Appendix A – Figures

Figure A-1

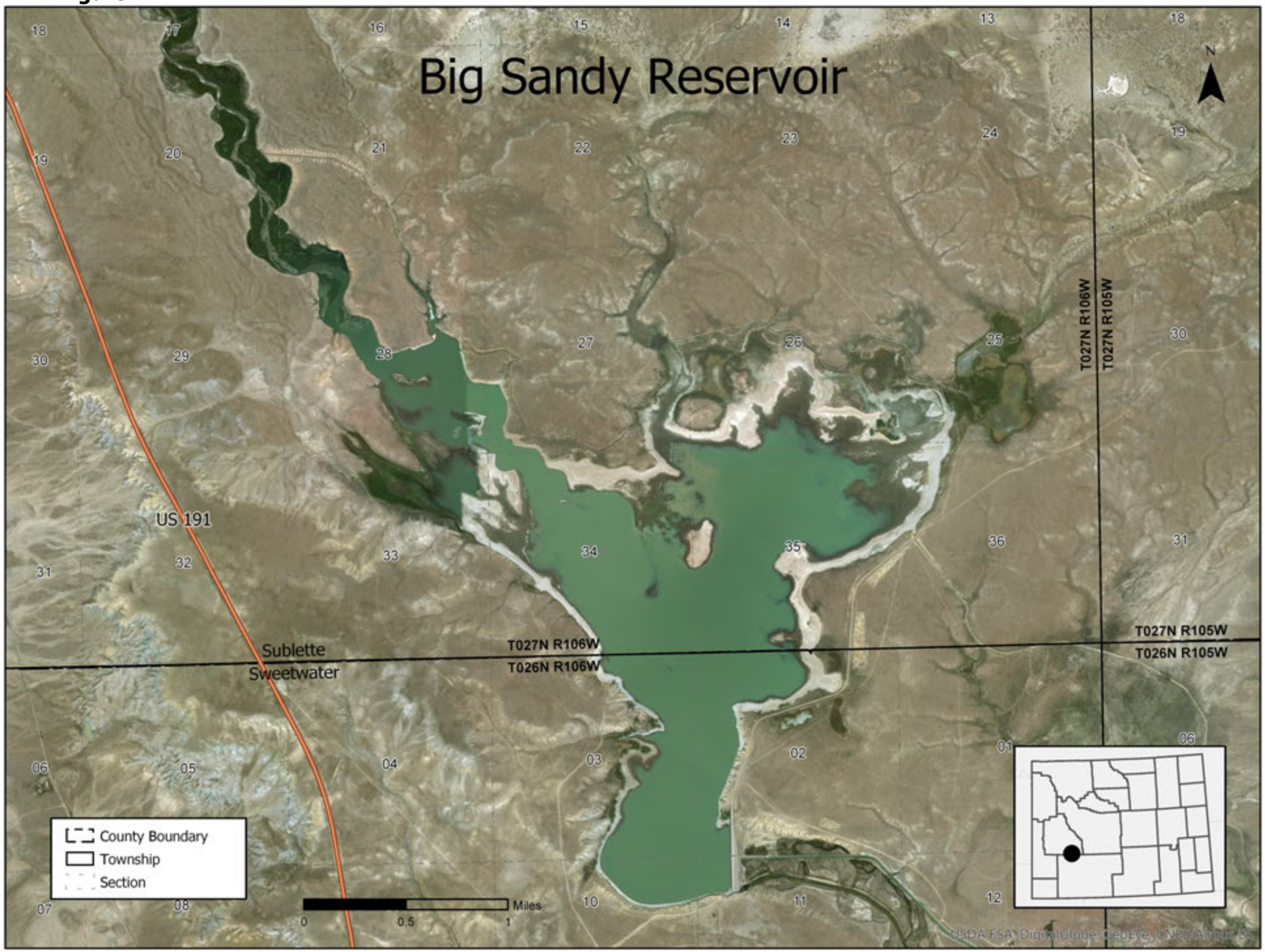

Big Sandy Reservoir
N
US 191
Sublette
Sweetwater
T027N R106W
T026N R106W
T027N R105W
T026N R105W
T027N R106W
T027N R105W
County Boundary
Township
Section
Miles
0
0.5
1

Figure A-2

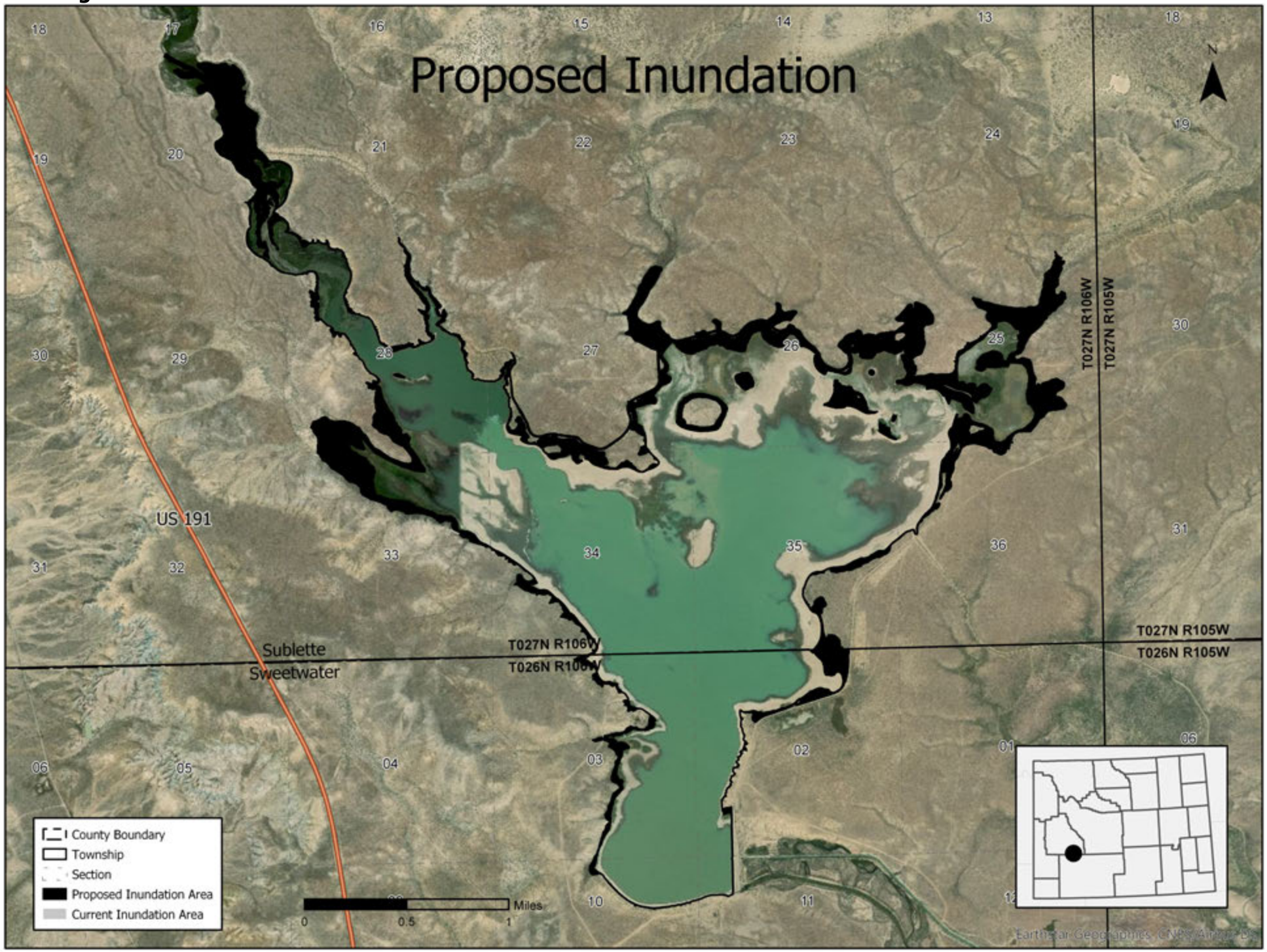

Proposed Inundation
N
US 191
Sublette
Sweetwater
T027N R106W
T026N R106W
T027N R105W
T026N R105W
T027N R106W
T027N R105W
County Boundary
Township
Section
Proposed Inundation Area
Current Inundation Area
Miles
0
0.5
1

Figure A-3

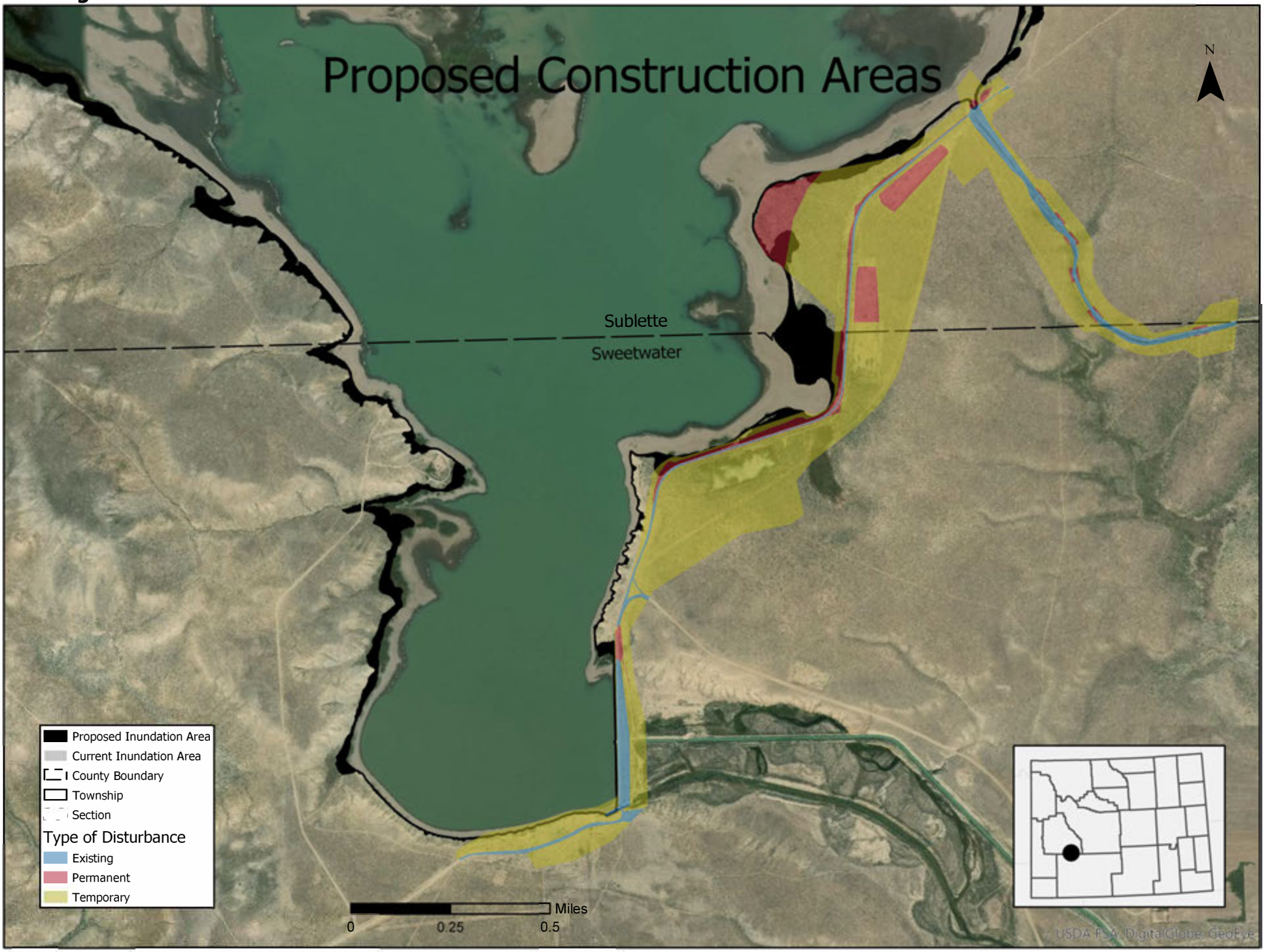

Proposed Construction Areas
N
Sublette
Sweetwater
Proposed Inundation Area
Current Inundation Area
County Boundary
Township
Section
Type of Disturbance
Existing
Permanent
Temporary
0
0.25
0.5
Miles
USDA FSA, DigitalGlobe, GeoEye

Figure A-4

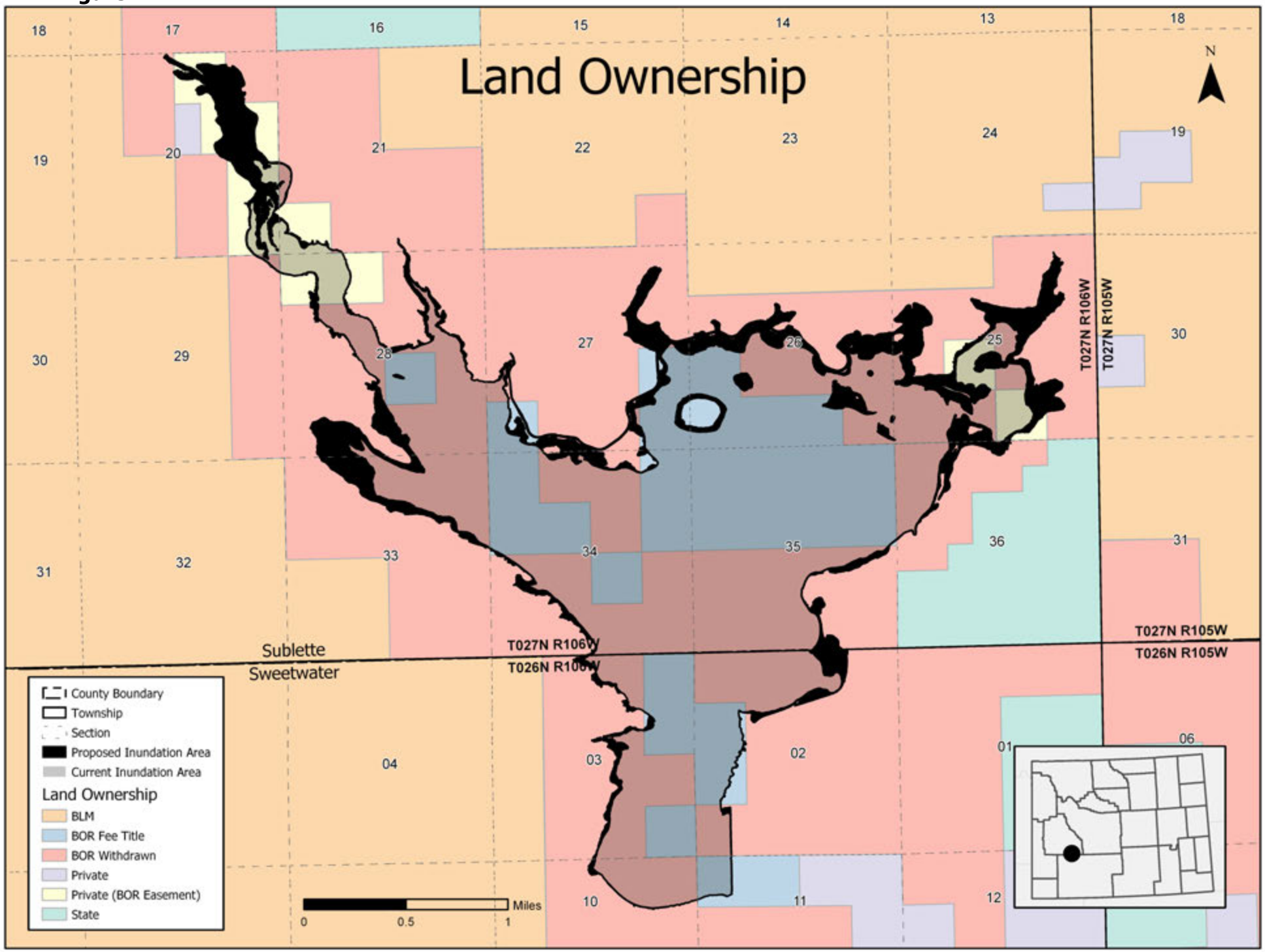

Land Ownership
N
Sublette
Sweetwater
T027N R106W
T026N R106W
T027N R105W
T026N R105W
T027N R106W
T027N R105W
County Boundary
Township
Section
Proposed Inundation Area
Current Inundation Area
Land Ownership
BLM
BOR Fee Title
BOR Withdrawn
Private
Private (BOR Easement)
State
0
0.5
1
Miles

Figure A-5

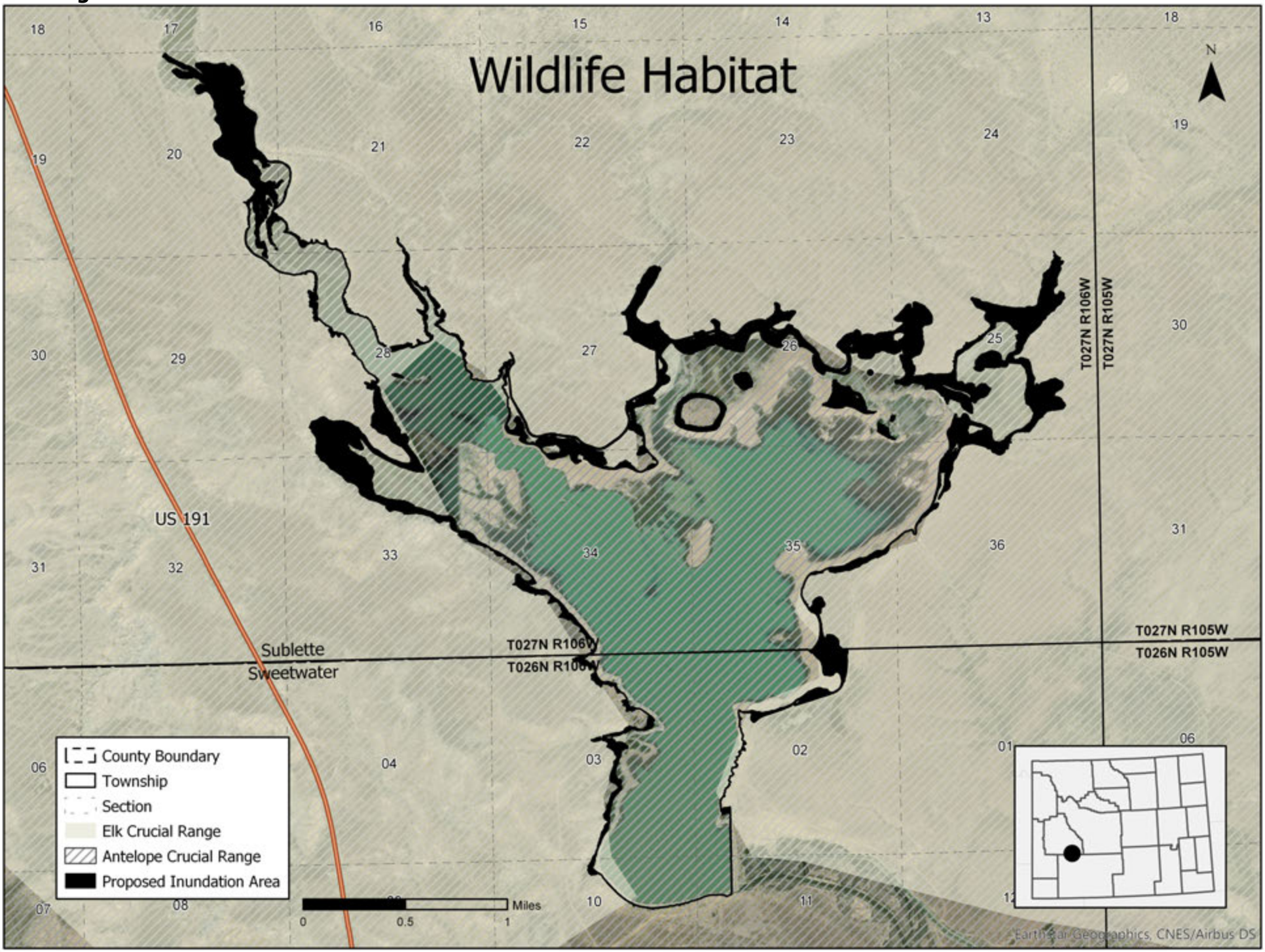
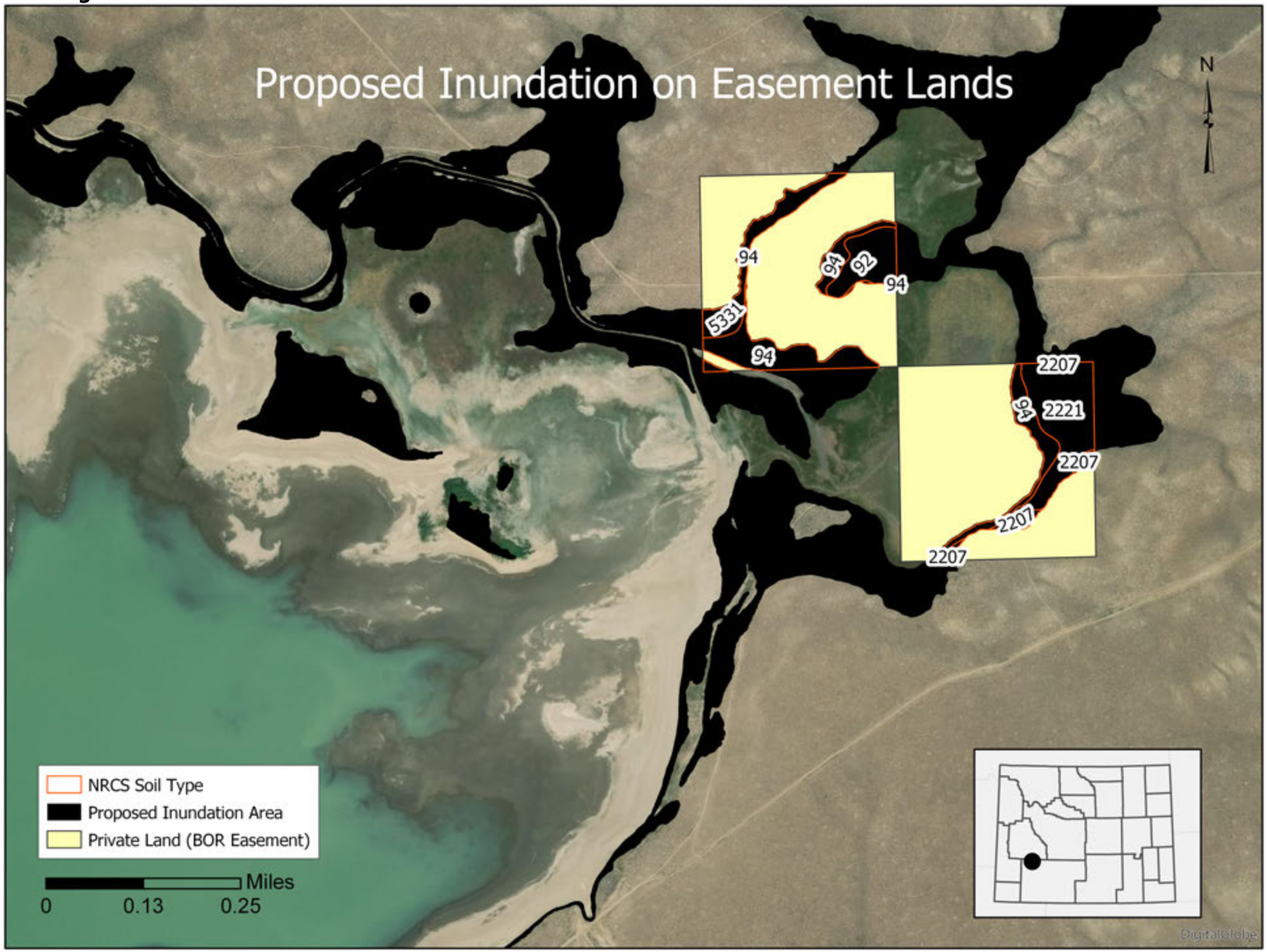

Wildlife Habitat
N
US 191
Sublette
Sweetwater
T027N R106W
T026N R106W
T027N R105W
T026N R105W
T027N R106W
T027N R105W
County Boundary
Township
Section
Elk Crucial Range
Antelope Crucial Range
Proposed Inundation Area
Miles
0
0.5
1
Earthstar Geographics, CNES/Airbus DS

Figure A-6


Proposed Inundation on Easement Lands
N
94
94
92
94
5331
94
2207
94
2221
2207
2207
2207
NRCS Soil Type
Proposed Inundation Area
Private Land (BOR Easement)
Miles
0
0.13
0.25
DigitalGlobe

Appendix B – IPaC Species List

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Wyoming Ecological Services Field Office
5353 Yellowstone Road, Suite 308a
Cheyenne, WY 82009-4178
Phone: (307) 772-2374 Fax: (307) 772-2358
http://www.fws.gov/wyominges/

In Reply Refer To: September 08, 2017
Consultation Code: 06E13000-2017-SLI-0247
Event Code: 06E13000-2017-E-01715
Project Name: Big Sandy Reservoir Enlargement

Subject: Updated list of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the Environmental Conservation Online System-Information, Planning, and Conservation System (ECOS-IPaC) website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

Please feel free to contact us if you need more information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. We also encourage you to visit the Wyoming Ecological Services website at http://www.fws.gov/wyominges/Pages/Species/Species_Endangered.html for more information about species occurrence and designated critical habitat.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 et seq.), Federal agencies are required to use their authorities to carry out programs for the conservation of threatened and endangered species

and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A biological assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a biological assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a biological assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the biological assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species, and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:
http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

We also recommend that you consider the following information when assessing impacts to federally listed species, as well as migratory birds, and other trust resources:

Colorado River and Platte River Systems: Consultation under section 7 of the Act is required for projects in Wyoming that may lead to water depletions or have the potential to impact water quality in the Colorado River system or the Platte River system, because these actions may affect threatened and endangered species inhabiting the downstream reaches of these river systems. In general, depletions include evaporative losses and/or consumptive use of surface or groundwater within the affected basin, often characterized as diversions minus return flows. Project elements that could be associated with depletions include, but are not limited to: ponds, lakes, and reservoirs (e.g., for detention, recreation, irrigation, storage, stock watering, municipal storage, and power generation); hydrostatic testing of pipelines; wells; dust abatement; diversion structures; and water treatment facilities.

Species that may be affected in the Colorado River system include the endangered bonytail (Gila elegans), Colorado pikeminnow (Ptychocheilus lucius), humpback chub (Gila cypha), and razorback sucker (Xyrauchen texanus) and their designated critical habitats. Projects in the Platte River system may impact the endangered interior population of the least tern (Sterna antillarum), the endangered pallid sturgeon (Scaphirhynchus albus), the threatened piping plover (Charadrius melodus), the threatened western prairie fringed orchid (Platanthera praeclara), as well as the endangered whooping crane (Grus americana) and its designated critical habitat. For more information on consultation requirements for the Platte River species, please visit http://www.fws.gov/platteriver.

Migratory Birds: The Migratory Bird Treaty Act (16 U.S.C. 703-712), prohibits the taking of any migratory birds, their parts, nests, or eggs except as permitted by regulations, and does not

require intent to be proven. Except for introduced species and some upland game birds, almost all birds occurring in the wild in the United States are protected (50 CFR 10.13). Guidance for minimizing impacts to migratory birds for projects that include communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm.

The Bald and Golden Eagle Protection Act (16 U.S.C. 668-668d) prohibits knowingly taking, or taking with wanton disregard for the consequences of an activity, any bald or golden eagles or their body parts, nests, or eggs, which includes collection, molestation, disturbance, or killing. Eagle nests are protected whether they are active or inactive. Removal or destruction of nests, or causing abandonment of a nest could constitute a violation of one or both of the above statutes. Projects affecting eagles may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (http://www.fws.gov/windenergy/) for minimizing impacts to migratory birds and bats.

If nesting migratory birds are present on or near the project area, timing of activities is an important consideration and should be addressed in project planning. Activities that could lead to the take of migratory birds or eagles, their young, eggs, or nests, should be coordinated with our office prior to project implementation. If nest manipulation (including removal) is proposed for the project, the project proponent should contact the Migratory Bird Office in Denver at 303-236-8171 to see if a permit can be issued for the project. If a permit cannot be issued, the project may need to be modified to protect migratory birds, eagles, their young, eggs, and nests.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List
- USFWS National Wildlife Refuges and Fish Hatcheries
- Migratory Birds
- Wetlands

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Wyoming Ecological Services Field Office
5353 Yellowstone Road, Suite 308a
Cheyenne, WY 82009-4178
(307) 772-2374

Project Summary

Consultation Code: 06E13000-2017-SLI-0247

Event Code: 06E13000-2017-E-01715

Project Name: Big Sandy Reservoir Enlargement

Project Type: DAM

Project Description: The spillway crest of Big Sandy Dam will be raised 5 feet to create storage for an additional 13,000 acre-feet. The headworks of the Big Sandy Feeder Canal will also modified and enlarged to accommodate the higher reservoir level.

Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/place/42.27604687606029N109.43501131642626W

Counties: Sublette, WY | Sweetwater, WY

Endangered Species Act Species

There is a total of 6 threatened, endangered, or candidate species on this species list. Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species. See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

Birds

NAME	STATUS
Yellow-billed Cuckoo *Coccyzus americanus* Population: Western U.S. DPS There is a **proposed** critical habitat for this species. Your location is outside the proposed critical habitat. Species profile: https://ecos.fws.gov/ecp/species/3911	Threatened

Fishes

NAME	STATUS
Bonytail Chub *Gila elegans* There is a **final** critical habitat designated for this species. Your location is outside the designated critical habitat. Species profile: https://ecos.fws.gov/ecp/species/1377	Endangered
Colorado Pikeminnow (=squawfish) *Ptychocheilus lucius* Population: Wherever found, except where listed as an experimental population There is a **final** critical habitat designated for this species. Your location is outside the designated critical habitat. Species profile: https://ecos.fws.gov/ecp/species/3531	Endangered
Humpback Chub *Gila cypha* There is a **final** critical habitat designated for this species. Your location is outside the designated critical habitat. Species profile: https://ecos.fws.gov/ecp/species/3930	Endangered
Razorback Sucker *Xyrauchen texanus* There is a **final** critical habitat designated for this species. Your location is outside the designated critical habitat. Species profile: https://ecos.fws.gov/ecp/species/530	Endangered

Flowering Plants

NAME	STATUS
Ute Ladies'-tresses *Spiranthes diluvialis*	Threatened

No critical habitat has been designated for this species.
Species profile: https://ecos.fws.gov/ecp/species/2159

Critical habitats

There are no critical habitats within your project area under this office's jurisdiction.

USFWS National Wildlife Refuges And Fish Hatcheries

Any activity proposed on National Wildlife Refuge lands must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

There are no refuges or fish hatcheries within your project area.

Migratory Birds

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any activity that results in the take of migratory birds or eagles is prohibited unless authorized by the U.S. Fish and Wildlife Service[3]. There are no provisions for allowing the take of migratory birds that are unintentionally killed or injured.

Any person or organization who plans or conducts activities that may result in the take of migratory birds is responsible for complying with the appropriate regulations and implementing appropriate conservation measures.

---

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.
3. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

The migratory birds species listed below are species of particular conservation concern (e.g. Birds of Conservation Concern) that may be potentially affected by activities in this location. It is not a list of every bird species you may find in this location, nor a guarantee that all of the bird species on this list will be found on or near this location. Although it is important to try to avoid and minimize impacts to all birds, special attention should be made to avoid and minimize impacts to birds of priority concern. To view available data on other bird species that may occur in your project area, please visit the AKN Histogram Tools and Other Bird Data Resources. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

NAME	SEASON(S)
American Bittern *Botaurus lentiginosus* https://ecos.fws.gov/ecp/species/6582	On Land: Breeding
Fox Sparrow *Passerella iliaca*	On Land: Breeding
Golden Eagle *Aquila chrysaetos* https://ecos.fws.gov/ecp/species/1680	On Land: Year-round
Bald Eagle *Haliaeetus leucocephalus* https://ecos.fws.gov/ecp/species/1626	On Land: Year-round
Black Rosy-finch *Leucosticte atrata* https://ecos.fws.gov/ecp/species/9460	On Land: Year-round
Brewer's Sparrow *Spizella breweri* https://ecos.fws.gov/ecp/species/9291	On Land: Breeding

Burrowing Owl *Athene cunicularia* https://ecos.fws.gov/ecp/species/9737	On Land: Breeding
Cassin's Finch *Carpodacus cassinii* https://ecos.fws.gov/ecp/species/9462	On Land: Year-round
Ferruginous Hawk *Buteo regalis* https://ecos.fws.gov/ecp/species/6038	On Land: Breeding
Greater Sage-grouse *Centrocercus urophasianus* https://ecos.fws.gov/ecp/species/8159	On Land: Year-round
Loggerhead Shrike *Lanius ludovicianus* https://ecos.fws.gov/ecp/species/8833	On Land: Breeding
Long-billed Curlew *Numenius americanus* https://ecos.fws.gov/ecp/species/5511	On Land: Breeding
Mountain Plover *Charadrius montanus* https://ecos.fws.gov/ecp/species/3638	On Land: Breeding
Olive-sided Flycatcher *Contopus cooperi* https://ecos.fws.gov/ecp/species/3914	On Land: Breeding
Sage Thrasher *Oreoscoptes montanus* https://ecos.fws.gov/ecp/species/9433	On Land: Breeding
Short-eared Owl *Asio flammeus* https://ecos.fws.gov/ecp/species/9295	On Land: Year-round
Swainson's Hawk *Buteo swainsoni* https://ecos.fws.gov/ecp/species/1098	On Land: Breeding
Western Grebe *aechmophorus occidentalis* https://ecos.fws.gov/ecp/species/6743	On Land: Breeding
Willow Flycatcher *Empidonax traillii* https://ecos.fws.gov/ecp/species/3482	On Land: Breeding
Calliope Hummingbird *Stellula calliope* https://ecos.fws.gov/ecp/species/9526	On Land: Migrating
Rufous Hummingbird *selasphorus rufus* https://ecos.fws.gov/ecp/species/8002	On Land: Migrating

Additional information can be found using the following links:

- Birds of Conservation Concern http://www.fws.gov/birds/management/managed-species/birds-of-conservation-concern.php
- Conservation measures for birds

http://www.fws.gov/birds/management/project-assessment-tools-and-guidance/conservation-measures.php

- Year-round bird occurrence data
  http://www.birdscanada.org/birdmon/default/datasummaries.jsp

Wetlands

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

FRESHWATER EMERGENT WETLAND

- PEMAh
- PEMCh
- PEMC
- PEMA
- PEMCx

FRESHWATER POND

- PABFh

LAKE

- L2USAh
- L1UBHh
- L2UBFh
- L2USCh

OTHER

- PUSCh

Appendix C – Biological Opinion

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Ecological Services
5353 Yellowstone Road, Suite 308A
Cheyenne, Wyoming 82009

MAY 0 9 2018

In Reply Refer To:
06E13000-2018-F-0174

Memorandum

To: Area Manager, Bureau of Reclamation, Provo Area Office, Provo, Utah

From: for Field Supervisor, U.S. Fish and Wildlife Service, Wyoming Field Office, Cheyenne, Wyoming

Subject: Big Sandy Reservoir Enlargement Project: Colorado River Depletions

In accordance with section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 *et seq.*), and the Interagency Cooperation Regulations (50 CFR 402), this document transmits the U.S. Fish and Wildlife Service's (Service) biological opinion based on our review of the proposed Big Sandy Reservoir Enlargement Project (Project) located in Sublette and Sweetwater Counties, Wyoming, and its effects on the endangered Colorado pikeminnow (*Ptychocheilus lucius*), humpback chub (*Gila cypha*), bonytail (*Gila elegans*), and razorback sucker (*Xyrauchen texanus*) and their designated critical habitat. This Biological Opinion is in response to the Bureau of Reclamation's (Reclamation) March 23, 2018, request to initiate formal consultation for the Project.

