of Salmon Flow Augmentation	MA-NLAA	MA-NLAA

4.2.1 Proposed Action: Future O&M in the Snake River System above Milner Dam

The ESA's section 7(a)(2) consultation requirements apply to all agency actions in which there is discretionary Federal involvement or control (50 CFR 402.03). However, where an agency lacks the ability to prevent a certain effect due to its limited statutory authority over the relevant actions, these particular actions are not considered discretionary actions subject to the requirements of Section 7(a)(2). It has been Reclamation's view that the ESA regulations for any consultation apply to Reclamation's actions only to the extent that Reclamation has discretionary involvement in or control of them. However, for convenience, this document analyzes the effects resulting from both discretionary and non-discretionary components of the proposed actions.

In determining whether the effects of the proposed action constitute an adverse effect, Reclamation also considered that the action areas represent the far northern edge of the YBCU's breeding range, are occupied sporadically and utilized by a very small percentage of the range-wide population of the Western DPS of the YBCU as a whole, and are subject to numerous outside influences beyond Reclamation's control that may affect occupancy year to year. As far as the previously discussed limits to Reclamation's discretion allow, the proposed action represents a continuation of the current operations that contribute to baseline conditions, wherein water management intentionally mimics natural flow regimes as closely as possible, given the nondiscretionary requirements to fulfill both flood control and irrigation flow provision demands.

This proposed action encompasses the following three component areas, as separated and discussed in detail in Chapter 3 – Environmental Baseline.

The Snake River from the top of Jackson Lake above Jackson Lake Dam (RM 988.9) to the Henrys Fork confluence, and continuing below the mouth of Henrys Fork to below Milner Dam, including American Falls Reservoir and American Falls Dam (RM 714), and Lake Walcott and Minidoka Dam (RM 674.5)

Yellow-billed Cuckoo

On the Snake River from Jackson Lake Dam downstream to Milner Dam, the potential adverse effects to the YBCU of Reclamation's proposed actions may include the loss of suitable cottonwood gallery nesting habitat due to alteration of the hydrograph. Specifically, the reduction in amount and frequency of peak flows below Palisades Dam from natural spring peak thresholds of greater than 28,000 cfs, as identified by Hauer, et al. (2004), may be expected to result in a suppression of cottonwood seedling recruitment and survival, which would eventually lead to altered age structure and quantity of nesting habitat if suppression is sustained over the long term. These peak flow reductions are a nondiscretionary component of Flood Control regulations under which authority Reclamation operates, as discussed in more detail in Section 3.3.1 (Flood Control-Based Limitations on Reclamation's Discretion). Eventual reduction of nesting habitat would be expected to have an adverse effect to the species in terms of reduced nesting opportunity and reduced reproduction.

However, due to the natural lifespan of cottonwood trees and the known age range of existing galleries, it is unlikely that cottonwood gallery habitat in the action area will be substantially reduced during the remaining 18 years covered by the existing BiOp, and it is unlikely that a reasonably informed observer would be able to meaningfully measure, detect, or evaluate the effects to YBCU of any habitat reduction that may occur within the next 18 years. Therefore, Reclamation has determined that the proposed action may affect, but is not likely to adversely affect, the YBCU in this area.

Proposed Critical Habitat

Long-term attenuation of peak flows disrupts the dynamic riverine processes necessary for CH (PCE 3), which in turn affects the quality and quantity of riparian woodlands (PCE 1) through alteration and suppression of germination, seedling establishment, and seedling survival cycles that create and replenish riparian woodland habitat. Although it has not been definitively quantified in studies to date, habitat alteration over a long-term time scale due to ongoing flood control operations has likely already occurred since the construction of Palisades Dam. Without sufficient seedling recruitment events, it is reasonable to expect a continued skewing of forest age structure toward older trees, which if unaddressed may result in the loss of these galleries over the longer term (50 to 100 years). Unaddressed in the long term, this habitat alteration is likely to result in the further decline and eventual loss of cottonwood gallery nesting habitat in the action area over the next 100 years.

However, due to the natural lifespan of cottonwood trees and the known age range of existing galleries, it is unlikely that cottonwood gallery habitat in the action area, including the PCH, will be substantially reduced during the remaining 18 years covered by the existing BiOp, and it is unlikely that a reasonably informed observer would be able to meaningfully measure, detect, or evaluate the effects to YBCU of any habitat reduction within the next 18 years. Therefore, Reclamation has determined that the proposed action may affect, but is not likely to adversely affect, proposed CH in this area.

Henrys Fork from below Island Park Dam (RM 91.7) to the confluence with the Snake River

Yellow-billed Cuckoo

On the Henrys Fork below Island Park Dam, flows are not expected to change from the baseline conditions identified in Section 3.1. Therefore, Reclamation has determined that the proposed action will have no effect on the YBCU in this area.

Proposed Critical Habitat

The effect of Island Park Dam operations on overall flows will remain unchanged from baseline conditions. The hydrologic effects of the operation of Island Park Dam are dissipated to such an extent by the time flows reach downstream YBCU habitat and subsequently join the mainstem Snake River that the proposed actions are expected to have an unmeasurable effect on the hydrologic conditions that affect YBCU habitat in this part of the action area and further downstream. Any potential effect to YBCU habitat downstream is expected to be undetectable. Therefore, Reclamation has determined that the proposed action will have an insignificant effect on proposed CH in this area.