The Reclamation proposes raising the reservoir spillway crest by 5 feet, increasing storage capacity. Reservoir enlargement would inundate an additional 500 acres of land. Associated Project actions include installing a toe drain and filter trench, installing a filter diaphragm, constructing a cement-bentonite wall, enlarging the headworks, and replacing the 6 drop structures. The storage rights and manages the water use contracts will be held by Reclamation. The action includes depletions of up to 2,435 acre-feet of water from the Colorado River Basin through evaporation and consumptive uses. The Service concurs that the proposed Project may adversely affect the endangered Colorado pikeminnow, humpback chub, bonytail, and razorback sucker, and their designated critical habitat.

On March 23, 2018, Reclamation requested formal consultation for the Project. A draft Biological Opinion was sent to Reclamation May 2, 2018. The Reclamation reviewed the draft Biological Opinion and provided comments on May 8.

We appreciate your efforts to ensure the conservation of endangered, threatened, and candidate species. If you have questions regarding this letter or your responsibilities under the ESA, please contact Lynn Gemlo of my office at the letterhead address or phone (307) 772-2374 extension 228.

Sincerely,

Tyler A. Abbott
Field Supervisor
Wyoming Field Office

Enclosure (Biological Opinion)

cc: BOR, Fish and Wildlife Biologist, Provo, UT (J. Baxter) (jbaxter@usbr.gov)
FWS, Acting Deputy Director Colorado River Recovery Program, Lakewood, CO (K. McAbee) (kevin_mcabee@fws.gov)
WGFD, Statewide Nongame Bird and Mammal Program Supervisor, Lander, WY (Z. Walker) (zack.walker@wyo.gov)
WGFD, Statewide Habitat Protection Program, Cheyenne, WY (wgfd.hpp@wyo.gov)

BIOLOGICAL OPINION

FOR BUREAU OF RECLAMATIONS'

BIG SANDY RESERVOIR ENLARGEMENT

PROJECT

06E13000-2018-F-0174

Prepared by:

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

For **Tyler A. Abbott**
Field Supervisor
Wyoming Field Office

May 9, 2018

Table of Contents

CONSULTATION HISTORY

On January 21-22, 1988, the Secretary of the Department of the Interior; the Governors of Wyoming, Colorado, and Utah; and the Administrator of the Western Area Power Administration signed a Cooperative Agreement to implement the "Recovery Implementation Program for Endangered Fish Species in the Upper Colorado River Basin" (USFWS 1987). In 2009, the Recovery Program was extended until September 30, 2023. The objective of the Recovery Program is to recover the listed species while water development continues in accordance with federal and state laws and interstate compacts.

In order to further define and clarify processes outlined in sections 4.1.5, 4.1.6, and 5.3.4 of the Recovery Program, a section 7 Agreement (Agreement) and a Recovery Implementation Program Recovery Action Plan (RIPRAP) was developed (USFWS 1993). The Agreement establishes a framework for conducting all future section 7 consultations on depletion impacts related to new projects and all impacts associated with historic projects in the Upper Basin. Procedures outlined in the Agreement are used to determine if sufficient progress is being accomplished in the recovery of the endangered fishes to enable the Recovery Program to serve as a reasonable and prudent alternative (RPA) to avoid jeopardy. The RIPRAP was finalized on October 15, 1993, and has been reviewed and updated annually.

In accordance with the 1993 Agreement, the Service annually assesses progress of the implementation of recovery actions to determine if progress toward recovery has been sufficient for the Recovery Program to serve as a RPA for projects that deplete water from the Colorado River. In the last review the Service determined that the Program has made sufficient progress to offset water depletions from individual projects up to 4,500 acre-feet/year. Therefore, it is appropriate for the Recovery Program actions to serve as Conservation Measures in the Project description for projects up to 4,500 acre-feet/year.

After many years of successful implementation of the Recovery Program and Agreement, federal action agencies have come to anticipate Recovery Program activities and a requirement of a financial contribution (for new depletions greater than 100 acre-feet) toward these activities serving as RPAs that must be included in their project planning to avoid jeopardy to listed species. Thus, the RPA has essentially become part of the proposed action. The Recovery Program activities will now serve as conservation measures within the proposed action and minimize adverse effects to listed species or critical habitat. The following excerpts summarize portions of the Recovery Program that address depletion impacts, section 7 consultation, and Project proponent responsibilities:

> "All future section 7 consultations completed after approval and implementation of this program (establishment of the Implementation Committee, provision of congressional funding, and initiation of the elements) will result in a one-time contribution to be paid to the Service by water Project proponents in the amount of $10.00 per acre-foot based on the average annual depletion of the Project . . . This figure will be adjusted annually for inflation [the current figure for FY2018 is $21.17 per acre-foot] . . . Concurrently with the completion of the Federal action which initiated the consultation, e.g., . . . issuance of a 404 permit,

> 10 percent of the total contribution will be provided. The balance . . . will be . . . due at the time the construction commences . . . ."

It is important to note that these provisions of the Recovery Program were based on appropriate legal protection of the instream flow needs of the endangered Colorado River fishes. Because Reclamation provides substantial funding for the Recovery Program, Reclamation projects are exempt from depletion fees.

The Recovery Program further states:

> ". . . it is necessary to protect and manage sufficient habitat to support self-sustaining populations of these species. One way to accomplish this is to provide long term protection of the habitat by acquiring or appropriating water rights to ensure instream flows. Since this program sets in place a mechanism and a commitment to assure that the instream flows are protected under State law, the Service will consider these elements under section 7 consultation as offsetting Project depletion impacts."

On March 23, 2018, the Bureau of Reclamation (Reclamation) requested formal consultation for the Project. A draft Biological Opinion was sent to Reclamation on May 2, 2018. The Reclamation reviewed the draft Biological Opinion and provided comments on May 8.

BIOLOGICAL OPINION

This biological opinion addresses an average annual depletion of 2,435 acre-feet (includes 955 acre-feet due to evaporation and 1,480 acre-feet for irrigation) of water from the Upper Colorado River Basin. Water depletions in the Upper Basin have been recognized as a major source of impact to endangered fish species. Continued water withdrawal has restricted the ability of the Colorado River system to produce flow conditions required by various life stages of the fishes.

Critical habitat has been designated for the Colorado pikeminnow (*Ptychocheilus lucius*), humpback chub (*Gila cypha*), bonytail (*Gila elegans*), and razorback sucker (*Xyrauchen texanus*) within the 100-year floodplain in portions of their historic range (59 FR 13374). On February 11, 2016, the Service published a final rule establishing a new regulatory definition (FR Feb. 11, 2016, Vol. 81, No.28) for destruction and adverse modification of critical habitat, which means a direct or indirect alteration that appreciably diminishes the value of critical habitat. In considering the biological basis for designating critical habitat, the Service focused on the primary physical and biological elements that are essential to the conservation of the species without consideration of land or water ownership or management. The Service has identified water, physical habitat, and biological environment as the primary constituent elements (PCE). This includes a quantity of water of sufficient quality that is delivered to a specific location in accordance with a hydrologic regime that is required for the particular life stage for each species. Water depletions reduce the ability of the river system to provide the required water quantity and hydrologic regime necessary for recovery of the fishes. The physical habitat includes areas of the Colorado River system that are inhabited or potentially habitable for use in spawning and feeding, as a nursery, or serve as corridors between these areas. In addition, oxbows,

backwaters, and other areas in the 100-year flood plain, when inundated, provide access to spawning, nursery, feeding, and rearing habitats.

DESCRIPTION OF THE PROPOSED ACTION

ACTION AREA

Our regulations define the action area as all areas directly or indirectly affected by the federal action and not merely the immediate area involved in the action (50 CFR 402.02). Water depletions associated with the proposed Big Sandy Reservoir Enlargement Project (Project) will result in a loss of water from the Upper Colorado River Basin.

PROJECT DESCRIPTION

The Reclamation as the Project proponent, proposes raising the reservoir spillway crest by 5 feet, increasing the reservoir's storage capacity. Reservoir enlargement would inundate an additional 500 acres of land. Associated Project actions include installing a toe drain and filter trench, installing a filter diaphragm, constructing a cement-bentonite wall, enlarging the headworks, and replacing the 6 drop structures. The storage rights and manages the water use contracts will be held by Reclamation. The action includes depletions of up to 2,435 acre-feet of water from the Colorado River Basin through evaporation (955 acre-feet) and consumptive use for irrigation (1,480 acre-feet). The Service concurs that the proposed Project may adversely affect the endangered Colorado pikeminnow, humpback chub, bonytail, and razorback sucker, and their designated critical habitat.

CONSERVATION MEASURES

Conservation measures are actions that the action agency and applicant agree to implement to further the recovery of the species under review. The beneficial effects of conservation measures are taken into consideration for determining both jeopardy and adverse modification analyses. As explained in the Consultation History section, the Recovery Program is intended to implement actions that are needed to recover the endangered fishes and avoid jeopardy and adverse modification of critical habitat. Included in the Recovery Program is a requirement for project proponents of projects that cause water depletions greater than 100 acre-feet per year to make monetary contributions to the Recovery Program. Because Reclamation provides substantial funding for the Recovery Program, Reclamation projects are exempt from depletion fees.

The following are conservation measures for this Project: The Recovery Program will serve as conservation measures to minimize adverse effects to the endangered fishes and their critical habitat caused by the Project's water depletions. Depletion impacts can be offset by completing activities necessary to recover the endangered fishes as specified under the Recovery Implementation Program Recovery Action Plan (RIPRAP) and the Project proponent's one-time contribution to the Recovery Program for new depletions greater than 100 acre-feet per year.

NEW DEPLETION

As the Project's average annual new depletion of 2,435 acre-feet is below the current sufficient progress threshold of 4,500 acre-feet, the Recovery Program will serve as conservation measures to minimize adverse effects to the Colorado pikeminnow, razorback sucker, humpback chub, and bonytail and designated critical habitat caused by the Project's new depletion.

STATUS OF THE SPECIES AND CRITICAL HABITAT

The purpose of this section is to summarize the best available information regarding the current range wide status of the listed fish species. Additional information regarding listed species may be obtained from the sources of information cited for these species[1].

COLORADO PIKEMINNOW

SPECIES DESCRIPTION

The Colorado pikeminnow (*Ptychocheilus lucius*) is the largest cyprinid fish (minnow family) native to North America and evolved as the main predator in the Colorado River system. Individuals begin consuming other fish for food at an early age and rarely eat anything else (Sigler and Sigler 1996). It is a long, slender, cylindrical fish with silvery sides, greenish back, and creamy white belly (Sigler and Sigler 1996). Historically, individuals may have grown as large as 6 feet long and weighed up to 100 pounds (estimates based on skeletal remains) (Sigler and Miller 1963), but today individuals rarely exceed 3 feet or weigh more than 18 pounds (Osmundson et al. 1997).

The species is endemic to the Colorado River Basin, where it was once widespread and abundant in warm water rivers and tributaries from Wyoming, Utah, New Mexico, and Colorado downstream to Arizona, Nevada, and California (multiple citations in U.S. Fish and Wildlife Service 2002b). Currently, wild populations of pikeminnow occur only in the Upper Colorado River Basin (above Lake Powell) and the species occupies only 25 percent of its historic range-wide habitat (U.S. Fish and Wildlife Service 2002b). Colorado pikeminnow are long distance migrators, moving hundreds of miles to and from spawning areas, and requiring long sections of river with unimpeded passage. They are adapted to desert river hydrology characterized by large spring peaks of snow-melt runoff and low, relatively stable base flows.

The Office of Endangered Species first included the Colorado pikeminnow (as the Colorado squawfish) in the List of Endangered Species on March 11, 1967 (32 FR 4001). It is currently protected under the Endangered Species Act of 1973 as an endangered species throughout its range, except the Salt and Verde River drainages in Arizona. The Service finalized the latest recovery plan for the species in 2002 (U.S. Fish and Wildlife Service 2002b) but is currently drafting an updated revision.

The Service designated six reaches of the Colorado River System as critical habitat for the Colorado pikeminnow on March 21, 1994 (59 FR 13374). These reaches total 1,148 miles as measured along the center line of each reach. Designated critical habitat makes up about 29 percent of the species' historic range and occurs exclusively in the Upper Colorado River Basin. Portions of the Colorado, Gunnison, Green, Yampa, White, and San Juan Rivers are designated critical habitat. The PCEs of the critical habitat are water, physical habitat, and the biological environment (59 FR 13374).
Water includes a quantity of water of sufficient quality delivered to a specific location in accordance with a hydrologic regime required for the species. The physical habitat includes

[1] The latest recovery goals for all four endangered fish, which provide information on species background, life history, and threats, can be found on the internet at: http://www.coloradoriverrecovery.org/documents-publications/foundational-documents/recovery-goals.html

areas of the Colorado River system that are inhabited or potentially habitable for use in spawning and feeding, as a nursery, or serve as corridors between these areas. This includes oxbows, backwaters, and other areas in the 100-year floodplain that provide access to spawning, nursery, feeding, and rearing habitats when inundated. The biological environment includes food supply, predation, and competition from other species.

Recovery of Colorado pikeminnow in the Colorado River Basin is considered necessary only in the Upper Colorado River Basin (above Glen Canyon Dam, including the San Juan, and Green River sub-basins) because of the present status of populations and because existing information on Colorado pikeminnow biology supports application of the metapopulation concept to extant populations (U.S. Fish and Wildlife Service 2002b). As a result, this biological opinion will focus on the status of the Colorado pikeminnow in that unit.

LIFE HISTORY

The Colorado pikeminnow requires relatively warm waters for spawning, egg incubation, and survival of young. Males become sexually mature at approximately 6 years of age, which corresponds to a length of about 400 millimeters (mm) (17 inches), and females mature one year later (Sigler and Sigler 1996).

Mature adults migrate to established spawning areas in late spring as water temperatures begin to warm, with migration events up to 745 river kilometers (km) round-trip on record (463 miles) (Bestgen et al. 2005). Spawning typically begins after peak flows have subsided and water temperatures are above 16° Celsius (°C) (60.8° Fahrenheit (°F)) (multiple references in Bestgen et al. 2005). Mature adults deposit eggs over gravel substrate through broadcast spawning and eggs generally hatch within 4 to 6 days (multiple references in Bestgen et al. 2005). River flows then carry emerging larvae fish (6.0 to 7.5 mm long (0.2 to 0.3 inches)) downstream 40 to 200 km (25 to 125 miles), to nursery backwaters, where they remain for the first year of life (U.S. Fish and Wildlife Service 2002b).

Colorado pikeminnow reach lengths of approximately 70 mm by age 1 (juveniles) (2.8 inches), 230 mm by age 3 (subadults) (9 inches), and 420 mm by age 6 (adults) (16.5 inches), with mean annual growth rates of adult and subadult fish slowing as fish become older (Osmundson et al. 1997). The largest fish reach lengths between 900 and 1000 mm (35 to 39 inches); these fish are quite old, likely being 47 to 55 years old with a minimum of 34 years (Osmundson et al. 1997). Reproductive success and recruitment of Colorado pikeminnow is pulsed, with certain years having highly successful productivity and other years marked by failed or low success (U.S. Fish and Wildlife Service 2002b). The most successful years produce a large cohort of individuals that is apparent in the population over time. Once individuals reach adulthood, approximately 80 to 90 percent of adults greater than 500 mm (20 inches) survive each year (Osmundson et al. 1997; Osmundson and White 2009). Strong cohorts, high adult survivorship, and extreme longevity are likely life history strategies that allow the species to survive in highly variable ecological conditions of desert rivers.

POPULATION DYNAMICS

Population dynamics of the Colorado pikeminnow are measured separately in the Green, upper Colorado, and San Juan River basins, because distinct recovery criteria are delineated for each of these three basins (U.S. Fish and Wildlife Service 2002b). In the 2002 recovery plan, initial abundance estimates for wild adults in the basins were: upper Colorado River, 600 to 900;

Green River, 6,000 to 8,000; and San Juan River, 19 to 50 (circa 2000 references for individual rivers found in U.S. Fish and Wildlife Service 2002b).

UPPER COLORADO RIVER – To monitor recovery of the Colorado pikeminnow, the Recovery Program conducts multiple-pass, capture-recapture sampling on two stretches of the upper Colorado River which are roughly above and below Westwater Canyon (Osmundson and White 2009). In the most recent summary of the data (Osmundson and White 2014) the principal investigators conclude that during the 19-year study period [1992-2010], the population remained self-sustaining. The current downlisting demographic criteria for Colorado pikeminnow (U.S. Fish and Wildlife Service 2002b) in the Upper Colorado River Subbasin is a self-sustaining population of at least 700 adults maintained over a 5-year period, with a trend in adult point estimates that does not decline significantly. Secondarily, recruitment of age-6 (400-449 mm Total Length (TL)), naturally produced fish must equal or exceed mean adult annual mortality (estimated to be about 20 percent). The average of all adult estimates (1992-2010) is 644. The average of the five most recent annual adult population estimates is 658. Osmundson and White (2014) determined that recruitment rates were less than annual adult mortality in six years and exceeded adult mortality in the other six years when sampling occurred. The estimated net gain for the 12 years studied was 32 fish >450 mm TL. Whereas the Colorado River population appears to meet the trend or 'self-sustainability' criterion, it has not met the abundance criteria of 'at least 700 adults' during the most recent five year period (Service 2015a).

Elverud and Ryden (2015) report that of the 203 individual Colorado pikeminnow collected in 2015, 81 (40%) were juvenile fish (<399 mm TL), indicating a pulse of sub-adults recruiting into the adult portion of the population. All of the 81 individual juvenile Colorado pikeminnow were between 300–399 mm TL. Twenty (10%) of the 203 individual Colorado pikeminnow were sub-adults (400-449 mm TL). The remaining 102 individual Colorado pikeminnow captured in 2015 were adult size (>450 mm TL). The adult Colorado pikeminnow ranged from 451 mm TL to 928 mm TL. No Colorado pikeminnow were collected in 2015 that were below the minimum size (150 mm TL) to be PIT-tagged. A healthy number of Colorado pikeminnow spawned 4-5 years ago are poised to enter the adult cohort. These recruit-sized Colorado pikeminnow present in the system today have largely made it through the gauntlet of troublesome densities of smallmouth bass and the relatively recent influx of nonnative walleye in the lower Colorado River. However, Recovery Program researchers can only speculate how much stronger the current pulse of recruitment would have been in the absence of these nonnative predators. Nonnative predation and competition is currently considered the greatest threat to the Colorado pikeminnow population in the Colorado River Subbasin.

Elverud and Ryden (2015) cautioned that the absence of Colorado pikeminnow less than 300 mm TL in the collections from 2015 suggests spawning success and/or recruitment has been poor the previous three years. Osmundson and White (2014) also expressed concern that pulses of recruitment in this population are too infrequent to provide the recruitment needed to offset adult mortality in the long term. However, some encouraging captures of age-0 Colorado pikeminnow in recent years, particularly in 2015, are discussed below.

To summarize, in the Upper Colorado River Subbasin, the Colorado pikeminnow subpopulation may be self-sustaining, but the number of adults is below the level needed for recovery.

Recruitment is quite variable over time, but has exceeded adult mortality in approximately half of the years when measured over the past two decades. The number of age-0 (young of year) Colorado pikeminnow is also quite variable over time, but appears to be less, on average, since the year 2000 than prior to 2000. Colorado pikeminnow are also generally distributed throughout the Colorado River now to the same extent that they were when they became listed.

GREEN RIVER – Population estimates for adult Colorado pikeminnow in the Green River subbasin began in 2000. Sampling occurs on the mainstem Green River from the Yampa confluence to the confluence with the Colorado River and includes the Yampa and White Rivers. The initial year of sampling did not include the lower Green River (near the confluence of the White River to the confluence with the Colorado River). Beginning in 2001, the sampling regime has consisted of three years of estimates followed by two years of no estimates (Bestgen et al. 2005). The first set of estimates showed a declining trend (2000-2003); however, the most recent interpretation (Bestgen et al.; in review) of estimates collected in 2006-2008 and 2011-2013 reveal a gradual but persistent decline in the adult population. Data from the third round (2011-2013) of population estimates for the Green River subbasin are still being analyzed (Bestgen et al. 2013). Preliminary results from Bestgen (2013) analysis indicate adults and sub-adults are decreasing throughout the entire Green River subbasin (U.S. Fish and Wildlife Service 2014b).

The downlisting demographic criteria for Colorado pikeminnow in the Green River Subbasin require that separate adult point estimates for the middle Green River (including the Yampa and White river sub-populations) and lower Green River do not decline significantly over a 5-year period, and each estimate for the Green River Subbasin exceeds 2,600 adults (estimated minimum viable population [MVP] number). The average of all estimates (1991-2013; including the CPUE-derived estimates) is 3,083 adult Colorado pikeminnow. The average of the more robust M/R population estimates (2000-2013) is 2,859 adults. The average of the three most recent M/R population estimates (2011-2013) is 1,999 adults. Despite a positive trend in the subbasin population in the early years of the Recovery Program (1991-2000), the most recent trend is clearly negative (causes for this recent decline and the Recovery Program's responses are discussed below).

Population estimation resumed throughout the Green River Sub-basin in 2016 and will continue in 2017 and 2018. Another demographic requirement in the 2002 Recovery Goals is that recruitment of age-6; naturally-produced fish must equal or exceed mean annual adult mortality. Estimates of recruitment age fish (subadults; 400-449mm TL) have averaged 1,455 since 2001, but have varied widely. Recruitment exceeded annual adult mortality only during the 2006-2008 periods. The numbers of recruits throughout the Green River Subbasin were high in 2011, but declined in subsequent years.

Bestgen et al. 2016 recognized that the mechanism driving frequency and strength of recruitment events was likely the strength of age-0 Colorado pikeminnow production in backwater nursery habitats. More specifically, they recognized the importance of considering multiple consecutive years of age-0 densities to describe adult densities 7-10 years later. Osmundson and White (2014) saw a similar relationship between a strong age-0 cohort in 1986 and subsequent recruitment of late juveniles five years later, but that relationship was more tenuous in later years. Researchers are particularly concerned with what appears to be very weak age-0 representation in the Middle Green reach (1994 through 2008) and in the lower Colorado River

(2001 through 2008). Bestgen and Hill (2016) reviewed fall densities of age-0 Colorado pikeminnow collected in the middle and lower Green River that date back to 1979. They compared those densities to August and September base flows and discovered that declines in summer base flow magnitude were correlated with declining densities of age-0 Colorado pikeminnow in both reaches. As a result, they recommended new base flow magnitudes to support increased age-0 production. Specifically, base flows between 1,700-3,000 cfs in the middle Green River, and 1,700-3,800 cfs in the lower Green River, increase the frequency and magnitude of age-0 Colorado pikeminnow production.

BASIN-WIDE STATUS AND DISTRIBUTION

In the upper Colorado and Green river sub-basins, Colorado pikeminnow exist as wild populations with no support from stocking hatchery-reared fish. The Recovery Program monitors the adult abundance of this species under a number of independent projects. Adult Colorado pikeminnow abundance in the Colorado River sub-basin increased from 1992 – 2005, but has declined since 2005; similarly, adult abundances in the Green River sub-basin increased from 1991 to 2000 but has declined since 2000 (Table 1). Although populations have declined over the past 10-20 years, this species still supports itself through wild reproduction and recruitment. In the Colorado River sub-basin, recruitment appears adequate to support a sustainable population. However, in the Green River sub-basin, recruitment has declined over the past 15 years and does not appear sufficient to support a sustainable population.

Table 1. Summary of Colorado pikeminnow status and trends.

Subbasin	Life Stage	2002 Recovery Goal Downlisting Criteria[2]	Long-term[3] abundance / trend	Short-term abundance / trend; 5 most recent data points	Summary
Colorado River	**Adults (≥450 mm TL)**	N = >700 individuals.	N = 596.	N = 446.	Population increased from 1999–2005; declined since 2005.
	Recruits (400–449 mm TL)	Estimates exceed annual adult mortality.	Criteria met in roughly 50% of years, consistent with indications of long-term stability in the adult population.	Criteria likely not met in recent years, consistent with recent declines in the adult population.	Criteria appear to have been met in many but not all years, consistent with a fluctuating population that demonstrates general long-term stability.
	Age-0	N/A (no specific recovery goal criteria for this life stage).	Densities dropped in 2001 and remained low through 2008.	Relatively low since mid-1990s, but a record high catch in 2015 and above average in 2016.	Pulses of recruitment may not be frequent enough to support stability in the adult populations in the long term.
Green River	**Adults (>450 mm TL)**	N = >2,600 individuals.	N = 2,859 (average of 10 point estimates since 2000).	N = 2,267 (average of 5 estimates 2007–2012).	Incorporating earlier CPUE data: population increased 1991–2000; declined since 2000.
	Recruits (400–449 mm TL)	Estimates exceed annual adult mortality.	Number of recruits has fluctuated greatly since 2000, but averages near 400 individuals. Average annual abundances of recruits not sufficient to offset adult		Precision of estimates varies greatly; recruitment appears insufficient to offset overall adult

1 Please see Recovery Goals (USFWS 2002a) for a complete description of demographic requirements.

2 "Long-term" refers to all Recovery Program monitoring information, which varies between subbasins and by life stage.

RAZORBACK SUCKER

SPECIES DESCRIPTION

The largest native sucker to the western United States, the razorback sucker (*Xyrauchen texanus*) is a robust, river catostomid endemic to the Colorado River Basin (Sigler and Sigler 1996; U.S. Fish and Wildlife Service 2002d). The species feeds primarily on algae, aquatic insects, and other available aquatic macroinvertebrates using their ventral mouths and fleshy lips (Sigler and Sigler 1996). Adults can be identified by olive to dark brown coloration above, with pink to reddish brown sides and a bony, sharp-edged dorsal keel immediately posterior to the head, which is not present in the young (Sigler and Sigler 1996). The species can reach lengths of 3 feet and weights of 16 pounds (7.3 kilogram), but the maximum weight of recently captured fish is 11 to 13 pounds (5 to 6 kilogram) (Sigler and Sigler 1996; U.S. Fish and Wildlife Service 2002d). Taxonomically, the species is unique, belonging to the monotypic genus *Xyrauchen*, meaning that razorback sucker is the only species in the genus (U.S. Fish and Wildlife Service 2002d).

Historically, the razorback sucker occupied the mainstem Colorado River and many of its tributaries from northern Mexico through Arizona and Utah into Wyoming, Colorado, and New Mexico (U.S. Fish and Wildlife Service 2002b). In the late 19th and early 20th centuries, it was abundant in the Lower Colorado River Basin and common in parts of the Upper Colorado River Basin, with numbers apparently declining with distance upstream (U.S. Fish and Wildlife Service 2002b). Bestgen (1990) reported that this species was once so numerous that it was commonly used as food by early settlers and that a commercially marketable quantity was caught in Arizona as recently as 1949. Distribution and abundance of razorback sucker declined throughout the 20th century across its historic range, and the species now exists naturally only in a few small, unconnected populations or as dispersed individuals. Specifically, razorback sucker are currently found in small numbers in the Green River, upper Colorado River, and San Juan River sub-basins; the lower Colorado River between Lake Havasu and Davis Dam; Lakes Mead and Mohave; in small tributaries of the Gila River sub-basin (Verde River, Salt River, and Fossil Creek); and in local areas under intensive management such as Cibola High Levee Pond, Achii Hanyo Native Fish Facility, and Parker Strip (U.S. Fish and Wildlife Service 2002b).

The razorback sucker is listed as endangered under the Endangered Species Act of 1973, as amended (ESA; 16 U.S.C. 1531 et. seq.), under a final rule published on October 23, 1991 (56 FR 54957). The Service finalized the latest recovery plan for the species in 2002 (U.S. Fish and Wildlife Service 2002d) but is currently drafting an updated revision.

The Service's 5-year status review of razorback sucker completed in 2012 reported that 85% of the downlisting recovery factor criteria (U.S. Fish and Wildlife Service 2002c) have been addressed to varying degrees. The Recovery Program (in coordination with the San Juan River Basin Recovery Implementation Program, the Glen Canyon Dam Adaptive Management Program, and the Lower Colorado River Multi-Species Conservation Program) initiated a Species Status Assessment in 2015, which may be completed in FY18. This SSA will serve as the basis for a 5-year status review to be completed the same year.

Fifteen reaches of the Colorado River system were designated as critical habitat for the razorback sucker on March 21, 1994 (59 FR 13374). These reaches total 2,776 kilometer (1,724 miles) as measured along the center line of the river within the subject reaches. Designated critical habitat makes up about 49% of the species' original range and occurs in both the Upper and Lower

Colorado River Basins. In the Upper Basin, critical habitat is designated for portions of the Green, Yampa, Duchesne, Colorado, White, Gunnison, and San Juan Rivers. Portions of the Colorado, Gila, Salt, and Verde Rivers are designated in the Lower Basin. The PCEs are the same as those described for Colorado pikeminnow.

Separate, objective recovery criteria were developed for each of two recovery units (the Upper Colorado and Lower Colorado River Basins as delineated at Glen Canyon Dam) to address unique threats and site specific management actions necessary to minimize or remove those threats. This biological opinion's focus is on the Upper Colorado River Basin recovery unit and will therefore describe the status of the razorback sucker in that unit.

LIFE HISTORY

Except during periods before and after spawning, adult razorback sucker are thought to be relatively sedentary and have high fidelity to overwintering sites (U.S. Fish and Wildlife Service 2002d). Adults become sexually mature at approximately 4 years and lengths of 400 mm (16 inches) (Zelasko et al. 2009), at which time they travel long distances to reach spawning sites (U.S. Fish and Wildlife Service 2002d). Mature adults breed in spring (mostly April-June) on the ascending limb of the hydrograph, congregating over cobble/gravel bars, backwaters, and impounded tributary mouths near spawning sites (multiple in U.S. Fish and Wildlife Service 2002d; Snyder and Muth 2004; Zelasko et al. 2009). Flow and water temperature cues may play an important role prompting razorback adults to aggregate prior to spawning (Muth et al. 2000).

Razorback sucker have high reproductive potential, with reported average female fecundity of approximately 50,000 to 100,000 eggs per fish (U.S. Fish and Wildlife Service 2002d). They are broadcast spawners that scatter adhesive eggs over gravel-cobble substrate (Snyder and Muth 2004). High springs flows are important to egg survival because they remove fine sediment that can otherwise suffocate eggs. Hatching is limited at temperatures less than 10°C (50° F) and best around 20°C (68° F) (Snyder and Muth 2004). Eggs hatch 6 to 11 days after being deposited and larval fish occupy the sediment for another 4 to 10 days before emerging into the water column. Larval fish occupy shallow, warm, low-velocity habitats in littoral zones, backwaters, and inundated floodplains and tributary mouths downstream of spawning bars for several weeks before dispersing to deeper water (U.S. Fish and Wildlife Service 2002d; Snyder and Muth 2004). It is believed that low survival in early life stages, attributed to loss of nursery habitat and predation by non-native fishes, causes extremely low recruitment in wild populations (Muth et al. 2000).

Razorback sucker in the Upper Basin tend to be smaller and grow slower than those in the Lower Basin, reaching 100 millimeters (4 inches) on average in the first year (U.S. Fish and Wildlife Service 2002b). Based on collections in the middle Green River, typical adult size centers around 510 mm (20 inches) (Modde et al. 1996). Razorback suckers are long-lived fishes, reaching 40+ years via high annual survival (U.S. Fish and Wildlife Service 2002d). Adult survivorship was estimated to be 71 to 73 percent in the Middle Green River from 1980-1992 (Modde et al. 1996; Bestgen et al. 2002) and 76 percent from 1990 to 1999 (Bestgen et al. 2002).

POPULATION DYNAMICS

Population estimates during the 1980 to 1992 period were on average between 300 and 600 wild fish (Modde et al. 1996). By the early 2000s, the wild population consisted of primarily aging adults, with steep decline in numbers caused by extremely low natural recruitment (U.S. Fish and

Wildlife Service 2002d). Although reproduction was occurring, very few juveniles were found (U.S. Fish and Wildlife Service 2002d).

In the early part of the 2000s, population numbers were extremely low. Population estimates from sampling efforts in the Middle Green River had declined to approximately 100 by 2002, with researchers hypothesizing that wild fish in the Green River Basin could become extirpated because of lack of recruitment (Bestgen et al. 2002). Similarly, in the upper Colorado River, razorback sucker were exceedingly rare. In the 2002 recovery plan, razorback sucker were considered extirpated in the Gunnison River, as fish were last captured in 1976 (U.S. Fish and Wildlife Service 2002d). Similarly, in the Grand Valley, only 12 fish were collected from 1984 to 1990, despite intensive sampling (Osmundson and Kaeding 1991 in U.S. Fish and Wildlife Service 2002d). No young razorback suckers were captured in the Upper Colorado River since the mid-1960s (Osmundson and Kaeding 1991 in U.S. Fish and Wildlife Service 2002d).

Because of the low numbers of wild fish and lack of recruitment, augmenting the remaining wild populations with hatchery-raised fish is a key step to creating self-sustaining populations. The Recovery Program is rebuilding razorback sucker populations with hatchery stocks. As populations increase, the Program expects to generate mark-recapture population estimates on adult razorback sucker comparable to the data reported for Colorado pikeminnow and humpback chub. Many stocked razorback sucker are being recaptured as part of other studies. Razorback sucker stocked in the Green and Colorado Rivers have been recaptured in reproductive condition and often in spawning groups. Captures of larvae in the Green, Gunnison, and Colorado Rivers document reproduction is occurring. Survival of larvae through their first year remains rare, largely due to a decrease in the availability of warm, food-rich floodplain areas and predation by a suite of nonnatives when the flood plain nursery habitats are available (Bestgen et al. 2011). However, occasional captures of juveniles (just over age-1) in the Green and Gunnison Rivers suggest that survival of early life stages is occurring. Larval captures in the Green, Gunnison, and Colorado rivers document reproduction. Collections of larvae by light trap in the middle Green River have generally been increasing since 2003; in 2013, the largest collection of light trapped larvae occurred.