The Snake River from below Milner Dam (RM674.5) to above Brownlee Reservoir

Yellow-billed Cuckoo

Below Milner Dam, flows are not expected to change from the baseline conditions identified in Section 3.1. Reclamation's historic and current water management actions upstream of Milner Dam do not have a measurable impact on the overall hydrologic conditions in the Snake River system below Milner Dam. Furthermore, the scant historic record of YBCU detections in this area suggests that this area does not support the species. Therefore, Reclamation has determined that the proposed action will have no effect on the YBCU in this area.

Proposed Critical Habitat

No proposed CH for this species exists in this area.

Reclamation has therefore determined that in this action area as a whole, the proposed action **may affect, but is not likely to adversely affect**, the YBCU and/or its proposed CH in the action area. Reclamation's EBSM research suggests that historic negative effects to riparian habitat in this part of the action area due to alteration of the hydrograph will be largely mitigated, to the extent over which Reclamation exercises discretionary control of operations, by continuation of EBSM adaptive management practices at Palisades Dam, with coordinated management at downstream American Falls and Minidoka Dams. Further consideration of implementation of discretionary measures, such as habitat surveys and monitoring, selective clearing and regrading of the floodplain to create suitable colonization sites (Tiedemann and Rood 2015), and targeted seedling planting operations to supplement recruitment in the future, may be warranted.

4.2.2 Proposed Action: Future O&M in the Boise River System

Yellow-billed Cuckoo

In determining whether the effects of the proposed action constitute an adverse effect, Reclamation also considered that it is not currently thought that suitable YBCU nesting habitat exists in this action area, and although a sporadic historic record of YBCU detections in the action area exists, it has not been interpreted to represent local breeding and nesting activity. The action area is also subject to numerous outside influences beyond Reclamation's control that may affect use by the species year to year.

No proposed CH exists in this action area; however, YBCU detections appear in the historic record with enough frequency to suggest that the area may be utilized by the species for migration. Less research specific to the black cottonwood galleries present in this action area is available; however, it is reasonable to expect that similar to the Snake River system, flood control operations will affect the same long-term habitat alteration through suppressed seedling recruitment. It is reasonable to expect a continued skewing of forest age structure toward older trees, which if unaddressed may result in the loss of these galleries over the longer term (50 to 100 years). Unaddressed, this habitat alteration is likely to result in the further decline and eventual loss of cottonwood gallery nesting habitat in the action area over the next 100 years. Tiedemann et al. (1994) indicated that at least a portion of the galleries along the Boise River contain a cohort of trees aged 38 to 52 years (now 57 to 71 years). Therefore, it is unlikely that cottonwood gallery habitat in the action area will be substantially reduced during the remaining 18 years covered by the existing BiOp, and it is unlikely that a reasonably informed observer would be able to meaningfully measure, detect, or evaluate the effects to YBCU of any habitat reduction in the next 18 years.

Therefore, Reclamation has determined that the proposed action **may affect, but is not likely to adversely affect**, the YBCU in the action area. Further consideration of implementation of discretionary measures, such as habitat surveys and monitoring, selective clearing and regrading of the floodplain to create suitable colonization sites (Tiedemann and Rood 2015), and targeted seedling planting operations to supplement recruitment in the future, may be warranted.

Proposed Critical Habitat

No proposed CH for this species exists in this area.

4.2.3 Proposed Action: Future Provision of Salmon Flow Augmentation

Because of safety restrictions applicable to augmentation releases, salmon flow augmentation operations have little potential to significantly affect the timing or magnitude of the spring peak of the hydrograph in either the Snake or Boise River systems; later in the year, continued augmentation flow releases may in fact have potential for beneficial effects to the maintenance of downstream riparian habitat, such as that utilized by the YBCU during migration through this area. Artificially higher flows maintain the riparian water table at a higher level longer into the summer and fall season, facilitating increased root connectivity of drought-sensitive seedlings and resulting in higher rates of year-to-year seedling survival. Therefore, Reclamation has determined that the proposed action **may affect, but is not likely to adversely affect** the species and/or its proposed CH.

4.2.4 Proposed Actions: Future O&M in the Little Wood, Owyhee, Payette, Malheur, Mann Creek, Burnt River, Upper Powder River, and Lower Powder River Systems

Reclamation has determined that due to an absence of historic detection data for the species, and/or absence of habitat suitable for YBCU nesting in the action areas, these eight proposed actions will have **no effect** on the species in these action areas. No proposed CH exists in these action areas.

4.3 Cumulative Effects to the Species

The analysis of cumulative effects on the species places an emphasis on the range-wide survival and recovery needs of the YBCU, and the role of the action areas considered in providing for those overall species needs. Cumulative effects include the effects of all future State, Tribal, local, or private actions that are reasonably likely to occur in the action area considered in this BA. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to Section 7 of the ESA.