Major advancements over the last decade have addressed the bottleneck to a self-sustaining wild population of razorback suckers which is larval recruitment to juvenile life stages. By tailoring peak spring releases from Flaming Gorge dam to overlap with larval razorback sucker drift under the Larval Trigger Study Plan (LTSP ad hoc Committee 2012); flows have been high enough in recent years to connect the Green River to off-channel wetland nursery habitats for larval razorback sucker. Picket weirs and similar devices exclude most large-bodied nonnative fishes from certain wetlands, improving water quality and reducing predation pressure on razorback sucker larvae during their most vulnerable first weeks. At Stewart Lake, a gated wetland near Jensen, Utah, managed by the Utah Division of Wildlife Resources, these management practices have made possible releases of wild-spawned young-of-year razorback suckers to the Green River during annual autumn draining every year since 2013.

BASIN-WIDE STATUS AND DISTRIBUTION

Hatchery-produced stocked fish form the foundation for reestablishing naturally self-sustaining populations of razorback sucker in the upper Colorado and Green river systems. The Recovery Program has been implementing an integrated stocking plan (Integrated Stocking Plan Revisions Committee 2015) with the goal of establishing self-sustaining populations of razorback sucker in

the upper Colorado River basin. The Recovery Program has been largely successful in meeting the plan's annual stocking targets. Stocked razorback sucker are surviving in the wild, expanding their range into previously unoccupied areas, and annually reproducing in both the Green and Colorado River sub-basins; wild juvenile razorback sucker (ages 0, 1, and 2) are starting to be captured in small numbers (Table 2).

Table 2. Summary of razorback sucker status and trends.

Subbasin	Life Stage	2002 Recovery Goal Downlisting Criteria[1,7]	Long-term abundance[8]	Short-term abundance; 5 most recent data points	Summary
Colorado River	**Adults (≥400 mm TL)**	N = >5,800 individuals.	Population of stocked adults increased steadily since 2005.	N = 3,356 adults and juveniles (average of 4 estimates collected 2005–2010).	Estimate for 2014 - 2016 in preparation. Population of stocked adults now expected to exceed 5,800 adults. Observations of spawning congregations have increased in recent years.
	Recruits (300–399 mm TL)	Estimates exceed annual adult mortality.	No wild-produced recruits have yet been detected.		Wild-produced recruits have not been captured. Criterion has not been met.
	Age-0	N/A (no specific recovery goal criteria for this life stage).	Wild-produced larvae have been detected in the Gunnison and Colorado River – new information pending.		Small numbers of wild-produced juveniles (age-2, 3) collected in 2013.
Green River	**Adults (>400 mm TL)**	N = >5,800 individuals.	Population of stocked adults increased steadily since 2006.	Most recent (preliminary) estimates greatly exceed 5.800 stocked adults.	Stocked adults well distributed throughout subbasin; observations of spawning congregations have increased in recent years.
	Recruits (300–399 mm TL)	Estimates exceed annual adult mortality.	No wild-produced recruits have yet been detected.		Wild-produced recruits have not been captured. This criterion has not been met.
	Age-0	N/A (no specific recovery goal criteria for this life stage).	Larvae consistently captured in middle and lower Green River.	Generally increasing with a record high catch of larvae in 2013 in the middle Green River.	Over-summer survival of age-0 greatly improved since 2012; highest number of fall age-0 documented in 2016.

1 Please see Recovery Goals (USFWS 2002c) for a complete description of demographic requirements.

2 "Long-term" refers to all Recovery Program monitoring information, which varies between subbasins and by life stage (discussed in text).

HUMPBACK CHUB

SPECIES DESCRIPTION

The humpback chub (*Gila cypha*) is a medium-sized freshwater fish of the minnow family endemic to the Colorado River basin. The species evolved around 3 to 5 million years ago (Sigler and Sigler 1996). The pronounced hump behind its head gives the humpback chub a striking, unusual appearance. It has an olive-colored back, silver sides, a white belly, small eyes, and a long snout that overhangs its jaw (Sigler and Sigler 1996). This fish can grow to nearly

500 mm (20 inches) and may survive more than 30 years in the wild (U.S. Fish and Wildlife Service 2002c). The humpback chub does not have the swimming speed or strength of species such as the Colorado pikeminnow. Instead, it uses its large fins to "glide" through slow-moving areas, feeding on insects. Examination of otoliths (Hendrickson 1993) and recapture data indicate that Humpback Chub frequently reach an age of over 20 years, with longevity of ~40 years (Coggins et al. 2006; STReaMS July, 2016).

The historical range includes the Colorado River from the Black Canyon near present-day Hoover Dam, Arizona/Nevada, upstream to Debeque Canyon, Colorado; the Green River to the Blacks Fork River, Wyoming; and the Yampa River through Cross Mountain Canyon, Colorado (Kolb and Kolb 1914; Miller 1946, 1955; McDonald and Dotson 1960; Smith 1960). The current range is ~1,353 kilometers, or 62% of historical range. Range reduction has occurred largely from inundation by large man-made reservoirs. Inundated habitat includes the Black Canyon and western Grand Canyon covered by Lake Mead in 1935; lower Cataract Canyon covered by Lake Powell in 1963; and Flaming Gorge/Hideout Canyon covered by Flaming Gorge Reservoir in 1962.

The species is currently found as five populations, including four in the upper basin (Black Rocks, Westwater Canyon, Desolation/Gray canyons, and Cataract Canyon), and one in the lower basin in the Grand Canyon. A sixth upper basin population in Dinosaur National Monument (DNM), comprised of Yampa and Whirlpool canyons, is below detection limits and is now considered functionally extirpated. The six populations occupy 598 kilometers of river, or ~78% of the historical 764 kilometers. Each population consists of a discrete, geographically separate group of fish, with a few individuals moving among populations at a decadal scale, based on genetic evidence (Douglas and Douglas 2007). The lower basin population became isolated from the five upper basin populations with completion of Glen Canyon Dam in 1963. Small enclave groups of fish are also present in localized canyon-like reaches of the upper basin, such as Beavertail Bend and Elephant Canyon in the upper Colorado River (Valdez 1990); and the Little Snake River, a tributary of the Yampa River in Colorado (Wick et al. 1991).

The Office of Endangered Species first included the humpback chub in the List of Endangered Species on March 11, 1967 (32 FR 4001). Subsequently, it was considered endangered under provisions of the Endangered Species Conservation Act of 1969 (16 U.S.C. 668aa) and was included in the United States List of Endangered Native Fish and Wildlife issued on June 4, 1973 (38 FR No. 106). It is currently protected under the Endangered Species Act of 1973 as an endangered species throughout its range (ESA; 16 U.S.C. 1531 et. seq.). The U.S. Fish and Wildlife Service (Service) recently completed a species status assessment (SSA) and a 5-year status review that concluded the current risk of extinction is low, such that the species is not in danger of extinction throughout all of its range. The SSA explained that the largest population of humpback chub, which is found in the Colorado and Little Colorado rivers in the Grand Canyon of Arizona, is a stable population of about 12,000 adults. Our SSA also explained that four smaller populations in the Green and Colorado rivers of the upper Colorado River basin have persisted and do not appear to be in immediate danger of extinction. All five populations are wild, persisting without the need for hatchery stocking. These population-monitoring results, when coupled with ongoing flow management and nonnative predatory fish control, mean that the humpback chub will be considered for reclassification from endangered to threatened in the next year.

Critical habitat was designated as six reaches total 610 kilometers of the Colorado River System on March 21, 1994 (59 FR 13374), including 319 kilometers in the upper basin and 291 kilometers in the lower basin. Designated critical habitat makes up about 28 % of the species' original range and occurs in both the Upper and Lower Colorado River Basins. In the Upper Colorado River Basin, critical habitat includes portions of the Yampa, Green, and Colorado Rivers, primarily including canyon habitats, such as Yampa, Desolation and Gray, Westwater, and Cataract Canyons. Although humpback chub life history and habitat use differs greatly from the other endangered Colorado River fish, the PCEs (water, physical habitat, and biological environment) of their critical habitat are the same (see above).

Separate, objective recovery criteria were developed for each of two recovery units (the Upper Colorado and Lower Colorado River Basins as delineated at Glen Canyon Dam) to address unique threats and site-specific management actions necessary to minimize or remove those threats. This Biological Opinion's focus is on the Upper Colorado River Basin recovery unit and will therefore describe the status of the humpback chub in that unit.

LIFE HISTORY

Like other large desert river fishes, the humpback chub is an obligate warm-water species that requires relatively warm temperatures for spawning, egg incubation, and survival of larvae. Unlike Colorado pikeminnow and razorback sucker, which are known to make extended migrations of up to several hundred miles to spawning areas, humpback chubs do not appear to make extensive migrations. Instead, humpback chub live and complete their entire life cycle in canyon-bound reaches of the Colorado River mainstem and larger tributaries characterized by deep water, swift currents, and rocky substrates (U.S. Fish and Wildlife Service 2002c). Individuals show high fidelity for canyon reaches and move very little.

Mature humpback chub typically spawn on the descending hydrograph between March and July in the Upper Basin (Karp and Tyus 1990). Humpback chub are broadcast spawners who may mature as young as 2 to 3 years old. Eggs incubate for three days before swimming up as larval fish (U.S. Fish and Wildlife Service 2002c). Egg and larvae survival are highest at temperatures close to 19 to 22 ^{0}C (U.S. Fish and Wildlife Service 2002c). Unlike larvae of other Colorado River fishes (e.g., Colorado pikeminnow and razorback sucker), larval humpback chub show no evidence of long-distance drift (Robinson et al.1998).

POPULATION DYNAMICS

Five wild populations of humpback chub inhabit canyon-bound sections of the Colorado, Green, and Yampa Rivers: Yampa Canyon; Desolation and Gray Canyons; Cataract Canyon; Black Rocks; and Westwater Canyon. Recovery goal downlisting demographic criteria (U.S. Fish and Wildlife Service 2002c) for humpback chub require each of five populations in the upper Colorado River basin to be self-sustaining over a 5-year period, with a trend in adult point estimates that does not decline significantly. Secondarily, recruitment of age-3 (150–199 mm TL) naturally produced fish must equal or exceed mean adult annual mortality. In addition, one of the five populations (e.g., Black Rocks/Westwater Canyon or Desolation/Gray Canyons) must be maintained as a core population such that each estimate exceeds 2,100 adults (estimated minimum viable population number).

Since 2007, mean sum of adults in the three upper basin populations with robust estimates is about 3,800, which is a period of apparent stability; the remaining two populations do not have recent robust estimates to report. The three largest populations in the upper basin supported 404

and 1,315 adults for Black Rocks and Westwater Canyon in 2012, respectively, and 1,672 adults in Desolation/Gray canyons in 2015. The smallest population is Cataract Canyon that ranged from 468 adults in 2003 to 295 in 2005. The Dinosaur National Monument population is below detection limits and considered functionally extirpated. No Humpback Chub have been collected since 2004 and four of the five upper basin populations are persisting.

BASIN-WIDE STATUS AND DISTRIBUTION

Humpback chub exist in five core populations, three in the Colorado River and two in the Green River (numbered 1 – 5 in Table 3, below). In the Colorado River, adult abundance estimates of the two core populations (Black Rocks and Westwater Canyon) indicate stability since 2007 but remain below recovery criteria levels. The Cataract Canyon population appears stable at low densities. In the Green River, adult abundance estimates in Desolation Canyon indicate stability since 1985, but captures of recruits have been low in recent years. It appears as though humpback chub are extirpated from the fifth population, Dinosaur National Monument (Yampa/Whirlpool), as no individuals have been detected since the early 2000s. The Recovery Program is evaluating the feasibility of and strategies for reintroducing fish to this area via translocation. The 2002 recovery goals require maintenance of all five populations.

Table 3. Summary of humpback chub status and trends.

	Population	Life Stage	2002 Recovery Goal Downlisting Criteria[4]	Long- term[5] abundance (average) / trend	Short-term abundance (average) / trend; 5 most recent data points	Summary
Colorado River	**1. Black Rocks (BR)**	**Adults (≥200 mm TL)**	Point estimates do not decline significantly for 5 years.	N = 579 adults (average of 9 BR-specific point estimates since 1998).	N = 403 (average of 5 WW-specific point estimates 2004–2012).	Steep decline in the late 1990s. Stable at low levels since 2007; adult survival appears stable since 1998.
		Recruits (150–199 mm TL)	Estimates exceed annual adult mortality.	Not enough mark / recapture information to estimate abundance of recruits.		We assume criterion not met 1998 – 2004 because number of adults dropped over this time period; likely has been met since 2007.
	2. Westwater Canyon (WW)	**Adults (≥200 mm TL)**	Point estimates do not decline significantly for 5 years.	N = 2,490 (average of 10 point estimates since 1998).	N = 1,426 (average of 5 estimates 2004–2012).	Steep decline in the late 1990s. Stable at low levels since 2007; adult survival appears stable since 1998.
		Recruits (150–199 mm TL)	Estimates exceed annual adult mortality.	Not enough mark / recapture information to estimate abundance of recruits.		We assume criterion was met sporadically through 2004 because number of adults declined; likely has been met since 2007.
	Core Population[6] - (Black Rocks + Westwater)	**Adults (≥200 mm TL)**	N = >2,100.	N = 3,124 (average of 9 combined (BR+WW) point estimates since 1998).	N =1,975 (average of 5 combined (BR+WW) estimates 2004–2012).	Steep decline in the late 1990s; adult numbers appear stable since 2007, but below core criteria level until 2016.
	3. Cataract Canyon	**Adults (≥200 mm TL)**	Point estimates do not decline significantly for 5 years.	Population too small to generate reliable mark/recapture point estimates. Monitoring consists of catch / effort (CPUE) metrics.		CPUE since 1991 indicates the population appears stable at low levels.
		Recruits (150–199 mm TL)	Estimates exceed annual adult mortality.			

Green River	**4. Desolation Canyon**	**Adults (≥200 mm TL)**	Point estimates do not decline significantly for 5 years.	N = 1,711 (average of 7 point estimates collected 2001–2011). Abundance sampling program has changed over time, complicating long-term comparisons.	CPUE estimates since 1985 indicate long-term stability in adults; captures of recruits have been low in recent years.
		Recruits (150–199 mm TL)	Estimates exceed annual adult mortality.	Not enough mark / recapture information to estimate abundance of recruits.	
	5. Dinosaur National	**Adults (≥200 mm**	Point estimates have not declined	From 1998 to 2000, researchers estimated ~400 adults occupied Yampa Canyon. Density has declined below level of detection since	

[1]Please see Recovery Goals (USFWS 2002b) for a complete description of demographic requirements.
[2]"Long-term" refers to all Recovery Program monitoring information, which varies by population (discussed in text)
Core populations must meet minimum viable population criteria metrics (e.g., N = 2,100 adults) as well as demonstrating long-term stability. Non-core populations must demonstrate long-term stability.

BONYTAIL

SPECIES DESCRIPTION

The bonytail (*Gila elegans*) is a medium-sized freshwater fish in the minnow family, endemic to the Colorado River Basin. The species evolved around 3 to 5 million years ago (Sigler and Sigler 1996). Individuals have large fins and a streamlined body that typically is very thin in front of the tail. They have a gray or olive-colored back, silver sides, and a white belly (Sigler and Sigler 1996). The mouth is slightly overhung by the snout and there is a smooth low hump behind the head that is not as pronounced as the hump on a humpback chub. A very close relative to the roundtail chub (*Gila robusta*), bonytail can be distinguished by counting the number of rays in the fins, with bonytail having 10 dorsal and anal fin rays (Sigler and Sigler 1996). The fish can grow to be 600 mm (24 inches) and are thought to live as long as 20 to 50 years (Sigler and Sigler 1996). Little is known about the specific food and habitat of the bonytail because the species was extirpated from most of its historic range prior to extensive fishery surveys, but it is considered adapted to mainstem rivers, residing in pools and eddies, while eating terrestrial and aquatic insects (U.S. Fish and Wildlife Service 2002a).

Bonytail were once widespread in the large rivers of the Colorado River Basin (multiple historic references in U.S. Fish and Wildlife Service 2002a). The species experienced a dramatic, but poorly documented, decline starting in about 1950, following construction of mainstem dams, introduction of nonnative fishes, poor land-use practices, and degraded water quality (U.S. Fish and Wildlife Service 2002a). Population trajectory over the past century and reasons for decline are unclear because lack of basin-wide fishery investigations precluded accurate distribution and abundance records.

Bonytail are now rarely found in the Green and Upper Colorado River sub-basins and are the rarest of all the endangered fish species in the Colorado River Basin. In fact, no wild, self-sustaining populations are known to exist upstream of Lake Powell; this fish is nearly extinct. In the last decade only a handful of bonytail were captured on the Yampa River in Dinosaur National Monument, on the Green River at Desolation and Gray canyons, and on the Colorado River at the Colorado/Utah border and in Cataract Canyon.

The bonytail is currently listed as endangered under the Endangered Species Act of 1973, as amended (ESA; 16 U.S.C. 1531 et. seq.), under a final rule published on April 23, 1980 (45 FR 27710). The Service finalized the latest recovery plan for the species in 2002 (U.S. Fish and Wildlife Service 2002a), but is currently drafting an updated revision.

The Service designated seven reaches of the Colorado River as critical habitat for the bonytail on March 21, 1994 (59 FR 13374). These reaches total 499 kilometers (312 miles) as measured along the center line of each reach. Portions of the Green, Yampa, and Colorado Rivers are designated as critical habitat, representing about 14 % of the species' historic range. The primay constituent elements (PCE) are the same as those described for Colorado pikeminnow, razorback sucker, and humpback chub.

LIFE HISTORY

Natural reproduction of bonytail was last documented in the Green River in 1959, 1960, and 1961 at water temperatures of 18°C (U.S. Fish and Wildlife Service 2002a). Similar to other closely related *Gila* species, bonytail in rivers probably spawn during spring over rocky substrates. While age at sexually maturity is unknown, they are capable of spawning at 5 to 7 years old. Recruitment and survival estimates are currently unknown because populations are not large enough for research to occur. Individuals in Lake Mohave have reached 40 to 50 years of age (U.S. Fish and Wildlife Service 2002a), but estimates for river inhabiting fish are not available.

The first reproduction by stocked bonytail was confirmed in floodplain habitats in the Green River in 2015 and again in 2016 (Bestgen et al. 2017). In 2002, the Service developed Recovery Goals (USFWS 2002 a–d) to supplement the individual endangered species recovery plans. The Recovery Goals contain specific demographic criteria to maintain self-sustaining populations and recovery factor criteria to ameliorate threats to the species.

POPULATION DYNAMICS

Bonytail are so rare that it is currently not possible to conduct population estimates. In response to the low abundance of individuals, the Recovery Program is implementing a stocking program to reestablish populations in the Upper Basin; stocking goals were met or exceeded the past three years (Upper Colorado River Endangered Fish Recovery Program and San Juan River Basin Recovery Implementation Program 2010). Since 1996, over 490,000 tagged bonytail subadults have been stocked in the Green and upper Colorado River subbasins.

To date, stocked bonytail do not appear to be surviving as well as stocked razorback sucker. Researchers continue to experiment with pre-release conditioning and exploring alternative release sites to improve their survival. Since 2009, an increasing number of bonytail have been detected at several locations throughout the Upper Colorado River Basin where stationary tag-reading antennas are used. During high spring flows in 2011, more than 1,100 bonytail (16.6 % of the 6,804 stocked in early April of that year) were detected by antenna arrays in the breach of the Stirrup floodplain on the Green River. The Price Stubb antenna array on the Colorado River detected 356 bonytail between November 2010 and September 2014. The fish detected in fall 2011 had been stocked above Price-Stubb in Debeque Canyon, but in spring 2012, some of those fish were moving upstream through the fish passage. In 2015, 22 were detected and 59 % were moving upstream, the others were either moving downstream or direction could not be determined (Francis and Ryden 2015a). In addition, 44 bonytail used the Redlands fish ladder and were moved above the diversion for further upstream access to the Gunnison River (Francis and Ryden 2015b).

BASIN-WIDE STATUS AND DISTRIBUTION

Hatchery-produced stocked fish form the foundation for reestablishing naturally self-sustaining populations[1] of bonytail in the upper Colorado and Green river systems. The Recovery Program has been implementing an integrated stocking plan (Integrated Stocking Plan Revisions Committee 2015) with the goal of establishing self-sustaining populations of bonytail in the upper Colorado River basin. The Recovery Program has been largely successful in meeting the plan's annual stocking targets.

Recaptures of stocked bonytail are rarer. However, increasing numbers of bonytail have been detected by stationary passive integrated transponder (PIT)-tag reading antennas and traditional sampling methods throughout the upper Colorado River basin (Table 4). The first reproduction by stocked bonytail was confirmed in floodplain habitats in the Green River in 2015 and again in 2016 (Bestgen et al. 2017). In 2002, the Service developed Recovery Goals (USFWS 2002 a–d) to supplement the individual endangered species recovery plans. The Recovery Goals contain specific demographic criteria to maintain self-sustaining populations and recovery factor criteria to ameliorate threats to the species.

Table 4. Summary of bonytail status and trends.

Subbasin	Life Stage	2002 Recovery Goal Downlisting Criteria[1,9]	Long-term[10] abundance	Short-term abundance; 5 most recent data points	Summary
Colorado River	**Adults (≥250 mm TL)**	N = >4,400 individuals.	N/A	No estimates; beginning to see some return of stocked individuals.	Stocking program began in 1996 on an experimental basis; full stocking program implemented in 2003. Observations of stocked adults increasing since 2013.
	Recruits (150–249 mm TL)	Estimates exceed annual adult mortality.	N/A	N/A	No wild recruitment has been detected.
	Age-0	N/A	N/A	N/A	N/A
Green River	**Adults (>250 mm TL)**	N = >4,400 individuals.	N/A	No estimates; beginning to see some returns of stocked individuals.	Stocked adults increasing since 2013.
	Recruits (150–249 mm TL)	Estimates exceed annual adult mortality.	N/A	N/A	No wild recruitment has been detected.
	Age-0	N/A	N/A	N/A	Successful reproduction in the wild (in floodplain habitats) in 2015 and 2016.

[1]To achieve naturally self-sustaining populations, adults must reproduce and recruitment of naturally spawned young fish into the adult population must occur at a rate to maintain the population at a minimum that meets the demographic criteria identified in the recovery goals. Also, because of their longevity, hatchery produced adult razorback sucker and bonytail (and Colorado pikeminnow in the San Juan River) will contribute toward recovery.

DESIGNATED CRITICAL HABITAT FOR LISTED COLORADO RIVER FISHES

HABITAT DESCRIPTION

In the Upper Colorado River Basin, portions of the White, Yampa, Gunnison, Green, Colorado, and San Juan Rivers and their 100-year floodplain are designated as critical habitat for one or more of the federally listed species described above. Critical habitat is defined as specific geographic areas, whether occupied by a listed species or not, that are essential for its conservation and that are formally designated by rule. In the state of Utah, immediately downstream of Wyoming, many of these critical habitat reaches overlap. Critical habitat for the humpback chub and bonytail are primarily canyon-bound reaches, while critical habitat for the Colorado pikeminnow and razorback sucker include long stretches of river required for migration corridors and larval fish drift.

Concurrently with designating critical habitat, the Service identified PCEs of the habitat. PCEs are physical or biological features essential to the conservation of a species for which its designated or proposed critical habitat is based on, such as: space for individual and population growth, and for normal behavior; food, water, air, light, minerals, or other nutritional or physiological requirements; cover or shelter; sites for breeding, reproduction, rearing of offspring, germination, or seed dispersal; and habitats that are protected from disturbance or are representative of the species historic geographic and ecological distribution.

The Service has identified water, physical habitat, and the biological environment as the PCEs of critical habitat for listed Colorado River fish species (59 FR 13374). Water includes a quantity of water of sufficient quality delivered to a specific location in accordance with a hydrologic regime required for the particular life stage for each species. The physical habitat includes areas of the Colorado River system that are inhabited or potentially habitable for use in spawning and feeding, as a nursery, or serve as corridors between these areas. In addition, oxbows, backwaters, and other areas in the 100-year floodplain, when inundated, provide access to spawning, nursery, feeding, and rearing habitats. Food supply, predation, and competition are important elements of the biological environment.

HABITAT USAGE

The four listed fish species are adapted to a hydrologic cycle characterized by large spring peaks of snowmelt runoff and low, relatively stable base flows (U.S. Fish and Wildlife Service 2002b). High spring flows maintain channel and habitat diversity, flush sediments from spawning areas, rejuvenate food production, form gravel and cobble deposits used for spawning, and rejuvenate backwater nursery habitats (U.S. Fish and Wildlife Service 2002b).

Throughout most of the year, juvenile, subadult, and adult Colorado pikeminnow use relatively deep, low-velocity eddies, pools, and runs that occur in near-shore areas of main river channels (multiple references in U.S. Fish and Wildlife Service 2002b). Adults require pools, deep runs, and eddy habitats maintained by high spring flows. In spring, however, adults use floodplain habitats, flooded tributary mouths, flooded side canyons, and eddies that are available only during high flows (multiple references in U.S. Fish and Wildlife Service 2002b). Newly hatched larval fish drift downstream to backwaters in sandy, alluvial regions, where they remain through most of their first year of life (multiple references in U.S. Fish and Wildlife Service 2002b). Because of their mobility and environmental tolerances, adult Colorado pikeminnow are more widely distributed than other life stages.

Similar to Colorado pikeminnow, razorback sucker use a variety of habitats throughout their life cycle. Outside of the spawning season, adult razorback suckers occupy a variety of shoreline and main channel habitats including slow runs, shallow to deep pools, backwaters, eddies, and other relatively slow velocity areas associated with sand substrates (U.S. Fish and Wildlife Service 2002d). In spring and winter adult razorback sucker require deeper, low-velocity habitat, but are known to occupy shallow sandbars in summer (McAda and Wydoski 1980 in Zelasko et al. 2009). Reproductive activities are believed to take place in off-channel habitats and tributaries because razorback sucker aggregations were reported in these areas. Off-channel habitats are much warmer than the mainstem river and razorback suckers presumably move to these areas for spawning and other activities, such as, feeding, resting, or sexual maturation.

Off channel and floodplain habitat is also important to young razorback sucker. After hatching, razorback sucker larvae drift downstream to low-velocity floodplain or backwater nursery habitat. The absence of seasonally flooded riverine habitats is believed to be a limiting factor in the successful recruitment of razorback suckers in their native environment. Starvation of larval razorback suckers due to low zooplankton densities in the main channel and loss of floodplain habitats which provide adequate zooplankton densities for larvae food is one of the most important factors limiting recruitment.

Unlike Colorado pikeminnow and razorback sucker, humpback chub show high site fidelity for canyon-bound reaches of mainstem rivers. Past captures of adults were associated with large boulders and steep cliffs. Reproductive habitat is not defined because although humpback chub are believed to broadcast eggs over mid-channel cobble and gravel bars, spawning in the wild has not been observed for this species. It is believed that upon emergence from spawning gravels, humpback chub larvae remain in the vicinity of bottom surfaces near spawning areas. As larval fish mature, backwaters, eddies, and runs were reported as common capture locations for young-of-year humpback chub.

While bonytail are closely related to humpback chub, their habitat usage may be slightly different. Bonytail are observed in pools and eddies in mainstem rivers, but recent information collected by the Recovery Program suggests that floodplain habitats may be more important to the survival and recovery of the bonytail than originally thought. Although spawning events in river habitat has not been documented, bonytail probably spawn in rivers over rocky substrates because spawning is observed in reservoirs over rocky shoals and shorelines. Recent hypotheses surmise that flooded bottomlands may provide important bonytail nursery habitat.

ENVIRONMENTAL BASELINE

Regulations implementing the ESA (50 CFR 402.02) define the environmental baseline as the past and present impacts of all federal, state, or private actions and other human activities in the action area, the anticipated impacts of all proposed state or federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of state or private actions which are contemporaneous with the consultation process.

STATUS OF THE SPECIES IN THE ACTION AREA

While the Project occurs in Wyoming, depletions associated with the Project from the Green River, a tributary to the Colorado River, adversely affect all four endangered fish species within

the Upper Colorado River Basin Recovery Unit. The use of water from the Upper Colorado River Basin affects the habitat quantity and quality downstream of the Project location, for many miles.

Within this Recovery Unit, specific recovery criteria are established for the Green River sub-basin for all four species, including population demographics. Self-sustaining and stable populations of these species in the Green River sub basin are required for full species recovery (U.S. Fish and Wildlife Service 2002a, 2002b, 2002c, 2002d). The entire length of the Green River and its 100 year floodplain are designated as critical habitat for at least one species between the Yampa River confluence and the Colorado River confluence (59 FR 13374).

The largest, most productive and most robust population of Colorado pikeminnow occurs in the mainstem Green River (combining the lower Green River, Desolation/Gray Canyon, and middle Green River populations). Higher abundance of Colorado pikeminnow juveniles and recruits in the 2006 to 2008 sampling period is attributed to a relatively strong year class of age-0 Colorado pikeminnow produced in the lower Green River in 2000 (Bestgen et al. 2010). Length frequency histograms, especially in the Desolation-Gray Canyon and lower Green River reaches, indicate that abundance of Colorado pikeminnow recruits was much higher in period 2006 to 2008 than from 2000 to 2003 (Bestgen et al. 2010). The importance of Green River populations is also evident because increased abundance of adult Colorado pikeminnow in the White River and middle Green River through 2008 almost certainly derived from upstream movement (high transition rates) of large numbers of juvenile and recruit-sized Colorado pikeminnow that originated in downstream reaches of the Green River in 2006 and 2007 (Bestgen et al. 2010). Colorado pikeminnow spawn in two principal sites: Gray Canyon in the lower Green River, and the lower Yampa River (U.S. Fish and Wildlife Service 2002b).

The action area includes the largest concentration of razorback suckers in the Upper Colorado River Basin, found in low-gradient flat-water reaches of the middle Green River between and including the lower few miles of the Duchesne River and the Yampa River. Known spawning sites for razorback sucker are located in the lower Yampa River and in the Green River near Escalante Ranch, but other, less-used sites are probable, such as Desolation Canyon (U.S. Fish and Wildlife Service 2002d). Both Colorado pikeminnow and razorback sucker are migratory spawners, whose young emerge as larval fish from spawning locations and drift downstream. Because Colorado pikeminnow and razorback sucker spawning locations occur downstream of the Project, all life stages are present within the action area.

Humpback chub occur in Westwater Canyon, Desolation/Gray Canyons and Cataract Canyon, but not in other river reaches in the action area. Preliminary population estimates in 2002 approximate 2,000 to 5,000 humpback chub in Westwater Canyon, 1,500 in Desolation/Gray Canyons, and 500 in Cataract Canyon (U.S. Fish and Wildlife Service 2002c).

Bonytail are so rare that it is currently not possible to conduct population estimates. However, the action area includes the middle Green River, which is part of the current stocking program area (along with the Yampa River in Dinosaur National Monument).

STATUS OF CRITICAL HABITAT IN THE ACTION AREA

The action area includes critical habitat units, which are identified as essential for the species' recovery (U.S. Fish and Wildlife Service 2002a, 2002b, 2002c, 2002d). While historical water

depletions do not occur within all critical habitat units, historical changes in Green River and Colorado River water volume have nonetheless affected critical habitat by changing the amount of water flowing into these designated habitat units. The action area includes critical habitat units on the mainstem Green River and Colorado River below the Green River confluence.

As previously described, all four of the listed Colorado River fish require the same PCEs essential for their survival. Water, physical habitat, and the biological environment are the PCEs of critical habitat. This includes a quantity of water of sufficient quality that is delivered to a specific location in accordance with a hydrologic regime that is required for the particular life stage for each species. The physical habitat includes areas of the Colorado River system that are inhabited or potentially habitable for use in spawning and feeding, as a nursery, or serve as corridors between these areas. In addition, oxbows, backwaters, and other areas in the 100-year floodplain, when inundated, provide access to spawning, nursery, feeding, and rearing habitats. Food supply, predation, and competition are important elements of the biological environment.

Historically, the Green River produced high spring turbid flows that maintained critical habitat by inundating floodplains, maintaining side channels, flushing fine sediment, and creating backwaters (Muth et al. 2000). However, with the completion of Flaming Gorge Dam in 1962, the mainstem Green River became highly regulated. The dam and reservoir physically altered the Green River and surrounding terrain and modified the pattern of flows downstream (Muth et al. 2000). Most notably, the construction of the dam created a fish passage barrier and transformed miles of riverine habitat into lacustrine habitat. These two changes isolated fish populations and decreased the amount of native habitat.

Operation of the dam also results in effects to native fish communities. Historically, water releases from Flaming Gorge Dam did not mimic natural flow patterns and introduced colder water into the river from the deep pool behind the dam (Muth et al. 2000). Alteration of the natural flow regime affects stream vegetation communities and channel morphology, which modify native fish habitat (Muth et al. 2000). Natural flow regimes may act as cues for important life history events, like spawning. Life history events are similarly affected by water temperature, with colder temperatures disrupting the temporal spawning regime of native fish.

Additionally, Flaming Gorge Dam created new water resource impacts, such as irrigation potential, municipal use, and recreational fisheries of introduced non-native species. Water storage provided by the dam allowed local communities to increase water usage for agriculture and municipal purposes. Increased water depletion from the Green River decreases native fish habitat and limits the amount of backwater nursery habitat for juvenile fish. Also, increased water supply for agriculture and municipal purposes increases the likelihood of degraded water quality from agricultural runoff (pesticides, fertilizers, etc.) and wastewater inputs.

All four federally listed species evolved in desert river hydrology, relying on high spring flows and stable base flows for habitat conditions essential to their survival (see STATUS OF THE SPECIES AND CRITICAL HABITAT). In addition to main channel migration corridors, Colorado pikeminnow, bonytail and razorback sucker rely on floodplain and backwater habitats for various stages of their life history. High spring flows also act as spawning queues. In contrast, humpback chub rely on canyon-bound reaches with swift currents and white water.

Currently, two primary reaches of Colorado pikeminnow nursery habitat are present in the Green River system. The lower reach occurs from near Green River, Utah, downstream to the Colorado River confluence. The upper reach occurs from near Jensen, Utah, downstream to the Duchesne River confluence. Larvae from Desolation Canyon colonize flooded backwater areas in the lower Green River area. These backwaters are especially important during the Colorado pikeminnow's critical first year of life. The Project is located upstream of both nursery habitat reaches and floodplain habitat.

Bottomlands, low-lying wetlands, and oxbow channels flooded and ephemerally connected to the main channel by high spring flows appear to be important habitats for all life stages of razorback sucker. These areas provide warm water temperatures, low-velocity flows, and increased food availability.

Humpback chub occur in Desolation/Gray Canyons, and within the action area. Adults require eddies and sheltered shoreline habitats maintained by high spring flows. These high spring flows maintain channel and habitat diversity, flush sediments from spawning areas, rejuvenate food production, and form gravel and cobble deposits used for spawning. Flow recommendations were developed that specifically consider flow-habitat relationships in habitats occupied by humpback chub in the upper basin, and were designed to enhance habitat complexity and to restore and maintain ecological processes.