A large number of activities occur in the action area, such as industrial, rural, and urban development, grazing and agricultural activities including water diversions for irrigation, recreation activities, and the continued depletion of regional aquifers. Continued O&M of non-Federal Idaho Power dams will continue to impact flows within the Snake River and Boise River systems as well. These activities are reasonably likely to continue to occur into the future, and their effects constitute cumulative effects.

4.4 Future Conditions/Climate Change Projections

Water discharge is impacted by changes and variability in regional climate across the Snake River basin. Seasonal variation in river discharge is impacted by winter precipitation amounts, variations in winter precipitation type (rain versus snow) and duration of storage of water in the snowpack at higher elevations. Possible future climate changes across the Snake River basin have the potential to affect snowpack, seasonal water volume, runoff timing, and spatial distribution of precipitation.

4.4.1 Possible Effects of Future Climate Change

Climate change has the potential to profoundly alter the riparian habitat through both direct and indirect effects. Direct effects would be evident in alterations of water yield, runoff timing, peak flows, and stream temperature. Future projections suggest that the Pacific Northwest may gradually become wetter than historical conditions. This is significantly different from projections in the southern United States. Warming trends may lead to a shift in cool-season precipitation, resulting in more rain and less snow, which would cause increased rainfall-runoff volume during the cool season, accompanied by less snowpack accumulation (Reclamation 2011b). Future climate projections based on hydrologic analyses suggest that warming and associated loss of snowpack will persist over much of the western United States.

Warming is expected to diminish the accumulation of snow during the cool season (i.e., late autumn through early spring) and the availability of snowmelt to sustain runoff during the warm season (i.e., late spring through early autumn). Decreased snowpack volume also could result in decreased groundwater infiltration, runoff, and ultimately decreased contribution to summer base flow in rivers.

Warming is expected to lead to more rainfall-runoff during the cool season than snowpack accumulation. This would lead to increases in the December-to-March runoff and decrease the April-to-July runoff. The resulting shift in the hydrograph to increased flows during the cool season and reduced late-spring peak flows may affect riparian habitat composition, growth, and structure, as cottonwood seed viability is highly temporally limited (generally seeds only remain viable for a few weeks after release), and seed release timing is highly synchronized to the seasonal point when receding peak flows leave new germination sites created by deposition of moist sediments available (Lytle and Merritt 2004). It is not known how projected changes in runoff associated with future climate change may directly impact the YBCU, but changes in vegetative growth and composition of riparian nesting habitat, as well as changes to the timing of availability of food sources, could represent indirect effects to the YBCU's success in a changing climate.

As an example of how these changes in flow timing may affect riparian habitat in an unregulated river system, a shift to an earlier peak in the hydrograph, coupled with reduced late-season flows, could lead to a decline in seedling germination if seed release is not synchronized with receding peak flow. It could also lead to a decline in seedling survival and die-off of mature, longer-lived perennial species such as cottonwoods and willows, if this hydrologic shift results in a prolonged late-summer dry season during which root systems are unable to maintain capillary connectivity to a lowering water table for extended periods. Such a die-off would lead to a shift in riparian species composition that might favor early-season, fast-growing ruderals (plant species that grow in areas with a high level of human or natural disturbance) that could take advantage of exposed deposits left by earlier spring flows, and complete their reproductive cycles before dropping water tables pose a barrier to growth and survival for their phreatophytic competitors. It could also lend itself to encroachment of more upland xeric (dry-land) species on the floodplain. In a regulated system such as exists on the Snake River in the action area, these effects would be more likely to be potentially mitigated through adaptive storage and release operations that are capable of mimicking the historic seasonal timing of peak flows and maintaining higher late-season flows in a manner more consistent with historic conditions. The slower ramping rate guidelines recommended by EBSM could actually provide net beneficial effects to the maintenance of riparian habitat in moderate to dry water volume years, in terms of providing more consistently higher flows for a more extended timeframe through the descending limb of the hydrograph in July and August (Hauer et al. 2004).

4.5 Conclusions

After reviewing the current status of the YBCU, the historic and current environmental baseline for the action areas, the effects of the proposed actions, and the foreseeable cumulative effects to the species, Reclamation makes the following conclusions:

- Future O&M in the Snake River System above Milner Dam **may affect, but is not likely to adversely affect** the YBCU and/or its proposed CH.

- Future O&M in the Boise River System **may affect, but is not likely to adversely affect** the YBCU and/or its proposed CH.
- Future Provision of Salmon Flow Augmentation **may affect, but is not likely to adversely affect** the YBCU and/or its proposed CH.
- As the action areas are not occupied by the species, and suitable riparian habitat capable of supporting the nesting needs of the species is not known to exist in the action areas, **no effects** to the YBCU are likely to occur as a result of the following proposed actions:
    - Future O&M in the Little Wood River System
    - Future O&M in the Owyhee River System
    - Future O&M in the Payette River System
    - Future O&M in the Malheur River System
    - Future O&M in the Mann Creek River System
    - Future O&M in the Burnt River System
    - Future O&M in the Upper Powder River System
    - Future O&M in the Lower Powder River System

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