PRIMARY CONSTITUENT ELEMENT – WATER - The quality and quantity of water in the action area of the Green River has decreased from water projects, most notably Flaming Gorge Dam and the Central Utah Project. A number of tributaries to the Green River appear on the State of Utah's 303(d) list of impaired streams for various reasons (Utah Division of Water Quality 2004). Tributaries and sections of the Price, San Rafael, and Duchesne Rivers are listed for elevated salinity, total dissolved solids, and chlorides, as are portions of Ashley and Pariette Draw Creeks. Brush, Pariette Draw, and Lower Ashley Creeks are listed for elevated selenium. Willow and Indian Canyon Creeks are listed for elevated total dissolved solids. Ninemile Creek is listed for elevated temperature. Lake Fork Creek is listed for elevated sediments. Lastly, Pariette Draw Creek is listed for elevated boron. These elevated pollutants pose a risk to this PCE. As these tributaries reach the main stem, these pollutants are introduced to the Green River as well. Currently the Green River acts as a dilution for these pollutants, as is evident by the Green River not appearing on the State of Utah's impaired water list. However, these pollutants still occur in the river and as new water depletions occur, these pollutants will be found in higher concentrations.

Large water diversion projects, large-scale agricultural water use, and climate change have all altered the water quantity in the Green River over the past 150 years. Most notably, Flaming Gorge Dam has altered the magnitude and timing of flows in endangered fish habitat. Peak spring flows in the Green River at Jensen, Utah, have decreased 13 to 35 percent and base flows have increased 10 to 140 percent due to regulation by Flaming Gorge Dam (Muth et al. 2000). However, since 2006 changes were made in the operation of Flaming Gorge Dam that provide flow and meet temperature requirements for native fish. The next major step in providing adequate habitat for the endangered fish is determining how to protect flows to consistently meet demands and endangered fish flow recommendations (see Flow Protection in the Green River, below). As part of this effort, researchers have created hydrologic models to determine how

often the flow recommendations would be met using current operations and past water supplies.

PRIMARY CONSTITUENT ELEMENT – PHYSICAL HABITAT- The completion of Flaming Gorge Dam created a fish passage barrier. Native Colorado pikeminnow, razorback sucker, humpback chub, and bonytail can no longer migrate into Wyoming from the lower Green River. Fish barriers isolate populations, decreasing the ability of individuals to interact, and hinder the transfer of genetic material. The quantity and timing of flows influence how the channel and various habitats are formed and maintained. Channel narrowing is a problem because as the channel width decreases, water velocity increases, and the amount of low velocity habitats, important to the early life stages of the fish, decreases. Habitat below Flaming Gorge Dam has historically been shaped by an artificial flow regime which decreased low flow habitats, disrupted vegetative communities, and altered channel morphology. However, recent operation changes have made this flow regime match more natural conditions. These changes affect temperature, channel morphology, and habitat conditions.

PRIMARY CONSTITUENT ELEMENT – BIOLOGICAL ENVIRONMENT- This PCE is impaired by the presence of non-native fishes common in the Green River. Non-native fishes occupy the same backwaters that are very important for young Colorado pikeminnow and razorback sucker. Specifically, largemouth (*Micropterus salmoides*) and smallmouth bass (*Micropterus dolomieu*), walleye (*Sander vitreus*), northern pike (*Esox lucius*), and channel catish (*Ictalurus punctatus*) are present in this system and predate upon juvenile native fish. Programs are ongoing to remove bass, walleye and northern pike from this system. Other non-natives found in the Green River include centrarchids and non-native cyprinids. Reduction in flows contributes to further habitat alterations that support nonnative fish species, such as increased temperatures, reduced habitat availability, and reduced turbidity.

FACTORS AFFECTING THE SPECIES ENVIRONMENT IN THE ACTION AREA

This baseline includes state, tribal, local, and private actions already affecting the species or that will occur contemporaneously with the consultation in progress. Unrelated federal actions affecting the same species or informal consultation are also part of the environmental baseline, as are federal and other actions within the action area that may benefit listed species or critical habitat.

UPPER COLORADO RIVER ENDANGERED FISH RECOVERY PROGRAM - The Upper Colorado River Endangered Fish Recovery Program was established in 1988 to help recover the four endangered fish species (see Consultation History). The Recovery Program implements management actions within seven Program elements, as dictated from species' recovery goals, with the focus of down-listing and de-listing the species. Five of these actions impact the species in the action area: instream flow identification and protection; habitat restoration; non-native fish management; propagation and stocking; and research and monitoring.

Current management actions performed by the Recovery Program in the Project action area include, but are not limited to:

- Overseeing non-native fish removal activities in the Green River Basin, downstream of the Project. Nonnative fishes of immediate primary concern and currently explicitly targeted for management are northern pike, smallmouth bass, walleye, and burbot (*Lota lota*). These nonnative fish species pose significant threats to the endangered fishes because of their high

or increasing abundance and range expansion, their habitat and resource requirements overlap with those of the endangered fish species, and their predatory impact;
- Participating in the Flaming Gorge Technical Workgroup, which manages releases from Flaming Gorge Dam to benefit endangered fish species while meeting other legal purposes of the dam. This technical team establishes base flow and spring peak release criteria from Flaming Gorge that meet the Flow Recommendations (Muth et al. 2000); and
- Stocking of bonytail and razorback sucker into the middle and lower Green River.

FLOW PROTECTION IN THE GREEN RIVER - Recovery cannot be accomplished without securing, protecting, and managing sufficient habitat to support self-sustaining populations of the endangered fishes. Identification and protection of instream flows are key elements in this process. The first step in this process, identifying instream flows needed for recovery, was completed for the action area with the publication of the Flow Recommendations (Muth et al. 2000). However, there is no legal protection of flows in the Utah portion of the Green River. The process for meeting this recovery goal is ongoing, as described below.

Several approaches may be taken under Utah water law to protect instream flows, including:
- Acquiring existing water rights and filing change applications to provide for instream flow purposes
- Withdrawing unappropriated waters by governor's proclamation;
- Approving presently filed and future applications subject to minimum flow levels;
- With proper compensation, preparing and executing contracts and subordinating diversions associated with approved and perfected rights.

Although Utah water law may not fully provide for all aspects of instream-flow protection, the State believes they can provide an adequate level of protection. Utah examined available flow protection approaches in the 1990's and determined that their primary strategy will be to condition the approval of presently filed and new applications, making them subject to predetermined streamflow levels. To accomplish this, the State Engineer adds a condition of approval to post-1994 water right applications above Jensen filed after the policy is adopted. The condition states that whenever the flow of the Green River (or other streams) drops below the predetermined streamflow level, then diversions associated with water rights approved after the condition is imposed are prohibited. Based on past legal challenges to the State's authority to impose conditions associated with new approvals, it was determined that this is within the authority of the State Engineer.

ENDANGERD FISH STOCKING - Each year tens of thousands of bonytail and razorback sucker are stocked into the main stem Green River. Two primary stocking locations are in the middle Green River near Ouray National Wildlife Refuge and in the lower Green River at Green River State Park. Stocking these fish in the main stem river is designed to supplement the population and eventually create a self-sustaining population.

EFFECTS OF THE ACTION

EFFECTS TO ENDANGERED SPECIES

The Project will adversely affect Colorado pikeminnow, razorback sucker, bonytail, and humpback chub by reducing the amount of water in the river system upon which they depend by up to 2,435 acre-feet per year. The effects to all four species primarily result from the effects of

the action upon their habitats. In general, the proposed action will adversely affect the four listed fish by reducing the amount of water available to them, increasing the likelihood of water quality issues, increasing their vulnerability to predation, and reducing their breeding opportunities by shrinking the amount of breeding and nursery habitat within their range.

Removing 2,435 acre-feet per year from the Colorado River Basin will alter the natural hydrological regime that creates and maintains important fish habitats, such as spawning habitats, and reduces the frequency and duration of availability of these habitats of the four endangered fish. The reduction of available habitats will directly affect individuals of all four species by decreasing reproductive potential and foraging and sheltering opportunities. Many of the habitats required for breeding become diminished when flows are reduced. As a result, individual fish within the action area may not find suitable breeding locations or will deposit eggs in less than optimal habitats more prone to failure or predation. In addition, reduction in flow rates lessens the ability of the river to inundate bottomland, a source of nutrient supply for fish productivity. Water depletions also exacerbate competition and predation by nonnative fishes by altering flow and temperature regimes toward conditions that favor non-natives.

The proposed depletions affect the water quality in the action area by increasing concentrations of heavy metals, selenium, salts, pesticides, and other contaminants. Increases in water depletions will cause associated reductions in assimilative capacity and dilution potential for any contaminants that enter the river. The Project depletions will cause a proportionate decrease in dilution, resulting in an increase in heavy metal, selenium, salts, pesticides, and other contaminant concentrations in the Colorado River system. An increase in contaminant concentrations in the river can result in an increase in the bioaccumulation of these contaminants in the food chain which could adversely affect the endangered fishes. Selenium is of particular concern due to its effects on fish reproduction and its tendency to concentrate in low velocity areas that are important habitats for Colorado pikeminnow and razorback sucker.

The proposed Project will affect the physical condition of habitat for the four listed fish by resulting in a reduction of water. This reduction will contribute to the cumulative reduction in high spring flows, which are essential for creating and maintaining complex channel geomorphology and suitable spawning substrates, creating and providing access to off-channel habitats, and possibly stimulating Colorado pikeminnow spawning migrations. Adequate summer and winter flows are important for providing a sufficient quantity of preferred habitats at a duration and frequency necessary to support all life stages of viable populations of all endangered fishes. To the extent that the proposed Project will reduce flows, the ability of the river to provide these functions will be reduced. This reduction of water affects habitat availability and habitat quality.

To the extent that it will reduce flows and contribute to further habitat alteration, the proposed Project may contribute to an increase in nonnative fish populations. The modification of flow regimes, water temperatures, sediment levels, and other habitat conditions caused by water depletions has contributed to the establishment of nonnative fishes. Endangered fishes within the action area will experience increased competition and predation as a result.

EFFECTS TO CRITICAL HABITAT

All four of the listed Colorado River fish require the same PCEs essential for their survival. Therefore, we are combining our analysis of all four species into one section. Because the

amount of designated critical habitat varies for each of the four species, the amount of critical habitat will vary; however, the effects will be the same for all critical habitats within the action area.

PRIMARY CONSTITUENT ELEMENT – WATER - The Project will deplete up to 2,435 acre-feet per year from the Colorado River Basin. Removing water from the river system changes the natural hydrological regime that creates and maintains important fish habitats, such as spawning habitats, and reduces the frequency and duration of availability of these habitats of the four endangered fish. In addition, reduction in flow rates lessens the ability of the river to inundate bottomland, a source of nutrient supply for fish productivity and important nursery habitat for razorback sucker. Water depletions change flow and temperature regimes toward conditions that favor nonnative fish, thus adding to pressures of competition and predation by these nonnative fishes as discussed above.

Changes in water quantity would affect water quality, which is a PCE of critical habitat. Contaminants enter the Colorado River from various point and non-point sources, resulting in increased concentrations of heavy metals, selenium, salts, pesticides, and other contaminants. Increases in water depletions will cause associated reductions in assimilative capacity and dilution potential for any contaminants that enter critical habitat in the Colorado River. The subject depletions will cause a proportionate decrease in dilution, which in turn would cause a proportionate increase in heavy metal, selenium, salts, pesticides, and other contaminant concentrations in the Upper Colorado River Basin, affecting water quality.

Water, physical habitat, and the biological environment are the PCEs of critical habitat. This includes a quantity of water of sufficient quality that is delivered to a specific location in accordance with a hydrologic regime that is required for the particular life stage for each species. The physical habitat includes areas of the Colorado River system that are inhabited or potentially habitable for use in spawning and feeding, as a nursery, or serve as corridors between these areas. In addition, oxbows, backwaters, and other areas in the 100-year floodplain, when inundated, provide access to spawning, nursery, feeding, and rearing habitats. Food supply, predation, and competition are important elements of the biological environment.

PRIMARY CONSTITUENT ELEMENT – PHYSICAL HABITAT - The Project will affect the physical condition of habitat for the four listed fish by resulting in a reduction of water. This reduction will contribute to the cumulative reduction in high spring flows, which are essential for creating and maintaining complex channel geomorphology and suitable spawning substrates, creating and providing access to off-channel habitats, and possibly stimulating Colorado pikeminnow spawning migrations. Adequate summer and winter flows are important for providing a sufficient quantity of preferred habitats for duration and at a frequency necessary to support all life stages of viable populations of all endangered fishes. To the extent that the subject action will reduce flows, the ability of the river to provide these functions will be reduced. This reduction of water affects habitat availability and habitat quality.

PRIMARY CONSTITUENT ELEMENT – BIOLOGICAL ENVIRONMENT - To the extent that it will reduce flows and contribute to further habitat alteration, the Project may contribute to an increase in nonnative fish populations. The modification of flow regimes, water temperatures, sediment levels, and other habitat conditions caused by water depletions has contributed to the

establishment of nonnative fishes. Endangered fishes within the action area would experience increased competition and predation as a result.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future state, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA. In Wyoming, most water depletions within the Colorado River Basin include a federal nexus and will be addressed in future section 7 consultations.

CONCLUSION

After reviewing the current status of the Colorado pikeminnow, humpback chub, bonytail, and razorback sucker, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that the Project, as described in this biological opinion, will not reduce the reproduction, numbers, or distribution of endangered fish in a manner that would be expected to reduce appreciably the likelihood of survival and recovery of endangered fish in the wild, and that the Project, as described, is not likely to destroy or adversely modify designated critical habitat.

INCIDENTAL TAKE STATEMENT

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

Colorado pikeminnow, humpback chub, bonytail, and razorback sucker are harmed from the reduction of water in their habitats resulting from the subject action in the following manner: (1) individuals using habitats diminished by the proposed water depletions could be more susceptible to predation and competition from non-native fish, and (2) habitat conditions may be rendered unsuitable for breeding because reduced flows would impact habitat formulation and maintenance as described in the biological opinion.

Estimating the number of individuals of these species that would be taken as a result of water depletions is difficult to quantify for the following reasons: (1) determining whether an individual forwent breeding as a result of water depletions versus natural causes would be

extremely difficult to determine; (2) finding a dead or injured listed fish would be difficult, due to the large size of the action area and because carcasses are subject to scavenging; (3) natural fluctuations in river flows and species abundance may mask depletion effects, and (4) effects that reduce fecundity are difficult to quantify. However, we believe the level of take of these species can be monitored by tracking the level of water reduction and adherence to the Recovery Program. Specifically, if the Recovery Program (and relevant RIPRAP measures) is not implemented, or if the current anticipated level of water depletion is exceeded, we fully expect the level of incidental take to increase as well. Therefore, we exempt all take in the form of harm that would occur from the removal of 2,435 acre-feet of water per year. Water depletions above the amount addressed in this biological opinion would exceed the anticipated level of incidental take and are not exempt from the prohibitions of section 9 of the ESA.

The implementation of the Recovery Program is intended to minimize impacts of water depletions; therefore, support of Recovery Program activities by Reclamation as described in the proposed action exempts Reclamation as the Project proponent from the prohibitions of section 9 of the ESA. The Reclamation is responsible for reporting to the Service if the amount of average annual depletion is exceeded.

REASONABLE AND PRUDENT MEASURES

In addition to the conservation measures identified earlier in this document, we believe the following reasonable and prudent measure is necessary and appropriate to minimize the impacts of incidental take of Colorado pikeminnow, humpback chub, bonytail, and razorback sucker:

1. The Reclamation must implement a monitoring and reporting program to ensure that the annual depletion does not exceed 2,435 acre-feet.

TERMS AND CONDITIONS

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

1. For the first three years of operation, Reclamation will provide an annual written report to the Service of water used from Big Sandy Reservoir for irrigation (and other consumptive) uses.

2. Reclamation must report any substantial changes in operation of Big Sandy Reservoir that could result in increasing the annual depletion, including but not limited to: an increase in use; and a change in the type, location, or timing of use.

3. If the water used for irrigation (and other non-evaporative uses) exceeds 1,480 acre-feet, or if there is a substantial change in the operation of Big Sandy Reservoir, the Reclamation will report this change to the Service.

REINITIATION NOTICE

This concludes formal consultation on the action outlined in the request. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded, (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion, (3) the action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion, or (4) a new species is listed or critical habitat designated that may be affected by the action.

LITERATURE CITED

Bestgen, K.R. 1990. Status review of the razorback sucker, *Xyrauchen texanus*. Larval Fish Laboratory #44. Colorado State University, Fort Collins, Colorado. 91 pp.

Bestgen, K.R., J.A. Hawkins, G.C. White, K. Chrisopherson, M. Hudson, M.H. Fuller, D.C. Kitcheyan, R. Brunson, P. Badame, G.B. Haines, J. Jackson, C.D. Walford, T.A. Sorenson, and T.B. Williams. 2005. Population status of Colorado pikeminnow in the Green River Basin, Utah and Colorado. Colorado River Recovery Implementation Program Project Numbers 22i and 22j. 113 pages.

Bestgen, K.R., J.A. Hawkins, G.C. White, C.D. Walford, P. Badame, and L. Monroe. 2010. Population Status of Colorado pikeminnow in the Green River Basin, Utah and Colorado, 2006-2008. Colorado River Recovery Implementation Program Project Number 128. 112 pages.

Bestgen, K.R., G.B. Haines, R. Brunson, T. Chart, M. Trammell, R.T. Muth, G. Birchell, K. Chrisopherson, and J.M. Bundy. 2002. Status of wild razorback sucker in the Green River Basin, Utah and Colorado, determined from basin-wide monitoring and other sampling programs. Colorado River Recovery Implementation Program Project Number 22D. 79 pages.

Bestgen, K.R., G.B. Haines, and A.A. Hill. 2011. Synthesis of floodplain wetland information: timing of razorback sucker reproduction in the Green River, Utah, related to streamflow, water temperature, and floodplain wetland availability. Final Report to the Upper Colorado River Endangered Fish Recovery Program. U. S. Fish and Wildlife Service, Denver, CO. Larval Fish Laboratory Contribution 163.

Bestgen, K R., K.A. Zelasko, and G.C. White. 2012. Monitoring reproduction, recruitment, and population status of razorback suckers in the Upper Colorado River Basin. Final Report to the Upper Colorado River Endangered Fish Recovery Program, U. S. Fish and Wildlife Service, Denver. Larval Fish Laboratory Contribution 170.

Bestgen, K.R., J.A. Hawkins, G.C. White, C.D. Walford, M. Breen, T. Jones, A. Weber, and J. Howard. 2013. Abundance Estimates for Colorado pikeminnow in the Green River Basin, Utah and Colorado. Colorado River Recovery Program FY 2013 Annual Project Report. Recovery Program project number: 128.

Bestgen, K.R. K.A. Zelasko, and G.C. White. Monitoring reproduction, recruitment, and population status of razorback suckers in the Upper Colorado River Basin. Final Report to the Upper Colorado River Endangered Fish Recovery Program. U. S. Fish and Wildlife Service, Denver, CO. Larval Fish Laboratory Contribution 170.

Bestgen, K.R. and A.A. Hill. 2016. Reproduction, abundance, and recruitment dynamics of young Colorado pikeminnow in the Green and Yampa rivers, Utah and Colorado, 1979-2012. Final report to the Upper Colorado River Endangered Fish Recovery Program, Project FW 51 BW-Synth, Denver, CO. Department of Fish, Wildlife, and Conservation Biology, Colorado State University, Fort Collins. Larval Fish Laboratory Contribution 183.

Bestgen, K.R., J.A. Hawkins, G.C. White, C.D. Walford, M.T. Jones, A. Webber, M. Breen, J. Skorupski, J. Howard, K. Creighton, J. Logan, K. Battige, and F.B. Wright. 2016. Population status of Colorado pikeminnow in the Green River basin, Colorado and Utah, 2000–2013. Final Report *in review*. Colorado State University, Larval Fish Laboratory to Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado. Larval Fish Laboratory Contribution 200.

Bestgen, K.R., R.C. Schelly, R.R. Staffeldt, M.J. Breen, D.E. Snyder, M.T. Jones. 2017. First Reproduction by stocked bonytail in the Upper Colorado River Basin, North American Journal of Fisheries Management, 37:2, 445-455, DOI: 0.1080/02755947.2017.1280571.

Elverud, D.S. and D. Ryden. 2015. Monitoring multi-life stages of the fish community in the lower Gunnison and upper Colorado Rivers, with emphasis on Colorado pikeminnow and razorback sucker populations, in response to reoperation of the Aspinall Unit and implementation of the Selenium Management Plan. FY 2015 Annual Project Report 163 of the Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Francis, T. and D. Ryden. 2015a. Upper Basin database. Annual Report Project 16, from U.S. Fish and Wildlife Service to Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Francis, T. and D. Ryden. 2015b. Annual operation and maintenance of the fish passage structure at the Redlands Diversion Dam on the Gunnison River. Annual Report Project C4-b-RED, from U.S. Fish and Wildlife Service to Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Francis, T.A., K.R. Bestgen, and G.C. White. 2016. Population size and structure of Humpback Chub, *Gila cypha* and Roundtail Chub, *Gila robusta*, in Black Rocks, Colorado River, Colorado, 2011-2012. Final Report. Upper Colorado River Endangered Fish Recovery Program, Denver, CO.

Holden, P. B., W. Masslich. 1997. Summary Report 1991-1997, San Juan River Recovery Implementation Program. Unpublished report of the San Juan River Recovery Implementation Program. 87 pp.

Integrated Stocking Plan Revision Committee. 2015. Revised integrated stocking plan for razorback sucker and bonytail. Final to Upper Colorado River Endangered Fish Recovery Program. Denver, Colorado.

Karp, C., H. Tyus. 1990. Humpback chub (*Gila cypha*) in the Yampa and Green Rivers, Dinosaur National Monument, with observations on roundtail chub (*Gila robusta*) and other sympatric fishes. Great Basin Naturalist 50:257-264.

Modde, T., K.P. Burnham, E.J. Wick. 1996. Population Status of the Razorback Sucker in the Middle Green River (U.S.A.). Conservation Biology 10:110-119.

Muth, R.T., L.W. Crist, K.E. LaGory, J.W. Hayse, K.R. Bestgen, T.P. Ryan, J.K. Lyons, and R.A. Valdez. 2000. Flow and temperature recommendations for endangered fishes in the Green River downstream of Flaming Gorge Dam: Upper Colorado River Endangered Fish Recovery Program, Project FG-53.

Osmundson, D.B., and K.P. Burnham. 1998. Status and Trends of the Endangered Colorado squawfish in the Upper Colorado River. Transaction of the American Fisheries Society 127:959-972.

Osmundson, D.B., and L.R. Kaeding. 1991. Recommendations for flows in the 15 mile reach during October-June for maintenance and enhancement of endangered fish populations in the Upper Colorado River. Final Report to the Recovery Program for the Endangered Fishes of the Upper Colorado River. U.S. Fish and Wildlife Service, Grand Junction, Colorado.

Osmundson, D.B., R.J. Ryel, and T.E. Mourning. 1997. Growth and survival of Colorado squawfish in the Upper Colorado River. Transactions of the American Fisheries Society 126:687-698.

Osmundson, D.B. and G.C. White. 2009. Population status and trends of Colorado pikeminnow of the Upper Colorado River, 1991–2005. Grand Junction, Colorado: U. S. Fish and Wildlife Service. 111 pages.

Osmundson, D.B. and G.C. White. 2013. Population structure, abundance and recruitment of Colorado pikeminnow of the Upper Colorado River, 2008–2010. Report of U. S. Fish and Wildlife Service to Upper Colorado River Endangered Fish Recovery Program, Lakewood, Colorado.

Osmundson, D.B., and G.C. White. 2014. Population structure, abundance and recruitment of Colorado pikeminnow of the Upper Colorado River, 2008–2010. Report of U. S. Fish and Wildlife Service to Upper Colorado River Endangered Fish Recovery Program, Lakewood, Colorado.

Robinson, A., R.W. Clarkson, R.E. Forrest. 1998. Dispersal of larval fishes in a regulated river tributary. Transactions of the American Fisheries Society 127:772-786.

Sigler, W.F. and R. Miller. 1963. Fishes of Utah. Salt Lake City, Utah: Utah State Department of Fish and Game.

Sigler, W.F. and J.W. Sigler. 1996. Fishes of Utah: A Natural History. Salt Lake City, Utah: University of Utah Press.

Snyder, D.E. and R.T. Muth. 2004. Catostomid fish larvae and early juveniles of the upper Colorado River basin - morphological descriptions, comparisons, and computer-interactive key. Colorado Division of Wildlife Technical Publication 42. 122 pages.

U.S. Fish and Wildlife Service. 1987. Recovery implementation program for endangered fish species in the Upper Colorado River Basin. U.S. Fish and Wildlife Service, Denver, Colorado. 82 pp.

U.S. Fish and Wildlife Service. 1993. Section 7 consultation, sufficient progress, and historic projects agreement and Recovery Action Plan, Recovery Implementation Program for Endangered Fish Species in the Upper Colorado River Basin. U. S. Fish and Wildlife Service, Denver, Colorado. 50 pp.

U.S. Fish and Wildlife Service. 2002a. Bonytail (*Gila elegans*) recovery goals: amendment and supplement to the Bonytail Chub Recovery Plan. Denver, Colorado: U. S. Fish and Wildlife Service, Mountain-Prairie Region. 97 pages.

U.S. Fish and Wildlife Service. 2002b. Colorado pikeminnow (*Ptychocheilus lucius*) recovery goals: amendment and supplement to the Colorado Squawfish Recovery Plan. Denver, Colorado: U. S. Fish and Wildlife Service, Mountain-Prairie Region. 111 pages.

U.S. Fish and Wildlife Service. 2002c. Humpback chub (*Gila cypha*) recovery goals: amendment and supplement to the Humpback Chub Recovery Plan. Denver, Colorado: U. S. Fish and Wildlife Service, Mountain-Prairie Region. 107 pages.

U.S. Fish and Wildlife Service. 2002d. Razorback Sucker (*Xyrauchen texanus*) recovery goals: amendment and supplement to the Razorback Sucker Recovery Plan. Denver, Colorado: U. S. Fish and Wildlife Service, Mountain-Prairie Region. 113 pages.

U.S. Fish and Wildlife Service. 2011a. Colorado pikeminnow (*Ptychocheilus lucius*) 5 year review: summary and evaluation. Denver, Colorado: U. S. Fish and Wildlife Service, Mountain-Prairie Region. 25 pages.

U.S. Fish and Wildlife Service. 2011b. Humpback chub (*Gila cypha*) 5 year review: summary and evaluation. Denver, Colorado: U. S. Fish and Wildlife Service, Mountain-Prairie Region. 26 pages.

U.S. Fish and Wildlife Service. 2012a. Bonytail (*Gila elegans*) 5 year review: summary and evaluation. Denver, Colorado: U. S. Fish and Wildlife Service, Mountain-Prairie Region. 26 pages.

U.S. Fish and Wildlife Service. 2012b. Razorback Sucker (*Xyrauchen texanus*) 5 year review: summary and evaluation. Denver, Colorado: U. S. Fish and Wildlife Service, Mountain-Prairie Region.35 pages.

U.S. Fish and Wildlife Service. 2014b. 2013-2014 assessment of sufficient progress under the Upper Colorado River Endangered Fish Recovery Program in the Upper Colorado River Basin, and of implementation of action items in the January 10, 2005, final programmatic biological opinion on the management plan for endangered fishes in the Yampa River Basin. Memo from Noreen Walsh, Regional Director, Region 6. September 10, 2014.

U.S. Fish and Wildlife Service. 2017. Assessment of sufficient progress under the Upper Colorado River Endangered Fish Recovery Program in the Upper Colorado River Basin, and implementation of action items in the December 20, 1999, 15-Mile Reach programmatic biological opinion and December 4, 2009, Gunnison River Basin programmatic biological opinion. Draft memo from Noreen Walsh, Regional Director, Region 6. August 4, 2014.

Upper Colorado River Endangered Fish Recovery Program and San Juan River Basin Recovery Implementation Program. 2010. 2009 - 2010 Highlights. 22 pages.

Utah Division of Water Quality. 2004. Utah's 2004 303(d) List of Impaired Waters. Utah Department of Environmental Quality pages.

Zelasko, K.A., K.R. Bestgen, and G.C. White. 2009. Survival rate estimation and movement of hatchery-reared razorback suckers *Xyrauchen texanus* in the Upper Colorado River Basin, Utah and Colorado. Fort Collins, Colorado: 88 pages.

Appendix D – Photographs

Appendix D Photographs

Figure D-1. Downstream face of Big Sandy Dam.

Figure D-2. Big Sandy Dam spillway crest to be raised 5 feet.

Figure D-3. Upstream side of the drop structure nearest to the headworks of the Big Sandy Feeder Canal.

Figure D-4. Downstream side of the drop structure nearest to the headworks of the Big Sandy Feeder Canal.

Figure D-5. Boat ramp on the west side of Big Sandy Reservoir.

Figure D-6. Artesian well on the west side of Big Sandy Reservoir.

Figure D-7. Typical fire pit at campsites near Big Sandy Reservoir.

Figure D-8. Typical concrete table at campsites near Big Sandy Reservoir.

Appendix E – WGFD Letter

WYOMING GAME AND FISH DEPARTMENT

5400 Bishop Blvd. Cheyenne, WY 82006

Phone: (307) 777-4600 Fax: (307) 777-4699

wgfd.wyo.gov

February 28, 2019

WER 12508.03
State of Wyoming's Sage Grouse Executive Order 2015-4
Density Disturbance Calculation Tool
U.S. Bureau of Reclamation
Big Sandy Reservoir Enlargement
Reservoir Enlargement
Sublette and Sweetwater Counties

Jared Baxter
Bureau of Reclamation
302 E. 1860 S.
Provo, UT 84606

Dear Mr. Baxter:

The staff of the Wyoming Game and Fish Department (Department) has reviewed the proposed project for compliance with the State of Wyoming's Sage Grouse Executive Order 2015-4 (SGEO). **Please note this letter is for sage-grouse recommendations only, and additional wildlife concerns may need to be addressed within the project area.**

It is the responsibility of the state permitting agency(s) to accept or deny the permit based on the following recommendations.

Project Description: The project proposes raising the spillway crest of Big Sandy Dam by 5 feet, installing filter diaphragm around existing outlet work, constructing a cement-bentonite wall through the Big Sandy Dike embankment and foundation, replacing the headworks of the Big sandy Feeder Canal, and replacing the 6 drop-structures below the headworks of the Big Sandy Feeder Canal. The Bureau of Reclamation (BOR) is seeking an exception to the SGEO timing stipulations in 2020 to construct between March 15 to June 30.

Avoidance and Minimization Measures:

- Current roads and previously disturbed areas will be used as much as possible, with the potential for some road improvements.
- A site south of the dam previously used for construction remains mostly barren soil material. This site will be used mainly during construction of the spillway crest and will be reclaimed.
- Approximately 15.6 acres of new disturbance would be co-located in areas that will be inundated.

- Certain areas calculated as disturbed in the DDCT will be marked as "Temp-Incentive" and might not be disturbed. These areas will include a stipulation to the contractor that use of the areas would require reclamation with sagebrush, native grasses and forbs at their own cost.
- All disturbed areas outside the inundation areas will be re-contoured with topsoil and re-vegetated with sagebrush, native grasses and forbs.
- Construction between March 15 and May 15 will only occur between the hours of 8:00 AM and 6:00 PM to reduce disturbance to breeding sage-grouse.

Project Disturbance: 456.43 acres

COT Threat: Infrastructure

Project Location: T26N R106W Sec1, 2, 3, 10, 11; T27N R106W Sec 20, 21, 25, 26, 27, 28, 29, 33, 34, 35, 36

Core Area: Greater South Pass

County: Sublette and Sweetwater

Surface/Mineral Ownership: Bureau of Reclamation, Private

Permitting Agencies: DEQ-WQD, DEQ-AQD, SEO, BOR

Density/Disturbance Calculation Tool (DDCT): The DDCT process was conducted per Executive Order 2015-4 guidelines using the DDCT web application and reviewed by the Department. DDCT results for the project are as follows:

- Project Disturbance = 0.52%
- Total Disturbance = 3.69%
- Density = 0.07/640 acres

Compliance: This project meets the 5% and 1/640 thresholds in the SGEO.

Stipulations and Recommendations for Development:
In addition to meeting SGEO disturbance/density guidelines, all stipulations outlined in Attachment B of the SGEO should be required by the permitting agency or agencies, and included in the conditions of the associated permit(s). These include general stipulations on surface disturbance, surface occupancy, seasonal use, geophysical exploration, transportation, overhead power lines, noise, vegetation removal, sagebrush treatment, monitoring/adaptive response, and reclamation, and specific stipulations pertaining to oil and gas, mining, connectivity area, underground rights-of-way, and wind energy development. All projects in

core area should be sited and designed to avoid and minimize impacts to sage-grouse and sagebrush habitat.

The following are areas where the submitted worksheet indicates implementation of the proposed project may deviate or not comply with Attachment B stipulations for development, and our subsequent recommendations:

- The project proposes construction during the SGEO timing stipulations between March 15 and June 30.
- The Department recommends granting a one-time seasonal exception to the SGEO to allow construction from March 15 to June 30, 2020. The State of Wyoming Greater Sage-Grouse Compensatory Mitigation Framework considers this a short-term impact to be assessed as a one-time requirement of 10 credits.
- All credits are required to meet the State of Wyoming Greater Sage-Grouse Compensatory Mitigation Framework definitions. The exception request for the Big Sandy Reservoir Enlargement Project is for the calendar year 2020. If the BOR chooses to conduct construction activity during this seasonal exception period, documentation of qualified credits must be provided to the permitting agencies.

Thank you for the opportunity to comment. If you have any questions or concerns, please contact Mark Conrad, Habitat Protection Biologist, at (307) 777-4509.

Sincerely,

Angi Bruce
Habitat Protection Supervisor

AB/mc/ml

Enclosures
1) Sage-Grouse Executive Order 2015-4 Worksheet
2) DDCT Final Results

cc: U.S. Fish and Wildlife Service
Dean Clause, Wyoming Game and Fish Department
Brandon Scurlock, Wyoming Game and Fish Department
Nick Meeker, Wyoming Department of Environmental Quality
Barb Sahl, Wyoming Department of Environmental Quality
Bill DiRienzo, Wyoming Department of Environmental Quality
Patrick Tyrell, Wyoming State Engineer
Rick Deuell, Wyoming State Engineer's Office
Nicholas Graf, Wyoming Geographic Information Science Center
Chris Wichmann, Wyoming Department of Agriculture, Cheyenne

Appendix F – Comments and Responses to First Draft EA

Bureau of Reclamation
Public Comments with Responses
Re: Big Sandy Enlargement Project (PRO-EA-16-012)

1. **Commenter:** Rodney Mines
   Comment:

This letter is in reference to the proposed Big Sandy Enlargement Project in Sweetwater County, Wyoming. I object to the enlargement project until such time that the Bureau of Reclamation, the Eden Valley Irrigation District, and I reach an agreement insuring that my water rights on the Big Sandy River will not be impeded by the enlargement proposal.

Please be advised of my intent to fully exercise my water rights in the Mines Sprinkler System, Permit No. 26141, diverting from Big Sandy River this coming and in subsequent seasons. This original supply water right carries a priority date of June 10, 1977 and serves 200.0 acres of my land.

I am letting the United States Department of Interior – Bureau of Reclamation know so it may anticipate my use of this water in its future water management decisions, including the passage of the appropriate amounts of Big Sandy River water through the Eden Valley District's system downstream to my pump diversion, which is situated in the SW¼NW¼ of Section 35, T.26N., R.106W.

Also, be advised that since this is a private water right, I am entitled to this water whenever it is available by priority date. My period of use of this water is not limited by the District's irrigation season. As such, please be aware that I may be irrigating when the District is storing water.

Response: In administration of Reclamation's Water Rights, Reclamation relies on the Hydrographer-commissioners that are responsible for the river system as appointed by the Governor on recommendation of the State Engineer to regulate the waters by priority. The Hydrographer-commissioner will ensure that the water rights entitled to water below Big Sandy that are senior in priority get met and Eden Valley Irrigation and Drainage District, the operating entity, will work with the Hydrographer-commissioner to release waters downstream to these senior water rights.

2. **Commenter:** Board of County Commissioners, Sweetwater County, Wyoming
   Comment:

Project Support: Sweetwater County strongly supports the Big Sandy Reservoir Project. We believe that the 5 foot raise of the spillway crest and the resulting 13,700 acre-foot expansion in reservoir capacity will benefit both Sweetwater and Sublette Counties by:

- Ensuring sufficient water supplies for crop production during periods of drought
- Providing additional water to potentially open up additional lands for irrigation and crop production
- Enhancing recreational opportunities related to the Big Sandy Reservoir
- Increasing and protecting the agricultural economic base of the Eden Valley and affected counties
- Protecting Wyoming waters by expanding the beneficial use of waters within the Big Sandy River.

Response: Thank you for your comment.

3. **Commenter:** Board of County Commissioners, Sweetwater County, Wyoming
   Comment:

Permits and Authorizations: Please amend the Draft EA Table 1-1 (Permits and Authorizations) by adding the following:

Agency/Department	Purpose
Sweetwater County, Wyoming	To ensure compliance with the Sweetwater County Comprehensive Plan and Development Codes, Sweetwater County will require the following plans, permits and authorizations: Grading, Drainage, Dust Control Plans, Construction/Use Permits, Conditional Use Permits for lay down yards, man camps, batch plants, and Authorizations for county road accesses, utility crossings, and overweight loads.

Response: Suggested amendment to Table 1-1 was incorporated.

4. **Commenter:** Board of County Commissioners, Sweetwater County, Wyoming
   Comment:

Recreation: Sweetwater County requests that the BOR strongly considers enhancing and expanding the recreational facilities at the Big Sandy Reservoir Project. The Big Sandy Reservoir is frequently utilized by Sweetwater and Sublette County residents. Improving and expanding the reservoir will increase recreational opportunities for area residents and will help strengthen the growing recreational economic base of the region.

Response: The following recreation improvements are commitments incorporated into the Proposed Action. The boat ramp will be replaced to match the proposed reservoir level; fire pits and picnic tables will be replaced and installed to match the proposed reservoir levels; the artesian well piping and valving will be extended to higher ground to maintain access to the well water for recreation and irrigation purposes, or a new well will be drilled; the irrigation piping will be replaced to continue irrigation of the west camping loop; and the vault restrooms in the west camping loop and southeast camping areas will be replaced at a higher elevation following construction, pending funding availability.

5. **Commenter:** Board of County Commissioners, Sweetwater County, Wyoming
   Comment:

Wyoming Game and Fish Department: Sweetwater County strongly encourages the BOR to work closely with the Wyoming Game and Fish Department to address any game and non-game wildlife issues – especially sage grouse. We also encourage the BOR to work with the WGFD to incorporate plans for improving the fisheries within the Big Sandy Reservoir and River.

Response: Reclamation has worked with Wyoming Game and Fish Department (WGFD) to assess the impacts to wildlife, especially sage-grouse. WGFD provided a letter of concurrence for the impacts to sage grouse (see Appendix E of the Draft EA).

6. **Commenter:** US Fish and Wildlife Service, Wyoming Field Office
   Comment:

Memorandum

To: Area Manager, U.S. Bureau of Reclamation, Provo Area Office, Provo, Utah

From: For Field Supervisor, U.S. Fish and Wildlife Service, Wyoming Field Office, Cheyenne, Wyoming

Subject: Draft Environmental Assessment (DEA), U.S Bureau of Reclamation (Bureau), Big Sandy Reservoir Enlargement Project, Sweetwater County, Wyoming

We have reviewed the DEA for the Big Sandy Enlargement Project (Project) and provide the following comments pursuant to the Endangered Species Act of 1973, as amended (ESA), 16 U.S.C. 1531 *et seq*. The Project will raise the spillway by 5 feet to increase the total storage capacity of the Big Sandy Reservoir by 13,700 acre-feet. The additional water storage is needed to firm up the water supply for lands irrigated in the Farson/Eden area through the Eden Project and to allow for more carryover water from wet years into future years so water deliveries can be made later in the summer. In addition to enlarging the Big Sandy Reservoir, the Project will modify the Big Sandy spillway crest and outlet works, Big Sandy Dike, the Big Sandy Feeder Canal.

The DEA concludes the Project will have no effect on the four Colorado River fish species, because the species do not occur in the Project area (p. 33). However, consultation under section 7 of the ESA is required for projects in Wyoming that may lead to water depletions or have the potential to impact water quality in the Colorado River system. In general, depletions include evaporative losses and/or consumptive use of surface or groundwater, often characterized as diversions minus return flows. The Project will increase the surface area of the Big Sandy Reservoir by 499 acres (p. 29) and increase evaporative losses by approximately 955 acre-feet per year (Table 3-2). In addition to new evaporative losses, the Project may create opportunities for additional consumptive use of Colorado River water, perhaps as a result of water deliveries made later in the summer (p. 2). We recommend the Bureau calculate the amount of evaporative losses and/or consumptive use associated with the Project and consult on that amount. In addition to the four Colorado River fish species, depletions adversely affect designated critical habitat of the four species; therefore, we recommend the consultation and the DEA also include and analyze effects to designated critical habitat.

Response: A Biological Assessment (BA) was prepared to formally consult on impacts (water depletions) to the four Colorado River endangered fish. Reclamation initiated consultation pursuant to Section 7 of the Endangered Species Act of 1973 at the end of March 2018. The Wyoming Ecological Services Field Office issued a Biological Opinion in May 2018 that is included as Appendix C in the Draft EA.

7. **Commenter:** Carmel Kail
   Comment:

- p. 16 Please more specifically define the project APE, Class III inventory area and "maximum limit of disturbance" *(For example, "0.25 mi beyond the proposed flood pool line or project-related earth disturbance, whichever is more, regardless of surface ownership". A 7.5' map depicting this would be very helpful.)*

Response: The direct APE includes 508.16 acres of proposed inundation between elevation 6757.5 and 6762.5 feet above mean sea level. However, a total of 1,114.33 acres were surveyed for cultural resources for this project to provide a buffer around the proposed inundation and for other project components.

8. **Commenter:** Carmel Kail
   Comment:

- p. 17 48.SW.1841, (Sublette Cut Off of the Oregon Trail), is eligible for the National Register and should have been so identified in the EA. *(It is identified as being in the APE, but is not listed among sites which Reclamation recommends as eligible for inclusion in the NRHP.)*

Response: Site 48SW1841 is not located in the direct APE. This was an error in the document. It is located within the indirect APE and was analyzed for visual effects for the cultural resource report.

9. **Commenter:** Carmel Kail
   Comment:

- pp. 42, 48 References to the Utah SHPO should be changed to Wyoming SHPO.

  Response: The references to Utah SHPO were changed to Wyoming SHPO.

10. **Commenter:** US Environmental Protection Agency, Region 8
    Comment:

1. Reduced peak flows can impact channel functions including sediment transport. We recommend the Final EA include an estimate of the percent decrease in spring runoff that would spill over into the Big Sandy River after reservoir enlargement, the volumes that would spill over and for what length of time, the flow that would be present in the river below the dam throughout the year as a result of the decreased spillover, and any expected impacts of these flow changes on riverine functions.

Response: The reservoir spilled in 10 of the 22 years from 1989-2010 (45 percent), passing a mean volume of 4800 acre-feet per year over that period. Outside of the three or so weeks of spring runoff spills, releases to the river are not typically made. Depending on the actual operations of the reservoir and water deliveries, spills could occur as infrequently as 3 in every 20 years (15 percent), with a mean annual spill volume up to 60% lower than the historic mean.

11. **Commenter:** US Environmental Protection Agency, Region 8
    Comment:

2. We recommend the Final EA assess whether the project has the potential to affect attainment or maintenance of water quality standards commonly associated with flow reductions or reservoir operation (e.g. temperature, dissolved oxygen), including beneficial uses, of the Big Sandy River below the Big Sandy dam. We suggest working with the Wyoming Department of Environmental Quality to complete this analysis.

Response: Water is released from a low level outlet in Big Sandy Dam to the Means Canal. Any water use requirements in the Big Sandy River below the Big Sandy Dam is diverted from the Means Canal into the Big Sandy River approximately 500 feet downstream of the Big Sandy Dam. Eden Valley Irrigation and Drainage District (EVIDD) operates the system and determines how much flow is diverted to the Big Sandy River based on water use demands. These diversions to the Big Sandy River are minimal and not expected to change with an enlarged reservoir; therefore, any water quality standards in the Big Sandy River downstream of the reservoir are not expected to change.

12. **Commenter:** US Environmental Protection Agency, Region 8
    Comment:

3. We note that a goal of the project is to extend the irrigation season beyond September 15, the period analyzed in the water quality assessment in the EA. We recommend the Final EA assess a lengthened irrigation season in the water quality model (vs April 1 to September 15, as indicated in the Draft EA) or explain why that late season information would not be relevant. We also suggest supporting the model results by briefly explaining why TSS and TDS would decrease as a result of reservoir enlargement.

Response: There is no proposal to extend the irrigation season beyond September 15, thus late season modeling is not relevant. A water quality analysis was performed and predicted the in-reservoir TSS concentrations would be reduced by approximately 25% and TDS concentrations would be reduced by approximately 8.5% after the enlargement. The reduction in TSS and TDS can be contributed to a couple of factors. The additional hydraulic residence time allows for more settling in the reservoir (decrease in TSS), and the enlargement allows for the storage of better quality of water (decrease in TSS and TDS). While baseline water quality data is limited on the Big Sandy River, USGS Station 09213500, located upstream of the Big Sandy Reservoir measures water quality data such as turbidity, specific conductance, and TSS. TDS was derived from specific conductance data, and this data was used in the water balance model. The average monthly TSS and TDS concentrations determined from the USGS station had peak concentrations during the high runoff months of March, April, and May. TSS and TDS concentrations dropped off significantly during the summer months of June (TDS dropped, TSS remained high), July and August. The enlargement of the reservoir allows for more storage of higher quality of water during the summer months and could be contributed to the decrease in in-reservoir TSS and TDS.

13. Commenter: US Environmental Protection Agency, Region 8

Comment:

4. In many cases, wetlands that experience inundation for a significant portion of the growing season lose much of their function due to loss of wetland vegetation and associated animal species. Typically, reservoir enlargements result in extended duration of existing wetland inundation around the reservoir margins; therefore, similar to the analysis completed for years 1990–2010, we recommend the Final EA include an estimate of the duration and depth of inundation of existing wetlands that would occur due to the proposed enlargement, and assess impacts by comparing those estimates to the referenced scientific literature. Alternatively, the Final EA could explain how the analysis of current wetland inundation and corresponding wetland quality and function relates to future inundation and quality of existing wetlands under operation of the enlarged reservoir.

Response: The wetlands adjacent to Big Sandy Reservoir and in the proposed inundation area of the expanded reservoir pool do not appear to be natural features, but rather were likely formed and sustained by periodic reservoir inundation. Wetlands in the survey area were comprised of fringe wetlands along the reservoir margins, broad meadows/depressions, and terrace/riparian corridors along the Big Sandy River. Fringe wetlands were primarily palustrine scrub-shrub (PSS) dominated by sandbar willow (Salix exigua) with limited herbaceous understory. Small palustrine emergent (PEM) fringes were also present. Three large PEM meadow wetlands were dominated by foxtail barley (Hordeum jubatum) and Douglas' sedge (Carex douglasii), both of which are considered facultative wetland species. Some areas within the wetlands had a high percentage of non-desirable annual species including tumbleweed (Salsola tragus) and halogeton (Halogeton glomeratus). The meadow wetlands were low quality, marginal habitats.

An inundation analysis on the wetlands at the Big Sandy Reservoir site was completed in the Level II feasibility study (Wenck, 2017). The maximum length of inundation of the existing wetlands in any given year was 211 days, while the average length of inundation was 53 days. However, if the seven years that wetlands were never inundated are removed, the mean length of inundation was 79 days during years that inundation occurred. The average length of time that water was at or above the elevation of 6,754 feet (bottom elevation of wetlands) was 53 days. The approximate depths of inundation also were examined. The mean length of time that wetlands at the bottom elevation (6,754 feet) were inundated with 1, 2, 3 and 4 feet of water was 37, 28, 20 and 4 days, respectively. The maximum number of days the wetlands were inundated with 1, 2, 3 or 4 feet of water in any given year was 147, 128, 116 and 48 days, respectively.

A literature review was conducted to determine the inundation duration tolerances of the dominant plant species found in wetlands at the Big Sandy Reservoir site. Rains et al. (2004) studied changes in vegetation distributions under different reservoir operation scenarios and found that the vegetation distributions on their study site were largely in equilibrium with depth to groundwater. Rains et al. (2004) also used modeling to predict vegetation community changes under various reservoir operation scenarios, including an expanded pool scenario. Rains' study indicates that the palustrine scrub-shrub (PSS) wetlands found at the upper end of the reservoir along Big Sandy River are likely to persist with the periodic flooding and drawdown that would occur if the reservoir is enlarged. PSS wetlands at the upper end of the reservoir are dominated primarily by sandbar willow (Salix exigua). Willows are well known

for their tolerance for flooding. River Partners (2008) found sandbar willow, along with other willow species, to be highly tolerant of long-duration flood conditions when they were flooded for 105 to 119 days during the growing season. Water depths ranged from 3.3 to 9.5 feet. Numerous other studies and websites note that sandbar willow has high tolerance of flooding (e.g., Dionigi et al. 1985; the USDA Plants Database; the U.S. Forest Service Fire Effects Information System Plants Database). Other studies have documented sandbar willow adaptations to flooding (Kuzovkina et al., 2004). Several studies report a tolerance of flooding for sedges (Carex spp.). Many of the palustrine emergent (PEM) wetland communities around the reservoir have Douglas sedge (Carex douglasii), Northwest Territory sedge (C. utriculata), Nebraska sedge (C. nebrascensis), Baltic rush (Juncus balticus), or creeping spikerush (Eleocharis palustris) (Hoag et al. 2011, CNPS no date, USDA NRCS 2005b). Based on these data, it seems reasonable to assume that all wetlands dominated by Northwest Territory sedge, Nebraska sedge, clustered field-sedge, Baltic rush or creeping spikerush would persist, with periodic inundation under normal high-water conditions. The length of time many of the dominant species found within project area wetlands are likely to tolerate flooding is provided in Appendix B of the Level II Report (Wenck, 2017) and a more detailed analysis of this summary and the references cited herein may be found in Sections 5.21-5.24 of the Level II Report.

The wetland species found at the Big Sandy Reservoir site appear tolerant of flooding for all or most of the growing season, particularly willows and sedges. Thus, sedges and rushes are likely to increase in dominance. No change in willow composition is anticipated. Based on this analysis, it is likely that wetlands would form both within and above the new normal high-water line of the expanded reservoir, as they would likely be subjected to similar inundation regimes as existing wetlands. These areas are currently uplands dominated by big sagebrush and rabbitbrush (Ericameria spp.).

14. **Commenter:** US Environmental Protection Agency, Region 8
    Comment:

5. We recommend the cumulative effects section describe the past effects to the Big Sandy River due to placement and operation of the dam, including effects on downstream wetland and riparian functions. This information will provide context for the effects associated with enlarging the reservoir.

Response: Thank you for your comment and recommendation.

15. **Commenter:** US Environmental Protection Agency, Region 8
    Comment:

6. We recommend giving consideration to whether mitigation is warranted to offset the impacts of further reduced downstream flows as well as for impacts associated with wetland and stream channel inundation. For example, some water supply projects have included an 'environmental pool' to enable flow release from the reservoir to support riverine functions below the dam as mitigation for the effects of reservoir enlargement.

Response: Thank you for your comment.

16. **Commenter:** Peter R. Arambel, President of Dunton Sheep Company and Midland Live Stock Company

Comment:

1. The Bureau of Reclamation (Bur. Rec.) and Wyoming Water Development Commission ("WWDC" or "Commission") failed to follow proper processes to involve affected private property owners. For example, WWDC is mandated to provide notice by Wyo. Stat. § 40-2-122, which requires the Commission to notify all affected landowners during the planning process during Level I. Further, the same statute requires the Commission to consult with affected landowners during the Level II planning process. Neither notification nor consultation occurred. It was not until Dunton Sheep Company and Midland Live Stock Company (commentors) notified the Commission of the failure to notify and consult with the affected landowners that any discussion has occurred between the commentors and Commission staff. Further, the Bur. Rec's November 20 letter advises that the draft was available online for review. However, it was only after commentors notified WWDC that the Draft EA was not available online that Bur. Rec. finally made the Draft EA available online.

Response: Notification of the project mandated by Wyo. Stat. §40-2-122 applies to WWDC, not Reclamation's NEPA process. Reclamation has followed NEPA standards for public involvement specified in 40 CFR 1500-1508 and 43 CFR 46. The Draft EA was made available as soon as staff were able to post it. Because the process of sending the notification letters and publishing the Draft EA online were not simultaneous, the comment period was extended by 2 weeks to account for the delay.

17. **Commenter:** Peter R. Arambel, President of Dunton Sheep Company and Midland Live Stock Company

Comment:

2. The cover letter seeking comment from "Interested Persons, Organizations, and Agencies" (but not sent to Sublette County government) notes that Bur. Rec. has already determined that an environmental impact statement is not required. However, in reality, the Draft EA does not provide sufficient information for determining whether to prepare an environmental impact statement or finding of no significant impact. Bur. Rec. must take action to rectify the deficiencies identified herein.

Response: The analysis in the Draft EA showed no significant impacts to the human or natural environment. Therefore, Reclamation did not need to prepare an Environmental Impact Statement (EIS). Further analysis, including analysis based on comments received on the Draft EA, did not show a significant impact to the human or natural environment.

18. **Commenter:** Peter R. Arambel, President of Dunton Sheep Company and Midland Live Stock Company

Comment:

3. As mentioned at the public meeting, notice of the Draft EA and FONSI was not posted at the Post Office or in any publication in the local area; therefore, sufficient notice was not provided. Further, no notice was provided to Sublette County and said County was not consulted at any time during the process despite the fact that more than half of the reservoir – and the vast majority of the land to be inundated – is located in Sublette County. Bur. Rec. failed to consult with Sublette County in any stage of the planning process for this project, in violation of the National Environmental Policy Act and the Council on Environmental Quality regulations, and the Bur. Rec's own guidelines. In addition to its failure to consult with the Sublette County Board of Commissioners, Bur. Rec. also failed to review its plans for compliance with the Sublette County Federal and State Land Use Policy, which states, in part, "Federal land management must facilitate cooperative conservation by fully involving local governmental entities, including the Sublette County Commission and Sublette County Conservation District; take appropriate account of and respect the interests of persons with ownership or other legally recognized interests in land and other natural resources; properly accommodate local participation in federal decision-making; and provide that the programs, projects, and activities are consistent with protecting public health, safety and welfare. Sublette County will not support projects where the federal agency has excluded local government entities and landowners." (SCFSLUP, P09: http://www.sublettewyo.com/DocumentCenter/Home/View/437)

Bur. Rec. has excluded local government entities and landowners in proceeding with this project. The Draft EA at 1.3 states: "The Proposed Action was presented to the public and interested agencies as outlined below." Most of the items on the list were actions that Bur. Rec. *intended* to undertake in the future. In addition, there was no public notice of the release of the Draft EA to the general public in Sublette County, and one directly impacted private property owner was not notified or consulted.

Response: As more than one participant noted in the public meeting, notice of the Draft Environmental Assessment (EA) was posted in the Post Office in Farson, Wyoming as a public notice. No Finding of No Significant Impact (FONSI) has been drafted or published.

According to 40 CFR §1506.6(a), agencies shall "make diligent efforts to involve the public in preparing and implementing their NEPA procedures." Subparts (i) through (ix) of 40 CFR §1506.6(b)(3) provide examples of public involvement when effects are "primarily of local concern". Reclamation mailed 132 letters to local residents, shareholders, and governmental organizations. Reclamation did not include Sublette County, Wyoming, on the mailing list. Reclamation has included Sublette County, Wyoming in all future correspondence and consultation concerning the EA, in addition to responding to comments of the Sublette County Board of County Commissioners that they provided on the Draft EA.

According to 43 CFR §46.305(a), "The bureau must, to the extent practicable, provide for public notification and public involvement when an environmental assessment is being prepared. However, the methods for providing public notification and opportunities for public involvement are at the discretion of the Responsible Official." Further, part (b) of the same section states "Publication of a "draft" environmental assessment is not required. Bureaus may seek comments on an environmental assessment if they determine it to be appropriate, such as when the level of public interest or the

uncertainty of effects warrants, and may revise environmental assessments based on comments received without initiating another comment period." No decision document (i.e. FONSI) has been prepared or signed, and revisions of the EA have continued beyond the initial Draft EA that was published.

The Draft EA was posted simultaneously with the process of mailing notification letters, which is why the Draft EA did not detail how many letters were sent.

19. **Commenter:** Peter R. Arambel, President of Dunton Sheep Company and Midland Live Stock Company

Comment:

4. The Draft EA summarily states that there are no private landowners in the area who will be adversely affected. Nothing could be farther from the truth. Commentors own 800 acres of land bordering the reservoir, bordering the Big Sandy River, and immediately below the reservoir, more particularly described as follows:

a. T27N, R106W, Sec. 20, E½SE¼, SE¼NE¼ &W½NE¼ (approx. 200 acres northwest of reservoir);
b. T27N, R106W, Sec. 21, SW¼SW¼ (approx. 40 acres northwest of reservoir);
c. T27N, R106W, Sec. 28, N½NW¼ (approx. 80 acres northwest of reservoir);
d. T27N, R106W, Sec. 25, NE¼SW¼ & SW¼SE¼ (approx. 80 acres on east shore of reservoir);
e. T26N, R105W, Sec. 7, SW¼, NW¼SE¼ & SW¼NE¼ (approx. 240 acres on Dewey Place owned by Midland Live Stock Company); and
f. T26N, R106W, Sec. 12, NE¼ (approx. 160 acres on Dewey Place).

Further, commentors own other property interests, including mineral interests, below the reservoir. The proposed project would inundate commentors' land and cause groundwater percolation to significantly damage their lands, resulting in an unconstitutional taking of commentors' lands. Commentors have worked with the State of Wyoming to attempt to reach an agreement to exchange lands. At this time, there is not been an approved agreement for flooding and otherwise damaging their private property. Unless and until such an agreement has been finalized, permitting for this project should not move forward.

Response: Reclamation recognizes there is currently privately-owned land that is partially inundated based on the current Big Sandy spillway crest elevation of 6757 ft. Reclamation was aware that a land exchange between the State of Wyoming and the private landowner was being considered. For this reason, Reclamation prepared the Environmental Assessment under the assumption that the land exchange would have to occur before the project would be implemented. Under this assumption, there would be no impacts to private land. Analysis regarding grazing and impacts to private land has now been described in the EA. The analysis showed there would be very little to no effect on grazing.

Under Land Purchase Contract I77r-502 and Warranty Deed, both signed on June 21, 1950 and recorded in both Sublette and Sweetwater Counties, authorize Reclamation to flood or otherwise affect with water the private lands in the reservoir basin. Furthermore, in the contract, it is understood that grazing/agricultural purposes may not interfere with Eden Project purposes.

20. **Commenter:** Peter R. Arambel, President of Dunton Sheep Company and Midland Live Stock Company

Comment:

5. The Draft EA does not accurately describe the capacity of the existing reservoir. The storage capacity of Big Sandy Reservoir has been reduced significantly over time due to siltation. The proposed enlargement seeks to replace the lost storage capacity by raising the elevation of the dam. In short, EVIDD is not authorized under Wyoming law to enlarge the reservoir and retain its 1903 water right for the new storage capacity created by a present day reservoir enlargement.

Response: A bathymetry survey was completed in 2010 and a LiDAR survey was completed in 2015. Using bathymetry surveys and LiDAR to digitally capture topography is an established and well-accepted geospatial technique.

21. **Commenter:** Peter R. Arambel, President of Dunton Sheep Company and Midland Live Stock Company

Comment:

6. The proposed enlargement of the reservoir would destroy vertebrate and invertebrate fossils contained in the areas proposed to be inundated by the proposed enlargement. Section 423.2 of Bur. Rec's Rules and Regulations defines "natural resources" to include paleontological resources. Congress has recognized that, under current public laws, including the Federal Land Management Policy Act of 1976, federal land management agencies are given the authority and mandate to protect public resources, including those of scientific value. These resources include fossilized paleontological specimens, which provide valuable clues to the earth's history." Sen. Report 105-227, p. 60. See also *Board of Regents of the University of Oklahoma,* 165 IBLA 231, April 13, 2005. The Draft DA states that paleontological resources will not be adversely affected so long as they do not dig into the bedrock. However, this completely ignores the fact that the proposed reservoir enlargement would inundate many acres of land. It is irrelevant whether the project digs into the fossilized remains or whether the reservoir inundates the surface of the lands containing the paleontological resources. The result is the same -- the paleontological resources would be lost. Both the public land and the commentors' private land surrounding the reservoir contain significant fossilized remains. Even if the federal government were to determine that there is no interest in excavating the fossilized remains underlying public lands, the commentors' lands contain fossils and they have been approached by private parties who would like to explore and or mine for fossilized remains on their deeded property, for both scientific and commercial purposes. The proposed reservoir enlargement would inundate these lands and cause groundwater percolation to make their lands too heavily saturated and alkaline to be used, therefore, it would destroy their lands' use for those purposes and for agricultural purposes.

Response: The Draft EA has been updated following a field assessment by Paleo Solutions, Inc. They found four fossil localities, one of which was considered significant. However, 1) this locality was located outside the direct APE away from ground disturbing activities, 2) the fossils (located on Reclamation withdrawn lands) were collected, and 3) the fossils were curated at the Utah Field Museum of Natural History. For these reasons, Paleo Solutions, Inc. did not recommend further mitigation measures. No localities were identified on private lands over which Reclamation has a perpetual easement.

Under Land Purchase Contract I77r-502 and Warranty Deed, both signed on June 21, 1950 and recorded in both Sublette and Sweetwater Counties, authorize Reclamation to flood or otherwise affect with water the private lands in the reservoir basin. Furthermore, in the contract, it is understood that grazing/agricultural purposes may not interfere with Eden Project purposes.

22. **Commenter:** Peter R. Arambel, President of Dunton Sheep Company and Midland Live Stock Company

Comment:

7. The Draft EA argues the proposed enlargement will not affect grazing. This is not accurate. Commentors own a sheep and cattle operation and are the grazing permittee/lessee on the BLM and State lands adjacent to the reservoir. Commentors' grazing operation would be significantly impacted by the enlarged reservoir in several ways. First, it would inundate commentors' grazing lands, which have lush green forage that they have previously used for grazing. In fact, the proposed enlargement would inundate their best riparian lands. Second, the proposed enlargement would cause the development of quicksand along the boundaries of the reservoir and Big Sandy River, which are dangerous to livestock, wildlife, people, guard dogs, and pets. The quicksand occurring at the Wyoming Game and Fish's fish barrier upstream of the proposed project demonstrates what will happen along the river corridor and the shore of the reservoir if the reservoir is enlarged. Commentors use the north end of the reservoir for lambing and calving in the spring and early summer and could no longer use it for birthing if there is quicksand between their livestock and their stock water supply. Third, it would cause the water table to rise, thus causing their fee lands below the reservoir and federal lands north and west of commentors' fee lands to become alkaline and muddy from ground water percolation. This percolation would occur within an alkali-based soil type. Groundwater percolation would cause alkali to rise up through the soils and kills the vegetation that their livestock graze and would instead grow vegetation that their livestock would not eat. Commentors are not aware of any water or soil sampling done in the existing percolation area – if it has been done on their fee lands, it was done without notice or permission. Also, the higher water table would cause the lands below the reservoir to become too muddy access by livestock, wildlife, people, horse or motor vehicle. We understand WWDC believes this will be addressed by building a 10-foot retaining wall, which WWDC believe would extend down to the bedrock. However, commentors do not believe this will work because the bedrock in this area is significantly deeper than 10 feet. Even if the wall extended down to bedrock, the bedrock in the area is a sandstone, which is permeable and would still allow percolation. Also, the increased percolation will effect existing fences downstream of the proposed project area. Fourth, there is an existing artesian well that will be submerged by the proposed enlargement. That well would need to be replaced or replicated to provide water access when the reservoir is frozen. The location of the well west of the existing reservoir. If the project mores forward, commentors believe a replacement groundwater well would need to be drilled in the R106W, T26N, Sec. 16, on the east side of Highway 191. Fifth, 2 allotment fences would be submerged by the proposed enlargement by the higher water levels. Those fences would need to be addressed. In light of the above, it is difficult to see how the agency has taken a hard look at the effects the proposed enlargement would have on grazing.

Response: Reclamation recognizes there is currently privately-owned land that is partially inundated based on the current Big Sandy spillway crest elevation of 6757 ft. Reclamation was aware that a land exchange between the State of Wyoming and the private landowner was being considered. For this reason, Reclamation prepared the Environmental Assessment under the assumption that the land exchange would have to occur before the project would be implemented. Under this assumption, there would be no impacts to grazing.

In response to the first portion of this comment, some riparian areas may be lost due to a spillway crest raise. However, based on the wetland analysis performed for the EA, the majority of the wetlands would persist, leaving much of the same forage available to livestock.

Second, there is the possibility that there would be additional areas of quicksand. Based on communications with Mr. Arambel, the area adjacent to the Big Sandy River on the inlet of the reservoir is not grazed or used for lambing/calving. Based on responses from Mr. Arambel to inquiries on annual revenue losses due to quicksand, it would be nearly impossible to accurately quantify those losses. Based on one response, a general statement was included regarding the possibility of revenue losses.

Third, again based on responses from Mr. Arambel, the area adjacent to the Big Sandy River is not grazed or used for lambing, so an increased water table would not affect livestock operations on the northwest side of the reservoir. Reclamation has no outstanding grazing permits on Reclamation withdrawn lands around Big Sandy Reservoir that would be affected by an increased water table. Soils on the north side of the reservoir are classified by the Natural Resource Conservation Service (NRCS) as 9203—Diamondville-Cushool-Edlin complex, 0 to 4 percent slopes. These types of soils are slightly saline to moderately saline. Therefore, little change in salinity would be expected.

Geotechnical work was completed to verify depth to bedrock. That information will be used to inform the construction of the cement-bentonite wall in the dike, which would prevent more seepage into areas on the southeast side of the reservoir.

Fourth, the artesian well is part of Reclamation's recreation facilities at Big Sandy Reservoir. The well would be extended or a new well drilled at a higher elevation as part of the Proposed Action (already stated in section 3.3.13.2 of the Draft EA).

Fifth, based on responses from Mr. Arambel to inquiries on where the fences are, the minimum distance from the enlarged reservoir to the closest corner portion of the Section the fence is located in (Sec 7 R105W T26N) is 1.5 miles. Based on this information and the fact that the proposed inundation area would move the reservoir <100ft closer to the fence, it is unlikely a spillway crest raise would affect the fences.

23. **Commenter:** Peter R. Arambel, President of Dunton Sheep Company and Midland Live Stock Company

Comment:

8. As the Bur. Rec. and the WWDC are aware, the wetlands issue was identified as one of the fatal flaws in the proposed project. With respect to the Draft EA's analysis of wetlands, the Draft EA claims the "duration of inundation would not be long enough" to kill wetland plants. This statement is based on a number of assumptions, which may be accurate some years and not others. First, it will only take one year of longer high water levels to kill the wetland vegetation and create a beach effect. Second, it assumes water would be drained from the enlarged reservoir fast enough to prevent such issues. However, in wet springs such as have been experienced the last few years, reservoirs fill completely and the water level remains at the high water line for a significant period of time. Commentors also question the math and the appropriateness of the numbers chosen for this analysis. Further, the loss of the wetland vegetation will cause a "beach effect," which will lead to blowing soils and sand, erosion, noxious weeds, and sand dunes.

Response: The response to Comment 13 addresses the concerns expressed in Comment 23. A hydrologic model was developed in the Level II study that simulated reservoir elevations and irrigation releases of the enlarged reservoir based on historic hydrologic data and irrigation releases. This model was used to assess inundation depth and duration tolerances for the species of wetlands located at Big Sandy Reservoir. A literature review of inundation tolerances for the species of wetlands at Big Sandy Reservoir was reviewed and based on this review of previous studies and the inundation limits determined from the hydrologic model, it is unlikely there will be any dramatic loss of wetlands due to the enlargement of Big Sandy Reservoir.

24. **Commenter:** Peter R. Arambel, President of Dunton Sheep Company and Midland Live Stock Company

Comment:

9. As the Bur. Rec. and the WWDC are aware, the sage grouse issue was identified as another of the fatal flaws in the proposed project. With the respect to the Draft EA's analysis of the sage grouse issues, the Draft EA contains some creative mathematics suggesting that only a 2.91% disturbance would occur. However, this is assuming that the agency's numbers are correct and that the tool is a valid measurement of wildlife disturbance. For example, the Draft EA appears to "compare apples and oranges." First, it describes the entire area of the project to include the entire surface area that would be inundated, but then uses only the surface area that would be inundated as the affected area, thus leading to the low percentage reported. The agency cannot have it both ways. Either the areas previously inundated need to be removed from the total project area or the area previously inundated needs to be added to the area affected by the proposed reservoir enlargement. The agency cannot have it both ways.

Response: The analysis performed using the State of Wyoming's Density Disturbance Calculation Tool (DDCT) is required for all projects that may affect sage grouse or their habitat in Wyoming. It was developed by the State of Wyoming to protect the species from large reductions in its habitat. The DDCT is not only the best available scientific method to estimate disturbance to sage grouse habitat, but is also what is required by Wyoming State law. Per the DDCT guidelines and WGFD personnel, the existing disturbance footprint of the reservoir was not included in the DDCT analysis. The inundation area was estimated based on well-accepted GIS tools and data (TIN tool in ArcGIS Pro v2.4 using LiDAR data collected in 2015).

25. **Commenter:** Peter R. Arambel, President of Dunton Sheep Company and Midland Live Stock Company

Comment:

10. The proposed plan to mine borrow from an area where there is currently standing water is infeasible. Further, to mine borrow from this particular area would exacerbate the problem of water standing below the reservoir. Borrow is available in other locations close to the project that would be much easier to mine and which would not further contribute to the issue of standing water below the reservoir.

Response: The area that is being described, an original borrow source south of the southern portion of the dike that has ponded water in low areas, is going to be partially filled in. The area being considered for a borrow source is inside the reservoir defined by the dike, being west and north of the dike, as the dike outlines the southeastern corner of the reservoir.

26. **Commenter:** Peter R. Arambel, President of Dunton Sheep Company and Midland Live Stock Company

Comment:

11. Further, the Draft EA proposes building a house of cards by building directly upon the existing dam, which is already in a state of disrepair. There are lateral and horizontal cracks in the existing spillway/dam and there is a 3-foot section of the structure that is missing. Commentors own land below the reservoir that would be devastated by a breach or failure of the Big Sandy Reservoir. Further, there were no drawings in the Draft EA for the structure proposed to elevate the water level and no proposed start date for the project. Further, commentors question the wisdom of the proposed toe drain on the other side of the reservoir and the proposed use of soil/shale on the reservoir banks rather than a gravel rip rap.

Response: Reclamation inspects Big Sandy Dam and Dike on an annual basis and there are currently no outstanding Category 1 recommendations which could indicate a potential threat to dam safety. There are some Category 2 maintenance recommendations that the Eden Valley Irrigation and Drainage District are responsible for completing but do not compromise the safety of the facility. An in-depth risk analysis has been performed previously by Reclamation's Technical Service Center which indicates that with the proposed modifications, the project would not increase failure risk with the increased reservoir level. Appraisal level drawings showing the proposed modifications to the spillway, dam, and dike have been incorporated in the EA as Appendix G.

The proposed toe drain on the left abutment of the dam alleviates potential pore pressures at the higher elevation thus increasing the safety of the dam. The proposal to utilize soil/shale on the dike banks to re-establish the original design slope of 8H:1V will result in a risk neutral design without the costly import of riprap. The embankment with this shallow of a slope results in a stable embankment to safely dissipate wave run-up and prevent severe erosion without the use of riprap.

Draft drawings have been included as Appendix G in the revised EA.

27. **Commenter:** Peter R. Arambel, President of Dunton Sheep Company and Midland Live Stock Company

Comment:

12. There is no indication in the Draft EA as to how the agency proposes to reclaim and seed the area and protect disturbed areas until vegetation recovers in the area. Commentors insist that all sites disturbed by the proposed project must be fenced until vegetation recovers in the area. However, that fencing cannot occur without first providing commentors' livestock with an alternative source of stock water.

Response: Reclaiming and seeding disturbed areas will be developed and incorporated into the construction contract in coordination with WGFD, BLM, NRCS, the Counties, etc. Disturbed areas do not need to be fenced.

28. **Commenter:** Peter R. Arambel, President of Dunton Sheep Company and Midland Live Stock Company

Comment:

13. The Draft EA claims that there are no man-made structures above the existing reservoir. This is inaccurate. There are 2 man-made structures on the river system: the Chinese weir and the Wyoming Game and Fish's new fish barrier.

Response: References to man-made structures was removed.

29. **Commenter:** Peter R. Arambel, President of Dunton Sheep Company and Midland Live Stock Company

Comment:

14. The Draft EA states that the consultation with the Wyoming State Geological Survey is not complete and its impacts are unknown. Therefore, the agency has clearly not taken a hard look at this area.

Response: In response to this and other comments regarding paleontological resources, Paleo Solutions, Inc. was hired to assess the project area for fossiliferous potential. Four fossil localities were identified, one of which was considered significant. Fossils were collected from that locality and will be curate at the Utah Field Museum of Natural History. Please see section 3.3.4 of the Draft EA for more information.

30. **Commenter:** Peter R. Arambel, President of Dunton Sheep Company and Midland Live Stock Company

Comment:

15. Commentors' family has farmed and ranched in the area for over 100 years and they are intimately familiar with the area. In fact, the land underlying the existing reservoir was their family's land. Commentors believe remains of paleo-Indian camps exist on the federal lands to be affected by the proposed enlargement that the Draft EA has not addressed.

Response: This topic is covered within the Class III cultural survey report. All prehistoric sites within the APE, whether previously identified by archaeologists or newly discovered, were evaluated for their significance against the criteria established for inclusion on the National Register of Historic Places. Reclamation determined that two prehistoric sites are eligible for inclusion thereon. Any adverse effects to these sites will be covered under a Memorandum of Agreement with the Wyoming State Historic Preservation Office.

31. **Commenter:** Peter R. Arambel, President of Dunton Sheep Company and Midland Live Stock Company

Comment:

16. The Draft EA fails to evaluate the impact of the that lack of flushing flows, which will no longer occur as frequently, or at all, on the Big Sandy River below the reservoir. These flushing flows have helped to enhance the health of fish habitat below the dam.

Response: Not all spills will have the volume and flow rate to have an impact on the channel - move gravels, cut the outside of river bends and deposit on the inside - but the decrease in "flushing flows" will probably align pretty directly with the decrease in spill frequencies and volumes. The reservoir spilled in 10 of the 22 years from 1989-2010 (45 percent), passing a mean volume of 4800 acre-feet per year over that period. Outside of the three or so weeks of spring runoff spills, releases to the river are not typically made. Depending on the actual operations of the reservoir and water deliveries, spills could occur as infrequently as 3 in every 20 years (15 percent), with a mean annual spill volume up to 60% lower than the historic mean. Because water is not released into Big Sandy River outside of the spills, Big Sandy River below the dam is dry or nearly dry for much of the year. The river would be recharged with return flows, seepage from nearby canals, and/or springs. Reduced flushing flows would not have an impact on a river that is only seasonally wet.

32. Commenter: Peter R. Arambel, President of Dunton Sheep Company and Midland Live Stock Company

Comment:

17. The Draft EA does not include the proposed timeline for the project; duration for construction; project costs; project construction diagrams; assessment of impacts to private landowners in Sublette County; and impacts to livestock operations and other existing uses. The Draft EA also failed to include the required distribution list. The Draft EA at page 2 notes that Bur. Rec's Dam Safety Office "has concluded that a reservoir enlargement would be approved if the dam safety risks remained neutral." Yet the Draft EA did not include a dam safety risk assessment. Without a firm timeline and plans for the construction project, there is no way to assess the environmental impact of the proposed action.

Response: The current proposed timeline for the project would have construction begin in the fall of 2019. It is anticipated construction would take place after irrigation season and be completed through in 2020. Increased storage would then be allowed to take place in 2021. While some construction costs have been estimated for budget planning purposes, an in-depth estimate has not been prepared. Once a final cost estimate has been prepared, a cost range will be posted with the solicitation for bidders to be aware of the potential construction costs.

A dam safety risk assessment was completed in the fall of 2013. This assessment indicated the risks of the enlargement would remain risk neutral with the proposed modifications.

33. **Commenter:** Peter R. Arambel, President of Dunton Sheep Company and Midland Live Stock Company

Comment:

18. The socio-economic section of the Draft EA includes a few statements about residents of Sweetwater County, but no mention of Sublette County is made. In fact, no "analysis" is made. The Draft EA should answer the following questions:

a. What is the anticipated impact for the period of construction?
b. How many workers and equipment will be on site, for how long, and where will they be housed?
c. Will the materials and labor come from local workforces and sources?
d. What is the anticipated economic impact?
e. What is the cost/benefit ratio for the project?
f. What are the direct and indirect economic benefits of the project?
g. What is the anticipated increase in agricultural production from added stored water?
h. Will increased storage result in added recreation days on the reservoir?
i. Will the construction phase result in negative consequences for other land users, and what measures will be taken to mitigate those impacts?
j. Will road closures be in effect during construction, and will recreational users and livestock producers be provided alternative access during the construction period?

Response:

a) During the construction period to enlarge Big Sandy Reservoir there would be an uptick in economic activity as contractors purchase food, fuel, and other amenities from local vendors. Earthen materials may be taken from local borrow areas (discussed in 2.3.7 of this EA) or trucked in from other areas. Due to the lack of significant industry in the local area, long-term/significant economic benefits of the construction activities would likely be minimal.

b) The construction period to enlarge Big Sandy Reservoir is expected to last from July or August until completion in April or May of the following year. The quantity of workers and equipment on site will be at the discretion of the contractors performing the construction work. As local lodging options are probably inadequate in number to accommodate the influx of workers needed to complete the construction activities, local trailer courts may see additional activity, or additional traffic on Highway 191 between the construction site and Rock Springs may occur. Ultimately, where engineers, surveyors, truck drivers, construction workers, etc. choose to be housed will be at their own discretion.

c) Whether materials and labor come from local sources or other locations will depend on suitability and economic viability of these resources. There may be vacancies on construction crews that could be filled by local individuals, but this socio-economic analysis does not pretend to mandate the use of local resources.

d) The total benefits of the Big Sandy Enlargement can be summarized as follows:

Table 8-1: Benefits of Big Sandy Enlargement

Summary of Benefits		
Benefit Type	**Annual Benefit**	**Present Value of Benefit**
Direct Irrigation	$ 283,423	$ 6,095,118
Indirect Irrigation	$ 461,980	$ 9,935,042
Recreation	$ 325,248	$ 6,994,580
Total	**$ 1,070,651**	**$ 23,024,740**

See responses to parts f, g, and h of this comment for a breakdown of these benefits.

e) The estimated present value of direct and indirect irrigation benefits and flat-water recreation benefits would be $23.02 million for the Big Sandy Reservoir Enlargement. When compared to an estimated construction cost of $8.4 million for the required enhancements, the benefit-cost ratio for the overall project is 2.74.

f) Direct irrigation benefits would accrue to local irrigators through a spillway raise/reservoir enlargement as additional supplemental water supply would be available on existing irrigated acreage. As stated, the enlargement of Big Sandy Reservoir would have an average annual yield of 2,936 acre-feet.

Applying the conveyance efficiency and on-farm application efficiency, an overall efficiency of 50.4% can be expected from the Big Sandy system. Applying this efficiency to the average annual yield of 2,936 acre-feet, results in 1,480 acre-feet of useable water at the crop through the enlargement of Big Sandy Reservoir.

Wyoming Agricultural Statistics publications between 2003 and 2014 were consulted to evaluate the cropping patterns and ratios for this area of the State, known as the South-Central Region. In 2014, approximately 59.5% of the crops reported in the County were Alfalfa Hay while 40.5% were reported as being Other Hay (Wyoming Agricultural Statistics Service 2015).

Crop-water production functions for alfalfa and other hay from the Upper Green River Basin were obtained for the Farson and Seedskadee areas and used to project crop production increases. The production functions were developed for the Upper Green River Basin within a report developed for the WWDC (Pochop and Burman 1987). The estimates presented in that report indicate that for every additional inch of evapotranspiration (ET) water available to the crops, an additional 0.142 tons/acre of alfalfa and 0.126 tons/acre of other hay can be generated. Estimating the additional crop production which would result from an enlargement to Big Sandy Reservoir yields an increase of 1,516 tons of alfalfa and 915 tons of other hay production every year.

The annual value of production increases was estimated using average crop prices in Wyoming from 2010-2014, as reported in Wyoming Agricultural Statistics (Wyoming Agricultural Statistics Service 2015). The average price for alfalfa was reported to be $156.20 per ton, and the average price for hay was reported to be $139.80 per ton. Applying these average prices to the production estimates derived above results in a total value of $364,716 annually.

Marginal unit production cost estimates for alfalfa were developed as part of a previous study prepared for the Torrington, Wyoming Region (Watts and Brookshire 2000). Those unit production cost estimates were updated to current (2016) dollars using a farm production cost index published in the current issue of Wyoming Agricultural Statistics. Those costs are $33.44 per ton of alfalfa and hay. The total marginal cost increase associated with the project is calculated by multiplying the unit marginal

production cost estimates by the amount of increased production, resulting in a marginal increase of $81,293.

Subtracting the marginal increase in production costs from the production value increases, yields an estimated annual net benefit of $283,423 for the Big Sandy Enlargement project. The present value of annual irrigation benefits would be $6.10 million for the project, assuming a 50-year project life and a four percent discount rate.

g) Wyoming Agricultural Statistics publications between 2003 and 2014 were consulted to evaluate the cropping patterns and ratios for this area of the State, known as the South-Central Region. In 2014, approximately 59.5% of the crops reported in the County were Alfalfa Hay while 40.5% were reported as being Other Hay (Wyoming Agricultural Statistics Service 2015).

Crop-water production functions for alfalfa and other hay from the Upper Green River Basin were obtained for the Farson and Seedskadee areas and used to project crop production increases. The production functions were developed for the Upper Green River Basin within a report developed for the WWDC (Pochop and Burman 1987). The estimates presented in that report indicate that for every additional inch of evapotranspiration (ET) water available to the crops, an additional 0.142 tons/acre of alfalfa and 0.126 tons/acre of other hay can be generated. Estimating the additional crop production which would result from an enlargement to Big Sandy Reservoir yields an increase of 1,516 tons of alfalfa and 915 tons of other hay production every year.

h) An enlargement at the Big Sandy Reservoir would result in a reservoir with a maximum surface area of 2,919 acres, a surface area increase of 500 acres. Although detailed studies have not been conducted, the enlargement has the potential to provide additional flat-water recreational opportunities in the summer and ice fishing in the winter.

For the purpose of this analysis, a usage rate of 10 activity days per acre per year has been used for purposes of benefit estimation. Using an increased average surface area of 500 acres, this equates to an added 5,000 activity days per year at the site.

The value of these visitor days was estimated from numerous studies at other recreational facilities. Assuming two fishing days for each boating/water skiing day implies an average activity day value of $65.18. Multiplying 5,000 activity days/year by $65.18/activity day, results in an annual recreational benefit estimate of $325,900 annually. The present value of that annual stream of benefits would be $7.0 million for the enlargement of Big Sandy Reservoir using a four percent discount rate and a 50-year project life.

i) Traffic across the dam would be restricted during certain phases of construction, subject to the contractor's schedule. Quantifying the impact is not feasible, as there is no data available for traffic across the dam.

j) Road closures would be in effect during construction. Alternate access across the dam would not be provided.

Literature Cited

Wyoming Agricultural Statistics Service. 2015. Wyoming Agricultural Statistics.

Pochop, L. and R. Burman. 1987. Development of evapotranspiration crop coefficients, climatological data, and evapotranspiration models for the upper Green River. WWDC Publication #87-06

Watts, Gary L. and David Brookshire. 2000. An economic analysis of impacts to Nebraska and Wyoming from post-1945 changes in North Platte River Basin Water Use. Report to the Wyoming Attorney General.

34. **Commenter:** Peter R. Arambel, President of Dunton Sheep Company and Midland Live Stock Company

Comment:

19. Since the Draft EA failed to identify the construction season, there is no way to identify the impacts to local wildlife resources. The Draft EA should hve answered the following questions and ignored them altogether, including:

a. Will there be impacts to wintering wildlife herds in the area (since this is crucial winter range)?
b. Will there be impacts to or wintering or nesting raptors?
c. What stipulations or mitigation will be put in place to protect these resources?

The Wyoming Game & Fish Department has requested the project comply with all the stipulations outlined in Attachment B of the Sage Grouse Executive Order, and those stipulations should be included in the Draft EA. They were not included or even mentioned. Among other provisions, the stipulations restrict construction activity during important seasons and hours for grouse.

Response: The EA has been updated to include a construction timeline (see response to comment 32 and Section 2.3.7.13 of the EA).

Wintering wildlife herds that occupy habitat near the dam and Big Sandy Feeder Canal would likely be displaced during construction. Pronghorn (Antilocapra americana), mule deer (Odocoileus hemionus), and elk (Cercus elaphus nelsoni) would move to adjacent, similar habitat.

A survey was performed by a wildlife biologist on January 31, 2018. One raptor nest was found near the dam where work would occur. No other nests were discovered near the dam or within 0.5 miles (the suggested distance buffer for golden eagles) of other proposed areas of disturbance. Reclamation has consulted with the U.S. Fish and Wildlife Service Wyoming Ecological Services Field Office to ensure compliance with the Migratory Bird Treaty Act of 1918. No mitigation measures were required.

The Draft EA did not include the Sage Grouse Executive Order (EO) in full, but did include it as reference for the reader. The EO was not included in order to reduce the length of the document (see 40 CFR §1500.4(j)). The EO, as well as other documents related to sage grouse conservation, can be found on the website of Wyoming Game and Fish Department at https://wgfd.wyo.gov/Habitat/Sage-Grouse-Management/Sage-Grouse-Executive-Order.

35. **Commenter:** Peter R. Arambel, President of Dunton Sheep Company and Midland Live Stock Company

Comment:

20. Golden eagles are known to inhabit the area and the Draft EA does not address the impacts on them.

Response: The EA has been updated to reflect this new information. See section 3.3.11.2 of the EA.

36. **Commenter:** Peter R. Arambel, President of Dunton Sheep Company and Midland Live Stock Company

Comment:

21. There was no cultural analysis pertaining to the effect of jobs (gain or loss) within the scope of the proposed project.

Response: No loss or gain of jobs would be expected as a result of implementing the Proposed Action (see response to comment 33).

37. **Commenter:** Peter R. Arambel, President of Dunton Sheep Company and Midland Live Stock Company

Comment:

22. There were no data in the Draft EA pertaining to evaporation of water off the surface area of the reservoir.

Response: This was addressed in the Draft EA, under the water quality section. An estimated 955 acre-feet would be lost annually due to evaporation.

38. **Commenter:** Peter R. Arambel, President of Dunton Sheep Company and Midland Live Stock Company

Comment:

23. Bur. Rec's own NEPA Handbook notes: "Compliance with NEPA is a Federal responsibility and involves the participation of Federal, State, tribal, and local agencies, as well as concerned and affected public in the planning process. NEPA requires full disclosure of the potential effects of major actions proposed by Federal agencies and accompanying alternatives, impacts, and possible mitigation. NEPA also requires that environmental concerns and impacts be considered during planning and decision-making so that steps may be more easily taken to correct or mitigate the impacts of an action." See *Handbook,* at 2.3.1.

Response: Thank you for the comment.

39. **Commenter:** Peter R. Arambel, President of Dunton Sheep Company and Midland Live Stock Company

Comment:

24. In summary, The Draft EA lacks sufficient information to assess environmental impacts of the proposed action; therefore, the Bur. Rec's statement that there are "no significant impacts" is not supported.

Response: Thank you for your comment. Based on the updated EA and analysis therein, Reclamation still finds there are no significant impacts associated with the Proposed Action. Therefore, an Environmental Impact Statement is not required.

40. **Commenter:** Peter R. Arambel, President of Dunton Sheep Company and Midland Live Stock Company

Comment:

25. Thank you for the opportunity to comment. Commentors retain the right to supplement these comments as other issues become known and/or file additional comments.

Response: Thank you for your comment.

41. **Commenter:** Wyoming Game and Fish Department
    Comment:

Terrestrial Considerations:

The uplands which will be inundated are considered crucial winter range for elk and crucial winter-yearlong range for pronghorn, yet the EA does not discuss this or evaluate the impacts to this habitat. This project will reduce the available sagebrush community habitat for these species. Habitat treatments such as forb seeding, burning, spraying, or mowing within the general area could help offset this habitat loss. We recommend working with the Department's local wildlife and habitat biologists to design and conduct sagebrush habitat treatments in the vicinity of the project area.

Response: The EA has been updated to reflect the impacts on elk and pronghorn habitat.

42. **Commenter:** Wyoming Game and Fish Department
    Comment:

Aquatic Considerations:

Based on our present understanding of this project as described in the EA, we perceive no potentially significant negative effects from the project, nor do we anticipate significant fishery benefits that warrant the project claiming credit for.

Response: It is unclear what benefits the EA is claiming for the fishery. Reclamation cannot find reference in the EA that the Proposed Action would benefit the fishery.

43. **Commenter:** Board of County Commissioners, Sublette County, Wyoming
Comment:

Generally, Sublette County supports this project as it will increase the agricultural economic base of the affected area as well as enhance recreational opportunities by expanding the reservoir. It is an opportunity to increase the beneficial use of Wyoming's water within Wyoming and within the Big Sandy watershed. Although Sublette County supports the project, we have major concerns with how the Bureau of Reclamation (BOR) has proceeded with the EA.

Response: Thank you for your comment.

44. **Commenter:** Board of County Commissioners, Sublette County, Wyoming
Comment:

In spite of the fact that over half of the Big Sandy reservoir is located in Sublette County, the County was not even notified about the project or offered any opportunity to become a cooperating agency.

Response: Reclamation did not send a letter to Sublette County, Wyoming notifying them of the proposed project. Reclamation did send a letter for the second Draft EA to the Sublette County Board of Commissioners.

45. **Commenter:** Board of County Commissioners, Sublette County, Wyoming

Comment:

The Big Sandy Reservoir Project will impact nearly 500 acres of property, yet the EA does not discuss impacts to private property or how those impacts will be mitigated. Furthermore, the most affected private property owner, Mr. Arambel, was not even notified of the project.

Response: The proposed project would impact an additional 98 acres of private land on which Reclamation already has an easement for flooding. The second Draft EA addresses the impacts to private land.

A letter was sent to Mr. Arambel notifying him of the Draft EA. "Notification of the project" is not part of the NEPA process.

46. **Commenter:** Board of County Commissioners, Sublette County, Wyoming
Comment:

This project could impose unintended consequences for sage grouse habitat, yet there is no discussion in the EA describing the impact or actions to be taken to mitigate the impacts to sage grouse. Please work with Wyoming Game and Fish to define these impacts and develop a mitigation strategy.

Response: An entire section in the Draft EA covered impacts to sage grouse, including use of Wyoming Game and Fish Department's (WGFD) Density Disturbance Calculation Tool (DDCT). Also included was a letter from WGFD approving the DDCT analysis.

47. **Commenter:** Board of County Commissioners, Sublette County, Wyoming
Comment:

In the cumulative effects section of the EA, there is no discussion of impacts to livestock grazing on agricultural operations in Sublette County. Please describe the loss of grazing AUMs and what is being done to compensate for that loss.

Response: There would be no loss of grazing AUMs on Federal public lands as there are no grazing permits on Reclamation withdrawn lands around the reservoir. Impacts to grazing on private lands is covered in Section 3.3.17 of the second Draft EA.

48. **Commenter:** Board of County Commissioners, Sublette County, Wyoming

Comment:

It has been reported to Sublette County by Mr. Arambel, that his private property was illegally trespassed on by BOR officials working on this project. What is being done to rectify this situation? Private property located immediately downstream and owned by Mr. Arambel will likely become nonproductive because of additional salinity. What is being done to mitigate this impact?

Response: Reclamation did not trespass because Reclamation has an easement on Mr. Arambel's land that allows for ingress and egress on said easement. The warranty deed conveying the easement is available on pages 280-283 of the pdf found on Sublette County's website at http://gwmap.s3.amazonaws.com/sublette/landrec/wd/006WD.pdf. An updated version of the land ownership map displaying this information is in the new Draft EA.

It is unclear what property is being referenced nor the expected manner in which soil salinity would increase under the Proposed Action. Except for the annual maximum of 955 acre-feet of evaporation, the amount of water released from the reservoir would be the same as in the past. The timing of the releases may be altered; however, this would not affect soil salinity.

49. **Commenter:** Board of County Commissioners, Sublette County, Wyoming
Comment:

Overall, there has been a severe lack of communication between the BOR and Sublette County as well as between the BOR and Mr. Arambel, the affected property owner, who lives in Sublette County. Please address this situation, both with Sublette County and with Mr. Arambel.

Response: Reclamation sent a letter to Sublette County notifying them of the new Draft EA. Reclamation has been in contact with Mr. Arambel since the beginning of the NEPA process. Communication between WWDC and Mr. Arambel is unrelated to NEPA as mentioned in comment 16.

50. **Commenter:** David Vlcek, Bonneville Archaeology

Comment:

First, under Purpose and Need, the EA states that flood control is one purpose of the project. Yet the document also states that "no exclusive flood control capacity is provided at Big Sandy Dam". The contradictions are obvious. EA at page one also states that a Risk Analysis, a Value Planning Study and other studies have previously been completed by BuRec. These efforts are not summarized, nor do they appear as appendices to the EA. In reality, the only purpose of the project seems to be to provide additional water storage for irrigation.

Response: The statements are not incongruous. Big Sandy Dam was not built to provide flood control. However, a secondary benefit of the dam is the ability to provide some flood control. The studies are not fully summarized in the cited paragraph, but the Proposed Action was developed from the studies, so the results of the studies is the Proposed Action.

51. **Commenter:** David Vlcek, Bonneville Archaeology

Comment:

1.3 is titled Scoping, Coordination and Public Involvement. BuRec has failed to scope the project with the Sublette County Commissioners, the general public, affected interests such as Mr. Pete Arambel, BLM, or announced a public meeting, at least in Pinedale, the Sublette County seat. Too, I have attended Wyoming Water Development Commission (WWDC) meetings in Pinedale and have no recollection of this project ever having been mentioned. At 1.3.2 BuRec states that public meetings "will be conducted". They have not been and BuRec and WWDC have failed to adequately inform the public, county officials and other potentially interested parties of the NEPA effort. 1.36. states that a Class III cultural resources survey was conducted (see also Ch. 3) but no report exists for WySHPO or other interested parties to review1.3.8 states that Native American Consultation will be done through the public involvement process, yet no public involvement process has been forthcoming. And which Tribes are envisioned for some vague future consultation? The document is silent upon this.

Response: Reclamation did not send a letter to the Sublette County Commissioners, but did so on the second Draft EA. The general public was notified of the first Draft EA, including a note at the Farson Post Office. Mr. Arambel was sent a letter notifying him of the NEPA process, as was the BLM Rock Springs field office. Reclamation's NEPA process is separate from any presentations of the WWDC. A public meeting was conducted on November 7th, 2017 in Farson, Wyoming. A cultural resource report has been prepared and submitted to Wyoming SHPO. Wyoming SHPO concurred with Reclamation's determination of effects. An MOA will be completed prior to issuing a decision document. Inter-governmental consultation with Native American Tribes is an important portion of the NEPA process that Reclamation takes seriously. Any Tribes with potential interest in the proposed project are being consulted.

52. **Commenter:** David Vlcek, Bonneville Archaeology

Comment:

1.5.1 mentions the BLM Rock Springs RMP revision. In a phone conversation I had with you (Mr. Baxter) on November 29th, you indicated a single letter was sent to BLM Rock Springs. Any reply was not articulated and it appears that BLM overall has been largely left in the dark concerning the project.

Response: A letter was sent to the BLM Rock Springs field office notifying them of the project. They were previously made aware of the project when Jared Baxter called the office to find out who the letter should be addressed to. He explained who he was, where the proposed project was, and who would be the best contact for the letter. Reclamation received no response from the BLM, whether formal or informal comments.

53. Commenter: David Vlcek, Bonneville Archaeology

Comment:

1.6 states that the EA is to determine of BuRec should authorize and provide funding and in concert with WWDC implement then project. Considering the many outstanding efforts neither BuRec or WWDC have done to date a FONSI is totally premature at this time. For example, 2.3.7.2 and 7.3 mentions haul roads and borrow areas. They are not identified within the EA, so the reader does not know where they will be, nor can one assess their potential impact. 2.3.7.10 involves restoration and rehabilitation. I was shocked and appalled when BuRec and the Wyoming Department of Transportation (WDOT) upgraded U,S, Highway 189 at Fontenelle Reservoir. The magnificent Eocene cliff face along the highway was flat bladed, destroying the thousands of years of exposed sediment and no attempt was made to restore the cliff face to its prior condition. BuRec's "track record" in reclamation and restoration is not satisfactory.

Response: Thank you for your comment. No new haul roads would be created as part of the Proposed Action. The borrow area was identified after the Draft EA was published, and is included in the second Draft EA.

54. **Commenter:** David Vlcek, Bonneville Archaeology

Comment:

2.5 is vague in the extreme. Surface disturbance will be confined to previously disturbed areas "to the extent possible" Where? If five feet of additional dam height is constructed and large quantities of additional water storage result, certainly previously nonflooded lands will be inundated. Dust control is mentioned in passing, yet no specifics are offered. Existing improvements such as fire pits benches, out houses (no mention is made of the requisite access roads and parking areas) and the like will be moved, but to where? How can these facilities be placed in "previously disturbed areas"?

Response: Confining surface disturbance to previously disturbed areas is a Reclamation best management practice. Surface disturbance generally refers to disturbance created by equipment necessary to implement the Proposed Action. The county road to the dam from Highway 189 would be the access road. Staging areas are identified in Figure A-3 in Appendix A of the Draft EA. Recreation facilities would be moved a short distance (<50m) in order to stay close to the reservoir, remaining in disturbed areas.

55. **Commenter:** David Vlcek, Bonneville Archaeology

Comment:

Table 3-1 suggests no prime and/or unique farmlands will be affected. This seems contradictory to Mr. Pete Arambel, who claims his lambing grounds will be inundated. He also suggests compensation via land transfer. Where will these lands come from? What of Mr. Arambel's concerns? He has indicated he was not consulted during development of the project. Why not?

Response: Prime and unique farmland refers to the lands designated by the Natural Resource Conservation Service (NRCS) as prime and/or unique farmland under the Farmland Protection Policy Act (contained in the Agriculture and Food Act of 1981).

The land exchange is negotiated between Mr. Arambel and the State of Wyoming. Reclamation is not party to the negotiations, and no Federal land is part of the swap.

Mr. Arambel was notified when the Draft EA was available to the public. The NEPA process is separate from the processes for the State of Wyoming. See response to comment 16 for more information.

56. **Commenter:** David Vlcek, Bonneville Archaeology

Comment:

Section 3.3.3 is the Cultural Resources section. Zachary Nelson, your archaeologist has apparently inventoried a large amount of space around the reservoir in what is described as the Area of Potential Effect (APE). Yet the APE is not defined or illustrated. And as of this writing (Dec. 6, 2017), no inventory report is available for review. While many previously recorded sites are within the project area, many of them were recorded several decades ago. It has been my experience that sites recorded in the 1960's, 70's, 80's and 90's will not stand up to the standards in the twentieth century. I understand that Zack Nelson is in the process of re-recording some of this data, yet the results are not available as of this writing. Old determinations of Not Eligible will need to be revisited. While the Oregon Trail is mentioned in passing, actually the affected resource is the Sublette Cutoff, 48SW1841, an integral part of the Nation's National Historic Trail system and a long standing National Register Eligible Historic Property. Reclamation excludes it from the short list of Eligible properties (N=5) and thus adds it to the lengthy Not Eligible list. This is totally unacceptable. Modern evaluation requirements of potentially affected segments of the National Historic Trails system require visibility assessments, viewshed studies condition assessments and documentation. All this is lacking. The MOA suggested does not include mention of the Oregon California Trails Association (OCTA), either the Sublette County or Sweetwater County Historic Preservation Commissions (CLGs), the Wyoming Association of Professional Archaeologists (WAPA), or the Wyoming Historical Society. These groups, at a minimum, include potentially "interested parties". I sit on the executive boards of WAPA and the Sublette County CLG and no outreach was made to these bodies. Clearly, Adverse Effects are envisioned to National Register historic properties (as the document indicated) so this alone should eliminate a FONSI, as a FONSI can only be supported by No Effect determinations to National Register Eligible historic properties. No mitigation is offered in the EA. And, of course, the Class III report is not yet available for review. It is totally premature to suggest that no Eligible archaeological sites will be impacted by reservoir expansion. Too, no mention is made of past illegal artifact collecting which is rampant at Big Sandy Reservoir and how such impact may make surface expressions of sites difficult or impossible.

Response: (1) The direct APE includes 508.16 acres of proposed inundation between elevation 6757.5 and 6762.5 feet above mean sea level. However, a total of 1,114.33 acres were surveyed for this project including a buffer (as appropriate) in particular areas. (2) Sites identified in the APE and additional inventory area were re-evaluated. (3) Site 48SW1841 was incorrectly identified as being in the APE. It is not. It is located near the APE and a viewshed analysis occurred. (4) The organizations mentioned were invited to participate in the Section 106 process that occurred after the draft EA was published for public comment. (5) A FONSI can be reached with a mitigation document in place, which will occur. (6) SHPO and Reclamation concurred on determinations of effect for all sites located in the direct APE and inventory area and will sign an MOA for mitigation. (7) The level of illegal artifact collecting is difficult to evaluate. As archaeologists, we rely heavily on surface manifestations of artifacts to determine site type and density. In this case, archaeologists surveyed Big Sandy prior to its use for recreation (Metcalf [SHPO project no. 52-1] and Davis [SHPO project no. 53-1]) and collected artifacts from across the reservoir basin and surrounding areas. Thus, significant loci of artifacts were discovered,

excavated, and important artifacts collected prior to wide-spread use of the area for recreational purposes.

57. **Commenter:** David Vlcek, Bonneville Archaeology

Comment:

I visited the reservoir on Dec. 1st, 2017, took several pictures, and examined the perimeter of the extant reservoir. I did note surfaces suggestive of poor buried prehistoric site potential but I also observed and photographed cut banks containing over a meter of soils. A large dune system exists on the northeast portion of the reservoir and such eolian deposits are known to contain abundant, buried archaeological deposits. Has Zack Taylor conducted evaluative testing is the dune field? If not, why not? Too, both the east and west sides of the existing reservoir contain low bays (willow habitats) with significant deposits of recent A and B horizon soils With thick vegetative comer, surficial examination alone is insufficient to assess presence of buried archaeological materials. In such settings, evaluative testing should be conducted to assess buried site potential. It remains to be seen if any of this work was performed by Dr. Taylor or other qualified archaeologists. As published I consider the EA's Cultural Resources section inadequate, incomplete, misleading and currently unverifiable.

Response: The cultural resources inventory was completed to the standards of the State Historic Preservation Office. Most of the eolian deposits are well outside of the proposed inundation area on the northeast side of the reservoir. The areas to be flooded were examined for surface manifestations of cultural material.

58. **Commenter:** David Vlcek, Bonneville Archaeology

Comment:

3.3.9.2 confuses me. It states that there are no structures within the proposed expanded boundary of the 100 year floodplain. Then why are picnic tables, fire pits, outhouses, parking and etc. being moved? And what of wildlife? My Dec. 1st visit involved location of a red fox scurrying out of a willow bottom on the west reservoir side, and a jack rabbit in the same area. Such meadow wetlands are described as "low quality, marginal wetlands". I beg to differ.

Response: References to the structures was removed from the EA. The determination of "low quality, marginal wetlands" came from the wetland delineation approved by the USACE.

59. **Commenter:** David Vlcek, Bonneville Archaeology

Comment:

3.3.10.2 seems to suggest that no Corps of Engineers 404 Permit will be required for this project. How can inundating over 300 acres of new land be covered by a nationwide Permit? Is this in error?

Response: The first Draft EA clearly stated that minor discharges associated with the spillway modification can be authorized by the Army Corp of Engineers NWP 18. The paragraph in the EA comes directly from the Army Corps letter Reclamation received specifically for this project. The EA never suggested that the whole project is exempt from Army Corps permitting. Only certain aspects of the project fall under an Army Corps exemption, which is clearly stated in the paragraph. A NWP will be required for the project.

60. **Commenter:** David Vlcek, Bonneville Archaeology

Comment:

3.3.11 incorrectly describes brown and rainbow trout as native fish species. They are not. The fish section identifies Big Sandy as a less desirable fishing destination. Thus expansion of the reservoir has little fishing recreational potential. Page 30, paragraph 2 states that "Current operation of the Big Sandy Reservoir has not resulted in creation of large areas devoid of vegetation around the perimeter". This is false. My Dec. 1st visit noted and I photographed large areas devoid of vegetation, low water conditions and cut bank erosion. Not to mention the parking areas, vehicle paths camping spots and the like that are devoid of vegetation.

Response: The EA was updated to reflect the fact that brown and rainbow trout are not native fish species to Big Sandy. Some areas are devoid of vegetation; however, these areas are generally either below the high water mark (created by the reservoir) or above it (parking areas, etc.). Other areas appear devoid of vegetation, but in fact grasses and sedges grow during the spring and summer. These species may be difficult to see in December. Therefore, the statement that the "Reservoir has not resulted in creation of large areas devoid of vegetation around the perimeter" is accurate.

61. **Commenter:** David Vlcek, Bonneville Archaeology
    Comment:

Table 3.8 lists adverse effects to cultural resources, "minor effects" to recreation and T and E species (what are "minor effects"?) and effects to wetlands and wildlife. Thus, assessing project cumulative effects as No Effect" is inappropriate, premature and not supported by data contained in the EA.

Response: "Minor effects" means the effects are expected to be short-term, localized, and/or do not rise to a level of significance (as defined in NEPA and CEQ regulations). If impacts are not expected to continue much beyond the duration of construction, a "no effect" is appropriate.

62. **Commenter:** David Vlcek, Bonneville Archaeology
Comment:

4.1.2 mentions silt fencing "if necessary" Who decides this?

Response: Silt fencing would be necessary in situations where siltation is avoidable by using fencing. Whether it is necessary is determined by conditions expressed in the construction contract.

63. **Commenter:** David Vlcek, Bonneville Archaeology

Comment:

4.6. mentions cultural resources discovered during construction. My 40 years of archaeological work in SW Wyoming clearly indicates that such discoveries are only reported and evaluated if a qualified archaeologist is present during construction, i.e. monitoring. No mention is made of this well entrenched and highly successful technique. Obviously notifying the Utah SHPO is a glaring error, as the project takes place in Wyoming. Also, the mention of discovering human remains in the project area excludes involvement of the appropriate law enforcement entities. Virtually all discoveries of human remains made during or subsequent to construction qualify as Unattended Death scenarios, thus the discovery is considered as a potential crime scene until so released by law enforcement authorities. My 40+ years of experience in such matters in Wyoming indicates: You call the police first.

Response: (1) Construction monitoring is an excellent technique, but not necessary for watching the reservoir fill. (2) The Utah SHPO reference is corrected in the final EA. (3) Yes, the police should be called first.

64. **Commenter:** David Vlcek, Bonneville Archaeology

Comment:

Figures A 2 and A 3 are of poor quality yet they are essential to assessing the project impact area. Too no mention is made of a Cumulative Impact Assessment Area, though NEPA indicates the CIAA should be part of the evaluation process.

Response: The Draft EA was accessed online at Reclamation's website (https://www.usbr.gov/uc/envdocs/ea/pdf/BigSandyEnlargeDraftEA.pdf) as recently as January 30, 2018. The images appear very readable.

A CIAA is not mentioned in NEPA/CEQ regulations nor in Reclamation NEPA guidance. Therefore, it is not required in assessing cumulative impacts.

65. **Commenter:** David Vlcek, Bonneville Archaeology

Comment:

Finally, it is eminently apparent that the benefits of this project are exclusively the Eden Valley Irrigation District users. I see no overall public benefit of the project. Thus I strongly object to spending federal and state dollars, my tax dollars, on such a narrowly focused effort. If the Eden Valley Irrigation District wants this project to proceed, then the Eden Valley Irrigation District themselves should foot the entire cost of the project, including all construction, mitigation, reclamation and evaluation studies. It appears to me as one big Pork Barrel project that no public monies should support.

Response: During spring of 2016, an application was submitted to WWDC for funding the reservoir enlargement and associated modifications (including Big Sandy Feeder Canal reconstruction) through the Upper Colorado River Basin Fund Memorandum of Agreement (MOA). The MOA provides funding through a percentage of collected hydropower revenues generated by Colorado River Storage Projects (CRSP) for participating projects within the Upper Colorado River Basin. The application was approved by the WWDC at their June 2017 meeting. Reclamation reviewed the application and approved the project near the beginning of 2017 for funding.

66. **Commenter:** David Vlcek, Bonneville Archaeology

Comment:

Thank you for the opportunity to comment. I wish to be identified as an Interested Party with standing in this and future related NEPA efforts, informed of any scheduled public meetings, on-site fieldwork and additional project documentation.

Response: Thank you for your comment.

67. **Commenter:** Gary Wockner, PhD, Director, Save the Colorado
Comment:

First, the DEA completely fails to identify or analyze the streamflow reduction in the Big Sandy River, downstream of the dam, due to the proposed reservoir enlargement. The "hydrology" section of the DEA (Section 3.3.5) is ridiculously facile and non-technical. The section completely fails to:

- Identify the amount, in acre feet or cubic feet per second, of additional water diverted from the Big Sandy River below the proposed expanded dam.
- Analyze the impacts of the additional water diversion on the hydrology of the river below the dam.

Then, absurdly, in Section 3.7 (page 40), in the "Summary of Environmental Effects" table, the DEA says there is "No Effect" on the hydrology of the Proposed Action.

Of course, there has to be an effect on the hydrology of the river, because the reservoir is proposed to be expanded precisely to take more water out of the river. In fact, the DEA identifies that the reservoir is proposed to be expanded – Section 1.2, the "Purpose and Need", states exactly that:

> "The current storage capacity is 38,600 acre-feet. A 5 foot raise of the spillway crest would allow a total storage capacity of 52,300 acre-feet or an increase of 13,700 acre-feet."

And then says,

> "The additional water stored in the reservoir is needed to firm up the water supply for lands irrigated in the Farson/Eden area through the Eden Project."

The streamflow reduction must be identified, and then the environmental impacts of that reduction must be analyzed on the downstream:

- Wetlands
- Water Quality
- Fishery
- Aquatic Life
- Other Wildlife Resources.

Response: Only spills from the reservoir enter the Big Sandy River below the dam. Water from the outlet works is released into the Means Canal, not the river. Hydrology, wetlands, the fishery, and aquatic life would be minimally affected because the river is dry or nearly dry for most of the year. This would not change if the reservoir were enlarged.

68. **Commenter:** Gary Wockner, PhD, Director, Save the Colorado
Comment:

Second, because the DEA completely fails to identify or analyze the reductions in streamflow in the river, and the total acre-feet reduced, the DEA completely fails to identify and analyze any cumulative impacts that may occur on the flow in the Green River downstream and the Colorado River further downstream.

As the Bureau of Reclamation is well aware, the entire Colorado River system – including its tributaries in Wyoming which includes the Big Sandy River – is extremely stressed with threats of shortages, compact calls, and other types of "contingency plans" to address the likely and looming water shortages. The Bureau itself has spent considerable resources studying the "water supply and demand" problem on the Colorado River[4]. The amount of new water

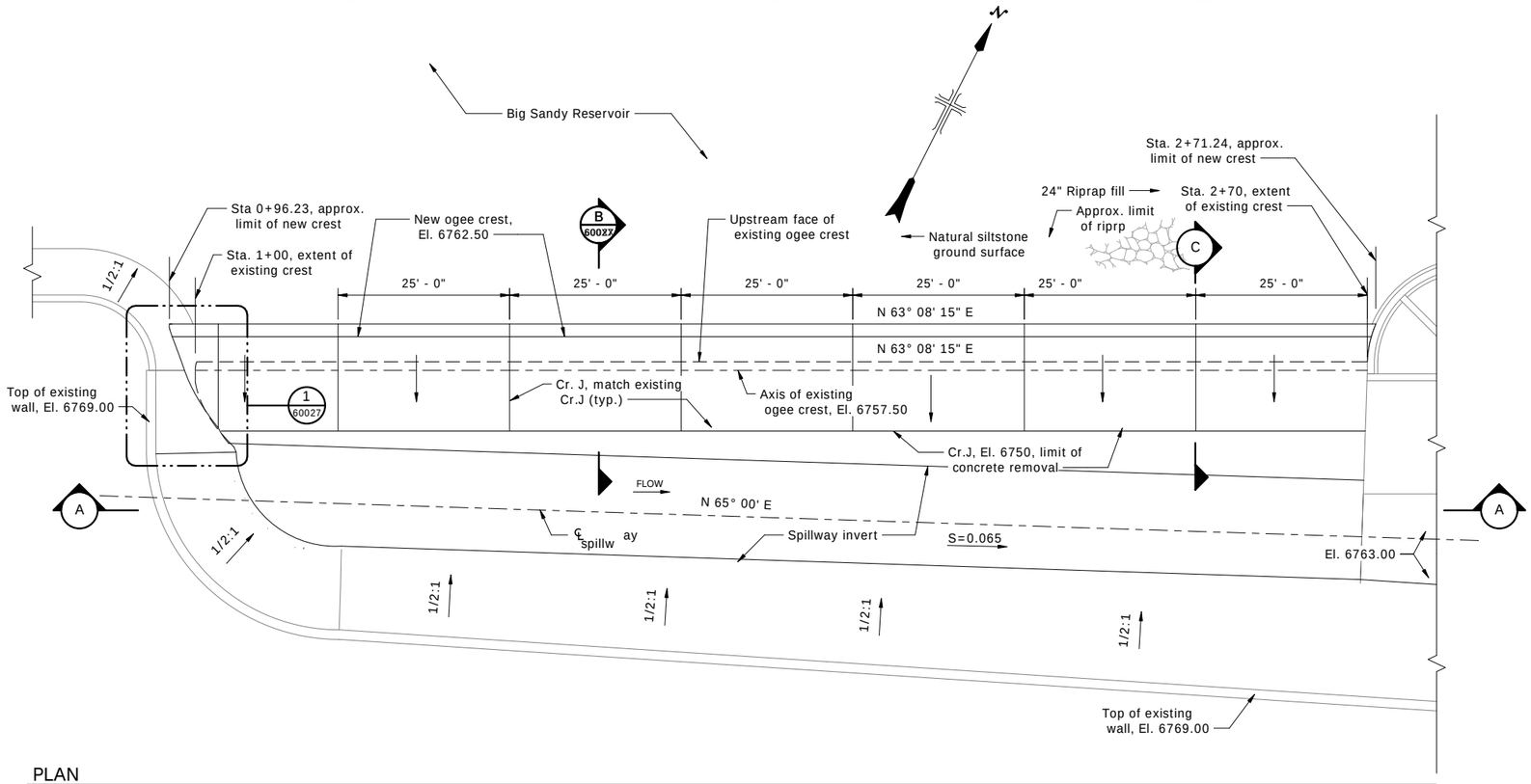
[4] https://www.usbr.gov/lc/region/programs/crbstudy.html

diverted from the proposed expansion of Big Sandy Reservoir must be identified, and then the cumulative impact of that new diversion must by analyzed in the face of the threats to water supply in the Colorado River basin.

Further, climate change scientists predict that the amount of water in the Colorado River system is going to decrease even further due to the impacts of climate change[5]. Any new diversion of water from the entire system must analyze its cumulative impact coupled with climate change reductions.

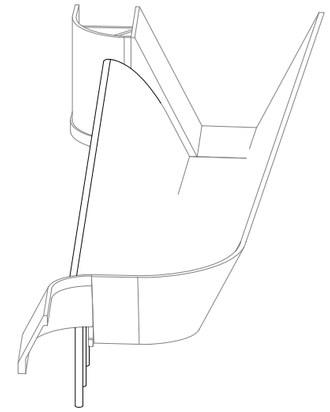
Response: Thank you for the comment, and for your concern for the future of the Colorado River system. Additional text quantifying the local flow impact has been added to sections 3.3.5 and 3.3.7. Hydrologic modelling for the Ultimate Phase – Green River Block water exchange contract between Reclamation and the State of Utah shows negligible impacts to water resources based on the development of 24 times the amount of depletions proposed in this EA (Patno 2018; Draft EA available at https://www.usbr.gov/uc/envdocs/ea/GreenRiverBlockWaterExchangeContract-DraftEA.pdf). Therefore, the cumulative effects of enlarging the reservoir on the overall Colorado River system would be negligible. Executive Order 13783 "Promoting Energy Independence and Economic Growth" rescinds the CEQ's guidance on including climate change in NEPA analyses.

Appendix G – Engineering Drawings



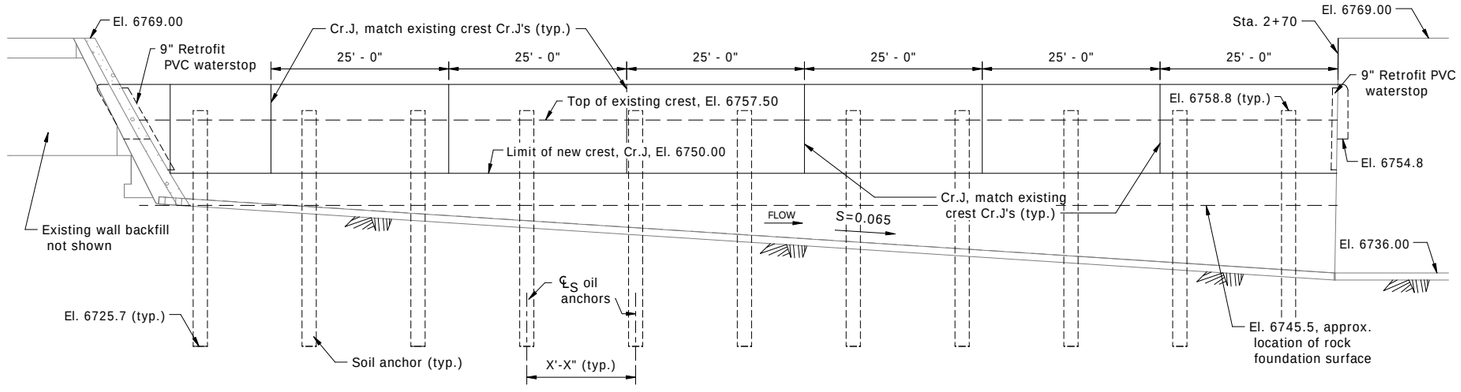
PLAN

0 10' 20'



ISOMETRIC

(NOT TO SCALE)



A SECTION

0 10' 20'

NOTES

1. For general concrete outline notes, see 40-D-7012.
2. For general notes and minimum requirements for detailing reinforcement, see 40-D-6263.
3. Design of concrete reinforcement based on a minimum yield stress of 60,000 psi and concrete having 28-day strength of 4,500 psi minimum.
4.

REFERENCE DRAWINGS

EXISING SPILLWAY CREST -CON CRETE REMOVAL _____ 153-D-600xx
SPILLWAY CREST RAISE - EXCAVATION _____ 153-D-600xx

RECLAMATION
Managing Water in the West

ALWAYS THINK **SAFETY**

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

EDEN PROJECT

BIG SANDY DAM

RESERVOIR ENLARGEMENT PROJECT

REV NO	DATE	NAME PROF. ABBR.	STA	DESCRIPTION

DESIGNER
DESIGNED
DRAWN
CHECKER
CHECKED
TECH. APPR. TECH APPROVER
APPROVED APPROVER
Admin Approver - TITLE
YYYY-MM-DD

SPILLWAY CREST RAISE

ISOMETRIC, PLAN AND PROFILE

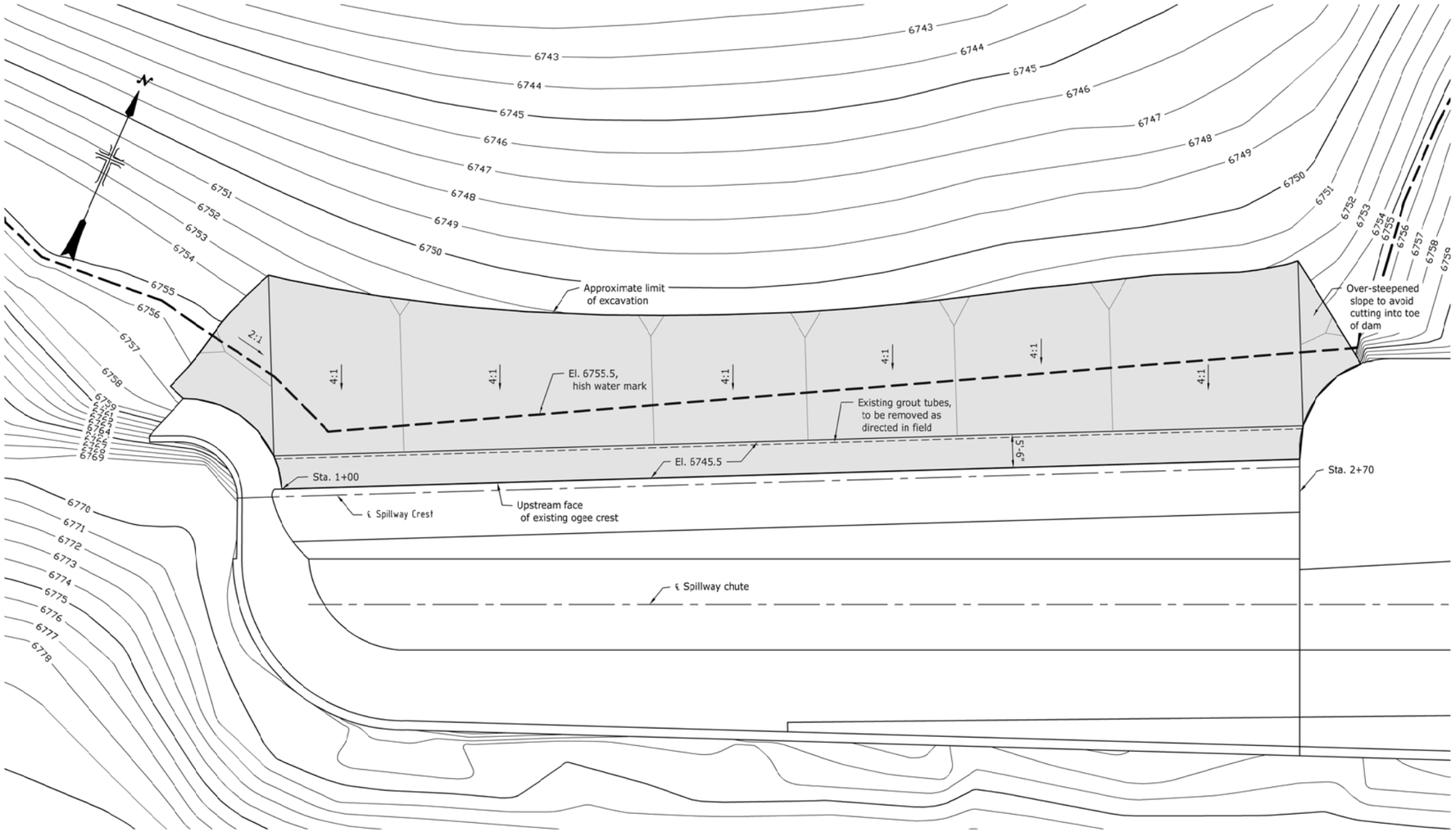
153-D-60026

DESIGN PHASE
Project Status

DATE AND TIME PLOTTED:
8/27/2018 2:03:07 PM

CAD SYSTEM:
Revit 2018.1

CAD FILENAME:
Z:\DO\TSC\Jobs\UC\Big Sandy Dams and Dikes\2017-POC-Reservoir Enlargement\FIN\DWG\Spillway\Spillway_Assy.rvt



EXCAVATION PLAN

0 10' 20'

EXCAVATION SUMMARY	
TOTAL (YD^3)	< 6755.5 (yd^3)
1200	1100

ALWAYS THINK SAFETY

"US DEPARTMENT OF THE INTERIOR" BUREAU OF RECLAMATION

PROJECT NAME
BIG SANDY DAM

DIVISION
RESERVOIR ENLARGEMENT

Draft
Not For Construction
Facility Use Only

X DESIGNED
X REVIEWED
X
X
PEER REVIEWER - TITLE

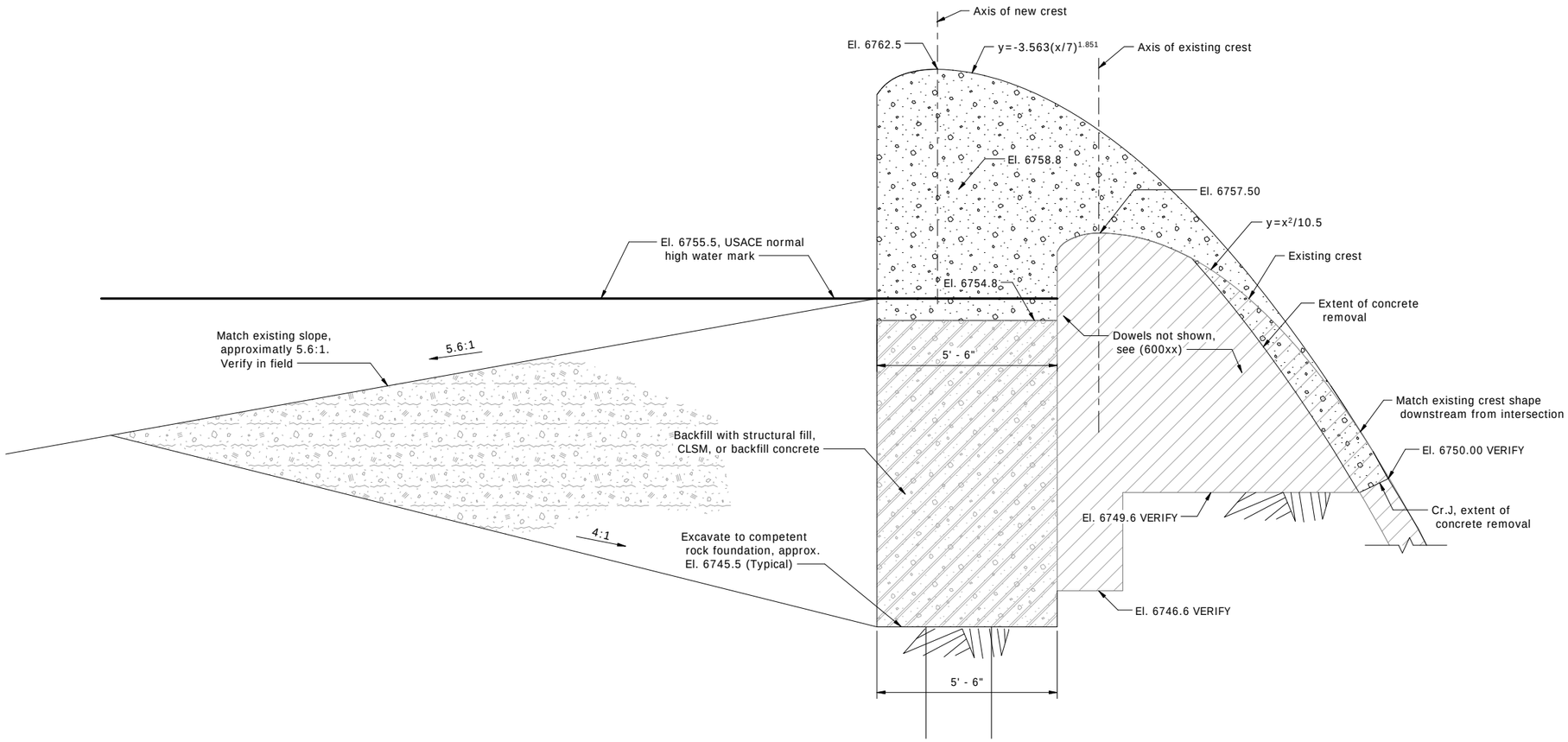
STATION NAME (CITY, ST) YYYY-MM-DD

EXCAVATION PLAN

PRJ-STA-SEQ

SHEET 1

DATE AND TIME PLOTTED
PLOTTED BY
CAD SYSTEM
CAD FILENAME



B SECTION
Scale: 1/2" = 1'-0"

Fill material below USACE High Water Mark, El. 6755.5

Material	Quantity (yd^3)
Compacted Backfill	755
Structural Concrete	23
Backfill Concrete or CLSM	322

RECLAMATION
Managing Water in the West

ALWAYS THINK **SAFETY**

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

EDEN PROJECT

BIG SANDY DAM

RESERVOIR ENLARGEMENT

REV NO	DATE	NAME PROF. ABBR.	STA	DESCRIPTION

Designer
DESIGNED
Author
DRAWN
Checker
CHECKED
TECH. APPR.
APPROVED Approver

08/27/18

BACKFILL BELOW HIGH WATER LINE, EL. 6755.5

GENERAL SECTION

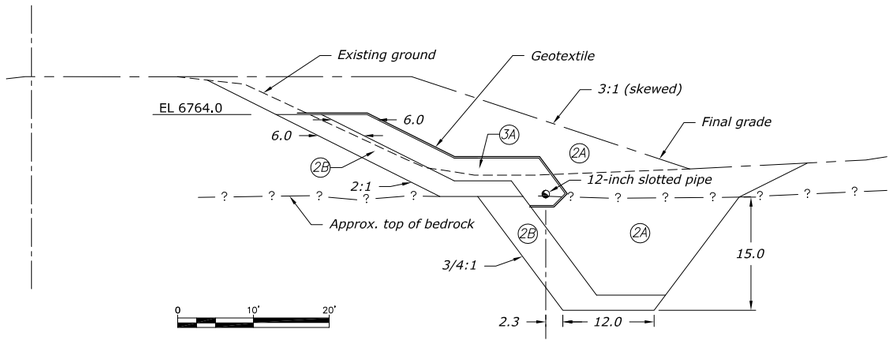
153-D-600XX

DESIGN PHASE:
Project Status

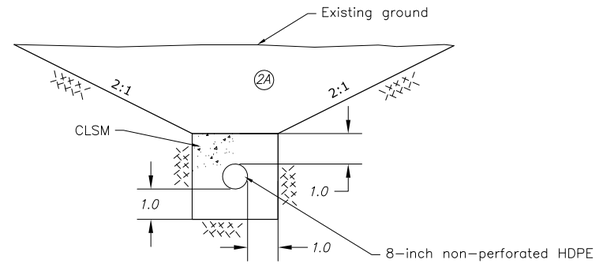
DATE AND TIME PLOTTED:
8/27/2018 2:43:00 PM

CAD SYSTEM:
Revit 2018.1

CAD FILENAME:
Z:\DO\TSC\Jobs\UC\Big Sandy Dams and Dykes\2017-PDC-Reservoir Enlargement\FIN\DWG\Spillway\Spillway_A.rvt



SECTION B-B, (####, ####)
LEFT ABUTMENT TOE DRAIN AND FILTER TRENCH STA. 0+75 TO STA. 3+77.5



SECTION C-C, (####, ####)
LEFT ABUTMENT TOE DRAIN OUTFALL
STA. 4+05 TO STA. 6+84

MATERIAL DESCRIPTION

(2A) *Sand and gravel compacted by crawler-type tractor to 6-inch layers.*

(2B) *Processed sand filter.*

(3A) *Processed gravel drain.*

0 2' 4'

RECLAMATION
Managing Water in the West

ALWAYS THINK SAFETY

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
EDEN PROJECT

BIG SANDY RESERVOIR
LEFT ABUTMENT FILTER TRENCH

X *DESIGNED*
X *DRAWN*
X *CHECKED*
TECH. APPR.
APPROVED
ADMIN APPROVAL - TITLE

DENVER, CO YYYY-MM-DD

LEFT ABUTMENT FILTER TRENCH

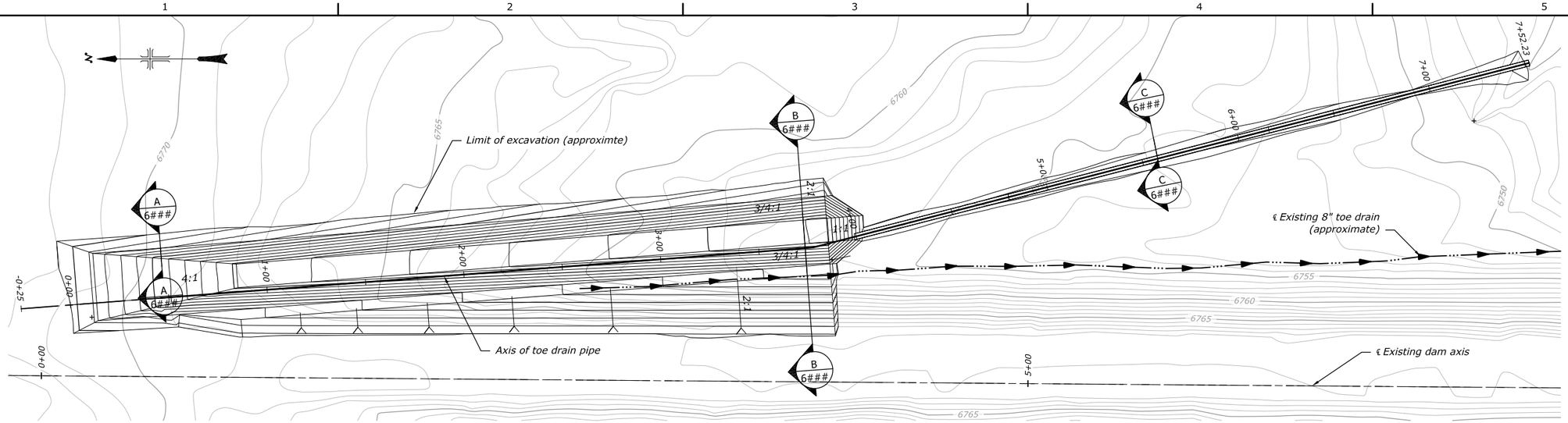
EXCAVATION PLAN, PROFILE AND DETAILS

153-D-T51865

SHEET 1

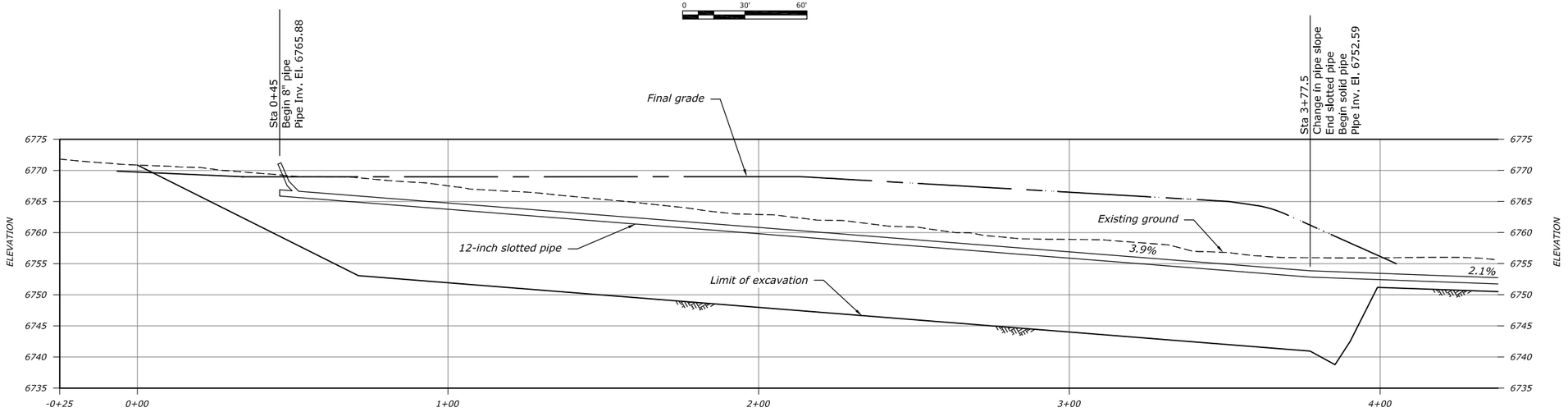
CAD SYSTEM
AutoCAD 22.0s
LAST PLOTTED
153-D-T51865-RD-1-L_ABUT_FILTER_RECOVER.DWG

LAST SAVED DATE
2018-08-21
LAST SAVED BY
USER



LEFT ABUTMENT FILTER TRENCH AND TOE DRAIN EXCAVATION PLAN

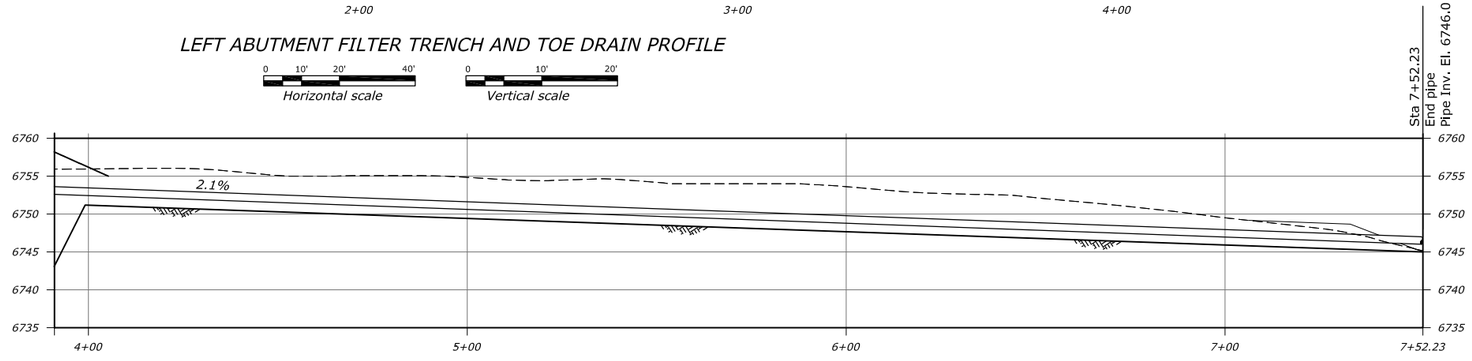
0 30' 60'



LEFT ABUTMENT FILTER TRENCH AND TOE DRAIN PROFILE

0 10' 20' 40' Horizontal scale

0 10' 20' Vertical scale



LEFT ABUTMENT FILTER TRENCH AND TOE DRAIN PROFILE

0 10' 20' 40' Horizontal scale

0 10' 20' Vertical scale

RECLAMATION
Managing Water in the West

ALWAYS THINK SAFETY

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

EDEN PROJECT

BIG SANDY RESERVOIR

LEFT ABUTMENT FILTER TRENCH

Draft
For Review Only
Not For Construction

X DESIGNED
X DRAWN
X CHECKED
TECH. APPR.
APPROVED
ADMIN APPROVAL - TITLE

DENVER, CO YYYY-MM-DD

LEFT ABUTMENT FILTER TRENCH

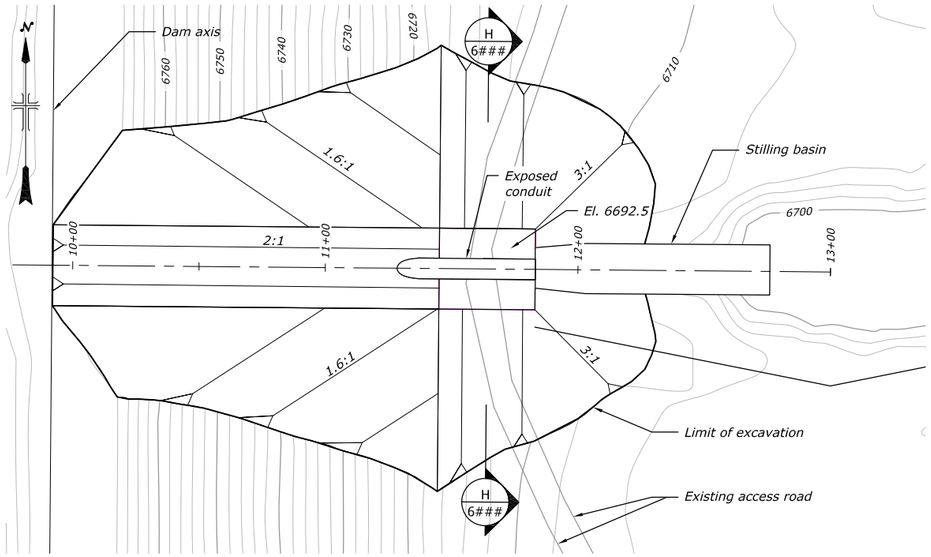
EXCAVATION PLAN, PROFILE AND DETAILS

153-D-T51865

SHEET 1

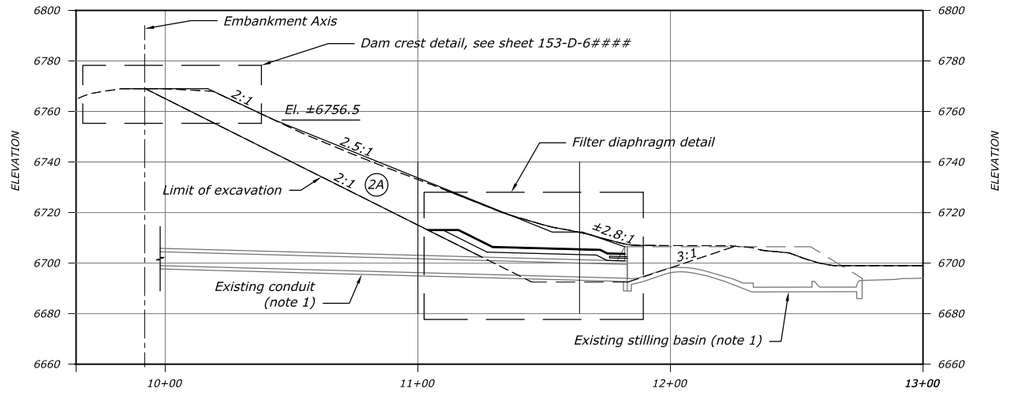
LAST SAVED DATE
2018-08-21
LAST SAVED BY
LOLSEN

CAD SYSTEM
AutoCAD 22.0s
CAD FILENAME
153-D-T51865-RD-1-L_ABUT_FILTER_RECOVER.DWG



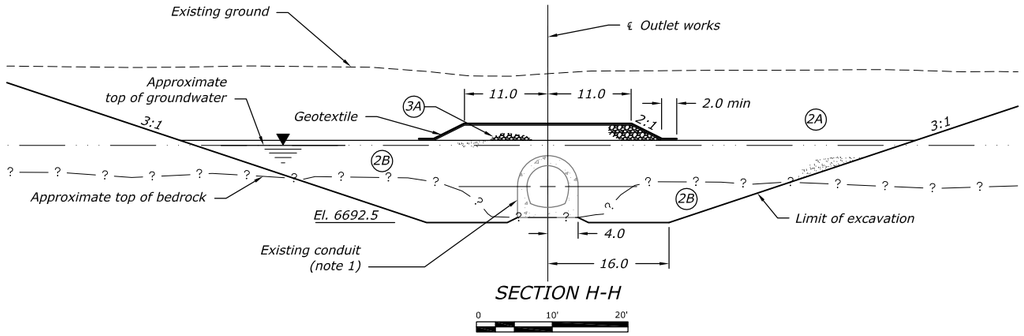
EXCAVATION PLAN

0 30' 60'



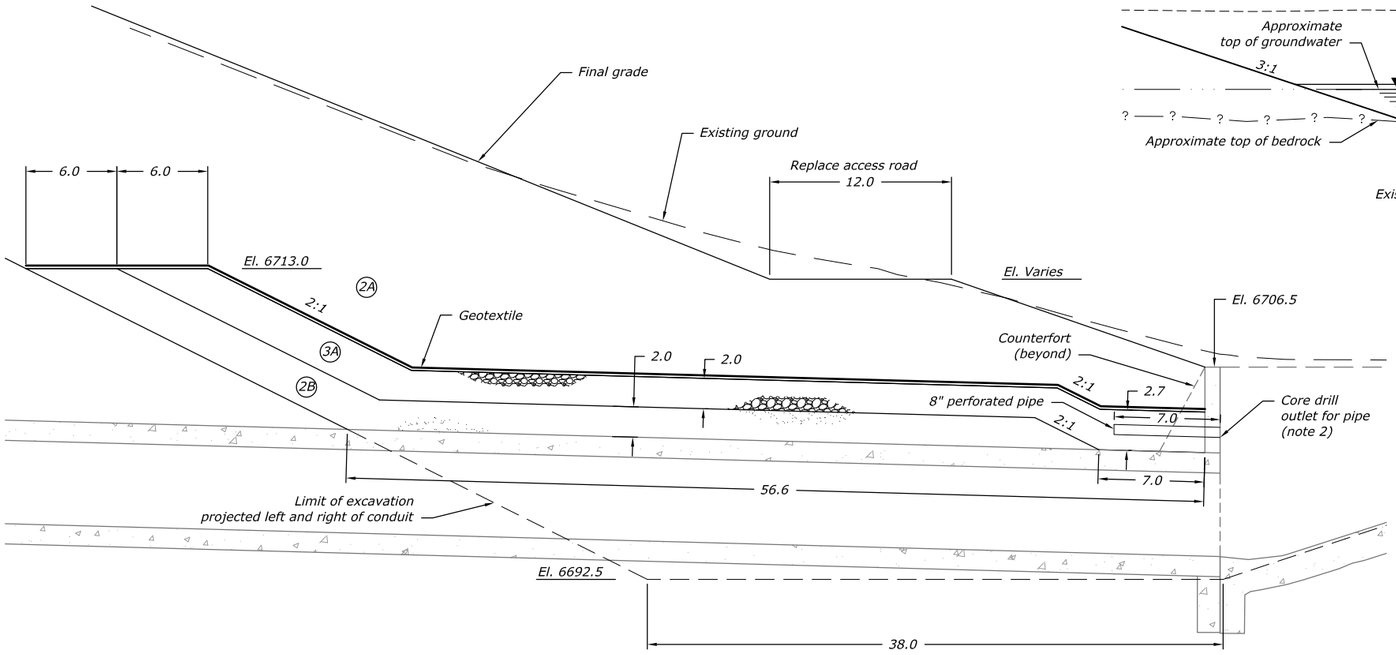
EXCAVATION PROFILE

0 30' 60'



SECTION H-H

0 10' 20'



FILTER DIAPHRAGM DETAIL

0 5' 10'

MATERIAL DESCRIPTION

(2A) Granular fill comprised predominately of sand and gravel.

(2B) Processed sand filter.

(3A) Processed drain gravel.

Notes

1. Preserve and protect existing concrete structures.
2. Locate reinforcement on both sides of wall, each way, with GPR prior to core drilling hole. Locate core hole to mitigate potential reduction in rebar clear cover.

RECLAMATION
Managing Water in the West

ALWAYS THINK SAFETY

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
EDEN PROJECT

BIG SANDY RESERVOIR
OUTLET WORKS FILTER DIAPHRAGM

X DESIGNED
X DRAWN
X CHECKED
TECH. APPR.
APPROVED
ADMIN APPROVAL - TITLE
DENVER, CO YYYY-MM-DD

OUTLET WORKS FILTER DIAPHRAGM

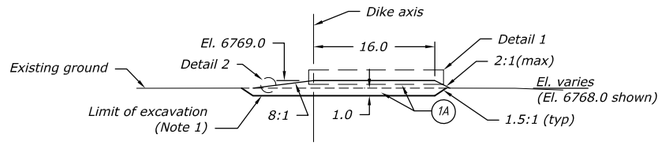
EXCAVATION PLAN, PROFILE, SECTIONS AND DETAILS

153-D-T51950

SHEET 1

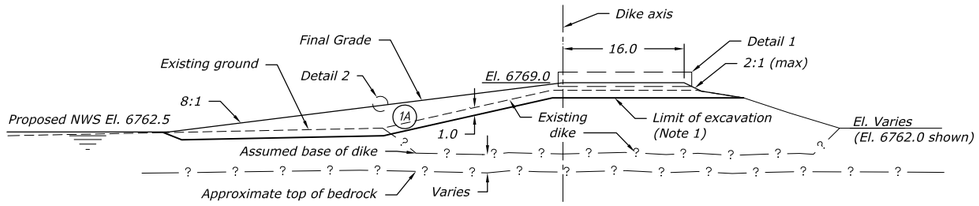
LAST SAVED DATE
2018-07-13
LAST SAVED BY
DLSEM

CAD SYSTEM
AutoCAD 22.0s
CAD FILENAME
153-D-T51950-RD-1.DWG



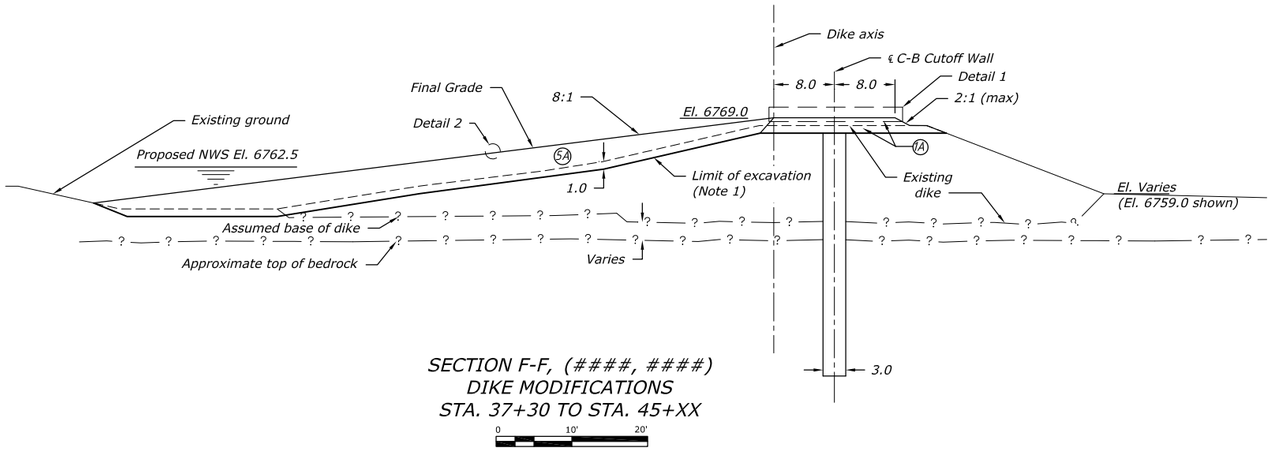
SECTION D-D, (####, ####)
DIKE MODIFICATIONS
STA. 2+50 TO STA. 10+00

0 10' 20'



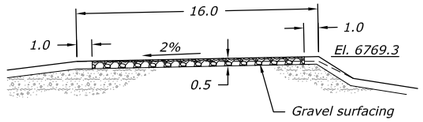
SECTION E-E, (####, ####)
DIKE MODIFICATIONS
STA. 10+00 TO STA. 37+00

0 10' 20'



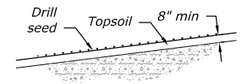
SECTION F-F, (####, ####)
DIKE MODIFICATIONS
STA. 37+30 TO STA. 45+XX

0 10' 20'

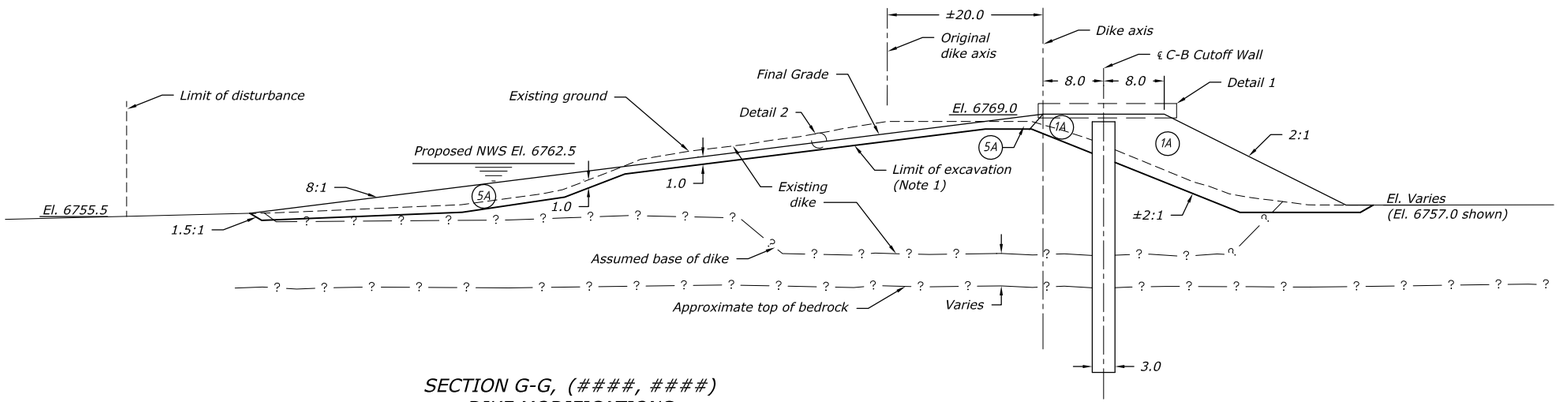


DETAIL 1, (####, ####)
DIKE CREST

0 5' 10'



DETAIL 2, (####, ####)
TOPSOIL
N.T.S



SECTION G-G, (####, ####)
DIKE MODIFICATIONS
STA. 51+00 TO STA. 70+XX

0 10' 20'

ABBREVIATIONS

NWS	Normal Water Surface
El.	Elevation

MATERIAL DESCRIPTION

(1A) Excavated material from crest and upstream slope, placed in 9–inch lifts.

(5A) Cement–bentonite trench spoils. Tracked to grade in 12–inch lifts maximum

Notes

1. Selectively excavate topsoil, existing gravel surfacing, and materials suitable for Zone 1A fill to at least 1 foot below the existing ground surface or proposed final grade, whichever is lowest.

RECLAMATION
Managing Water in the West

ALWAYS THINK SAFETY

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
EDEN PROJECT

BIG SANDY RESERVOIR
DIKE MODIFICATIONS

X DESIGNED
X DRAWN
X CHECKED
TECH. APPR.
APPROVED ADMIN APPROVAL - TITLE
DENVER, CO YYYY-MM-DD

DIKE MODIFICATIONS

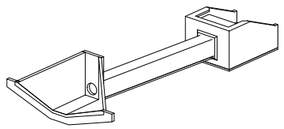
DIKE GRADING AND CUTOFF WALL SECTIONS AND DETAILS

153-D-T51968

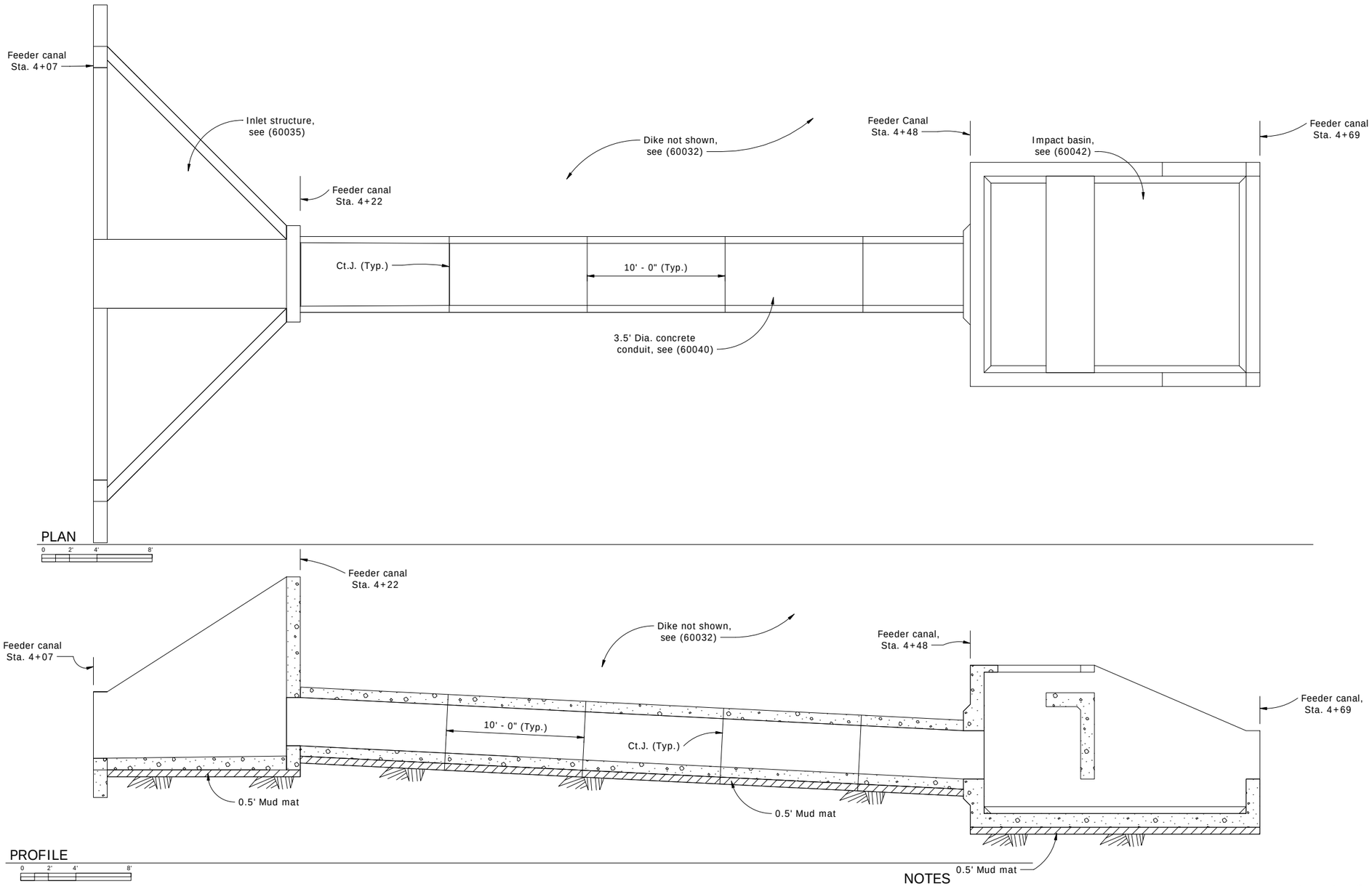
SHEET 1

LAST SAVED DATE
2018-07-13
LAST SAVED BY
IDLSEM

CAD SYSTEM
AutoCAD 22.0s
CAD FILENAME
153-D-T51968-RD-1.DWG



ISOMETRIC



PLAN

0 2' 4' 8'

PROFILE

0 2' 4' 8'

NOTES

1. For general concrete outline notes, see 40-D-7012.
2. For general notes and minimum requirements for detailing reinforcement, see 40-D-6263.
3. Design of concrete reinforcement based on a minimum yield stress of 60,000 psi and concrete having 28-day strength of 4,500 psi minimum.

REFERENCE DRAWINGS

FEEDER CANAL EXCAVATION	153-D-60033
FEEDER CANAL INLET STRUCTURE PLAN AND SECTIONS	153-D-60035
FEEDER CANAL CONDUIT PLAN AND SECTIONS	153-D-60040
FEEDER CANAL OUTLET STRUCTURE PLAN AND SECTIONS	153-D-60043

RECLAMATION
Managing Water in the West

ALWAYS THINK **SAFETY**

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

EDEN PROJECT

BIG SANDY DAM

Designer
DESIGNED
Author
DRAWN
Checker
CHECKED
TECH. APPR.
APPROVED Approver
07/10/18

FEEDER CANAL

PLAN AND PROFILE

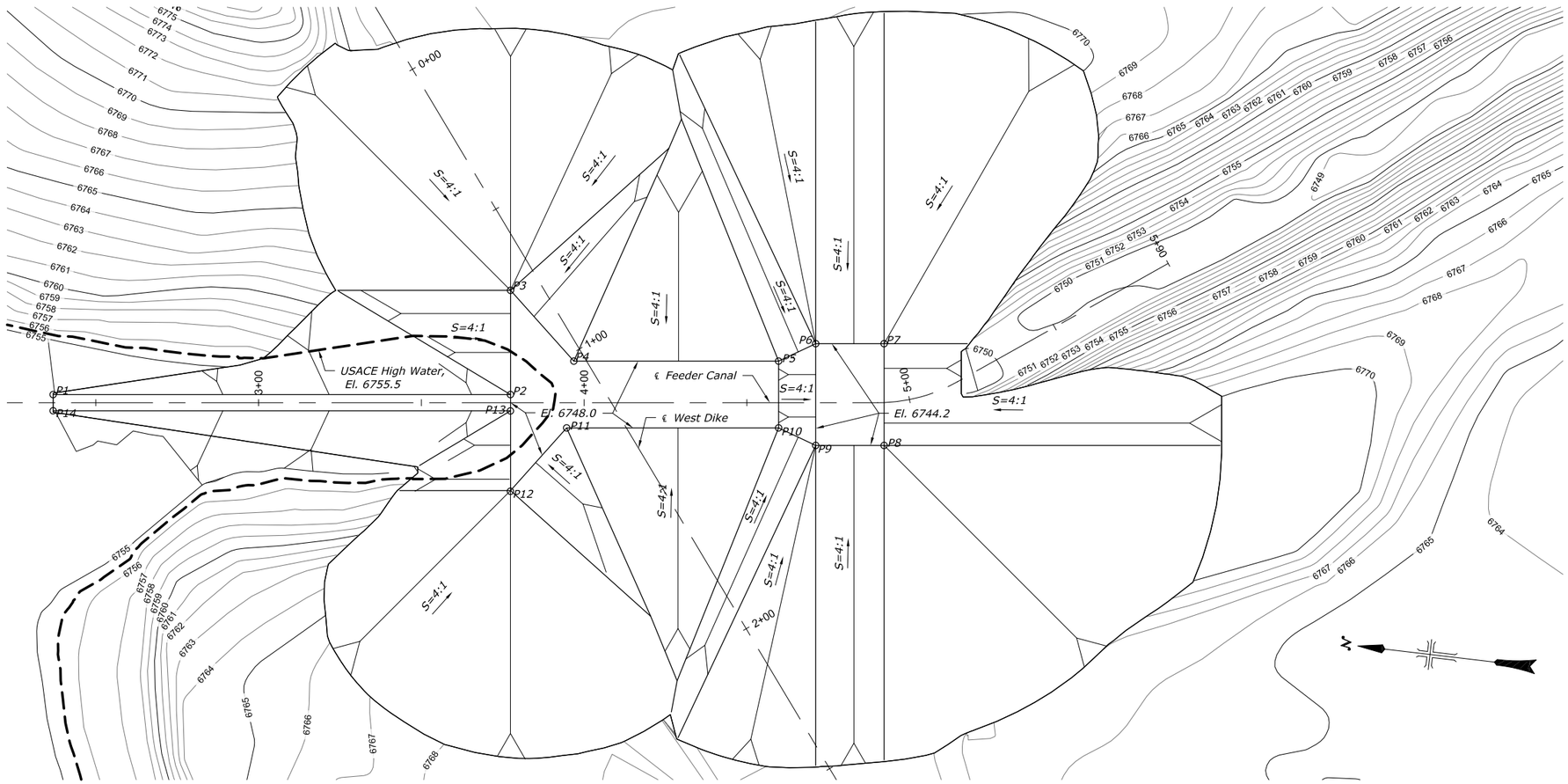
153-D-60032

DESIGN PHASE:
Project Status

DATE AND TIME PLOTTED:
7/13/2018 2:04:13 PM

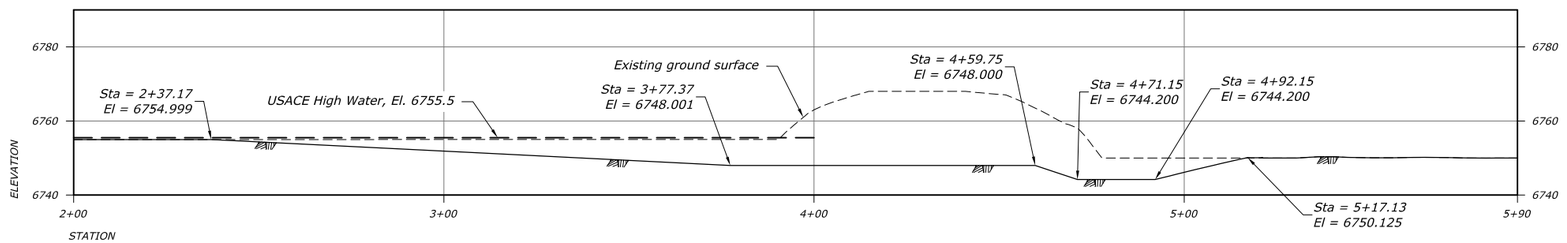
CAD SYSTEM:
Revit 2018.3

CAD FILENAME:
Z:\DO\TSC\Jobs\UC\Big Sandy Dams and Dikes\2017-PDC-Reservoir Enlargement\FIN\DWG\Feeder Canal\Feeder Canal Project v2.rvt



EXCAVATION PLAN

SCALE OF FEET



EXCAVATION PROFILE ALONG FEEDER CANAL

EXCAVATION SUMMARY	
TOTAL (YD^3)	< 6755.5 (yd^3)
16100	3700

RECLAMATION
Managing Water in the West

ALWAYS THINK SAFETY

"U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION"

EDEN PROJECT

LIG SAND DAM

RESERVOIR ENLARGEMENT PROJECT

Draft
Not For Construction
For Discussion Purposes Only

DESIGNED
DRAWN
CHECKED
TECH. APPR.
APPROVED
ADMIN APPROVAL -
DENVER, CO

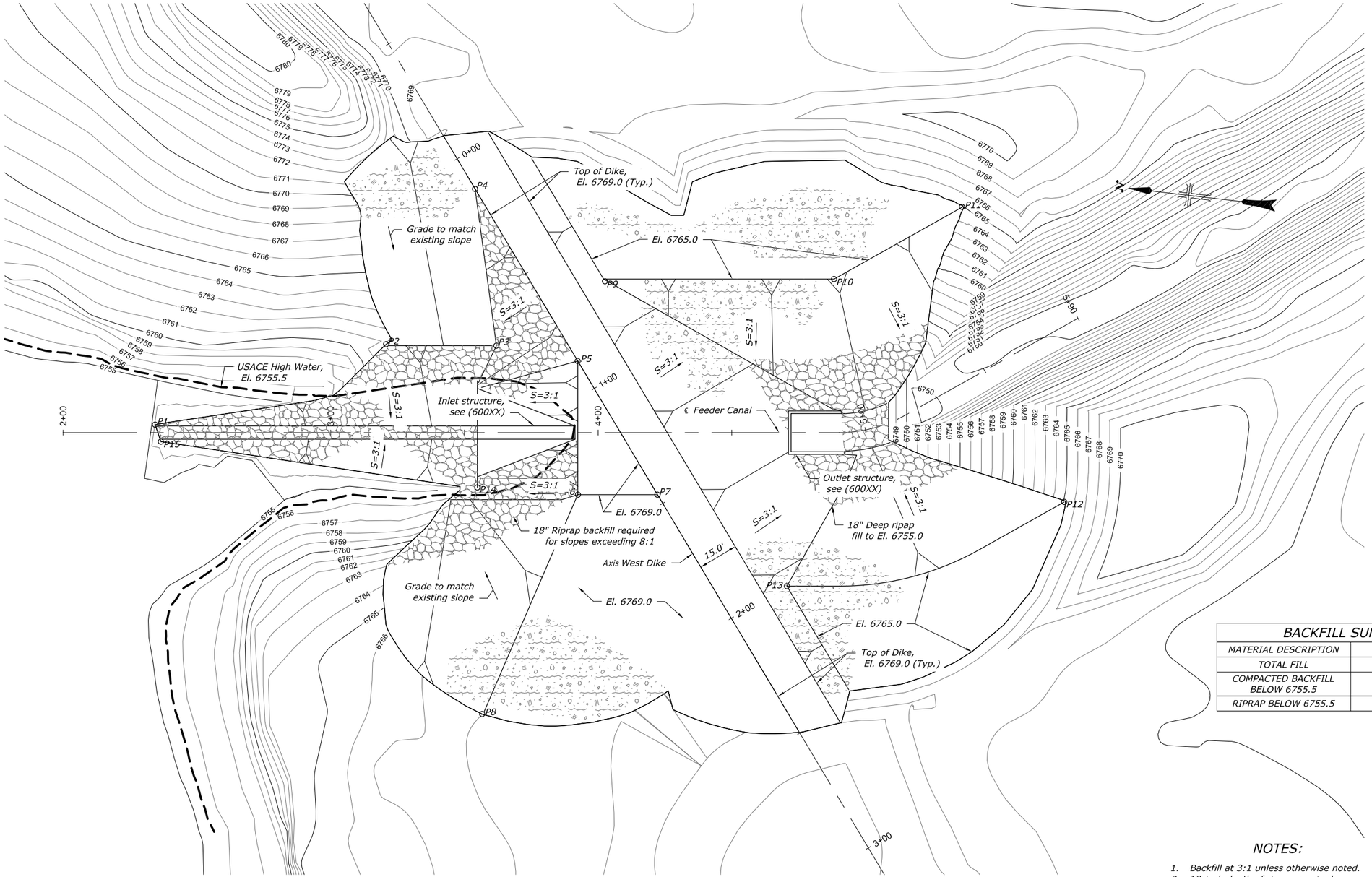
FEEDER CANAL EXCAVATION

153-D-60033

SHEET 1

DATE AND TIME PLOTTED
AUGUST 31, 2018 11:27
PLOTTED BY
JEAST

CAD SYSTEM
AutoCAD Rel. 22.0s
CAD FILENAME
153-D-60032-RD-1.DWG



PLAN

BACKFILL SUMMARY	
MATERIAL DESCRIPTION	QUANTITY (yd^3)
TOTAL FILL	11200
COMPACTED BACKFILL BELOW 6755.5	280
RIPRAP BELOW 6755.5	240

NOTES:

1. Backfill at 3:1 unless otherwise noted.
2. 18-inch depth of riprap required on upstream face of dike for slopes steeper than 8:1.
3. 18-inch depth of riprap required on downstream face of dike on modified slopes below El. 6755.0.

RECLAMATION
Managing Water in the West

ALWAYS THINK SAFETY

"U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION"

EDEN PROJECT

LIG SAND DAM

RESERVOIR ENLARGEMENT PROJECT

Draft
For Internal Use Only
Not For Distribution

DESIGNED
DRAWN
CHECKED
TECH. APPR.
APPROVED
ADMIN APPROVAL -
DENVER, CO

FEEDER CANAL BACKFILL

153-D-60033

SHEET 1

DATE AND TIME PLOTTED
AUGUST 31, 2016 11:26
PLOTTED BY
JEAST

CAD SYSTEM
AutoCAD Rel. 22.0s
CAD FILENAME
153-D-60033-RD-1.DWG

Appendix H – SHPO Concurrence

WYOMING
STATE Historic Preservation OFFICE

September 28, 2018

Wayne G. Pullan
Bureau of Reclamation
302 East 1860 South
Provo, UT 84606-7317

re: Big Sandy Reservoir Enlargement Project (PRO-EA-16-012) (SHPO File #1017EMD017)

Dear Mr. Pullan:

Thank you for consulting with the Wyoming State Historic Preservation Office (SHPO) regarding the referenced undertaking. We have reviewed the associated report and find the documentation meets the Secretary of the Interior's Standards for Archaeology and Historic Preservation (48 FR 44716-42). We concur with the following findings of eligibility for listing in the National Register of Historic Places and effect:

Site #	Eligibility	Effect	Site #	Eligibility	Effect
SU1	Not Eligible	No Effect	SW1	Not Eligible	No Effect
SU2	Eligible	No Adverse Effect	SW2	Not Eligible	No Effect
SU3	Unevaluated	Outside APE	SW3	Not Eligible	No Effect
SU4	Not Eligible	No Effect	SW4	Not Eligible	No Effect
SU5	Not Eligible	No Effect	SW6	Destroyed	No Effect
SU6	Not Eligible	No Effect	SW104	Destroyed	No Effect
SU7	Not Eligible	No Effect	SW9110	Eligible	Adverse Effect
SU102	Not Eligible	No Effect	SW19744	Eligible	Adverse Effect
SU3546	Eligible	Adverse Effect	SW19750	Not Eligible	No Effect
SU5328	Eligible	No Adverse Effect	SW19751	Not Eligible	No Effect
SU7646	Eligible	Adverse Effect	SW19753	Not Eligible	No Effect
SU7670	Not Eligible	No Effect			

We concur that 48SU3546/48SW9110 and 48SU7646/48SW19744 will be adversely impacted by the undertaking as planned. We also concur that adverse effects to 48SU3546/48SW9110 are being mitigated through an existing agreement between our offices. In accordance with 36 CFR § 800.6, we recommend the Bureau of Reclamation develop a Memorandum of Agreement

(MOA), specifying the terms under which the adverse effects to 48SU7646/48SW19744 will be minimized or mitigated. The agency official, SHPO, and the Advisory Council (should they choose to participate) are the signatories and consulting parties to the MOA. The agency official and the SHPO, in agreement with the agency official, may choose to invite additional parties to be signatories and to concur in the MOA. Invited signatories and consulting parties may include Native American tribes and any party that assumes a responsibility under the MOA.

Please refer to SHPO project #1017EMD017 on any future correspondence regarding this undertaking. If you have any questions, please contact Brian Beadles at 307-777-8594 or brian.beadles@wyo.gov.

Sincerely,

Erica Duvic
Historic Preservation Specialist

100 635
105 636
106
600
630

Action
Project
Classificaton
Control
Folder

Notice if you detach enclosure insert code here: