BUREAU OF RECLAMATION

Environmental Assessment and Finding of No Significant Impact for the Root and Ratliff Ditch Pipeline Project

Colorado River Basin Salinity Control Program
Interior Region 7, Upper Colorado Basin

Cover Photo: Example habitat replacement site (SGM Inc.)

Estimated Lead Agency Total Costs Associated with Developing and Producing this EA: $159,000

U.S. Department of the Interior

September 2020

Mission Statements

The Department of the Interior (DOI) conserves and manages the Nation's natural resources and cultural heritage for the benefit and enjoyment of the American people, provides scientific and other information about natural resources and natural hazards to address societal challenges and create opportunities for the American people, and honors the Nation's trust responsibilities or special commitments to American Indians, Alaska Natives, and affiliated island communities to help them prosper.

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

Finding of No Significant Impact

Introduction

In compliance with the National Environmental Policy Act of 1969, as amended (NEPA), the Bureau of Reclamation (Reclamation) has conducted an environmental assessment (EA) for a Proposed Action authorizing the use of Federal funds to implement the Root and Ratliff Ditch Company's Root and Ratliff Ditch Pipeline Project in Montezuma County, Colorado. Reclamation is providing the majority of funding for the project through the Colorado River Basinwide Salinity Control Program and is therefore the lead agency for the purposes of compliance with NEPA for the Proposed Action. An EA was prepared to address the potential impacts to the human environment due to implementation of the Proposed Action.

Alternatives

The EA analyzed the No Action Alternative and the Proposed Action Alternative to authorize and fund the implementation of the Root and Ratliff Ditch Pipeline Project.

Decision and Finding of No Significant Impact

Based upon a review of the EA and supporting documents, Reclamation has determined that implementation the Proposed Action will not significantly affect the quality of the human environment, individually or cumulatively with other actions in the area. No environmental affects meet the definition of significance in context or intensity as defined at 40 CFR 1508.27. Therefore, an environmental impact statement is not required for this Proposed Action. This finding is based on consideration of the context and intensity as summarized in the EA. Reclamation's decision is to implement the Proposed Action Alternative.

Context

The affected locality is the existing Root and Ratliff Ditch, located near the town of Mancos in Montezuma County, Colorado. Affected interests include Reclamation, ditch shareholders, and adjacent landowners. The project does not have national, regional, or state-wide importance.

Intensity

The following discussion is organized around the 10 significance criteria described in 40 CFR 1508.27. These criteria were incorporated into the resource analysis and issues concerned in the EA.

1. Impacts may be both beneficial and adverse.

The Proposed Action will impact resources as described in the EA. Implementation of the Proposed Action will result in beneficial effects related to reduction of salt and selenium loading in the Mancos, San Juan, and Colorado River basins, increased efficiency and control of irrigation water, and reductions in fish entrainment with the project's new headgate and fish screen.

Best Management Practices (BMPs) and mitigating measures were incorporated into the design of the Proposed Action to reduce impacts. The predicted short-term effects of the Proposed Action include wildlife disturbance and displacement from noise, traffic, and increased human presence during project construction, reduction in water quality due to sedimentation during headgate construction at the Mancos River, increase in dust within and adjacent to the project area, temporary grazing displacement, and disturbance to pasture and farmland. Predicted long-term effects to cultural resources are adverse effects to historic irrigation structures eligible for listing in the National Register of Historic Places (NRHP), loss of wetland and riparian habitat along the ditch, and continued water depletions to downstream critical habitat for Colorado River Basin endangered fishes. The long-term effect on cultural resources is being mitigated by the preparation of archival documentation. The long-term loss of wetland and riparian habitat is being mitigated with a habitat replacement project. Water depletions to critical habitat for Colorado River Basin endangered fishes are mitigated by the San Juan River Basin Recovery Implementation Program. Target flows of the San Juan River Flow Recommendations through Reclamation's reoperation of Navajo Dam to mimic the natural hydrograph would still be met with the Proposed Action.

As discussed in detail in the EA, none of the environmental effects are considered significant. None of the effects from the Proposed Action, together with other past, current, and reasonably foreseeable actions, rise to a significant cumulative impact.

2. The degree to which the selected alternative will affect public health or safety or a minority or low-income population.

The proposed Action will have no significant impacts on public health or safety. No minority or low-income populations would be disproportionately affected by the Proposed Action.

3. Unique characteristics of the geographic area.

Prime farmlands are located throughout the area of the Proposed Action. These prime farmlands would be reclaimed and reseeded as approved by private landowners and specified in easement agreements. The Proposed Action is located approximately 4.5 miles east of Mesa Verde National Park (at its closest point) and in proximity to Weber Mountain and Menefee Mountain Wilderness Study Areas. The Proposed Action is not anticipated to impact the viewsheds and visual resources of these areas. The Proposed Action would impact surface and shallow subsurface hydrology supplied to wetland and riparian areas along the Root and Ratliff Ditch, however, these waters were determined to be not be subject to U.S. Army Corps of Engineers jurisdiction under Section 404 of the Clean Water Act. No wild and scenic rivers or other ecologically critical areas would be negatively affected by the Proposed Action.

4. The degree to which the effects on the quality of the human environment are likely to be highly controversial.

Reclamation contacted representatives of other Federal agencies, state and local governments, public and private organizations, and individuals regarding the Proposed Action and its effects on resources. Based on the responses received, the effects of the Proposed Action on the quality of the human environment are not highly controversial.

5. The degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks.

There are no predicted effects on the human environment that are considered highly uncertain of that involve unique or unknown risks.

6. The degree to which the action may establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration.

Implementing the action will not establish a precedent for future actions with significant effects and will not represent a decision in principle about a future consideration.

7. Whether the action is related to other actions which are individually insignificant but cumulatively significant.

Cumulative impacts are possible when the effects of the Proposed Action are added to other past, present, and reasonably foreseeable future actions as described under related NEPA documents or approved plans; however, significant cumulative effects are not predicted, as described in the EA in Section 3.12.

8. The degree to which the action may adversely affect sites, districts, buildings, structures, and objects listed in or eligible for listing in the National Register of Historic Places.

The Colorado State Historic Preservation Officer (SHPO) has concurred with a determination of adverse effect to the irrigation structures involved in the Proposed Action. The Root and Ratliff Ditch, which will be backfilled as part of the Proposed Action, has been identified as eligible for inclusion in the NRHP. Reclamation has entered into a Memorandum of Agreement (MOA) with the SHPO and Root and Ratliff Ditch Company to mitigate the impacts to the affected structures through archival documentation.

9. The degree to which the action may adversely affect an endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act of 1973.

Reclamation consulted with the USFWS regarding the effects on threatened or endangered species and critical habitat from the Proposed Action (USFWS TAILS: 06E24100-2020-F-0211). USFWS concurred that the Proposed Action may affect, and is likely to adversely affect, the endangered Colorado River Basin fishes: Colorado pikeminnow and razorback sucker. The endangered fishes occur downstream of the Proposed Action in the San Juan and Colorado River basins, and they and their designated critical habitat are affected by historic water depletions caused by the consumptive use of water by irrigation systems. Consumptive loss of water in the Mancos, San Juan, and Colorado River basins due to agricultural irrigation from the Root and Ratliff Ditch results in an average annual depletion of 4,144 acre-feet from the Mancos River watershed. Root and Ratliff Ditch Company's annual depletion rate is not expected to change as a result of the Proposed Action; however, the project's habitat replacement sites are anticipated to use an additional 0.95 acre-feet per year. Water depletions to critical habitat for Colorado River basin endangered fishes are mitigated by the San Juan River Basin Recovery Implementation Program. Target flows of the San Juan River Flow Recommendations through Reclamation's reoperation of Navajo Dam to mimic the natural hydrograph would still be met with the Proposed Action. The Proposed Action's biological opinion states that the Project is not likely to jeopardize the continued existence of the Colorado pikeminnow or razorback sucker, and is not likely to destroy or adversely modify designated critical habitat. The USFWS concurred that the Proposed Action may affect, but is not likely to adversely affect the New Mexico meadow jumping mouse, southwestern willow flycatcher, and yellow-billed cuckoo. The Proposed Action would have no effect to any other threatened or endangered species or their critical habitat.

10. Whether the action threatens a violation of Federal, state, local, or tribal law, regulation or policy imposed for the protection of the environment.

The Proposed Action does not violate any Federal, state, local, or tribal law, regulation, or policy imposed for the protection of the environment. In addition, the Proposed Action is consistent with applicable land management plans, policies, and programs. State, local, and interested members of the public were given the opportunity to participate in the environmental analysis process.

Environmental Commitments

- Environmental commitments shall be implemented as specified in Chapter 4 of the EA to protect water quality and soils, minimize ground and vegetation disturbance, protect wildlife resources, and minimize the spread of noxious and invasive weeds (environmental commitments described in the EA are incorporated herein by reference).

- Required permits, licenses, clearances, and approvals as described in the EA shall be acquired prior to implementation of the Proposed Action.
- If previously undiscovered cultural or paleontological resources are discovered during construction, construction activities must immediately cease in the vicinity of the discovery and Reclamation must be notified. In this event, the Colorado SHPO shall be consulted, and work shall not be resumed until consultation has been completed, as outlined in the Unanticipated Discovery Plan in the MOA between Reclamation, the Root and Ratliff Ditch Company, and the Colorado SHPO.
- In the event that uninventoried threatened or endangered species are discovered during construction, construction activities shall halt until consultation is completed with the USFWS and protection measures are implemented. Additional surveys shall be required for threatened or endangered species if construction plans or proposed disturbance areas are changed.

Approval

Area Manager:  Digitally signed by LOUIS WARNER
Date: 2020.09.29 10:17:03 -06'00'

Environmental Assessment for the Root and Ratliff Ditch Piping Project

Colorado River Basin Salinity Control Program
Interior Region 7, Upper Colorado Basin

prepared by

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on behalf of

Western Colorado Area Office

September 2020

Contents

Page

Table of Contents

List of Tables

List of Figures

Appendices

Abbreviations and Acronyms

BLM	Bureau of Land Management
BMP	Best Management Practice
BO	Biological Opinion
CDOT	Colorado Department of Transportation
CDPHE	Colorado Department of Public Health & Environment
cfs	cubic feet per second
CPW	Colorado Parks & Wildlife
CWA	Clean Water Act
EA	Environmental Assessment
EPA	U.S. Environmental Protection Agency
ESA	U.S. Endangered Species Act
FONSI	Finding of No Significant Impact
HDPE	high-density polyethylene
HU	Habitat Unit
HUC	Hydrologic Unit Code
iPaC	USFWS Information for Planning and Consultation website
MBTA	Migratory Bird Treaty Act
MOA	Memorandum of Agreement
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NMMJM	New Mexico meadow jumping mouse
NMPM	New Mexico Principal Meridian
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NWP	Nationwide Permit
OAHP	Colorado Office of Archaeology and Historic Preservation
pikeminnow	Colorado pikeminnow
PIP	plastic irrigation pipe
PM	particulate matter
psi	pounds per square inch
PVC	polyvinyl chloride
Reclamation	Bureau of Reclamation
SCP	Salinity Control Program
SHPO	State Historic Preservation Office
SWFL	Southwestern willow flycatcher
UDP	Unanticipated Discovery Plan
USFWS	U.S. Fish & Wildlife Service
USACE	U.S. Army Corps of Engineers
USC	U.S. Code
USDA	U.S. Department of Agriculture
YBCU	Yellow-billed cuckoo

1.0 Purpose and Need for Proposed Action

This Environmental Assessment (EA) has been prepared in compliance with the National Environmental Policy Act (NEPA) of 1969, as amended, to disclose and evaluate the potential environmental impacts of the Root and Ratliff Ditch Company's (Applicant's) proposed Root and Ratliff Ditch Piping Project (hereinafter, Project or Proposed Action). The Applicant is a non-profit corporation formed in May 1947 to operate and maintain the Root and Ratliff Ditch (note: the ditch was incorporated under the name of the Ratliff and Root Ditch; however, it is now referred to as the Root and Ratliff Ditch by its shareholders and for the purposes of this report).

The Proposed Action is to replace approximately 5.4 miles of the Root and Ratliff Ditch with a buried pipe. The Root and Ratliff Ditch is currently an unlined, open irrigation ditch system. The piping of the ditch would include the re-alignment of certain reaches of the ditch for efficiency. The purpose of the Proposed Action is to reduce salinity concentrations in the Colorado River Basin as well as increase the efficiency of the existing delivery system by preventing water loss through both evaporation and deep percolation. The Project would be funded through a financial assistance agreement from the U.S. Bureau of Reclamation (Reclamation) under the Colorado River Basin Salinity Control Program (SCP). The Federal action is authorizing the use of federal funds to implement the salinity control project.

1.1 Background

The Colorado River system is naturally very saline. While natural sources account for 47% of the salinity in the Colorado River, irrigation practices account for 37% (Reclamation 2017). Irrigation can increase the salinity in a system by mobilizing salts found in the soils of an unlined ditch or flooded field. Water loss due to evaporation can also contribute to an increase in salinity by concentrating any salts in the remaining water. Increases in water salinity can result in reduced agricultural yields as well as the corrosion and plugging of pipes in houses and industry (Reclamation 2017).

The SCP was authorized under Title II of the Colorado River Basin Salinity Control Act (Salinity Control Act) (Public Law 93-320, as amended by Public Laws 98-569, 104-20, 104-127, and 106-459). The Salinity Control Act authorizes the secretaries of the U.S. Department of the Interior and U.S. Department of Agriculture (USDA) to enhance and protect the quality of water available in the Colorado River for use in the United States and the Republic of Mexico. Through a broad range of specific and general salinity control measures the SCP prevents further degradation of water quality in the United States. Salinity control measures under the SCP are implemented by Reclamation, the Bureau of Land Management (BLM), and the USDA Natural Resources Conservation Service (NRCS). These federal agencies are required to work together under the Salinity Control Act, as amended; with Reclamation being the lead federal agency (Reclamation 2017).

Reclamation awarded a financial assistance agreement to the Applicant for the Project under Funding Opportunity Announcement No. BOR-UC-17-F003 and Agreement No. R18AC00078. Funding assistance for construction costs have also been committed by the USDA NRCS Regional Conservation Partnership Program and the State of Colorado Non-Point Source Program. The Root and Ratliff Ditch Company would construct, operate, and maintain the Project.

2.0 Proposed Action and Alternatives

The alternatives evaluated in this EA include a No Action Alternative and the Proposed Action.

2.1 No Action Alternative

In accordance with the NEPA and the Council on Environmental Quality regulations, a No Action Alternative is presented and analyzed in this EA in order to provide a baseline for comparison to the Proposed Action. Under the No Action Alternative, Reclamation would not authorize funding to the Root and Ratliff Ditch Company to pipe the Root and Ratliff Ditch. Irrigation practices and seepage from the unlined ditch would continue to contribute to salt loading in the Colorado River Basin. Riparian and wetland habitats associated with the unlined ditch would likely remain in place and continue to provide habitat to local wildlife.

2.2 Proposed Action

The Proposed Action would replace approximately 5.4 miles of open, unlined irrigation ditch with approximately 4.7 miles of buried irrigation pipe. The Root and Ratliff Ditch is located in Montezuma County, Colorado, east and south of the town of Mancos (Figure 1). The legal description for the ditch includes Sections 26, 27, 28, and 33 in Township 36 North, Range 13 West, New Mexico Principal Meridian (NMPM) and Sections 4, 5, and 8 in Township 35 North, Range 13 West, NMPM. The Project area is primarily on private property. The project also includes improvements within the rights-of-way for U.S. Highway 160 and Montezuma County Roads 43, 41, G, and H. Figure 2 shows the alignment of the existing ditch and the location of the proposed pipeline alignment.

The proposed pipeline alignment roughly follows the existing ditch, although the pipeline would leave the existing ditch alignment in several sections in order to create a straighter alignment and improve efficiency. Approximately 2.4 miles of the new pipeline would be located outside of the existing ditch easement. The existing ditch is in a prescriptive easement on private lands and crosses 42 separate parcels. The new pipeline would be located in dedicated easements negotiated with landowners. The pipeline would cross the parcels of 37 private landowners, three of which did not previously have the Root and Ratliff Ditch on their land. The general pipeline easement would be 50 feet during construction and 30 feet after the alignment has been reclaimed. Dedicated easements would be recorded with Montezuma County.

In accordance with the SCP, three habitat replacement sites have been proposed to mitigate riparian and wetland habitat loss resulting from the removal of an open irrigation ditch. The habitat replacement sites are located west of the Root and Ratliff Ditch and south of G Road in Section 8, Township 35 North, Range 13 West, NMPM. The sites are on private lands owned by three different landowners and are in close proximity to each other. The Hoessle property is located on the northern end of Mormon Lake. The Willenbuecher and Strother properties share a common boundary line with each other and are located west of the Hoessle property. Figure 2 shows the location of the three habitat replacement sites in relation to each other, the existing ditch, and the proposed pipeline alignment.

Several staging areas have been identified for the Proposed Action and are shown on Figure 2. These staging areas would be used for the storage of pipe, construction equipment, fencing materials, fill materials, and other construction materials. Pipe arriving at the staging areas would be transported on flatbed trucks and/or trailers. Front end loaders with pallet forks would likely be used to handle pipe in the staging areas. The areas would also be used for contractor office trailers (if needed) and construction staff parking. The working surfaces of all staging locations would be graded with stormwater erosion control installed for the duration of construction.

Construction and access footprints would be limited to only those necessary to safely implement the Proposed Action. Existing county roads, private roads, and rights-of-way would be used for construction access as much as possible. Some access routes may require minor grading to provide for truck travel to the project alignment. Access routes and road crossings would be returned to the same or better condition than they were prior to construction once the pipeline has been completed. There would be no new permanent roads. All cattle guards and fences affected by construction activities would be returned to conditions substantially similar to those existing prior to construction.

2.2.1 Habitat Replacement Sites

An "Evaluation of Habitat Impacts Associated with Piping of the Root and Ratliff Ditch" was written by SGM in July 2019 and approved by Reclamation. This report determined that 44.5 habitat units (HUs) would be lost from filling in the open Root and Ratliff Ditch. HUs are defined in Appendix A of the "National Environmental Policy Act (NEPA)-Guidance for Preparing Salinity Control Program Projects" (Reclamation 2018). The "Root and Ratliff Ditch Piping Project Habitat Replacement Plan" was prepared by SGM to replace the 44.5 HUs by creating additional wildlife habitat.

The three proposed habitat replacement sites total approximately 15 acres. The sites already include some open water and wetland habitat. The value of these areas for wildlife is presently limited by several factors, including the overall lack of trees and shrubs, the presence of weeds, cattle grazing, and fencing. In order to enlarge and improve the quality of wildlife habitat on the three parcels several enhancement activities are proposed. The proposed work for the habitat replacement sites is listed below. Figures 3a-c show the proposed work plans for the sites.

- Existing wetland habitat would be expanded by 0.37 acre on the Hoessle habitat replacement site.
- A new 0.20-acre pond would be built along an existing ditch on the Willenbuecher property.
- Emergent wetland vegetation would be planted in the shallow areas of the existing ponds and new pond on the Willenbuecher and Strother properties. The addition of vegetation that is interspersed with open water would promote use of the habitat by waterfowl.
- Mixed tree and shrub plantings on all three properties would increase the habitat diversity and functionality of the sites for wildlife. Both riparian and upland species would be planted.
- The upland area to the north of the wetland on the Hoessle property contains appreciable noxious weeds. These weeds would be treated with an approved herbicide and the area would be revegetated.

- Areas of noxious weeds on the Willenbuecher and Strother properties would be treated using biological agents or herbicides.
- A series of nest boxes would be installed at the sites to encourage use by birds.
- The connectivity of the Willenbuecher property with adjacent areas of value to wildlife would be increased by reducing fencing and modifying fencing to be more wildlife friendly.
- The outlet structure for the existing pond on the Willenbuecher property can be controlled from above the pond but needs to be reconnected to the ditch downstream. Approximately 16 linear feet of pipe would be installed to allow the structure to take water from the bottom of the pond rather than the top.
- The reliability of the water supply for the sites would be increased through dedication of water rights. Ten shares of Jackson Reservoir water (delivering approximately 10 acre-feet per year) would be purchased by the applicant for the mititgation sites.
- The sites would be protected from future disturbance through the use of deed restrictions that prevent any development or activities that could negatively impact the wildlife habitat, such as construction of roads, structures, or filling any portion of the site.

The habitat replacement site work would be completed concurrently with the ditch piping project. The Habitat Replacement Plan would be implemented in accordance with the environmental commitments listed in Section 4. The habitat replacement project is required to function for 50 years following construction. The Root and Ratliff Ditch Company would be responsible for maintenance and monitoring to ensure success.

2.2.2 Headgate Replacement

The existing headgate would be replaced with a screen structure and intake box to accommodate the pipe. A totalizer meter would be installed that records continuous flows to enable measurement of diversions. The existing headgate for the ditch is located in a forebay that detains water below the diversion structure on the south bank of the of the Mancos River. The diversion structure is an in-stream rock check with an adjacent screw gate and headwall structure that can be adjusted to divert the required flow for the time of year and ditch operations.

After the headgate replacement, water would flow from the diversion structure, through the forebay, and over the fish screen. The screen would sit between the forebay and an overflow channel that flows back to the Mancos River approximately 230 feet downstream of the main diversion. The fish screen would consist of a 12-foot wide coanda-effect wedge-wire screen that is sloped downhill at 30 degrees with openings of approximately 1.0 mm. The screen would be attached to a concrete box, complete with aprons and wingwalls to fit the geometry of the channel, to help guide flow through the structure. Clean water that passes through the screen would feed the Root and Ratliff Ditch. Any excess water, debris, or aquatic organisms greater in size than 1.0 mm that enter the forebay would continue over and past the fish screen into the overflow channel. When the ditch is in operation, there would always be a small amount of water in the overflow channel to ensure the ditch is fully pressurized and that fish have passage back to the Mancos River. Flows through the diversion and forebay would typically be between 2 and 30 cubic feet per second (cfs) depending on the season, water needs, and availability.

To construct the new fish screen, the headgate on the Mancos River would simply be closed and any residual water (groundwater, seepage, etc.) would be directed to the overflow channel or pumped out if needed. No work on the main channel diversion or headgate on the Mancos River, or grading of the diversion channel would be required. The return flow channel from the screen structure to the river would be flattened and lowered to provide adequate operation of the self-cleaning screen structure.

2.2.3 Pipeline Installation

The pipeline component of the Proposed Action was designed and engineered by SGM of Durango, Colorado. The entire length of the Root and Ratliff Ditch would be piped, from the headgate below the diversion structure on the Mancos River to a concrete splitter box that represents the end of the ditch as owned and operated by the Root and Ratliff Ditch Company. A total of 26 outlets would release water to farm turnouts or laterals along the length of the pipeline, including three at the splitter box that lead to the privately-owned Graf and Cox Pipeline and Doerfer Ditch. The turnout structures would be replaced with new structures equipped with electronic flow meters and control valves.

The new irrigation pipeline would begin with a 27-inch nominal diameter in the initial reach below the intake. The nominal diameter would be reduced as the amount of flow required decreases. The pipeline would reduce down to a 24-inch nominal diameter at the end of the pipeline, south of Road G. The maximum rating of the pipe would be 125 pounds per square inch (psi). The majority of the pipeline would be plastic irrigation pipe (PIP) and the larger pipes (sizes above 27-inch nominal diameter) would be C-900 PVC. A short run of pipe that would cross under U.S. Highway 160 through an existing irrigation culvert would be high-density polyethylene (HDPE) pipe. The irrigation pipeline would be gravity-pressurized and no pumps, compressor stations, or water storage facilities would be included in the project.

Portions of the proposed pipeline alignment that are outside of the existing ditch alignment would be cleared of vegetation with a bulldozer. The construction workspace would be graded as needed in steeper areas to allow for safe operation of construction equipment. A track hoe would be used to excavate a maximum trench of approximately 4 feet wide and 6 feet deep and position pipe in the trench. No blasting is expected. Crews would utilize rock-saws or hydraulic hammers to excavate if rock formations are encountered unexpectedly during construction. Excavated material would be side cast for backfilling after pipeline installation. All available topsoil to a depth of approximately 1-foot would be stockpiled separately from the subsoil for use in reclamation. Sifted soil fines from the excavated subsoils would provide rock-free pipeline padding and bedding. Sandbags may be used to pad the bottom of the trench instead of, or in combination with, padding with soil fines. In rocky areas, padding material or a rock shield would be used to protect the pipe. Sections of the proposed pipeline alignment that would overlap the existing ditch alignment would first be prepared by backfilling the existing irrigation ditch with a bulldozer. An excavator would then trench in the prepared bed to place the pipe.

Backfilling would be conducted using an excavator, bulldozer, or other suitable equipment. Backfilling the trench would generally use the subsoil previously excavated from the trench except in rocky areas where imported fill material may be needed. Backfill would be graded and compacted. Any excavated materials that are not used for backfilling operations would either be spread out in pastures adjacent to the pipeline or would be used to backfill the existing Root & Ratliff Ditch.

At the state and county road crossings, the pipeline would cross through existing culverts if feasible. Otherwise, an open trench would be required to construct the pipeline. The portion of the pipeline that would cross under the Colorado Department of Transportation (CDOT) right-of-way along U.S. Highway 160 east of the Mancos River would be slip lined through the existing irrigation culvert in lieu of open cutting.

The piping component of the Proposed Action would occur incrementally across the Proposed Action area during the non-irrigation season (approximately October through March). The proposed pipeline outside the existing ditch alignment could be installed any time of year.

2.2.4 Ditch Decommissioning

Decommissioning of the existing ditch would be accomplished by filling the ditch with clean, local soil material, compacting the material, and grading the surface to match surrounding contours and restore drainage patterns. Car tires and household waste that exist in some reaches of the ditch would be recycled or disposed of in a suitable land fill. A bulldozer would be used to grub vegetation and fill and bed the existing ditch. The material needed for construction fill would be generated within the construction footprint as much as possible. However, it is anticipated that additional fill would be required from a commercial source. Fill material would be transported in tandem dump trucks. Decommissioning and backfilling of the ditch to be abandoned would be performed after proper operation of the new pipeline has been verified. These activities could be performed any time of the year.

2.2.5 Revegetation

All areas disturbed during construction of the Proposed Action would be reclaimed subject to any conditions from private land owners. Disturbed surfaces would be contoured to match the surrounding area and restore drainage patterns. Drought-tolerant seed mixes appropriate for the surrounding native vegetation would be used as approved by private land owners and Reclamation.

The contractor would employ drill or broadcast seed methods to ensure proper seed placement. Drill seeding is preferred and would be used wherever soil characteristics and slope allow effective operation of a rangeland seed drill. Drill seeding would be performed perpendicular to the slope; seed would be placed in direct contact with the soil at an average depth of 0.5 inches, covered with soil, and compacted to eliminate air pockets around the seeds. Broadcast seeding would be employed in areas where drill seeding is unsafe or physically impossible. Seed would be applied uniformly over disturbed areas with manually operated cyclone-bucket spreaders, mechanical spreaders, or other methods. Broadcast application rates would be twice that of drill rates. The seed would be uniformly raked, chained, dragged, or cultipacked to incorporate seed to a sufficient seeding depth, if possible. Reseeded sites would be mulched to facilitate germination and growth.

Best Management Practices (BMPs) would be used to control erosion, minimize harm to wildlife, and minimize the spread of noxious weeds during and following construction. Noxious weeds would be controlled in disturbed areas according to right-of-way stipulations and Montezuma County standards. BMPs and other protective measures are described and analyzed as part of the Proposed Action in Section 3 (Affected Environment & Environmental Consequences) under each resource topic and summarized in Section 4 (Environmental Commitments).

2.3 Alternatives Considered but Not Carried Forward

Several alternatives were considered during the conceptual design process for the Project but were not proposed to Reclamation because they were determined to be technically challenging, economically prohibitive, and/or potentially more destructive to existing habitat than the Proposed Alternative.

3.0 Affected Environment and Environmental Consequences

This section discusses resources that may be affected by the Proposed Action and the No Action Alternative.

For each resource the existing conditions are described, and potential impacts and environmental consequences predicted under the No Action and Proposed Action alternatives. BMPs or other mitigative or protective measures described below are considered part of the Proposed Action and are taken into consideration when predicting environmental consequences. These measures are listed in Section 4.0, Environmental Commitments. A summary of impacts/environmental consequences of the Proposed Action is included at the end of this section.

3.1 Water Rights and Use

Figure 4 shows the hydrologic units in the vicinity of the Proposed Action. Both the Proposed Action area and the habitat replacement sites are located within the Mancos River watershed [hydrologic unit code (HUC) 14080107] in the Upper Colorado Region. Official designated uses for this unit are a combination of recreation, water supply, and agriculture.

The Root and Ratliff Ditch delivers irrigation water to approximately 1,290 acres. On-farm irrigation is accomplished using laterals, gated pipe, or sprinkler systems. The main crops grown are hay and pasture grass. The irrigation season typically runs for approximately 153 days from May through September, during which the average diversion from the Mancos River is 12.8 cfs. The ditch also delivers an average of 2.44 cfs of stock water to shareholders during the non-irrigation season. During the period of record from 1950 through 2019, the average annual total diversions to the ditch were 4,144 acre-feet. The minimum annual diversions during this period were 2,182 acre-feet, while the maximum annual diversions were 5,895 acre-feet. Irrigation return flows eventually reach the Mancos River through tributaries (Weber Creek) generally south of the Project area.

The Root and Ratliff is owned and operated as a mutual ditch company under Colorado Water Law. There are 2,337 shares in the Root and Ratliff Ditch Company which total 37.8 cfs of decreed water rights. The Root and Ratliff Ditch also conveys water to the Webber and Smith ditches which have 4.5 and 2.3 cfs of decreed water rights, respectively. In addition, several water users along the Root and Ratliff Ditch have contract water stored in Jackson Gulch Reservoir, upstream of the Root and Ratliff Ditch diversion point on the Mancos River. The water for this supplemental supply is transported through the Root and Ratliff Ditch. There is a cumulative total of 44.8 cfs of water rights conveyed by the Root and Ratliff Ditch. The water rights are administered by the Colorado Division

of Water Resources and subject to the system of prior appropriation, so the ditch does not transport this total amount of water at one time. The new pipeline would be designed to carry approximately 30 cfs from the diversion point on the Mancos River. The Mancos River is over appropriated in terms of water rights and the river in proximity to the Project area often has little to no flow in it during times of peak irrigation demand.

No Action: The No Action alternative would have no effect on water rights and uses within the Mancos River Basin. The water delivery system would continue to function as it has in the past. The improved efficiency due to less evaporation and seepage and improved control over irrigation flows from the installation of meters and valves would not be realized by water users.

Proposed Action: The Proposed Action would increase the efficiency of the Root and Ratliff Ditch by eliminating the seepage and evaporation from 5.4 miles of open, unlined ditch. The Project would also provide more reliable and flexible flow because diversions to users would be metered and irrigators would have the ability to shut off water when their irrigation is complete. The increased efficiency may result in more water being available during the irrigation season; however, the irrigation of new land is not a part of the Proposed Action. The Proposed Action would also allow for the development of a gravity fed pressurized delivery system for improved on-farm water management and potential conversion to more high-efficiency irritation systems for certain users.

Under the Proposed Action alternative, the Root and Ratliff Ditch would be administered under Colorado Water Law as it has in the past. No adverse effects on water rights in the Mancos or San Juan River basins would occur. An increase in efficiency may allow for less water demand and less water diverted.

The proposed expansion of wetland habitat and a new pond on the habitat replacement sites would slightly increase evaporative water loss. The wetland habitat on the Hoessle property would be expanded by 0.37 acres and a new 0.2-acre pond would be constructed on the Willenbuecher property. The predicted total annual depletions from the pond and expanded wetland (0.57 acres total) based on the gross annual evaporation and average annual precipitation for the area would be 0.95 acre-feet (DWR 2019, Farnsworth et al. 1982, WRCC 2009). Shares in the Root and Ratliff Ditch would be dedicated to improve the supply of water to these sites.

3.2 Water Quality

The Proposed Action is in the Mancos River watershed. The Mancos River is a tributary of the San Juan River, which is a major tributary of the Colorado River. Parameters of concern for the Mancos River include salinity, selenium, and bacteria (Larrick and Ashmore 2013). Irrigation practices in the region and in the Proposed Action area contribute to downstream salinity and selenium levels. Mancos shale exists through much of the Mancos River watershed. This geologic formation is naturally high in mobile selenium, arsenic, and salt compounds. As irrigation return flows travel through the underlying formations, salts and minerals are mobilized and flow into the river system, especially during flood irrigation practices. Irrigated agriculture contributes approximately 37 percent of the salinity in the Colorado River system (Reclamation 2017). In the Mancos watershed, as water moves downstream from just below the mountain tributaries and across irrigated lands, salinity increases approximately 5-fold (Larrick and Ashmore 2013). High salinity levels make it difficult to grow agricultural crops. In addition, salt in water systems plugs and damages municipal and household pipes

and fixtures. Water conservation within irrigation projects on saline soils is the single most effective salinity control measure found in the past 30 years of investigations (Reclamation 2017).

Selenium occurs in the region's soils in soluble forms such as selenite and is leached into surface water by runoff and irrigation return flows. Though trace amounts of selenium are necessary for cellular functioning of many organisms, it is toxic in slightly elevated amounts. Elevated selenium levels can cause reproductive failure and deformities in fish and aquatic birds.

The presence of fecal coliform bacteria in aquatic environments indicates that the water has been contaminated with the fecal material of man or other animals. High bacteria levels in the Mancos River are likely due to the presence of intensive cattle grazing (Larrick and Ashmore 2013).

No Action: Under the No Action alternative, the estimated 2,347 tons of salt annually contributed to the Colorado River Basin from this system would continue. Current selenium loading levels would also continue.

Proposed Action: Piping the existing ditch would help to reduce salinity loading to the Mancos River and Colorado River Basin. Upon completion of the Project, the annual reduction of approximately 2,347 tons of salt loading to the Colorado River at a cost of $58.21 per ton of salt is anticipated. The Proposed Action is also expected to reduce selenium loading into the downstream river systems. The reduced salt and selenium loading would benefit downstream water users as well as fish and aquatic birds.

In the short term, construction activities have the potential to mobilize sediments. There may be localized, short-term effects to water quality as a result of headgate construction in the forebay below the Mancos River diversion and the flattening and lowering of the return flow channel to the river. Burial of irrigation pipe in the Root and Ratliff Ditch would occur during the irrigation off-season while no water is flowing in the ditch. In addition, the Proposed Action would include stormwater BMPs, revegetation of disturbed areas, and the restoration of drainage patterns in the Project area.

The Proposed Action would affect surface and shallow subsurface hydrology supplied to wetland and riparian areas in the Project area. A jurisdictional determination indicating the existing ditch is not a Water of the U.S. and therefore not subject to U.S. Army Corps of Engineers (USACE) jurisdiction under Section 404 of the Clean Water Act (CWA) (33 USC 1344) was approved in March 2019. The approval letter is included in Appendix B.

Construction of the proposed project would involve the discharge of fill material into waters that could be considered jurisdictional. Replacement of the ditch headgate would occur in a forebay that detains water on the south bank of the Mancos River. The return flow channel from the headgate to the river would be flattened and lowered. No grading of the diversion channel from the river to the forebay would be required. Also, the proposed pipeline would cross Watercress Canyon, a drainage located downstream of County Road H. The drainage contains a riparian area with dense stands of willow (*Salix* sp.) and areas of Nebraska sedge (*Carex nebrascensis*) and broadleaf cattail (*Typha latifolia*). The pipeline would be constructed in this area using an open trench. Pipeline construction in areas of potential jurisdictional waters would be exempt from permitting requirements under Section 404(f)(1) of the CWA, which allows for the construction

and maintenance of irrigation ditches. Drainage patterns would be restored and disturbed areas would be revegetated in these areas.

The proposed work at the habitat replacement sites would fall under NWP No. 27 for "Aquatic Habitat Restoration, Enhancement, and Establishment Activities". A Pre-Construction Notification would be submitted to the USACE prior to beginning construction at these sites.

3.3 Air Quality

The National Ambient Air Quality Standards (NAAQS) established by the U.S. Environmental Protection Agency (EPA) under the Clean Air Act specify limits for criteria air pollutants. Criteria pollutants include carbon monoxide, particulate matter (PM 10 and PM 2.5), ozone, sulfur dioxide, lead, and nitrogen. If the levels of a criteria pollutant in an area are higher than the NAAQS, the airshed is designated as a nonattainment area. Areas that meet the NAAQS for criteria pollutants are designated as attainment areas. Montezuma County is in attainment for all criteria pollutants (EPA 2019a).

No Action: There would be no effect on air quality in the Proposed Action area from the No Action alternative. The ditch system would continue to operate in its current configuration and dust and exhaust would occasionally be generated by vehicles and equipment conducting routine ditch maintenance.

Proposed Action: There would be no long-term impacts to air quality from the Proposed Action. Dust from construction activities would have a temporary, short-term effect on the air quality in the vicinity of the Proposed Action area. Dust would be generated by earthwork activities and the movement of construction equipment on unpaved roads. BMPs would be implemented to minimize dust and would include measures such as watering the construction site and access roads, as appropriate, and long-term revegetation to stabilize disturbed areas. Impacts on air quality would cease once construction is complete.

Following construction, impacts to air quality from routine maintenance and operation activities along the pipeline corridor would be similar in magnitude to those currently occurring for the existing ditch. Impacts to air quality from routine maintenance include dust from occasional travel in light vehicles along the Project corridor.

3.4 Access, Transportation, and Public Safety

The major access route for the Proposed Action area is U.S. Highway 160 east of the Town of Mancos (Figure 1). The Project area and habitat replacement sites would be accessed from local county roads, including Montezuma County Roads 41, G, and H. Several private roads and drives would also be used for construction access. The county roads and private roads in the Project area are primarily used by local residents for traveling in and out of the area. The existing ditch is in a prescriptive easement on private lands and crosses 42 separate parcels.

No Action: There would be no effect to public safety, transportation, or public access from the No Action Alternative since no additional traffic from construction activities would occur.

Proposed Action: The Proposed Action would increase large vehicle and truck traffic on the county roads and private roads in the Project area. Construction and access footprints would be limited to only those necessary to safely implement the Proposed Action. There would be no new permanent roads. Some access routes may require minor grading to provide for truck travel to the project alignment. Access routes and road crossings would be returned to the same or better condition than they were prior to construction once the pipeline has been completed.

Implementation of the Proposed Action may cause brief delays along public roadways adjacent to the Proposed Action area from construction vehicles entering and exiting the roadways. If open trench road crossings are necessary, traffic would be temporarily re-routed around the construction zone. The proposed pipeline would use the existing culvert under U.S. Highway 160 and would not impact U.S. Highway 160 traffic. The Root and Ratliff Ditch Company and the construction contractor would coordinate with the Colorado Department of Transportation (CDOT) on work within the highway right-of-way, and with the Montezuma County Public Works Department for work within the county road rights-of-way. The County Sheriff Department would be notified when traffic or access would be delayed or significantly re-routed.

Access to the new pipeline alignment would be negotiated with private landowners and dedicated easements would be obtained. The pipeline would cross the parcels of 37 private landowners, three of which did not previously have the Root and Ratliff Ditch on their land. The general pipeline easement would be 50 feet during construction and 30 feet after the alignment has been reclaimed.

3.5 Recreational and Visual Resources

The Project area is located entirely on private lands, with the exception of several public rights-of-way for road crossings. The habitat replacement sites are located on private property as well and do not have public access. The majority of the area in the immediate vicinity of the ditch and habitat replacement sites has been disturbed by agricultural activities and rural residential development. Viewsheds from the proposed Project area include Menefee Mountain to the south and east, Weber Mountain and Mesa Verde to the south and west, and the La Plata Mountains to the northeast. There are no designated visual resources in the proposed Project area.

There is no public land, except for road rights-of-way, or public recreation areas in the proposed Project area. There is no public access for fishing on the Mancos River. Recreation use is limited to sporadic use of roads by local residents for walking, jogging, and biking.

No Action: The No Action alternative would have no effect on recreational or visual resources. Recreation in the Proposed Action area would continue as in the past and visual resources would remain unchanged.

Proposed Action: The Proposed Action alternative would have minimal effect on visual resources. The piping and backfilling of the ditch would change the appearance of the land along the ditch, including the loss of some trees and shrubs. However, the overall appearance would be consistent with the rural and agricultural character of the surrounding area. Many car tires have been placed in the ditch for bank protection between County Road 41 and H Road. These tires would be removed and disposed of properly. Following construction, any construction debris would be removed and properly disposed.

The Proposed Action could disrupt local recreational use of county roads during construction of the pipeline at road crossings and due to an increase in traffic. However, these disruptions would be temporary. Disruptions from pipeline construction in the road right-of-way would take place incrementally over the course of the Project and are not likely to last more than 36 hours. To ensure public safety, pipe trenches left open while unattended (e.g. overnight) that could pose a hazard to recreators would be covered and marked. Upon completion of the Proposed Action, there would be no further impact to recreation.

3.6 Livestock Grazing

The Project area includes private lands used for livestock grazing. Most of these lands are seeded pasture with and without irrigation and are dominated by grasses. Evidence of significant grazing exists in some areas. There are no public grazing allotments within the proposed Project area.

No Action: The No Action alternative would have no effect on grazing. Livestock grazing in the proposed Action area would continue as in the past.

Proposed Action: Under the Proposed Action alternative, temporary disturbance to pastures used for grazing would occur. Disturbances would be from construction traffic and activity in fenced pastures. Livestock may need to be relocated during construction activities. The contractor would contact landowners before trenching a section of the pipeline in order to ensure livestock are not released due to downed fences or prevented from reaching water sources because of open trenches. All cattle guards and fences affected by construction activities would be returned to conditions substantially similar to those existing prior to construction. Any surface disturbance in pastures would be reclaimed and reseeded as approved by private landowners and specified in easement agreements.

The habitat replacement site on the Willenbuecher property is located in an actively grazed pasture. The existing pond and new pond would be fenced to protect the riparian vegetation from grazing impacts. A portion of the ditch between the ponds would be left unfenced to provide livestock access to water.

3.7 Vegetative Resources and Weeds

The Project is located in the Colorado Plateau physiographic province. The climate is semi-arid continental characterized by low humidity and moderately low precipitation. The Project area averages about 16.87 inches annually (WRCC 2009). The average elevation in the Project area is about 7,100 feet above mean sea level. Land cover in the vicinity of the Project area consists primarily of irrigated agricultural lands with pinon-juniper on hills and ridges. Rural, residential development occurs throughout the area. Appendix A contains photographs of the vegetation along the ditch alignment.

Habitat along the Mancos River, where the ditch diversion structure is located, is riparian woodlands. The Mancos River is approximately 26 feet wide and is approximately 200 feet north of U.S. Highway 160. Upstream of the headgate, the Mancos River's riparian corridor is very narrow. Much of the riparian woodland habitat has been replaced by irrigated agricultural meadows, small ponds, and ranch facilities. The riparian corridor in these areas ranges in width from 10 to just over 100 feet in width. Downgradient from the headgate, riparian woodlands are much more extensive, averaging around 400

feet in width. However, these woodlands are somewhat fragmented by ponds, residences, driveways, and access roads, including County Road 43. Dominant species include thinleaf alder (*Alnus incana* ssp. *tenuifolia*), narrowleaf cottonwood (*Populus angustifolia*), river hawthorn (*Crataegus rivularis*), narrowleaf willow (*Salix exigua*), cattail (*Typha* sp.), mountain rush (*Juncus arcticus*), reed canarygrass (*Phalaris arundinacea*), and Woods' rose (*Rosa woodsii*). This area also includes noxious weed species such as Russian olive (*Elaeagnus angustifolia*), cocklebur (*Xanthium* sp.), lesser burdock (*Arctium minus*), and Canada thistle (*Cirsium arvense*). The ditch also passes through more managed landscape in this area such as residential lawns.

After approximately 0.5 mile, the ditch leaves the riparian woodlands and runs through a relatively consistent agricultural meadow habitat type for the remaining 5.1 miles to the end of the Project. Adjacent to the ditch more mesic species exist, including reed canarygrass, redtop (*Agrostis gigantea*), common reed (*Phragmites australis*), narrowleaf willow, narrowleaf cottonwood saplings, and Woods' rose. The density and cover of willows, cottonwood saplings, and grass varies.

The surrounding lands are dominated by agricultural hay fields. Agricultural fields are dominated by orchardgrass (*Dactylis glomerata*), smooth brome (*Bromus inermis*), Kentucky bluegrass (*Poa pratensis*), common dandelion (*Taraxacum officinale*), and alfalfa (*Medicago sativa*). There is one 550-foot section of the ditch that occurs adjacent to a hillside dominated by pinyon-juniper forest (*Pinus edulis* and *Juniperus osteosperma*, respectively).

The three habitat replacement sites are located on private properties with scattered rural residential development. The properties each contain some wetland or riparian habitat that is surrounded by fenced pasture. Most of the Hoessle property consists of upland pasture grasses and weeds. It lacks trees and shrubs and has a large prairie dog colony. A robust emergent wetland exists along the northern shore of Mormon Lake. This wetland is dominated by softstem bulrush (*Schoenoplectus tabernaemontani*), hardstem bulrush (*S. acutus*), and broadleaf cattail.

The Willenbuecher property contains primarily pasture grass with some areas of Canada thistle. An approximate 1-acre pond on the Willenbuecher property contains wetland vegetation along the shoreline. A patch of broadleaf cattail exists below the pond on the north side; a wetland dominated by reed canarygrass exists south of the pond; mountain rush occurs northeast of the pond; and a narrow band of wetland vegetation occurs along a swale downstream of the pond. The owner planted ornamental willows around the pond and buffaloberry (*Shepherdia* sp.) in areas. Relatively large alders also occur around the pond.

The Strother property contains pasture grass with some forbs. An emergent wetland exists around much of the shoreline of a 0.79-acre pond. The wetland is dominated by bulrush species and broadleaf cattails. The extent of this wetland varies depending on the slope of the shore/bank. There are some cottonwood trees and shrubs on an old berm from a previous and larger pond at the site, but the wetland generally lacks trees and shrubs. A relatively small area of Canada thistle and whitetop (*Cardaria draba*) exists on the west side of the pond and there is a medium-sized tamarisk (*Tamarix* sp.) on the northeast shore.

No Action: There would be no effect on existing vegetation or habitat from the No Action alternative. Riparian habitat along the existing irrigation ditch would remain undisturbed and the additional habitat replacement activities would not occur.

Proposed Action: The Proposed Action would result in the permanent loss of riparian vegetation associated with approximately 5.4 miles of open irrigation ditch. Approximately 4,000 linear feet of riparian woodland habitat would be removed at the northern end of the Project area adjacent

to the Mancos River. In addition, approximately 2.4 miles of undisturbed pastureland would be disturbed for construction of the new pipeline outside of the existing ditch alignment. Vegetation removal would be confined to the smallest portion of the Proposed Action area necessary for completion of the work. Any areas disturbed for construction of the pipeline and after backfilling the existing ditch would be revegetated. Drought-tolerant and weed-free seed mixes appropriate for the surrounding native vegetation would be used as approved by private landowners and Reclamation.

To compensate for the loss of riparian habitat along the irrigation ditch, additional riparian habitat would be expanded and improved at the three habitat replacement sites. The three proposed habitat replacement sites total approximately 15 acres. The work proposed at these sites includes the expansion of 0.37 acres of wetland habitat, the construction of a new 0.2-acre pond, and the planting of additional wetland vegetation, trees, and shrubs.

Construction footprints in certain areas would extend into previously undisturbed ground, creating conditions for weeds to spread. Efforts to remove and curtail the spread of noxious weeds would be undertaken during the construction of the Proposed Action. BMPs, including cleaning vehicles and equipment prior to bringing them onsite, would be implemented to help minimize the risk of weed infestations. In addition, disturbed areas would be revegetated as soon as possible following disturbance. The upland area to the north of the wetland on the Hoessle property contains appreciable noxious weeds. These weeds would be treated with an approved herbicide and the area would be revegetated. Areas of noxious weeds on the Willenbuecher and Strother properties would be treated using biological agents or herbicides. In the long-term, piping the ditch would remove an important vector of weed seed transport, which is the open water in the ditch.

3.8 Wildlife Resources

In the Proposed Action area, the ditch provides a ribbon of riparian and wetland habitat within a mainly rural, agricultural area. The vegetation and water associated with the ditch provide habitat for wildlife for nesting, breeding, foraging, cover, and movement corridors. The quality of the habitat varies along the ditch, depending on the extent and nature of the vegetation community and degree of development in proximity to the ditch. The ditch mostly runs through agricultural fields used for grazing and/or hay production that have limited wildlife value. It crosses and has connectivity with higher value wildlife habitat in several areas that include the Mancos River riparian corridor, a riparian area along H Road, and Mormon Lake.

The Project area has been identified by Colorado Parks and Wildlife (CPW) as including mule deer (*Odocoileus hemionus*) winter range south of the Town of Mancos and summer range in the vicinity of Mormon Lake. The portion of the pipeline alignment around U.S. Highway 160 has been identified as a winter concentration area for elk (*Cervus elaphus*) and overall range occurs throughout the Project area. The Project occurs in an area that has also been identified by CPW as overall mountain lion (*Felis concolor*) range and overall black bear (*Ursus americanus*) range (CPW 2018). A variety of small mammals, reptiles, and amphibians also inhabit the general area. Those that would be likely to use the canal or adjacent areas include ground-dwelling rodents, such as white-tailed prairie dog (*Cynomys leucurus*) and several species of mice, voles (*Microtus* spp.), and shrews (family Soricidae). Some of the other wildlife in the area includes cottontail rabbit (*Sylvilagus* sp.), striped skunk (*Mephitis mephitis*), raccoon (*Procyon lotor*), red fox (*Vulpes vulpes*), coyote (*Canis latrans*), ground squirrels (*Spermophilus* spp.), terrestrial gartersnake (*Thamnophis elegans*), smooth greensnake (*Opheodrys vernalis*), and tiger salamander

(*Ambystoma tigrinum*) (CPW 2019). The Mancos River in the vicinity of the Project area contains some fish species including rainbow trout (*Oncorhynchus mykiss*) and bluehead sucker (*Catostomus discobolus*).

No Action: Under the No Action alternative, terrestrial wildlife habitat would remain in its current condition and no displacement of wildlife would occur. Salinity loading of the Colorado River Basin would continue at its current rate, which would continue to affect water quality within the drainage, potentially affecting the wildlife using the area.

Proposed Action: The Proposed Action would remove riparian habitat along approximately 5.4 miles of open irrigation ditch, including approximately 4,000 linear feet of riparian woodland habitat adjacent to the Mancos River. It would also remove a source of drinking water for wildlife by filling in the ditch. However, other drinking water sources are available throughout the area, including the Mancos River, small on-farm irrigation ditches, stock water ponds, and Mormon Lake.

Impacts to small animals, especially burrowing amphibians, reptiles, and small mammals, could include direct mortality and displacement during construction activities. Impacts to big game could include disturbance and displacement due to noise, traffic, and increased human presence. Pipeline trenches may also present a hazard to wildlife that could become trapped in the trench. Temporary wooden escape ramps would be placed in any trenches left open overnight to provide a way for wildlife or livestock to escape from or cross the trench. Disturbances to wildlife would be short-term during construction activities and would occur in an area where human presence is not uncommon.

The installation of a new headgate and the flattening and lowering of the return flow channel may temporarily increase the sediment in the Mancos River at the ditch diversion. These impacts would be localized and short-term. In the long-term, the reduction in salinity and selenium contributed to the river basins downstream of the Project area would benefit fish and aquatic birds.

To prevent fish from entering the water pipeline after construction, a fish screen would be placed over the intake structure of the headgate. The forebay at the Mancos River diversion would help to slow the water approach velocity and reduce fish impingement and injury at the screen. In addition, the proposed coanda style fish screen excludes fine debris and small aquatic organisms since the screen design encourages shallow, high velocity flow across the screen face (Reclamation 2006). The fast water flow would sweep fish and other organisms across the screen and back to the Mancos River through the return flow channel. A long-term benefit is expected from reduced fish entrainment in the pipeline.

To compensate for the loss of riparian habitat along the irrigation ditch, additional riparian habitat would be expanded and improved at the three habitat replacement sites. The work proposed at these sites includes the expansion of 0.37 acres of wetland habitat, the construction of a new 0.2-acre pond, and the planting of additional wetland vegetation, trees, and shrubs. A series of nest boxes would be installed at all three sites to encourage use by birds. On the Willenbuecher property, fencing would be reduced and replaced with wildlife friendly fencing. The sites would be protected from future disturbance through deed restrictions that prevent any development or activities that could negatively impact the wildlife habitat.

3.9 Special Status Species

3.9.1 Migratory Birds and Bald and Golden Eagles

The Migratory Bird Treaty Act (MBTA) provides federal protection to all migratory birds, as well as their nests and eggs. Destruction of vegetation that harbors active bird nests during nesting season can result in direct loss (i.e. "take") of eggs or young or cause adult birds to abandon eggs. The primary nesting season for migratory birds in the Proposed Action area is April 1 through July 15.

The U.S. Fish & Wildlife Service (USFWS) Birds of Conservation Concern for the project area include Grace's warbler (*Dendroica graciae*), Lewis's woodpecker (*Melanerpes lewis*), pinyon jay (*Gymnorhinus cyanocephalus*), rufous hummingbird (*Selasphorus rufus*), and Virginia's warbler (*Vermivora virginiae*) (USFWS 2019). Of these species, the rufous hummingbird is the only one with potential habitat in the project area where tubular flowers in pastures or feeders in backyards may provide a food source. This species does not breed in Colorado, but rather moves through the area while migrating.

Bald eagles (*Haliaeetus leucocephalus*) and golden eagles (*Aquila chrysaetos*) are protected under the Bald and Golden Eagle Protection Act and the MBTA. The golden eagle nests primarily on rock ledges or cliffs, less often in large trees, at elevations ranging from 4,000 to 10,000 feet. They are typically found in mountainous regions of open country, prairies, arctic and alpine tundra, open wooded areas, and barren areas. Golden eagles feed mainly on small mammals, as well as invertebrates, carrion, and other wildlife. Golden eagles nest between December 15 and July 15. Suitable cliff nesting sites for golden eagles do not exist in or within a mile of the Proposed Action area.

The bald eagle is typically found in various riparian habitats such as seacoasts, rivers, lakes, and marshes. They require mature stands of coniferous or hardwood trees for perching, roosting, and nesting. Bald eagles prey on fish as well as mammals, especially prairie dogs. Bald eagles nest during the period between October 15 and July 31. According to CPW, the Project is located within Bald Eagle winter range and a portion of the Project area south of the Town of Mancos and U.S. Highway 160 runs along the southern edge of a mapped winter concentration area. Tall cottonwoods suitable for tree-nesting raptors exist along the Mancos River corridor and at Mormon Lake. The nearest known active bald eagle nest is north of the Mancos River more than 2.5 miles from any part of the Proposed Action area.

No Action: In the absence of the Proposed Action, migratory bird and bald and golden eagle nesting and foraging habitat would remain in its current condition. No temporary displacement of migratory birds or eagles would occur. Salinity and selenium loading in the Colorado River Basin would continue at its current rate, potentially affecting migratory aquatic bird species.

Proposed Action: Direct impacts to migratory birds and eagles would include short-term disturbance and displacement during construction activities due to noise, traffic, and increased human presence. Wintering and migrating birds are not expected to experience measurable effects since adult birds have the flexibility to move away from disturbances to other suitable areas.

The removal of vegetation prior to construction activities has the potential to cause the loss of eggs or young if active nests are present. In addition, noise and human presence associated with construction activity has the potential to cause adult birds to abandon active nests. If feasible, any vegetation removal would occur outside the primary migratory bird breeding season (April 1 –

July 15). Any vegetation removal during the breeding season would be preceded by nesting surveys to identify any occupied nests and establish avoidance buffers until the young have fledged.

The nearest documented active bald eagle nest lies more than 2.5 miles from any part of the Proposed Action and lies outside the CPW recommended buffer distance for human encroachment. Therefore, nesting bald eagles are not likely to be affected by the Proposed Action. If during construction a new active raptor nest or a bald eagle roost site is discovered within 0.5 mile of the Proposed Action, construction would cease until Reclamation could complete consultations with USFWS and CPW.

3.9.2 Threatened and Endangered Species and Critical Habitat

The Endangered Species Act (ESA) of 1973 protects federally listed endangered, threatened, and candidate plant and animal species and their critical habitats. Table 1 presents the federally listed species that may occur within or near the Proposed Action area according to the USFWS Information for Planning and Consultation (IPaC) website (USFWS 2019). This table also summarizes habitat requirements and the potential for a species to occur in the Project area. An assessment of the actual potential for occurrence and potential for adverse impacts is based on known species habitat requirements, species geographic ranges, the presence of habitat within the Project area, and potential threats associated with the Project. There is no critical habitat within or directly adjacent to the Project area.

Table 1. Federally Listed Species Potentially Occurring in or Near the Project Area

Species	Status[1]	Habitat Requirements and Range	Potential to Occur in Project Area	Determination of Effect
MAMMALS				
New Mexico meadow jumping mouse (*Zapus hudsonius luteus*)	E	Perennial flowing water with dense, herbaceous riparian vegetation and adjacent xeric upland areas for nesting. Historically found in the Sangre De Cristo Mountains and San Juan Mountains from southern Colorado to central New Mexico and into eastern Arizona.	Yes	May affect, is not likely to adversely affect
BIRDS				
Mexican spotted owl (*Strix occidentalis lucida*)	T	Deep, shaded canyons and closed canopy old growth forests in canyons. Occurs in mountains and canyonlands in Utah, southern Colorado, and into New Mexico.	No. Project area does not include canyons or old growth forests.	No effect

Species	Status[1]	Habitat Requirements and Range	Potential to Occur in Project Area	Determination of Effect
Southwestern willow flycatcher (*Empidonax traillii extimus*)	E	Shrubby areas with standing water or along streams, woodland edges, and brush thickets. Occurs in the southwestern U.S. Occupies suitable habitats throughout New Mexico and the Pecos River.	Yes	May affect, is not likely to adversely affect
Yellow-billed cuckoo (*Coccyzus americanus*)	T	Mature cottonwood forests along major rivers in the southwestern U.S.	Yes	May affect, is not likely to adversely affect
FISH				
Colorado pikeminnow (*Ptychocheilus lucius*)	E	Occurs in large rivers in the Colorado River Basin. May be affected by water depletions in the upper Colorado River basin.	No. Minor water depletions may affect.	May affect, is likely to adversely affect
Greenback cutthroat trout (*Oncorhynchus clarkii stomias*)	T	Clear, cold mountain streams. Native to the headwaters of the South Platte and Arkansas River drainages in eastern Colorado, and a few headwater tributaries of the South Platte in southeastern Wyoming. Also occurs on the west slope of Colorado in tributaries to the Dolores River.	No. No streams in the action area or downstream are tributaries to any occupied greenback cutthroat trout streams.	No effect
Razorback sucker (*Xyrauchen texanus*)	E	Occurs in large rivers in Colorado River Basin. May be affected by water depletions in the upper Colorado River basin.	No. Minor water depletions may affect.	May affect, is likely to adversely affect

FLOWERING PLANTS				
Chapin mesa milkvetch (*Astragalus schmolliae*)	C	Pinyon-juniper habitat on Chapin Mesa in deep red loess soils. Known only to occur in Mesa Verde National Park and Ute Mountain Tribal Park.	No. No loess soils are present in the Project area and only minimal areas of pinyon-juniper woodland occur.	No effect

(1) USFWS status definitions:

E – Endangered. An animal or plant in danger of extinction within the foreseeable future throughout all or a significant portion of its range.

T – Threatened. Any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

C – Candidate. An animal or plant for which the USFWS has sufficient information on their biological status and threats to propose them as endangered or threatened under the ESA, but for which development of a proposed listing regulation is precluded by other higher priority listing activities.

The three federally listed threatened, endangered, and candidate species that were considered to have the potential to occur in the Project area or vicinity based on the presence of suitable habitat are discussed in further detail below. In addition, the Colorado pikeminnow and razorback sucker are discussed in further detail due to the potential for water depletions associated with the Proposed Action to impact downstream critical habitat. Designated critical habitat for the Colorado pikeminnow and razorback sucker is present in the San Juan River, more than 50 miles downriver from the Project area.

New Mexico meadow jumping mouse

Potential New Mexico meadow jumping mouse (NMMJM) habitat occurs in the riparian vegetation along the existing irrigation ditch where the vegetation is not heavily managed by landowners and where pinyon-juniper or pastureland does not directly abut the ditch. The areas of potential habitat were confined to the portion of the ditch north of U.S. Highway 160, where dense herbaceous vegetation and isolated willows dominate the banks of the ditch. Approximately 4,000 linear feet of the existing ditch alignment was surveyed for the presence of NMMJM following the USFWS protocols. No NMMJM were captured during the survey (Zahratka 2019).

Southwestern willow flycatcher

The Project Area contains approximately 25 acres of riparian areas considered suitable habitat for the southwestern willow flycatcher (SWFL). The large majority of suitable habitat, approximately 22 acres, is concentrated at the north end of the Project area within or near the riparian corridor of the Mancos River. The remaining suitable habitat, approximately 3 acres, occurs along the southern portion of the Project area where narrow bands of willow and Russian olive are present. The open agricultural fields and areas bordered by pinyon-juniper woodlands were not considered suitable SWFL habitat. The project area was intensively surveyed by SGM staff in accordance with protocols established by USFWS (Sogge et al. 2010). There were no observed SWFL adults or nests found during the surveys.

Yellow-billed cuckoo

Potential suitable habitat for the yellow-billed cuckoo (YBCU) was identified in the Project area along the riparian corridor of the Mancos River. Vegetated portions along the southern part of the ditch were not considered potential habitat due to a lack of continuous riparian vegetation and the narrowness of the vegetation corridor along the ditch. Surveys for the presence of YBCU were conducted within 0.5 mile of the Mancos River from U.S. Highway 160 north to the diversion point for the Proposed Action and along a 0.5 mile stretch above the diversion point. Surveys were conducted in accordance with USFWS protocols by SGM staff (Halterman et al. 2015). Approximately 52 acres were included in the survey. There were no observed YBCU adults or nests found during the surveys.

Colorado pikeminnow

No habitat for the Colorado pikeminnow (pikeminnow) exists within or adjacent to the Root & Ratliff Ditch or within the Mancos River adjacent to the Project area. The Mancos River is too cold and fast to support pikeminnow. The Mancos River is tributary to pikeminnow critical habitat in the San Juan River. A naturally reproducing population of pikeminnow is known to inhabit the San Juan River at its confluence with the Mancos River, more than 50 miles downstream of the Project area. In addition, return flows from the irrigation ditch eventually run back to the Mancos River south of the project area through Weber Creek.

Razorback sucker

The Mancos River is tributary to razorback sucker critical habitat in the San Juan River, located more than 50 miles downstream of the Project area. Larval razorback suckers have been collected from the San Juan River between Farmington, New Mexico and Shiprock, New Mexico, indicating the fish are spawning in this area (Platania and Farrington 2019). No habitat for the razorback sucker exists within or adjacent to the Root & Ratliff Ditch or within the Mancos River adjacent to the Project area.

No Action: The No Action alternative would have no effect on threatened and endangered species.

Proposed Action:

Reclamation consulted with the USFWS regarding the effects on threatened or endangered species and critical habitat from the Proposed Action (USFWS TAILS: 06E24100-2020-F-0211; Appendix D). USFWS concurred that the Proposed Action may affect, and is likely to adversely affect, the endangered Colorado River Basin fishes: Colorado pikeminnow and razorback sucker. The Proposed Action's biological opinion states that the Project is not likely to jeopardize the continued existence of the Colorado pikeminnow or razorback sucker, and is not likely to destroy or adversely modify designated critical habitat. The USFWS concurred that the Proposed Action may affect, but is not likely to adversely affect the New Mexico meadow jumping mouse, southwestern willow flycatcher, and yellow-billed cuckoo. The Proposed Action would have no effect to any other threatened or endangered species or their critical habitat.

New Mexico meadow jumping mouse. Potential direct impacts to the NMMJM from the proposed Project include the loss of approximately 4,000 linear feet of habitat along the north end of the current ditch alignment adjacent to the Mancos River riparian corridor. Due to the level of grazing that occurs along the Mancos River corridor, the area is not highly suitable for NMMJM. Indirectly, the piping and backfilling of the ditch could result in disturbance to potential NMMJM habitat surrounding the Project area due to construction activity and noise.

Southwestern willow flycatcher. Potential direct impacts to the SWFL from the proposed Project include the loss of possible habitat along the current ditch alignment. These impacts would be located primarily on the north end of the Project area where vegetation is denser and meets the characteristics of potential SWFL habitat. Although an area of riparian vegetation along the southern part of the Project area was identified as meeting the characteristics of SWFL habitat, this area is not considered great habitat since it is narrow and adjacent to active hay fields. Indirectly, the piping and backfilling of the ditch could result in disturbance to potential SWFL habitat surrounding the Project area due to construction activity and noise. An increase in potential SWFL habitat is expected from the proposed work at the habitat replacement sites. An improved water supply and the addition of trees and shrubs, as well as fences, would improve the quality of potential habitat at these locations.

Yellow-Billed Cuckoo. Potential direct impacts to the YBCU from the proposed Project include the loss of possible habitat along an approximate 0.5-mile length of the Mancos River riparian corridor. Indirectly, the piping and backfilling of the ditch could result in disturbance to potential YBCU habitat surrounding the ditch in this area due to construction activity and noise. Ground disturbance associated with the construction of the Proposed Action could create an avenue for invasive species to increase their presence in the riparian corridor as well. Of concern to YBCU is a potential increase in tamarisk abundance. Tamarisk invasion of riparian forests reduces the habitat effectiveness of an area for YBCU, with habitat effectiveness reaching near-zero as tamarisk approaches dominance.

Colorado pikeminnow and Razorback sucker. Water loss from evaporation would be slightly increased at the habitat replacement sites due to the proposed expansion of wetland habitat and construction of a new pond. The predicted total annual depletions from the pond and expanded wetland (0.57 acres total) based on the gross annual evaporation and average annual precipitation for the area would be 0.95 acre-feet (DWR 2019, Farnsworth et al. 1982, WRCC 2009). In addition, the Root and Ratliff Ditch has been diverting water from the Mancos River since 1875 with an estimated historic diversion of 4,144 acre-feet annually.

Water depletions occurring within the upper San Juan River Basin diminish backwater spawning areas for the pikeminnow and razorback sucker in downstream designated critical habitat. "Depletion" is defined as water which would contribute to the river flow if not intercepted and not returned to the system. This includes both surface and groundwater. Irrigation practices in the San Juan River Basin have diverted water from the basin rivers for over 140 years and continue to contribute to water depletions from the San Juan River.

A Biological Opinion (BO) was issued for the Animas-La Plata Project and again for the Navajo-Gallup Water Supply Project that analyzed historic depletions from the San Juan and Mancos Rivers in their environmental baselines. In 1999, the USFWS issued a BO to address the impact of individual minor water depletions of 100 acre-feet or less from the San Juan River Basin up to a cumulative annual total of 3,000 acre-feet. The BO determined that projects with minor water depletions less than 100 acre-feet within the aggregate total of 3,000 acre-feet are not likely to jeopardize the continued existence of the Colorado pikeminnow or razorback sucker and are not likely to destroy or adversely modify designated critical habitat.

Based on the BO issued in 1999, any actions which contribute to the cumulative effect of water depletions in the San Juan Basin constitute "may affect" determinations. Depletions associated with the Proposed Action include 4,144 acre-feet of historic depletions, which began in approximately 1875, and 0.95 acre-feet of new depletions. Although the historic depletions from

the Mancos River were included in the environmental baselines for the Animas-La Plata Project and Navajo-Gallup Water Supply Project, the USFWS has not been directly consulted regarding the historic depletions from the Root and Ratliff Ditch. Due to the associated water depletions, the Proposed Action "may affect, is likely to adversely affect" the Colorado pikeminnow and razorback sucker and their designated critical habitats. Water depletions to critical habitat for Colorado River basin endangered fishes are mitigated by the San Juan River Basin Recovery Implementation Program. Target flows of the San Juan River Flow Recommendations through Reclamation's reoperation of Navajo Dam to mimic the natural hydrograph would still be met with the Proposed Action.

3.10 Cultural Resources

Cultural resources are defined as physical or other expressions of human activity or occupation. Title 54 USC 300101 et seq., National Park Service and Related Programs (formerly known as the NHPA of 1966), requires Federal agencies to take into account the potential effects of a proposed Federal undertaking on historic properties. Such resources include culturally significant landscapes, prehistoric and historic archaeological sites, isolated artifacts or features, traditional cultural properties, Native American and other sacred places, and artifacts and documents of cultural and historical significance.

SWCA, Inc. conducted a Class III cultural resource inventory of the Proposed Action area. The inventory was conducted in November 2018 and July and September 2019. The cultural resource inventory covered 121.67 acres and included the proposed pipe alignment in a 100-foot wide corridor as well as the existing ditch, proposed access roads, staging areas, and habitat replacement sites. The purpose of a Class III cultural resource inventory is to identify and record all visible cultural resources within the Proposed Action area, including previously recorded cultural resources; evaluate the significance of the cultural resources and make recommendations regarding their eligibility to be recorded in the National Register of Historic Places (NRHP); assess the potential impact of the Proposed Action on significant cultural resources; and identify possible measures to mitigate such impacts. A total of 14 cultural resource sites were documented in the proposed Project area during the inventory. A summary of the results of the inventory is shown in Table 2.

Table 2. Summary of Documented Cultural Resource Sites

Site Number	Site Type	NHRP Eligibility Recommendation	Project Effect	Management Recommendations
5MT22131.4	Historic road segment	Eligible	No adverse effect	No further work
5MT23084	Historic/structural	Eligible	No adverse effect	Monitoring
5MT23085	Prehistoric artifact scatter with feature	Needs data	No adverse effect	Monitoring
5MT23086	Prehistoric artifact scatter	Eligible	No effect	No further work
5MT23087	Prehistoric artifact scatter	Needs data	No adverse effect	Monitoring and Constriction of construction right-of-way

Site Number	Site Type	NHRP Eligibility Recommendation	Project Effect	Management Recommendations
5MT23088.1	Historic road segment	Needs data	No adverse effect	No further work
5MT23089.1	Historic road segment	Needs data	No adverse effect	No further work
5MT23090.1	Historic road segment	Needs data	No adverse effect	No further work
5MT23091	Historic road segment	Needs data	No adverse effect	No further work
5MT23092	Historic ditch	Eligible	Adverse effect	Mitigation (Level II Documentation)
5MT23093	Isolated find	Not eligible	No effect	No further work
5MT23518	Historic building	Needs data	No adverse effect	Monitoring
5MT23520	Prehistoric artifact scatter	Needs data	No adverse effect	Monitoring
5MT23521	Historic homestead	Not eligible	No effect	No further work

Four sites were recommended eligible for inclusion in the NRHP, including the existing Root and Ratliff Ditch (5MT23092). The Root and Ratliff Ditch was one of the first irrigation systems in southwestern Colorado in the late nineteenth and early twentieth centuries and falls within the scope of the Water and Irrigation portion of the *Colorado Plateau Country Historic Context* (Hubbard 1984). The Ratliff and Root Ditch was constructed at the very beginning of the period of significance (1874–1922) and was instrumental in facilitating irrigation of the arid land near Mancos and settlement of the region, including successful cattle ranching and farming. SWCA Inc. recommended a finding of *Adverse Effects to Historic Properties* for the proposed Project since the historic feature of the Ratliff and Root Ditch would be adversely affected. A Colorado Office of Archaeology and Historic Preservation (OAHP) Level II Historic Site Documentation of the ditch was recommended to mitigate impacts to the ditch.

Five sites (5MT23084, 5MT23085, 5MT23087, 5MT23518, and 5MT23520) were recommended for monitoring by a qualified archaeologist during ground-disturbing activities within 100 feet. Other recommendations for these sites include backfilling the ditch with clean dirt obtained from outside of the site and raking and reseeding any vehicle tracks within the site boundaries after project completion to restore the sites to pre-project conditions. Additional recommendations for two of the four sites (5MT23085 and 5MT23087) included constricting the construction area immediately adjacent to and within 100 feet of the site to ensure site avoidance. If the recommendations are followed, then SWCA Inc. recommends no adverse effect on these five sites.

No Action: The No Action Alternative would have no effect on cultural resources.

Proposed Action: As a result of the Class III cultural resources inventory completed for the Proposed Action and in consultation with the Colorado State Historic Preservation Office

(SHPO), Reclamation has determined that the Proposed Action would have an adverse effect to historic irrigation structures within the Project area. The Root and Ratliff Ditch, which will be backfilled as part of the Proposed Action, has been identified as eligible for inclusion in the NRHP. Reclamation has entered into a Memorandum of Agreement (MOA) with the SHPO and Root and Ratliff Ditch Company to mitigate the impacts to the affected structures. The MOA is included as Appendix C and stipulates that Level II documentation be completed prior to any earth disturbing activities and an archaeological monitor be present during construction activities within 100 feet of five archaeological sites as recommended by the Class III cultural survey report. An Unanticipated Discovery Plan (UDP) is also attached to the MOA. Under the UDP, if previously undiscovered cultural or paleontological resources are discovered during construction, construction activities would immediately cease in the vicinity of the discovery, Reclamation would be notified, and SHPO would be consulted. Work would not resume until consultation was complete.

3.11 Agricultural Resources and Soils

The Root and Ratliff is owned and operated as a mutual ditch company under Colorado Water Law. There are 2,337 shares in the Root and Ratliff Ditch Company. The ditch delivers water to approximately 1,290 acres. On-farm irrigation is accomplished using laterals, gated pipe, or sprinkler systems. The main crops grown are hay and pasture grass. The irrigation season typically runs for approximately 153 days from May through September, during which the average diversion from the Mancos River is 12.8 cfs. The ditch also delivers an average of 2.44 cfs of stock water to shareholders during the non-irrigation season.

NRCS identifies categories of farmlands of national and statewide importance in the region, based on soil types and irrigation status. According to USDA, prime farmland has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber and oilseed crops. There are areas of prime farmland throughout the Project area. These areas are shown in Figure 4 along with the mapped soils for the Project area.

The major mapped soil units found in the Proposed Action Area are Pogo loam, Sideshow silty clay loam, Sideslide silty clay loam, Ustorthents, Collide clay loam, and Purcella loam. The Sideshow silty clay loam and Sideslide silty clay loam soils are derived from Mancos Shale, which formed in a marine environment and now contribute salinity and selenium loading in the Colorado River Basin.

No Action: The No Action alternative would have no effect on prime farmlands or agriculture. Farmlands in the Proposed Action area would continue to produce as in the past. Salinity loading from irrigation water contact with Mancos Shale-derived soils in the current irrigation ditch system would continue as it has in the past.

Proposed Action: Under the Proposed Action alternative, installation of the pipeline would disturb areas of existing agricultural production or pasture. Some of these areas have been designated as prime farmland by the NRCS. These areas would be reclaimed and reseeded as approved by private landowners and specified in easement agreements. No change in the amount or configuration of irrigated lands would occur as a result of the Proposed Action. Pipeline construction would occur during the off-season when no water is running through the ditch. Once the pipeline is functional, then the existing ditch would be decommissioned. No interruption to agricultural production is anticipated.

To minimize soil erosion during implementation of the Proposed Action, disturbed areas would be revegetated as soon as possible following disturbance. BMPs to promote revegetation success, such as stockpiling topsoil and using it for reclamation activities, would be followed.

In the long-term, the users of the Root and Ratliff Ditch would benefit from the increased efficiency of the ditch. The ditch would also provide a more reliable and flexible flow because diversions to users would be metered and irrigators would have the ability to shut off water when their irrigation is complete. The increased efficiency may result in more water being available during the irrigation season. The Proposed Action would also allow for the development of a gravity fed pressurized delivery system for improved on-farm water management and potential conversion to more high-efficiency irritation systems for certain users.

3.12 Cumulative Impacts

Cumulative impacts are impacts on the environment, which result from the incremental impact of the Proposed Action when added to other past, present, and reasonably foreseeable future actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. Past, present, and reasonably foreseeable future actions which may contribute cumulatively to impacts from the Proposed Action are described below. The cumulative area of analysis is limited to those actions identified within the immediate vicinity of the Proposed Action.

The Proposed Action may contribute to a reduction in riparian wildlife habitat that results from water management and land-use practices. As irrigation water is used more efficiently by agricultural producers, it becomes less available for wildlife. The Project would also continue to support grazing activities in the area, which can be destructive to riparian habitat. Ultimately, the intent of the proposed habitat replacement work is to offset the cumulative impacts from habitat loss associated with the Proposed Action.

The main cumulative impact expected from the Proposed Action is a decrease in the amount of salinity and selenium loading contributed to the Colorado River Basin from the Project Area. With the support of the Salinity Control Act, such projects are expected to continue in the overall basin with an overall improvement in the water quality downstream.

3.13 Summary of Impacts

Table 3 summarizes the predicted impacts/environmental consequences of the No Action and Proposed Action alternatives analyzed in this EA.

Table 3. Summary of Impacts of the Proposed Action

Resource	Impacts of No Action Alternative	Impacts of Proposed Action Alternative
Water Rights & Use	No effect	Positive long-term impact to water users from increased efficiency and control of irrigation water. No effect on water rights.

Resource	Impacts of No Action Alternative	Impacts of Proposed Action Alternative
Water Quality	Negative long-term impact to downstream water quality.	Positive long-term impact to downstream water quality. Short-term impact to local water quality during headgate construction.
Air Quality	No effect	Short-term increase in local dust during construction.
Access, Transportation, & Public Safety	No effect	Short-term increase in large vehicle and truck traffic on local roads. Short-term increase in traffic delays on local roads. Short-term increase in safety hazards to local residents on roads in Project area.
Recreation & Visual Resources	No effect	Minor impact on local viewshed with removal of riparian vegetation. Short-term impact to local residents using local roads for recreation.
Livestock Grazing	No effect	Short-term impact to livestock during construction due to trenches and possible need for relocation. Short-term impact to pasturelands and fences during construction.
Vegetative Resources & Weeds	No effect	Long-term impact to riparian vegetation along existing ditch and riparian woodland at Mancos River diversion. Possible impact to construction areas following revegetation due to an increased likelihood of noxious weed infestation. Positive impact at habitat replacement sites with expanded habitat, improved vegetation, and weed control.

Resource	Impacts of No Action Alternative	Impacts of Proposed Action Alternative
Wildlife Resources	Negative long-term impact to downstream fish and aquatic birds from selenium loading.	Long-term loss of water and riparian habitat along ditch and riparian woodland at Mancos River diversion. Possible mortality of small burrowing animals during construction. Short-term impacts to wildlife during construction from noise, increased human presence, increased traffic, and the possible presence of pipeline trenches left open overnight. Short-term impacts to local fish in Mancos River from sediment mobilization during headgate construction. Positive impact at habitat replacement sites with expanded habitat, improved vegetation, improved fencing, and the installation of nest boxes. Positive long-term impact to downstream fish and aquatic birds from improved water quality.
Special Status Species	No effect	Short-term disturbance and displacement during construction due to noise, traffic, and increased human presence. Long-term loss of riparian habitat along ditch and riparian woodland at Mancos River diversion. Positive impact at habitat replacement sites with expanded habitat, improved vegetation, and weed control. Positive long-term impact to downstream endangered fish and migratory aquatic birds from improved water quality. Minor impact to downstream endangered fish from increased water depletions at habitat replacement sites.
Cultural Resources	No effect	Long-term impact due to loss of Ratliff and Root Ditch historic feature. Impact would be mitigated through a Level II Historic Site Documentation of the ditch.
Agricultural Resources & Soils	No effect	Short-term impact to agricultural land during construction. Positive long-term impact to water users from increased efficiency and control of irrigation water.

Resource	Impacts of No Action Alternative	Impacts of Proposed Action Alternative
Cumulative Impacts	No effect	Cumulative decrease in the amount of salinity and selenium loading contributed to the Colorado River Basin and an overall improvement in the water quality downstream. Cumulative reduction in riparian wildlife habitat from water management and land-use practices.

4.0 Environmental Commitments

This section summarizes the environmental protection measures committed by the applicant to avoid or minimize resource impacts. These measures have been incorporated into the design of the Proposed Action and shall be included in the contractor bid specifications. Some commitments may be subject to approval by private landowners as addressed in individual easement agreements. The environmental commitments for the Proposed Action are described below under the resource they are designed to protect, although some of these measures are designed to protect or mitigate impacts to multiple resources.

Water Rights and Use

- The reliability of the water supply for the habitat replacement sites would be increased through the dedication of water rights (shares) in the Root and Ratliff Ditch.

Water Quality

- Construction activities and the storage of construction equipment and materials would be restricted to the established construction areas and staging areas. The boundaries of staging areas would be clearly marked.
- A Stormwater Management Plan would be prepared and submitted to the Colorado Department of Public Health & Environment (CDPHE) by the construction contractor prior to construction disturbance.
- Creek crossings would be constructed during periods when the watercourse is not flowing or flowing at low levels. If a small amount of flow is present, appropriate water control measures would be employed, such as temporary impoundments or drain ditches, which allow for construction to proceed while minimizing potential for mobilization of silt or erosion.
- Culverts would be appropriately sized to allow for normal stream flow and bedded and stabilized to prevent erosion. Embankments would be stabilized and appropriately vegetated.
- The working surfaces of all staging locations would be graded with stormwater erosion control installed for the duration of construction.
- Construction equipment would be stored and serviced only at an approved staging area.
- Equipment would be inspected daily and immediately repaired as necessary to ensure equipment is free of petrochemical leaks.

- A Spill Response Plan would be prepared in advance of construction by the contractor for areas of work where contaminants could flow into water bodies.
- Portable secondary containment would be provided for any fuel or lubricant containers. Any staging of fuel or lubricants, or fueling or maintenance of vehicles or equipment, would not be conducted within 100 feet of any surface water or drainage.
- No hazardous materials would be stored along the pipeline or ditch right-of-way.
- Gaps would be left at regular intervals in windrowed topsoil and subsoil stock piles to avoid ponding and excess diversion of natural runoff during storm events. Dry drainages or washes that cross the construction workspace would not be blocked with topsoil or subsoil piles. Topsoil and subsoil would be placed outside of the ordinary high-water mark of drainages.
- Any concrete pours would occur in forms and/or behind cofferdams to prevent discharge into waterways. Any wastewater from concrete-batching, vehicle wash down, and aggregate processing would be contained and treated or removed for off-site disposal.
- Work at the habitat replacement sites would be completed during the non-irrigation season (Approximately October through March) when the site has less water.
- Pre-construction notification would be given to the USACE under Nationwide Permit (NWP) No. 27. Care would be taken to minimize disturbance to wetland areas and restore these areas to pre-construction conditions as quickly as possible. Erosion and sediment controls would be used and all temporary fill, including sediment, mats, etc. would be removed once construction is complete and prior to reclamation activities.

Air Quality

- Fugitive dust would be minimized by wetting down exposed soils with potable water as necessary. Soil stockpiles may be compacted where appropriate.
- Traffic speeds would be minimized on unpaved roads.
- Open trucks would be covered while transporting materials likely to produce airborne dust.

Access, Transportation, and Public Safety

- The Root and Ratliff Ditch Company and the construction contractor would coordinate with the CDOT on work within the highway right-of-way, and with the Montezuma County Public Works Department for work within the county road right-of-way.
- Utility clearances would be obtained by the construction contractor prior to construction activities from local utilities in the area.
- The County Sheriff Department would be notified when traffic or access would be delayed or significantly re-routed.
- Existing county roads, private roads, and rights-of-way would be used for construction access as much as possible. Some access routes may require minor grading to provide for truck travel to the project alignment.
- The construction workspace would be graded as needed in steeper areas to allow for safe operation of construction equipment.

- Access routes and road crossings would be returned to the same or better condition than they were prior to construction once the pipeline has been completed.
- Dedicated easements would be negotiated with private landowners for the pipeline right-of-way prior to construction. Easements would be recorded with Montezuma County.
- The depth to the top of the pipeline would not be less than 2 feet.
- All pipeline welds would be visually inspected by a qualified inspector before backfilling operations.
- Larger rocks would be sifted out from excavated material and not used for backfilling around the installed pipeline. In rocky areas, padding material or a rock shield would be used to protect the pipe.

Recreational and Visual Resources

- Following construction, any construction debris would be removed and disposed of properly.
- Car tires and household waste that exist in some reaches of the ditch would be recycled or disposed of in a suitable land fill.
- To ensure public safety, pipe trenches left open while unattended (e.g. overnight) that could pose a hazard to recreators on public roads would be covered and marked.

Livestock Grazing

- The contractor would contact landowners before trenching a section of the pipeline in order to ensure livestock are not released due to downed fences or prevented from reaching water sources because of open trenches.
- A portion of the ditch on the Willenbuecher property habitat replacement site would be left unfenced to provide access to water for livestock.
- All cattle guards and fences affected by construction activities would be returned to conditions substantially similar to those existing prior to construction.

Vegetative Resources and Weeds

- Vegetation removal would be confined to the smallest portion of the Proposed Action area necessary for completion of the work.
- The top 12 inches of topsoil excavated from the pipeline trench would be stockpiled and used in reclamation activities following construction. Topsoil would be stockpiled separately from subsoil.
- All areas disturbed during construction would be reclaimed subject to any conditions from private land owners. Disturbed surfaces would be contoured to match the surrounding area and restore drainage patterns.
- Drought-tolerant and weed-free seed mixes appropriate for the surrounding native vegetation would be used as approved by private land owners and Reclamation.
- The contractor would employ drill or broadcast seed methods to ensure proper seed placement. The seed would be uniformly raked, chained, dragged, or cultipacked to incorporate seed to a sufficient seeding depth, if possible. Reseeded sites would be mulched to facilitate germination and growth.

- Drill seeding is preferred and would be used wherever soil characteristics and slope allow effective operation of a rangeland seed drill. Drill seeding would be performed perpendicular to the slope; seed would be placed in direct contact with the soil at an average depth of 0.5 inches, covered with soil, and compacted to eliminate air pockets around the seeds.
- Broadcast seeding would be employed in areas where drill seeding is unsafe or physically impossible. Seed would be applied uniformly over disturbed areas with manually operated cyclone-bucket spreaders, mechanical spreaders, or other methods. Broadcast application rates would be twice that of drill rates.
- Weed control would be implemented by the ditch company contractor in accordance with right-of-way stipulations and current Montezuma County weed control standards.
- All equipment would be cleaned before it is brought to the construction area to remove seeds and/or pieces of noxious weeds in order to minimize the introduction and spread of noxious weeds.
- Weed-free straw or hay bales would be required to be used on the site for erosion control. Seed applied in reclamation would be required to be weed free. Only clean fill materials would be imported onto the site for use during construction.
- Revegetation would occur at the earliest practical time to re-establish a ground cover on exposed soils that would help prevent the encroachment, establishment, and/or spread of invasive species.
- Areas of noxious weeds on the habitat replacement sites would be treated using biological agents or herbicides as approved by the landowner.

Wildlife Resources

- Temporary wooden escape ramps or dirt plugs would be placed in any trenches left open overnight to provide a way for wildlife or livestock to escape from or cross the trench.
- To prevent fish from entering the water pipeline, screens would be placed over the intake structure at the Mancos River diversion.
- The habitat replacement sites would be protected from future disturbance through the use of deed restrictions that prevent any development or activities that could negatively impact the wildlife habitat.
- Fencing would be reduced and replaced with wildlife friendly fencing on the Willenbuecher property habitat replacement site.
- A series of nest boxes would be installed at the habitat replacement sites to encourage use by birds.

Special Status Species

- If feasible, any vegetation removal would occur outside the migratory bird breeding season (April 1 – July 15). Any vegetation removal during the breeding season would be preceded by nesting surveys to identify any occupied nests and establish avoidance buffers until the young have fledged.
- If during construction a new active raptor nest or a bald eagle roost site is discovered within 0.5 mile of the Proposed Action, construction would cease until Reclamation could complete consultations with USFWS and CPW.

- In the event that threatened or endangered species are encountered during construction, the ditch company shall stop construction activities until Reclamation has consulted with USFWS to ensure that adequate measures are in place to avoid or reduce impacts to the species.

Cultural Resources

- A Colorado OAHP Level II Historic Site Documentation would be completed for the existing Root and Ratliff Ditch (cultural site 5MT23092) prior to any ground-disturbing activities.
- Ground-disturbing activities within 100 feet of cultural sites 5MT23084, 5MT23085, 5MT23087, 5MT23518, and 5MT23520 would be monitored by a qualified archaeologist.
- The irrigation ditch in the vicinity of cultural sites 5MT23084, 5MT23085, 5MT23087, 5MT23518, and 5MT23520 would be backfilled with clean dirt obtained from outside of the site.
- After project completion, any vehicle tracks within the boundary of cultural sites 5MT23084, 5MT23085, 5MT23087, 5MT23518, and 5MT23520 would be raked and reseeded to restore the sites to pre-project conditions.
- The construction area immediately adjacent to and within 100 feet of cultural sites 5MT23085 and 5MT23087 would be constricted to ensure site avoidance.
- An Unanticipated Discovery Plan (UDP) is also attached to the MOA. Under the Unanticipated Discovery Plan attached to the MOA, if previously undiscovered cultural or paleontological resources are discovered during construction, construction activities would immediately cease in the vicinity of the discovery, Reclamation would be notified, and SHPO would be consulted. Work would not resume until consultation was complete.

Agricultural Resources and Soils

- Construction of the pipeline in the existing ditch alignment would occur during the non-irrigation season (approximately October through March) in order to allow use of the irrigation ditch by water users. Decommissioning and backfilling of the ditch would be performed after proper operation of the new pipeline has been verified.

5.0 Consultation and Coordination

Reclamation's consultation and coordination process presents other agencies, interest groups, and the general public with opportunities to obtain information about a given project and allows interested parties to participate in the project through written comments. The key objective is to facilitate a well-informed, active public that assists decision-makers throughout the process, culminating in the implementation of an alternative. This section explains consultation and coordination undertaken for the Proposed Action.

5.1 Scoping and Coordination

Scoping for this EA was completed by Reclamation, in consultation with the agencies and organizations listed below, during the planning stages of the Proposed Action to identify the potential environmental and human environment issues and concerns associated with implementation of the Proposed Action and No Action alternatives.

- Montezuma County
- U.S. Fish & Wildlife Service, Ecological Services, Grand Junction, CO
- U.S. Army Corps of Engineers, Colorado West Regulatory Branch, Durango, CO

Consultation with the Colorado Office of Archaeology and Historic Preservation, the Hopi Tribe, Kewa Pueblo, Navajo Nation, Ohkay Owingeh Pueblo, Pueblo of Acoma, Pueblo of Cochiti, Pueblo of Isleta, Pueblo of Jemez, Pueblo of Laguna, Pueblo of Nambe, Pueblo of Picuris, Pueblo of Pojoaque, Pueblo of San Felipe, Pueblo of San Ildefonso, Pueblo of Sandia, Pueblo of Santa Ana, Pueblo of Santa Clara, Pueblo of Taos, Pueblo of Tesuque, Southern Ute Tribe, Ute Indian Tribe, Ute Mountain Ute Tribe, Zia Pueblo, and Zuni Pueblo was conducted pursuant to Title 54 USC 300101 et seq.

5.2 Public Review

In compliance with NEPA, the Draft EA was available for public comment for a 30-day period during April 2020 via Reclamation's website at https://www.usbr.gov/uc/envdocs/index.html. Notice of publication of the Draft EA was distributed to Root and Ratliff Ditch shareholders, private landowners adjacent to the Proposed Action, and the organizations and agencies listed in Appendix E. No comments were received during the review period. The Final EA will be made available on Reclamation's website (see above).

6.0 References

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Figures

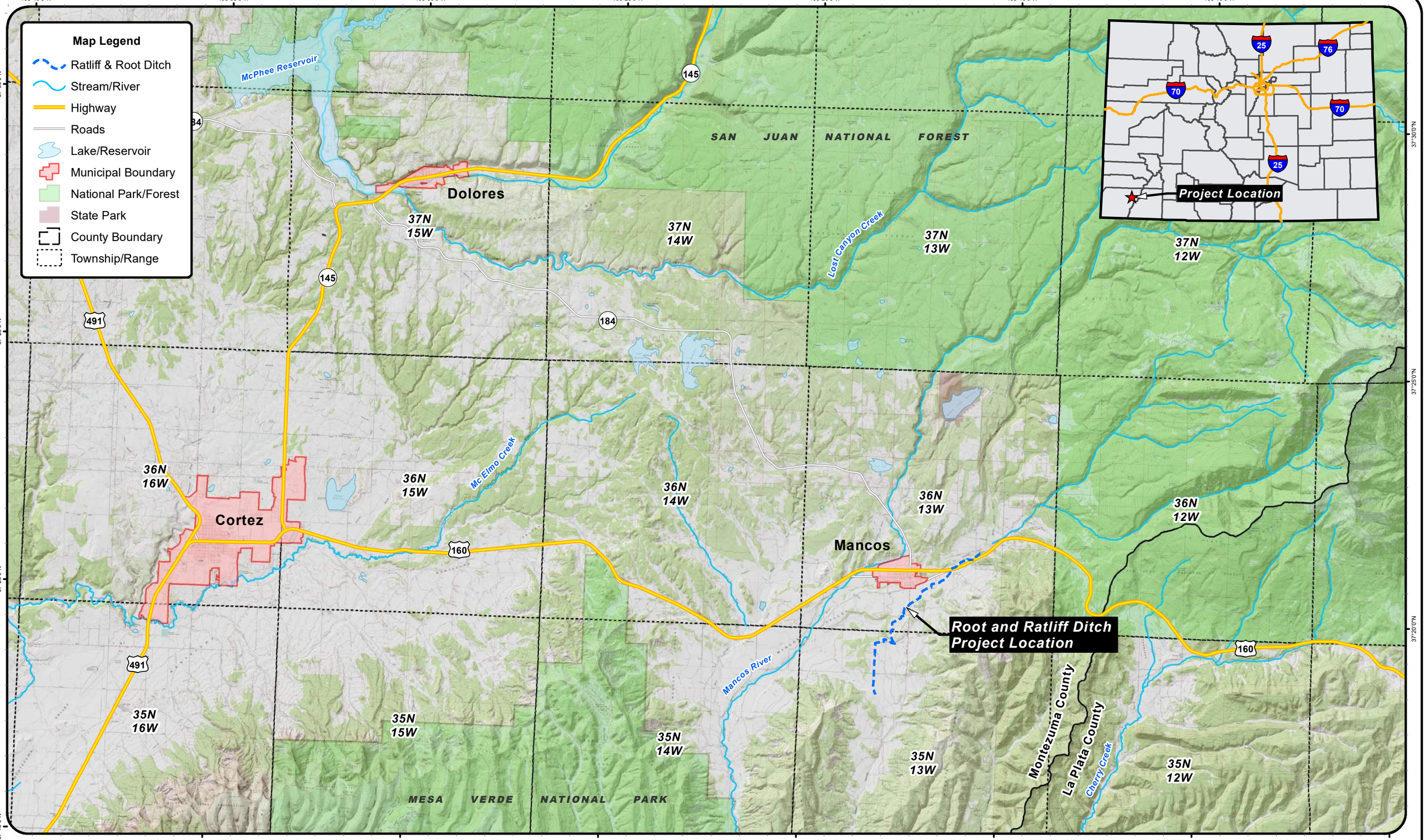

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Figure 1.
Ratliff and Root Ditch Vicinity Map

Date: 11/19/2018	Job No. 2018-391.001	Map by: RZM	Checked by: DBM	Scale: 1:126,720

Data Sources: USGS, CDOT, Montezuma County GIS, ESRI

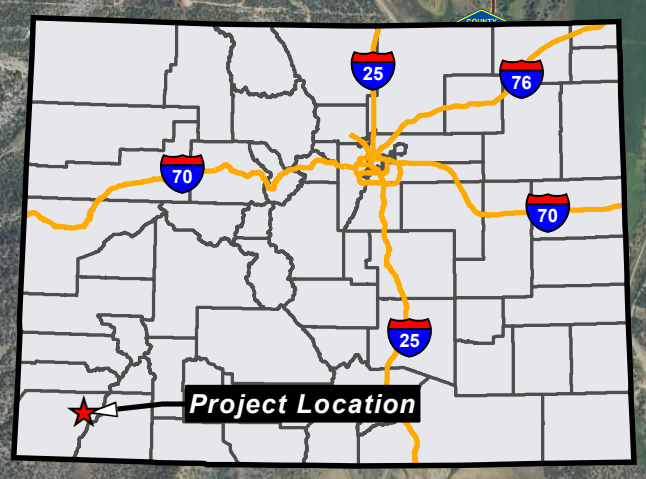
File: P:\Project Files\2018-391.001 Ratliff & Root Ditch\H-Dwgs\GIS\MXDs\Fig1-VicinityMap.mxd

The information displayed above is intended for general planning purposes. Refer to legal documentation/data sources for descriptions/locations.

0 2 4 Miles

1 inch = 2 miles

N



Ratliff & Root Point of Diversion

Staging Areas

Staging will ocur inside 50 FT easment along this area of alignment

Strother Site

Staging Areas For Habitat Replacement Sites

Hoessle Site

Willenbuecher Site

Contractor is responsible for obtaining excess borrow needed to complete project outside of material generated from pipe trench excavation and ditch

Mancos

36N 13W

35N 13W

160

Webber Ditch

COUNTY 41 ROAD

COUNTY H ROAD

COUNTY G ROAD

108°19'0"W 108°18'30"W 108°18'0"W 108°17'30"W 108°17'0"W 108°16'30"W 108°16'0"W 108°15'30"W

37°22'0"N 37°21'30"N 37°21'0"N 37°20'30"N 37°20'0"N 37°19'30"N 37°19'0"N 37°18'30"N 37°18'0"N

Map Legend

- Point of Diversion
- Ratliff & Root Ditch
- Proposed Pipeline Alignment
- Staging Areas
- Other Ditch/Lateral
- Other Road
- Highway
- Municipal Boundary
- Township/Range

Habitat Replacement Site

- Willenbuecher Site
- Strother Site
- Hoessle Site

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Figure 2
Ratliff & Root Ditch
Project Area Map

Date:12/27/2019 | Job No. 2018-391.001 | Map by: ANW | Checked by: BK | Scale: 1:21,000

Data Sources: DWR, CDOT, Montezuma County GIS, ESRI, NAIP 2017 Imagery

File: P:\Project Files\2018-391.001 Ratliff & Root Ditch\H-Dwgs\GIS\MXDs\BA\Fig2-ProjectAreaMap.mxd

0 1,750 3,500 Feet

1 inch = 1,750 feet

N

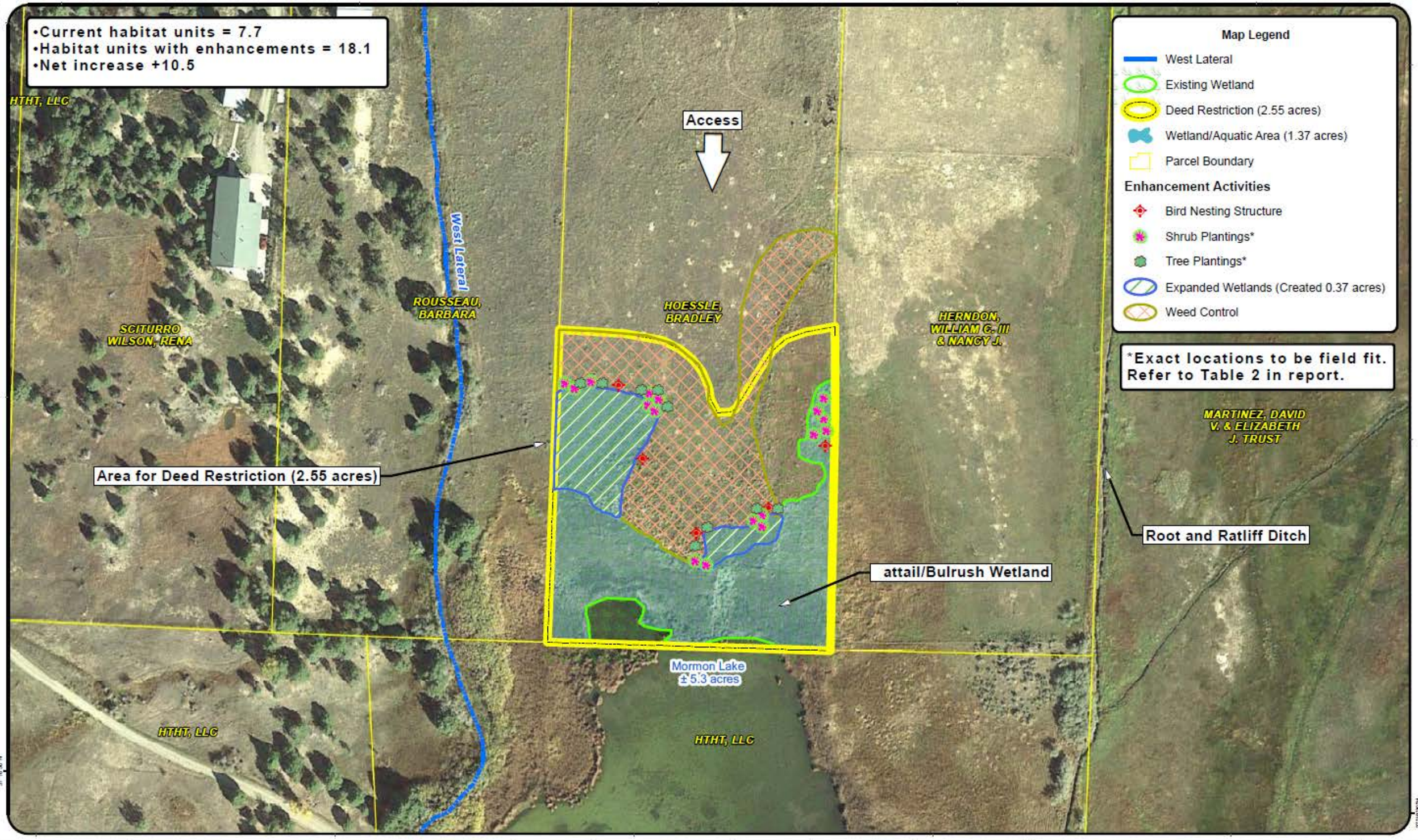

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Figure 3a
Proposed Work Plan for Hoessle Site
Root and Ratliff Ditch

Date: 12/27/2019	Job No. 2018-391.001	Map by: DSS	Checked by: DBM	Scale: 1:1,200

Data Sources: Montezuma County GIS, Google Earth Imagery - 10/12/2017

File: P:\Project Files\2018-391.001 Ratliff & Root Ditch\H-Dwgs\GIS\MXDs\BA\Fig3a-WorkPlan-HossleSite20191213.mxd

The information displayed above is intended for general planning purposes. Refer to legal documentation/data sources for descriptions/locations.

0 100 200 300 Feet

1 inch = 100 feet

N

Pasture

Access

Swale (Ditch)

Fence Kept As Is

Area for Deed Restriction (10.10 acres)

Open Reach Between the Existing Braces (at least 41.5 FT long) For Cattle Watering

Access

STROTHER FAMILY TRUST

Create Habitat Along Ditch

WILLENBUECHER, ILSE

Fence Kept As Is

SCITURRO WILSON, RENA

Pasture

Private Drive (Access)

Install Pipe to Connect Outlet Structure with Ditch

Shallow Pond

Fence Kept As Is

HTHT, LLC

Map Legend

- Swale (Ditch)
- Existing Wetland
- Area for Deed Restriction (10.10 acres)
- Wetland/Aquatic Area (2.23 acres)
- Parcel Boundary

Enhancement Activities

- Bird Nesting Structure
- Pond Plantings
- Shrub Plantings*
- Tree Plantings*
- Fence Removed
- Fencing Enhanced For Wildlife
- New Pond - (0.2 acres)
- Weed Control

*Exact locations to be field fit. Refer to Table 2 in report.

- Current habitat units = 50.1
- Habitat units with enhancements = 78.8
- Net increase + 28.7

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Figure 3b
Proposed Work Plan for Willenbuecher Site
Root and Ratliff Ditch

Date: 12/27/2019	Job No. 2019-391.001	Map by: DSS	Checked by: DBM	Scale: 1:1,200

Data Sources: Montezuma County GIS, Google Earth Imagery - 10/12/2017

File: P:\Project Files\2018-391.001 Ratliff & Root Ditch\H-Dwgs\GIS\MXDs\BA\Fig3b-WorkPlan-WillenbuecherSite.mxd

The information displayed above is intended for general planning purposes. Refer to legal documentation/data sources for descriptions/locations.

0 100 200 300 Feet

1 inch = 100 feet

N

Map Legend

- Deed Restriction Area (2.36 acres)
- Wetland/Aquatic Area (1.17 acres)
- Parcel Boundary

Enhancement Activities

- Bird Nesting Structure
- Pond Plantings
- Shrub Plantings*
- Tree Plantings*
- Weed Control

Access

G Road

STROTHER FAMILY TRUST

WILLENBUECHER, ILSE

Outlet

Irrigated Pasture

Access

STROTHER FAMILY TRUST

WILLENBUECHER, ILSE

Area for Deed Restriction (2.36 acres)

Fence Kept As Is

*Exact locations to be field fit. Refer to Table 2 in report.

- Current habitat units = 13.5
- Habitat units with enhancements = 19.1
- Net increase + 5.7

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Figure 3c
Proposed Work Plan for Strother Property
Root and Ratliff Ditch

Date: 12/27/2019	Job No. 2018-391.001	Map by: DSS	Checked by: DBM	Scale: 1:1,200

Data Sources: Montezuma County GIS, Google Earth Imagery - 10/12/2017

File: P:\Project Files\2018-391.001 Ratliff & Root Ditch\H-Dwgs\GIS\MXDs\BA\Fig3c-WorkPlan-StrotherSite.mxd

0 100 200 300 Feet

1 inch = 100 feet

N

Appendix A
Photographs of Project Area

Appendix A
Photographs of Project Area
Root & Ratliff Ditch

Photo 1. Ditch headgate on the Mancos River.

Photo 2. Segment with riparian forest north of State Highway 160.

Photo 3.Large alders in incised ditch north of State Highway 160.

Appendix A
Photographs of Project Area
Root & Ratliff Ditch

Photo 4. Reach with trampled banks and dead willows south of State Highway 160.

Photo 5. Reach of ditch below cemetery on dry hillside with no wildlife habitat.

Photo 6. Segment with monoculture of reed canarygrass on both lower banks.

Appendix A
Photographs of Project Area
Root & Ratliff Ditch

Photo 7. Segment with old cottonwoods along ditch.

Photo 8. Reach with herbaceous and shrub layers.

Photo 9. Reach with large, narrowleaf cottonwoods, willows, and herbaceous layer (and tires in the ditch).

Appendix A
Photographs of Project Area
Root & Ratliff Ditch

Photo 10. Relatively large wetland with willows and herbaceous understory at H Road.

Photo11. Reach with dense willows along H Road.

Photo 12. Willows along ditch south of H Road. Note grazed/cut field up to willows.

Photo 13. Towards the end of ditch looking west at Mormon Lake in the background. The ditch is incised 2-3 feet in this reach.

Appendix A
Photographs of Project Area
Root & Ratliff Ditch

Photo 14. Ditch through large wetland area with Mormon lake to the right off the photo.

Photo 15. Concrete splitter box at the end of the ditch.

Appendix B

U.S. Army Corps of Engineers Approved Jurisdictional Determination

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, SACRAMENTO DISTRICT
1325 J STREET
SACRAMENTO CA 95814-2922

March 25, 2019

Regulatory Division (SPK-2019-00108)

Root and Ratliff Ditch Company
Attn: Mr. Sam Perry
Root and Ratliff Ditch
Mancos, Colorado 81328
salomesam@gmail.com

Dear Mr. Perry:

We are responding to your February 12, 2019, request for an approved jurisdictional determination for the Root and Ratliff Ditch Pipeline site. The project site is located along the Root and Ratcliff irrigation ditch that starts at the Mancos River at Latitude 37.353940°, Longitude -108.260298°, and terminates below Mormon Lake, Latitude 37.305245°, Longitude -108.301836°, Montezuma County, Colorado.

Based on available information, we concur with your aquatic resources delineation for the site, as depicted on the enclosed map of the review area, prepared by SGM (enclosure 1). The review area is limited to the Root and Ratliff Ditch, which is an irrigation ditch that does not convey water to a waters of the United States. The ditch is located in uplands and does not act as a drainage ditch. During normal conditions, in which irrigation water is not turned on, this ditch would not have an ordinary high-water mark or support wetland conditions. The preamble to 33 CFR Parts 320 through 330 states that non-tidal drainage and irrigation ditches excavated on dry land are generally not waters of the United States. Therefore, this ditch is not a waters of the United States. We are enclosing a copy of the *Approved Jurisdictional Determination Form* for your site (enclosure 2).

This approved jurisdictional determination is valid for five years from the date of this letter, unless new information warrants revision of the determination before the expiration date. If you object to this determination, you may request an administrative appeal under Corps regulations at 33 Code of Federal Regulations (CFR) Part 331.

A *Notification of Appeal Process (NAP) and Request for Appeal (RFA) Form* is enclosed (enclosure 3). If you request to appeal this determination, you must submit a completed RFA form to the South Pacific Division Office at the following address: Administrative Appeal Review Officer, Army Corps of Engineers, South Pacific Division, CESPD-PDO, 1455 Market Street, 2052B, San Francisco, California 94103-1399, Telephone: 415-503-6574, FAX: 415-503-6646.

In order for an RFA to be accepted by the Corps, we must determine that the form is complete, that it meets the criteria for appeal under 33 CFR Part 331.5, and that the form was received by the Division Office within 60 days of the date of the NAP. It is not necessary to submit an RFA form to the Division Office unless you object to the determination in this letter.

We recommend that you provide a copy of this letter and notice to all other affected parties, including any individual who has an identifiable and substantial legal interest in the property.

This approved jurisdictional determination has been conducted to identify the limits of aquatic resources subject to U.S. Army Corps of Engineers jurisdiction under Section 404 of the Clean Water Act for the particular site identified in this request.

We appreciate feedback, especially about interaction with our staff and our processes.

Please refer to identification number SPK-2019-00108 in any correspondence concerning this project. If you have any questions, please contact me at the Durango Regulatory Office, 1970 E 3rd Ave., #109, Durango, Colorado 81301, by email at *Kara.A.Hellige@usace.army.mil*, or telephone at (970) 259-1604. For program information or to complete our Customer Survey, visit our website at *www.spk.usace.army.mil/Missions/Regulatory.aspx*.

Sincerely,

HELLIGE.KARA.A.1230362676

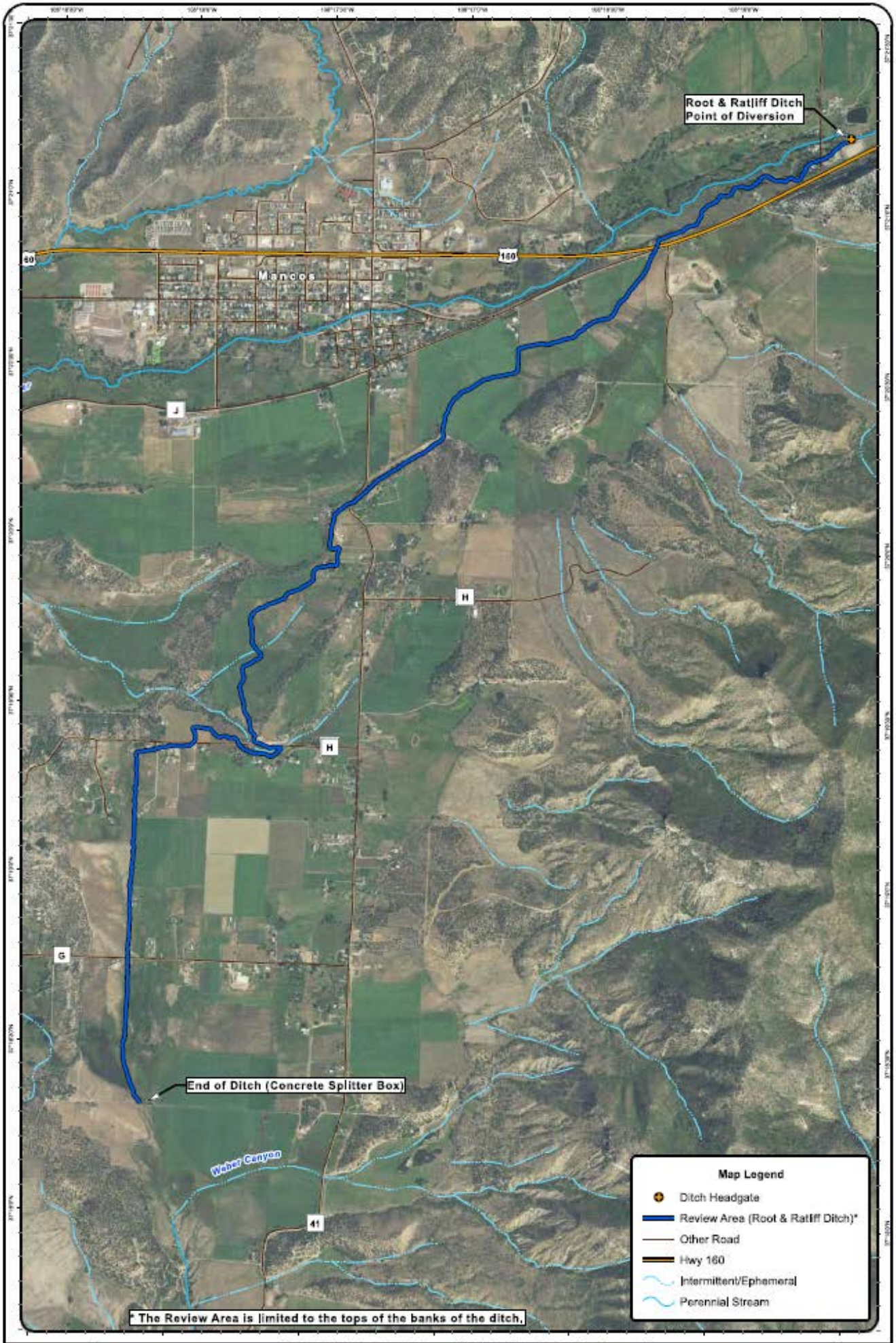
Digitally signed by HELLIGE.KARA.A.1230362676
DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=USA, cn=HELLIGE.KARA.A.1230362676
Date: 2019.03.25 15:16:29 -06'00'

Kara A. Hellige
Senior Project Manager
CO West Section

Enclosures

cc:

Mr. Dave Mehan, SGM, *davem@sgm-inc.com*



SGM

Figure 3
Review Area Root and Ratliff Ditch
Approved JD Request (SPK - 2009 - 00108)

Date: 3/21/2019 | Job No.: 2018-891.001 | Map by: RDM | Checked by: DSM | Scale: 1:15,000
Data Sources: NAIP 2017, Montezuma County GIS, CDOT, USGS
File: P:\Project Files\2018\891.001 Ratliff & Root Ditch\Maps\ReMXD\Fig3aReviewArea.mxd
The information displayed above is intended for general planning purposes. Refer to legal documents/data sources for descriptions/locations.

0 1,500 3,000 Feet
1 inch = 1,500 feet

N

APPROVED JURISDICTIONAL DETERMINATION FORM
U.S. Army Corps of Engineers

This form should be completed by following the instructions provided in Section IV of the JD Form Instructional Guidebook.

SECTION I: BACKGROUND INFORMATION

A. REPORT COMPLETION DATE FOR APPROVED JURISDICTIONAL DETERMINATION (JD): March 22, 2019

B. DISTRICT OFFICE, FILE NAME, AND NUMBER: Sacramento District, **Root and Ratliff Ditch Pipeline**, **SPK-2019-00108**

C. PROJECT LOCATION AND BACKGROUND INFORMATION:
State: **Colorado** County/parish/borough: **Montezuma County** City:
Center coordinates of site (lat/long in degree decimal format): Lat. **37.3538333333333**°, Long. **-108.259791666667**°
Universal Transverse Mercator: **12 742703.18 4137648.28**
Name of nearest waterbody: **Weber Canyon**
Name of nearest Traditional Navigable Water (TNW) into which the aquatic resource flows: **East Mancos River**
Name of watershed or Hydrologic Unit Code (HUC): **Mancos, 14080107**
☒ Check if map/diagram of review area and/or potential jurisdictional areas is/are available upon request.
☐ Check if other sites (e.g., offsite mitigation sites, disposal sites, etc…) are associated with this action and are recorded on a different JD form:

D. REVIEW PERFORMED FOR SITE EVALUATION (CHECK ALL THAT APPLY):
☒ Office (Desk) Determination. Date: **March 22, 2019**
☐ Field Determination. Date(s):

SECTION II: SUMMARY OF FINDINGS

A. RHA SECTION 10 DETERMINATION OF JURISDICTION.

There **are no** "*navigable waters of the U.S.*" within Rivers and Harbors Act (RHA) jurisdiction (as defined by 33 CFR part 329) in the review area. [*Required*]
☐ Waters subject to the ebb and flow of the tide.
☐ Waters are presently used, or have been used in the past, or may be susceptible for use to transport interstate or foreign commerce. Explain:

B. CWA SECTION 404 DETERMINATION OF JURISDICTION.

There **are no** "*waters of the U.S.*" within Clean Water Act (CWA) jurisdiction (as defined by 33 CFR part 328) in the review area. [*Required*]

1. **Waters of the U.S.**
   a. **Indicate presence of waters of U.S. in review area (check all that apply):** [1]
      ☐ TNWs, including territorial seas
      ☐ Wetlands adjacent to TNWs
      ☐ Relatively permanent waters[2] (RPWs) that flow directly or indirectly into TNWs
      ☐ Non-RPWs that flow directly or indirectly into TNWs
      ☐ Wetlands directly abutting RPWs that flow directly or indirectly into TNWs
      ☐ Wetlands adjacent to but not directly abutting RPWs that flow directly or indirectly into TNWs
      ☐ Wetlands adjacent to non-RPWs that flow directly or indirectly into TNWs
      ☐ Impoundments of jurisdictional waters
      ☐ Isolated (interstate or intrastate) waters, including isolated wetlands

   b. **Identify (estimate) size of waters of the U.S. in the review area:**
      Non-wetland waters: linear feet, wide, and/or acres.
      Wetlands: acres.

   c. **Limits (boundaries) of jurisdiction** based on: **Pick List**
      Elevation of established OHWM (if known):

2. **Non-regulated waters/wetlands (check if applicable):**[3]
   ☒ Potentially jurisdictional waters and/or wetlands were assessed within the review area and determined to be not jurisdictional. Explain: **The review area contains an irrigation ditch that does not convey water to a waters of the United States. The ditch is located in uplands and does not act as a drainage ditch. During normal conditions, in which irrigation water is not turned on, this ditch would not have an ordinary high-water**

[1] Boxes checked below shall be supported by completing the appropriate sections in Section III below.
[2] For purposes of this form, an RPW is defined as a tributary that is not a TNW and that typically flows year-round or has continuous flow at least "seasonally" (e.g., typically 3 months).
[3] Supporting documentation is presented in Section III.F.

mark or support wetland conditions. The preamble to 33 CFR Parts 320 through 330 states that non-tidal drainage and irrigation ditches excavated on dry land are generally not waters of the United States.

SECTION III: CWA ANALYSIS

A. TNWs AND WETLANDS ADJACENT TO TNWs

The agencies will assert jurisdiction over TNWs and wetlands adjacent to TNWs. If the aquatic resource is a TNW, complete Section III.A.1 and Section III.D.1. only; if the aquatic resource is a wetland adjacent to a TNW, complete Sections III.A.1 and 2 and Section III.D.1.; otherwise, see Section III.B below.

1. TNW
Identify TNW:

Summarize rationale supporting determination:

2. Wetland adjacent to TNW
Summarize rationale supporting conclusion that wetland is "adjacent":

B. CHARACTERISTICS OF TRIBUTARY (THAT IS NOT A TNW) AND ITS ADJACENT WETLANDS (IF ANY):

This section summarizes information regarding characteristics of the tributary and its adjacent wetlands, if any, and it helps determine whether or not the standards for jurisdiction established under *Rapanos* have been met.

The agencies will assert jurisdiction over non-navigable tributaries of TNWs where the tributaries are "relatively permanent waters" (RPWs), i.e. tributaries that typically flow year-round or have continuous flow at least seasonally (e.g., typically 3 months). A wetland that directly abuts an RPW is also jurisdictional. If the aquatic resource is not a TNW, but has year-round (perennial) flow, skip to Section III.D.2. If the aquatic resource is a wetland directly abutting a tributary with perennial flow, skip to Section III.D.4.

A wetland that is adjacent to but that does not directly abut an RPW requires a significant nexus evaluation. Corps districts and EPA regions will include in the record any available information that documents the existence of a significant nexus between a relatively permanent tributary that is not perennial (and its adjacent wetlands if any) and a traditional navigable water, even though a significant nexus finding is not required as a matter of law.

If the waterbody[4] is not an RPW, or a wetland directly abutting an RPW, a JD will require additional data to determine if the waterbody has a significant nexus with a TNW. If the tributary has adjacent wetlands, the significant nexus evaluation must consider the tributary in combination with all of its adjacent wetlands. This significant nexus evaluation that combines, for analytical purposes, the tributary and all of its adjacent wetlands is used whether the review area identified in the JD request is the tributary, or its adjacent wetlands, or both. If the JD covers a tributary with adjacent wetlands, complete Section III.B.1 for the tributary, Section III.B.2 for any onsite wetlands, and Section III.B.3 for all wetlands adjacent to that tributary, both onsite and offsite. The determination whether a significant nexus exists is determined in Section III.C below.

1. Characteristics of non-TNWs that flow directly or indirectly into TNW

(i) General Area Conditions:
Watershed size: **Pick List**
Drainage area: **Pick List**
Average annual rainfall: inches
Average annual snowfall: inches

(ii) Physical Characteristics:
(a) Relationship with TNW:
☐ Tributary flows directly into TNW.
☐ Tributary flows through **Pick List** tributaries before entering TNW.

Project waters are **Pick List** river miles from TNW.
Project waters are **Pick List** river miles from RPW.
Project waters are **Pick List** aerial (straight) miles from TNW.
Project waters are **Pick List** aerial (straight) miles from RPW.
Project waters cross or serve as state boundaries. Explain:

[4] Note that the Instructional Guidebook contains additional information regarding swales, ditches, washes, and erosional features generally and in the arid West.

Identify flow route to TNW[5]:
Tributary stream order, if known:

(b) General Tributary Characteristics (check all that apply):
Tributary is: ☐ Natural
☐ Artificial (man-made). Explain:
☐ Manipulated (man-altered). Explain:

Tributary properties with respect to top of bank (estimate):
Average width: feet
Average depth: feet
Average side slopes: **Pick List.**

Primary tributary substrate composition (check all that apply):
☐ Silts ☐ Sands ☐ Concrete
☐ Cobbles ☐ Gravel ☐ Muck
☐ Bedrock ☐ Vegetation. Type/% cover:
☐ Other. Explain:

Tributary condition/stability [e.g., highly eroding, sloughing banks]. Explain:
Presence of run/riffle/pool complexes. Explain:
Tributary geometry: **Pick List**
Tributary gradient (approximate average slope): %

(c) Flow:
Tributary provides for: **Pick List**
Estimate average number of flow events in review area/year: **Pick List**
Describe flow regime:
Other information on duration and volume:

Surface flow is: **Pick List.** Characteristics:

Subsurface flow: **Pick List**. Explain findings:
☐ Dye (or other) test performed:

Tributary has (check all that apply):
☐ Bed and banks
☐ OHWM[6] (check all indicators that apply):
☐ clear, natural line impressed on the bank
☐ changes in the character of soil
☐ shelving
☐ vegetation matted down, bent, or absent
☐ leaf litter disturbed or washed away
☐ sediment deposition
☐ water staining
☐ other (list):
☐ the presence of litter and debris
☐ destruction of terrestrial vegetation
☐ the presence of wrack line
☐ sediment sorting
☐ scour
☐ multiple observed or predicted flow events
☐ abrupt change in plant community
☐ Discontinuous OHWM.[7] Explain:

If factors other than the OHWM were used to determine lateral extent of CWA jurisdiction (check all that apply):
☐ High Tide Line indicated by:
☐ oil or scum line along shore objects
☐ fine shell or debris deposits (foreshore)
☐ physical markings/characteristics
☐ tidal gauges
☐ other (list):
☐ Mean High Water Mark indicated by:
☐ survey to available datum;
☐ physical markings;
☐ vegetation lines/changes in vegetation types.

(iii) Chemical Characteristics:

[5] Flow route can be described by identifying, e.g., tributary a, which flows through the review area, to flow into tributary b, which then flows into TNW.
[6] A natural or man-made discontinuity in the OHWM does not necessarily sever jurisdiction (e.g., where the stream temporarily flows underground, or where the OHWM has been removed by development or agricultural practices). Where there is a break in the OHWM that is unrelated to the waterbody's flow regime (e.g., flow over a rock outcrop or through a culvert), the agencies will look for indicators of flow above and below the break.
[7] Ibid.

Characterize tributary (e.g., water color is clear, discolored, oily film; water quality; general watershed characteristics, etc.). Explain:
Identify specific pollutants, if known:

(iv) Biological Characteristics. Channel supports (check all that apply):
☐ Riparian corridor. Characteristics (type, average width):
☐ Wetland fringe. Characteristics:
☐ Habitat for:
☐ Federally Listed species. Explain findings:
☐ Fish/spawn areas. Explain findings:
☐ Other environmentally-sensitive species. Explain findings:
☐ Aquatic/wildlife diversity. Explain findings:

2. Characteristics of wetlands adjacent to non-TNW that flow directly or indirectly into TNW

(i) Physical Characteristics:
(a) General Wetland Characteristics:
Properties:
Wetland size: acres
Wetland type. Explain:
Wetland quality. Explain:
Project wetlands cross or serve as state boundaries. Explain:

(b) General Flow Relationship with Non-TNW:
Flow is: **Pick List**. Explain:

Surface flow is: **Pick List**
Characteristics:

Subsurface flow: **Pick List**. Explain findings:
☐ Dye (or other) test performed:

(c) Wetland Adjacency Determination with Non-TNW:
☐ Directly abutting
☐ Not directly abutting
☐ Discrete wetland hydrologic connection. Explain:
☐ Ecological connection. Explain:
☐ Separated by berm/barrier. Explain:

(d) Proximity (Relationship) to TNW
Project wetlands are **Pick List** river miles from TNW.
Project waters are **Pick List** aerial (straight) miles from TNW.
Flow is from: **Pick List**.
Estimate approximate location of wetland as within the **Pick List** floodplain.

(ii) Chemical Characteristics:
Characterize wetland system (e.g., water color is clear, brown, oil film on surface; water quality; general watershed characteristics; etc.). Explain:
Identify specific pollutants, if known:

(iii) Biological Characteristics. Wetland supports (check all that apply):
☐ Riparian buffer. Characteristics (type, average width):
☐ Vegetation type/percent cover. Explain:
☐ Habitat for:
☐ Federally Listed species. Explain findings:
☐ Fish/spawn areas. Explain findings:
☐ Other environmentally-sensitive species. Explain findings:
☐ Aquatic/wildlife diversity. Explain findings:

3. Characteristics of all wetlands adjacent to the tributary (if any)
All wetland(s) being considered in the cumulative analysis: **Pick List**
Approximately acres in total are being considered in the cumulative analysis.

For each wetland, specify the following:

Directly abuts? (Y/N)	Size (in acres)	Directly abuts? (Y/N)	Size (in acres)

Summarize overall biological, chemical and physical functions being performed:

C. SIGNIFICANT NEXUS DETERMINATION

A significant nexus analysis will assess the flow characteristics and functions of the tributary itself and the functions performed by any wetlands adjacent to the tributary to determine if they significantly affect the chemical, physical, and biological integrity of a TNW. For each of the following situations, a significant nexus exists if the tributary, in combination with all of its adjacent wetlands, has more than a speculative or insubstantial effect on the chemical, physical and/or biological integrity of a TNW. Considerations when evaluating significant nexus include, but are not limited to the volume, duration, and frequency of the flow of water in the tributary and its proximity to a TNW, and the functions performed by the tributary and all its adjacent wetlands. It is not appropriate to determine significant nexus based solely on any specific threshold of distance (e.g. between a tributary and its adjacent wetland or between a tributary and the TNW). Similarly, the fact an adjacent wetland lies within or outside of a floodplain is not solely determinative of significant nexus.

Draw connections between the features documented and the effects on the TNW, as identified in the *Rapanos* Guidance and discussed in the Instructional Guidebook. Factors to consider include, for example:

- Does the tributary, in combination with its adjacent wetlands (if any), have the capacity to carry pollutants or flood waters to TNWs, or to reduce the amount of pollutants or flood waters reaching a TNW?
- Does the tributary, in combination with its adjacent wetlands (if any), provide habitat and lifecycle support functions for fish and other species, such as feeding, nesting, spawning, or rearing young for species that are present in the TNW?
- Does the tributary, in combination with its adjacent wetlands (if any), have the capacity to transfer nutrients and organic carbon that support downstream foodwebs?
- Does the tributary, in combination with its adjacent wetlands (if any), have other relationships to the physical, chemical, or biological integrity of the TNW?

Note: the above list of considerations is not inclusive and other functions observed or known to occur should be documented below:

1. **Significant nexus findings for non-RPW that has no adjacent wetlands and flows directly or indirectly into TNWs.** Explain findings of presence or absence of significant nexus below, based on the tributary itself, then go to Section III.D:

2. **Significant nexus findings for non-RPW and its adjacent wetlands, where the non-RPW flows directly or indirectly into TNWs.** Explain findings of presence or absence of significant nexus below, based on the tributary in combination with all of its adjacent wetlands, then go to Section III.D:

3. **Significant nexus findings for wetlands adjacent to an RPW but that do not directly abut the RPW.** Explain findings of presence or absence of significant nexus below, based on the tributary in combination with all of its adjacent wetlands, then go to Section III.D:

D. DETERMINATIONS OF JURISDICTIONAL FINDINGS. THE SUBJECT WATERS/WETLANDS ARE (CHECK ALL THAT APPLY):

1. **TNWs and Adjacent Wetlands.** Check all that apply and provide size estimates in review area:
   - ☐ TNWs: linear feet, wide, Or acres.
   - ☐ Wetlands adjacent to TNWs: acres.

2. **RPWs that flow directly or indirectly into TNWs.**
   - ☐ Tributaries of TNWs where tributaries typically flow year-round are jurisdictional. Provide data and rationale indicating that tributary is perennial:
   - ☐ Tributaries of TNW where tributaries have continuous flow "seasonally" (e.g., typically three months each year) are jurisdictional. Data supporting this conclusion is provided at Section III.B. Provide rationale indicating that tributary flows seasonally:

   Provide estimates for jurisdictional waters in the review area (check all that apply):
   - ☐ Tributary waters: linear feet wide.
   - ☐ Other non-wetland waters: acres.
     Identify type(s) of waters:

3. **Non-RPWs[8] that flow directly or indirectly into TNWs.**
☐ Waterbody that is not a TNW or an RPW, but flows directly or indirectly into a TNW, and it has a significant nexus with a TNW is jurisdictional. Data supporting this conclusion is provided at Section III.C.

Provide estimates for jurisdictional waters within the review area (check all that apply):
☐ Tributary waters: linear feet, wide.
☐ Other non-wetland waters: acres.
Identify type(s) of waters:

4. **Wetlands directly abutting an RPW that flow directly or indirectly into TNWs.**
☐ Wetlands directly abut RPW and thus are jurisdictional as adjacent wetlands.
☐ Wetlands directly abutting an RPW where tributaries typically flow year-round. Provide data and rationale indicating that tributary is perennial in Section III.D.2, above. Provide rationale indicating that wetland is directly abutting an RPW:

☐ Wetlands directly abutting an RPW where tributaries typically flow "seasonally." Provide data indicating that tributary is seasonal in Section III.B and rationale in Section III.D.2, above. Provide rationale indicating that wetland is directly abutting an RPW:

Provide acreage estimates for jurisdictional wetlands in the review area: acres.

5. **Wetlands adjacent to but not directly abutting an RPW that flow directly or indirectly into TNWs.**
☐ Wetlands that do not directly abut an RPW, but when considered in combination with the tributary to which they are adjacent and with similarly situated adjacent wetlands, have a significant nexus with a TNW are jurisidictional. Data supporting this conclusion is provided at Section III.C.

Provide acreage estimates for jurisdictional wetlands in the review area: acres.

6. **Wetlands adjacent to non-RPWs that flow directly or indirectly into TNWs.**
☐ Wetlands adjacent to such waters, and have when considered in combination with the tributary to which they are adjacent and with similarly situated adjacent wetlands, have a significant nexus with a TNW are jurisdictional. Data supporting this conclusion is provided at Section III.C.

Provide estimates for jurisdictional wetlands in the review area: acres.

7. **Impoundments of jurisdictional waters.[9]**
As a general rule, the impoundment of a jurisdictional tributary remains jurisdictional.
☐ Demonstrate that impoundment was created from "waters of the U.S.," or
☐ Demonstrate that water meets the criteria for one of the categories presented above (1-6), or
☐ Demonstrate that water is isolated with a nexus to commerce (see E below).

E. ISOLATED [INTERSTATE OR INTRA-STATE] WATERS, INCLUDING ISOLATED WETLANDS, THE USE, DEGRADATION OR DESTRUCTION OF WHICH COULD AFFECT INTERSTATE COMMERCE, INCLUDING ANY SUCH WATERS (CHECK ALL THAT APPLY):[10]
☐ which are or could be used by interstate or foreign travelers for recreational or other purposes.
☐ from which fish or shellfish are or could be taken and sold in interstate or foreign commerce.
☐ which are or could be used for industrial purposes by industries in interstate commerce.
☐ Interstate isolated waters. Explain:
☐ Other factors. Explain:

Identify water body and summarize rationale supporting determination:

Provide estimates for jurisdictional waters in the review area (check all that apply):
☐ Tributary waters: linear feet, wide.
☐ Other non-wetland waters: acres.
Identify type(s) of waters:
☐ Wetlands: acres.

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[8]See Footnote # 3.
[9] To complete the analysis refer to the key in Section III.D.6 of the Instructional Guidebook.
[10] **Prior to asserting or declining CWA jurisdiction based solely on this category, Corps Districts will elevate the action to Corps and EPA HQ for review consistent with the process described in the Corps/EPA *Memorandum Regarding CWA Act Jurisdiction Following Rapanos.***

F. NON-JURISDICTIONAL WATERS, INCLUDING WETLANDS (CHECK ALL THAT APPLY):

☐ If potential wetlands were assessed within the review area, these areas did not meet the criteria in the 1987 Corps of Engineers Wetland Delineation Manual and/or appropriate Regional Supplements.
☐ Review area included isolated waters with no substantial nexus to interstate (or foreign) commerce.
  ☐ Prior to the Jan 2001 Supreme Court decision in "*SWANCC*," the review area would have been regulated based solely on the "Migratory Bird Rule" (MBR).
☐ Waters do not meet the "Significant Nexus" standard, where such a finding is required for jurisdiction. Explain:
☒ Other: (explain, if not covered above): **The review area contains an irrigation ditch that does not convey water to a waters of the United States.**

Provide acreage estimates for non-jurisdictional waters in the review area, where the sole potential basis of jurisdiction is the MBR factors (i.e., presence of migratory birds, presence of endangered species, use of water for irrigated agriculture), using best professional judgment (check all that apply):
☐ Non-wetland waters (i.e., rivers, streams): linear feet, wide.
☐ Lakes/ponds: acres.
☐ Other non-wetland waters: acres. List type of aquatic resource:
☐ Wetlands: acres.

Provide acreage estimates for non-jurisdictional waters in the review area that do not meet the "Significant Nexus" standard, where such a finding is required for jurisdiction (check all that apply):
☐ Non-wetland waters (i.e., rivers, streams): linear feet, wide.
☐ Lakes/ponds: acres.
☐ Other non-wetland waters: acres. List type of aquatic resource:
☐ Wetlands: acres.

SECTION IV: DATA SOURCES.

A. SUPPORTING DATA. Data reviewed for JD (check all that apply - checked items shall be included in case file and, where checked and requested, appropriately reference sources below):
☒ Maps, plans, plots or plat submitted by or on behalf of the applicant/consultant: Approved Jurisdictional Determination for the Root and Ratliff Ditch Pipeline Project, Montezuma County, Colorado
☐ Data sheets prepared/submitted by or on behalf of the applicant/consultant.
  ☐ Office concurs with data sheets/delineation report.
  ☐ Office does not concur with data sheets/delineation report.
☐ Data sheets prepared by the Corps:
☐ Corps navigable waters' study:
☐ U.S. Geological Survey Hydrologic Atlas:
  ☐ USGS NHD data.
  ☐ USGS 8 and 12 digit HUC maps.
☒ U.S. Geological Survey map(s). Cite scale & quad name: **1:24K; Mancos**
☐ USDA Natural Resources Conservation Service Soil Survey. Citation:
☐ National wetlands inventory map(s). Cite name:
☐ State/Local wetland inventory map(s):
☐ FEMA/FIRM maps:
☐ 100-year Floodplain Elevation is: (National Geodectic Vertical Datum of 1929)
☒ Photographs: ☒ Aerial (Name & Date):2017
  or ☐ Other (Name & Date):
☐ Previous determination(s). File no. and date of response letter:
☐ Applicable/supporting case law:
☐ Applicable/supporting scientific literature:
☐ Other information (please specify):

B. ADDITIONAL COMMENTS TO SUPPORT JD:

Appendix C
Cultural Resources Compliance Documentation

MEMORANDUM OF AGREEMENT
AMONG
THE WESTERN COLORADO AREA OFFICE, BUREAU OF RECLAMATION,
THE ROOT AND RATLIFF DITCH COMPANY, AND THE COLORADO
STATE HISTORIC PRESERVATION OFFICER REGARDING THE
ROOT & RATLIFF DITCH PIPING PROJECT,
SALINITY CONTROL PROGRAM,
MONTEZUMA COUNTY,
COLORADO

WHEREAS, the Bureau of Reclamation (Reclamation) plans to replace approximately 5.4 miles of the Root & Ratliff ditch with approximately 4.7 miles of buried irrigation pipe in Montezuma County Colorado (Project), thereby making the Project an undertaking subject to review under Section 106 of the National Historic Preservation Act (NHPA), 54 U.S.C. § 306108, and its implementing regulations, 36 CFR Part 800; and

WHEREAS, Reclamation has defined the undertaking's area of potential effect (APE) as the ditch easement which is a 100-foot-wide corridor centered on 5.4 miles of existing ditch (65.45 acres), as well as 37.01-acre area centered on proposed reroutes associated with the proposed pipeline and 27.98 acres spread across three different areas associated with proposed wetland mitigation for the project, totaling 172.37 acres as described in Attachment A; and

WHEREAS, Reclamation has determined, in consultation with the Colorado State Historic Preservation Officer (SHPO), that 5MT23085, 5MT23087, 5MT23518, and 5MT23520 need data to determine the eligibility of the resources for listing to the National Register of Historic Places (NRHP); and that 5MT23084 and the Ratliff and Root Ditch (5MT23092) is eligible for listing on the NRHP under Criterion A; and

WHEREAS, Reclamation has determined, in consultation with the Colorado State Historic Preservation Officer (SHPO), that the undertaking will result in an adverse effect to 5MT23092; and

WHEREAS, the Root and Ratliff Ditch Company operates the Root & Ratliff Ditch, and has been invited to sign the Memorandum of Agreement (MOA) as an invited signatory, and it has chosen to participate as an invited signatory to the MOA; and

WHEREAS, Reclamation consulted with the Hopi Tribe, Kewa Pueblo, Navajo Nation, Ohkay Owingeh Pueblo, Pueblo of Acoma, Pueblo of Cochiti, Pueblo of Isleta, Pueblo of Jemez, Pueblo of Laguna, Pueblo of Nambe, Pueblo of Picuris, Pueblo of Pojoaque, Pueblo of San Felipe, Pueblo of San Ildefonso, Pueblo of Sandia, Pueblo of Santa Ana, Pueblo of Santa Clara, Pueblo of Taos, Pueblo of Tesuque, Southern Ute Tribe, Ute Indian Tribe, Ute Mountain Ute Tribe, Zia Pueblo, and Zuni Pueblo via an April 11th, 2020 letter to invite the tribes to participate as concurring parties in the development of this MOA, pursuant to 36 CFR § 800.2; and

WHEREAS, only the Navajo Nation, Laguna Pueblo, and the Southern Ute Tribe responded as of the signing of this document and have chosen not to participate in the

consultation as concurring parties; and

WHEREAS, Reclamation consulted with the Montezuma Heritage Museum and Montezuma County Historical Society via an April 11th, 2020 letter, and the Mancos Valley Historical Society via an April 13th, 2020 letter to invite the organizations to participate in the development of this MOA for the proposed undertaking as concurring parties, and the Montezuma Heritage Museum and Montezuma County Historical Society responded as of the signing of this document and have chosen not to participate; and

WHEREAS, in accordance with 36 CFR § 800.6(a)(l), Reclamation has notified the Advisory Council on Historic Preservation (ACHP) of its adverse effect determination and provided the specified documentation, and the Council has chosen not to participate in the consultation pursuant to 36 CFR § 800.6(a)(l)(iii);

NOW, THEREFORE, pursuant to Section 106 of the NHPA, Reclamation and the SHPO agree that the undertaking shall be implemented in accordance with the following stipulations in order to take into account the effect on historic properties.

STIPULATIONS

Reclamation shall ensure that the following measures are carried out:

I. AVOIDANCE AND MITIGATION

a. Prior to any modification of the Ratliff and Root Ditch (5MT23092), Reclamation will ensure that the property shall be recorded in accordance with the guidance for Level II Documentation found in "Historic Resource Documentation, Standards for Level I, II, and III Documentation" (Office of Archaeology and Historic Preservation Publication 1595, March 2013). The documentation will be of archival quality, and will include a detailed narrative history, mapping of the property and photographic documentation of the portions of the historic property to be included in the project. Photographs will be black and white archival quality (4" x 6") prints. Features will be plotted on the maps with GPS waypoints and will be extensively described and indexed in the report. Representative design drawings will not be necessary for this property, as it is not significant for its design characteristics.

   Stipulation I documentation shall be satisfied prior to construction and/or any earth disturbances within the APE.

b. 5MT23085, 5MT23087, and 5MT23520 will be avoided by ground disturbing activities. Ground disturbing activities will also avoid components of 5MT23084 and 5MT23518 that contribute to the eligibility of the resource for the NRHP. An archaeologist will monitor ground disturbing activities within 100 feet of 5MT23084, 5MT23085, 5MT23087, 5MT23518, and 5MT23520 to ensure avoidance of the resources. If the undertaking results in a post-review discovery, Reclamation will follow the requirements of Stipulation V, below.

c. No new borrow sources will be created for the undertaking. Fill excavated for the pipeline will be reused in the backfilling of the trench and ditch. If additional fill is

required, fill from a commercial source will be used.

II. GENERAL REQUIREMENTS AND STANDARDS

Reclamation will submit a copy of the Level II Documentation to the SHPO within one (1) year of the execution of this MOA. The SHPO shall review and provide comments within thirty (30) calendar days of receipt. Once accepted by SHPO, SHPO shall receive a minimum of one archivally stable copy of the final recordation for its files and provide documentation of acceptance. The activities prescribed by the stipulations of this MOA shall be carried out by or under the direct supervision of a person or persons meeting, at minimum, the Secretary of the Interior Professional Qualifications Standards (48 FR44738-39) (PQS) in the appropriate discipline. This does not preclude the use of properly supervised persons who do not meet the PQS.

III. PUBLIC BENEFIT STRATEGY

A Rehabilitation Act Section 508 compliant copy of the Level II Documentation will be placed on the Reclamation Western Colorado Area Office's cultural resource webpage to be made available to the public. The SHPO shall receive notification from Reclamation once the document is placed on the webpage. Reclamation will create an interpretive poster for exhibit with the Root and Ratliff Ditch Company and copies will be made available to individuals and institutions interested in displaying and interpreting the history of the ditch. Prior to its release to Root and Ratliff Ditch Company, Reclamation will submit, electronically, a draft of the poster for review by the Colorado SHPO. The Root and Ratliff Ditch Company will also be provided the Level II documentation as a supplement to the poster. These efforts will provide a broader public benefit to those living along the ditch and have an interest in the history of irrigation project within Montezuma County.

IV. DURATION

This MOA will be null and void if its terms are not carried out within two (2) years from the date of its execution. Prior to such time, Reclamation may consult with the other signatories to reconsider the terms of the agreement and amend it in accordance with Stipulation VIII below. Unless terminated pursuant to Stipulation IX, below, this MOA will be in effect through Reclamation's implementation of the stipulations of this MOA and will terminate and have no further force or effect when Reclamation, in consultation with the SHPO, determines that the terms of the MOA have been fulfilled in a satisfactory manner.

V. POST-REVIEW DISCOVERIES

If potential historic properties are discovered or unanticipated effects on historic properties found, Reclamation shall implement the discovery plan included as Attachment B of this MOA.

VI. MONITORING AND REPORTING

No later than July 31st of each year following the execution of this MOA until its stipulations are carried out, it expires, or is terminated, Root and Ratliff Ditch Company, on behalf of Reclamation, shall provide all parties to this MOA a summary report detailing work carried out pursuant to its terms. Such report shall include any scheduling changes proposed, any problems encountered, and any disputes and objections received in Root and Ratliff Ditch Company's efforts to carry out the terms of this MOA.

The signatories may monitor activities pursuant to this MOA**,** and the Council will review such activities if so requested by a party to this MOA. Reclamation will cooperate with the signatories in carrying out their review and monitoring responsibilities.

VII. DISPUTE RESOLUTION

Should any signatory or concurring party to this MOA object at any time to any actions proposed or the manner in which the terms of this MOA are implemented, Reclamation shall consult with such party to resolve the objection. If Reclamation determines that such objection cannot be resolved, Reclamation will:

a. Forward all documentation relevant to this dispute, including Reclamation's proposed resolution, to the ACHP. The ACHP shall provide Reclamation with its advice on the resolution of the objection within thirty (30) days of receiving adequate documentation. Prior to reaching a final decision on the dispute, Reclamation shall prepare a written response that considers any timely advice or comments regarding the dispute from the ACHP, signatories and concurring parties, and provide them with a copy of this written response. Reclamation will then proceed according to its final decision.

b. If the ACHP does not provide its advice regarding the dispute within the thirty-day (30) time period, Reclamation may make a final decision on the dispute and proceed accordingly. Prior to reaching such a final decision, Reclamation shall prepare a written response that considers any timely comments regarding the dispute from the signatories and concurring parties to the MOA and provide them and the ACHP with a copy of such written response.

c. Reclamation's responsibility to carry out all other actions subject to the terms of this MOA that are not the subject of the dispute remain unchanged.

VIII. AMENDMENTS

This MOA may be amended when such an amendment is agreed to in writing by all signatories. The amendment will be effective on the date a copy signed by all signatories is filed with the ACHP.

IX.TERMINATION

If any signatory to this MOA determines that its terms will not or cannot be carried out, that party shall immediately consult with the other signatories to attempt to develop an amendment per Stipulation VIII, above. If within thirty (30) days (or another time period agreed to by all signatories) an amendment cannot be reached, any signatory may terminate the MOA upon written notification to the other signatories.

Once the MOA is terminated, and prior to work continuing the undertaking, Reclamation must either (a) execute a MOA pursuant to 36 CFR § 800.6 or (b) request, take into account, and respond to the comments of the ACHP under 36 CFR § 800.7. Reclamation shall notify the signatories as to the course of action it will pursue.

Execution of this MOA by Reclamation, Root and Ratliff Ditch Company, and SHPO and implementation of its terms evidence that Reclamation has considered the effects of this undertaking on historic properties and afforded the ACHP an opportunity to comment.

LIST OF ATTACHMENTS

Attachment A: Area of Potential Effect
Attachment B: Unanticipated Discovery Plan

SIGNATORIES:

Colorado State Historic Preservation Office

Dr. Holly Kathryn Norton Digitally signed by Dr. Holly Kathryn Norton
Date: 2020.09.21 08:23:49 -06'00'

By:_____ Date:_____

Steve Turner, AIA, State Historic Preservation Officer

Bureau of Reclamation, Western Colorado Area Office

Digitally signed by LOUIS WARNER
Date: 2020.09.16 11:15:29 -06'00'

By:_____ Date:_____

Ed Warner, Area Manager

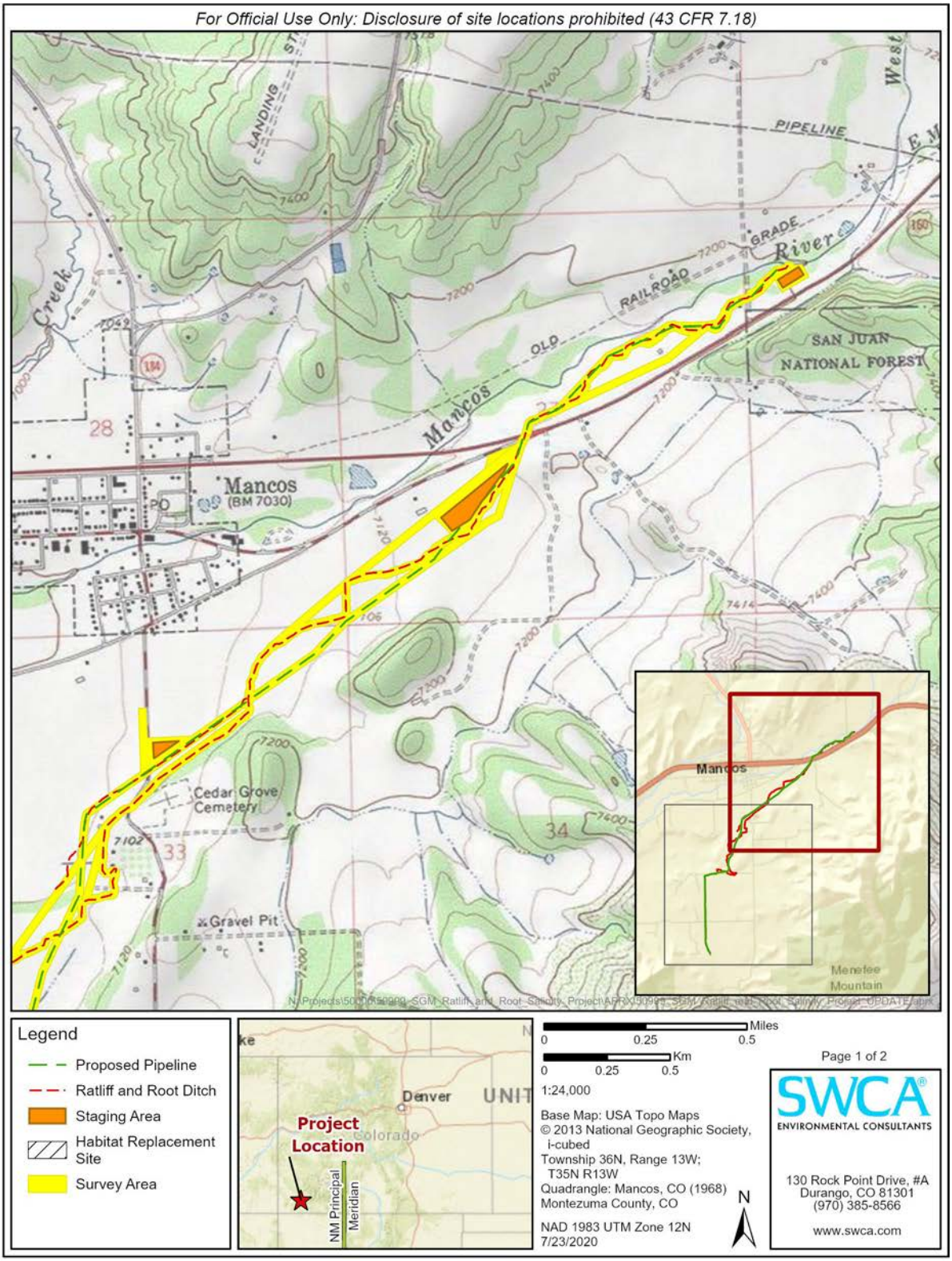
INVITED SIGNATORIES:

Root and Ratliff Ditch Company

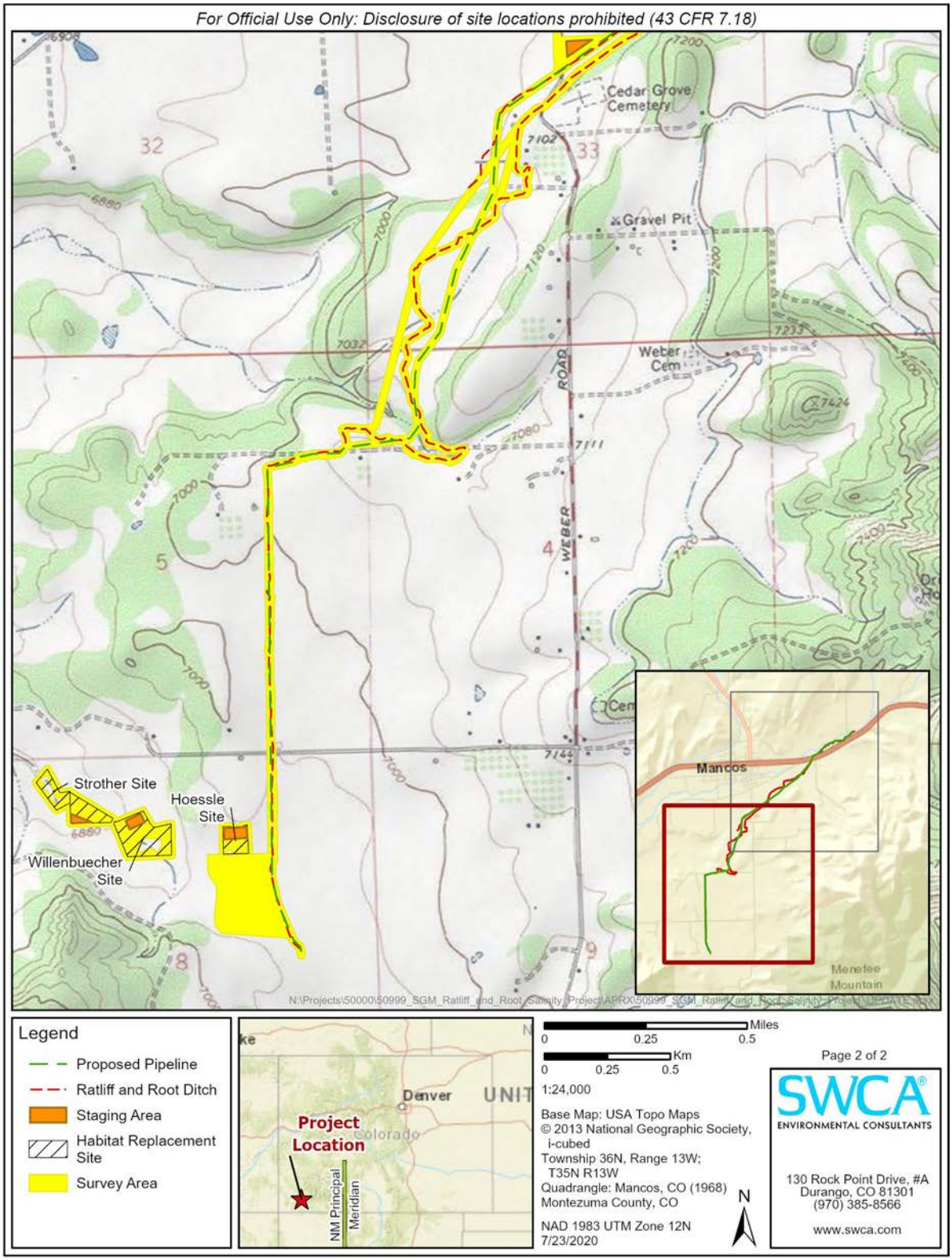
By:_____ Date: 9/15/20

Sam Perry, President

ATTACHMENT A – AREA OF POTENTIAL EFFECT



Attachment A – Project Location Map 1 of 2



Attachment A – Project Location Map 2 of 2

ATTACHMENT B - UNANTICIPATED DISCOVERY PLAN

PLAN AND PROCEDURES FOR THE UNANTICIPATED DISCOVERY
OF CULTURAL RESOURCES
FOR THE
ROOT AND RATLIFF DITCH
PIPING PROJECT, MONTEZUMA
COUNTY, COLORADO

1. INTRODUCTION

The Root and Ratliff Ditch Company plans to replace approximately 5.4 miles of the existing unlined Ratliff and Root Ditch (5MT23092) with a buried pipe and create habitat replacement on private property. The purpose of the project is to reduce salinity concentrations in the Colorado River Basin and increase the efficiency of the existing delivery system by preventing water loss through both evaporation and deep percolation. The purpose of the habitat replacement project is to restore functions of riparian and wetland areas that will be lost after the ditch is piped. The following Unanticipated Discovery Plan (UDP) outlines procedures to follow, in accordance with state and federal laws, if archaeological materials are discovered.

2. RECOGNIZING CULTURAL RESOURCES

A cultural resource discovery could be prehistoric or historic. Examples include, but are not limited to:

- An accumulation of shell, burned rocks, or other food related materials,
- An area of charcoal or very dark stained soil with artifacts,
- Lithic tools or waste flakes (i.e. an arrowhead, or stone chips),
- Clusters of tin cans or bottles, logging or agricultural equipment that appears to be older than 50 years,
- Abandoned mining structures and features (i.e. mine shafts or adits, head frames, processing mills, or tailings and waste rock piles),
- Buried railroad tracks, decking, or other industrial materials.

When in doubt, assume the material is a cultural resource.

3. ON-SITE RESPONSIBILITIES

STEP 1: STOP WORK. If any Root and Ratliff Ditch Company employee, contractor or subcontractor believes that he or she has uncovered a cultural resource at any point in the project, all work adjacent to the discovery must stop. The discovery location should be secured at all times.

STEP 2: NOTIFY MONITOR. If there is an archaeological monitor for the project, notify that person. If there is a monitoring plan in place, the monitor will follow its provisions. If there is not an archaeological monitor, notify the Root and Ratliff Ditch Company's Project Manager.

STEP 3: NOTIFY BUREAU OF RECLAMATION. Contact the Reclamation's Project Manager and Reclamation's Archaeologist at:

Reclamation Project Manager:	Reclamation Archaeologist:
Ernie Rheaume	Jimmie McKenzie
970-385-6521	970-385-6565
erheaume@usbr.gov	jmckenzie@usbr.gov

If human remains are encountered, treat them with dignity and respect at all times. Do not take, or allow anyone to take, any photographs of human remains at any time. Cover the remains with a tarp or other materials (not soil or rocks) for temporary protection in place and to shield them from being photographed.

4. FURTHER CONTACTS AND CONSULTATION

A. Root and Ratliff Ditch Company's Project Manager's Responsibilities:

- Protect Find: The Project Manager is responsible for taking appropriate steps to protect the discovery site. All work will stop in an area adequate to provide for the total security, protection, and integrity of the resource. Vehicles, equipment, and unauthorized personnel will not be permitted to traverse the discovery site. Work in the immediate area will not resume until treatment of the discovery has been completed following provisions for treating archaeological/cultural material as set forth in this document.

- Direct Construction Elsewhere On-site: The Project Manager may direct construction away from cultural resources to work in other areas prior to contacting the concerned parties.

- Contact Reclamation Archaeologist: If the Archaeologist at the Bureau of Reclamation has not yet been contacted, the Project Manager will do so.

- Identify Find: The Project Manager will ensure that a qualified professional archaeologist examines the find to determine if it is archaeological.

    - If it is determined not archaeological, work may proceed with no further delay.

- If it is determined to be archaeological, the Project Archaeologist will continue with notification.

- If the find may be human remains or funerary objects, the Project Manager will ensure that a qualified physical anthropologist examines the find. If it is determined to be human remains, the procedure described in Section 5 will be followed.

B. Reclamation's Project Manager and Archaeologist's Responsibilities:

- Notify SHPO: The Reclamation Archaeologist will notify the SHPO within 48 hours of the discovery. Reclamation shall contact:

  - Dr. Holly Norton
    Deputy State Historic Preservation Officer
    History Colorado
    1200 Broadway Denver CO, 80203
    (303) 866-2736

C. Further Activities:

- Archaeological discoveries will be documented as described in Section 6.

- Construction in the discovery area may resume as described in Section 7.

5. SPECIAL PROCEDURES FOR THE DISCOVERY OF HUMAN SKELETAL MATERIAL

A. Any human skeletal remains, regardless of antiquity or ethnic origin, will at all times be treated with dignity and respect.

The project is located private lands. On private lands, the requirements under State Law Colorado Revised Statute (CRS) 24-80 part 13 apply. The Unmarked Human Graves Colorado Statute (CRS 24-80-1301 - 13 05) applies if the human remains are Native American and/or determined to be of archaeological interest.

In the event possible human skeletal remains are discovered, Reclamation will comply with the procedures outlined in CRS 24-80-1301-1305, and will coordinate with the following contacts:

Montezuma County Sheriff:
(970) 565-8452

Montezuma County Coroner:
(970) 749-1771

Reclamation's Federal Preservation Officer, Joseph Giliberti:
(303)445-3206

Deputy State Historic Preservation Officer, Dr. Holly Norton:

(303) 866-2736

B. Further Activities:

Until disposition is determined, if at all possible, discovered human remains and associated funerary items will be left in situ. Root and Ratliff Ditch Company will establish adequate measures to safeguard the site in consultation with the Reclamation archaeologist and SHPO. If the remains are under imminent or anticipated threat of disturbance, and therefore the Reclamation Archaeologist decides it is necessary to remove the individuals and associated funerary items from the site, they will be held at a secure facility until a decision on final disposition is made. All items will be placed in containers made of natural materials (e.g. linen, cotton, new cardboard boxes) and each box will be placed on a shelf with nothing stacked upon it. Associated funerary items will only be recorded at a descriptive non-invasive level, and no destructive analysis of any kind will be conducted on the remains.

When consultation and documentation activities are complete, construction in the discovery area may resume as described in Section 7

6. DOCUMENTATION OF ARCHAEOLOGICAL MATERIALS

Archaeological deposits discovered during construction will be assumed eligible for inclusion in the National Register of Historic Places under Criterion D until a formal Determination of Eligibility is made.

The Reclamation Archaeologist will ensure the proper documentation and assessment of any discovered cultural resources in cooperation with the SHPO, affected tribes, and a contracted consultant (if any). All prehistoric and historic cultural material discovered during project construction will be recorded by a professional archaeologist in accordance with all state and federal laws.

7. PROCEEDING WITH CONSTRUCTION

Project construction outside the discovery location may continue while documentation and assessment of the cultural resources proceed. A professional archaeologist must determine the boundaries of the discovery location. In consultation with SHPO and affected tribes, the Reclamation Archaeologist will determine the appropriate level of documentation and treatment of the resource.

Construction may continue at the discovery location only after the process outlined in this plan is followed and the Bureau of Reclamation determines that compliance with state and federal laws is complete.

Appendix D
Endangered Species Act Compliance Documentation

United States Department of the Interior

FISH AND WILDLIFE SERVICE
445 West Gunnison Ave, Suite 240
Grand Junction, Colorado 81501

IN REPLY REFER TO:
FWS/IR05/IR07

TAILS 06E24100-2020-F-0211

May 22, 2020

Memorandum

To: Area Manager, Western Colorado Area Office, Bureau of Reclamation, Grand Junction, Colorado

From: for J. Creed Clayton
Western Slope Supervisor, U.S. Fish and Wildlife Service, Ecological Services, Grand Junction, Colorado

Subject: Request for Consultation under Section 7 of Endangered Species Act for the Root and Ratliff Ditch Project, Salinity Control Program, Colorado

In accordance with section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.), and the Interagency Cooperation Regulations (50 CFR 402), this transmits the U.S. Fish and Wildlife Service's (Service) final biological opinion for impacts to federally listed threatened and endangered species for The Root and Ratliff Ditch Pipeline project, located within Montezuma County, Colorado, replacing approximately 5.4 miles of Root and Ratliff Ditch with 4.7 miles of buried irrigation pipe in the fall of 2020. The project will cause a new water depletion of 0.95 acre feet per year in addition to the historic water depletions of 4,144 acre-feet per year. This biological opinion has been reviewed by and prepared in cooperation with our Albuquerque, New Mexico, Ecological Services Field Office in Region 2 of the Service.

This biological opinion is in response to your April 2, 2020, correspondence requesting initiation of consultation for the Root and Ratliff Ditch Pipeline Project. The Service agrees that the proposed project may adversely affect the Colorado pikeminnow (*Ptychocheilus lucius)* and razorback sucker (*Xyrauchen texanus*) and their designated critical habitat on the San Juan River.

Additionally, the Service concurs that the proposed project may affect, but not likely to adversely affect the New Mexico meadow jumping mouse (*Zapus hudsonius luteus)*, the southwestern

willow flycatcher *(Empidonax trailii extimus),* and the yellow-billed cuckoo *(Coccyzus americanus).*

BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

The Bureau of Reclamation (BOR) proposes to replace approximately 5.4 miles of open, unlined irrigation ditch with approximately 4.7 miles of buried irrigation pipe. The Root and Ratliff Ditch is located in Montezuma County, near the Town of Mancos, Colorado.

The legal description for the ditch includes Sections 26, 27, 28, and 33 in Township 36 North, Range 13 West, New Mexico Principal Meridian (NMPM) and Sections 4, 5, and 8 in Township 35 North, Range 13 West, NMPM. The Project area is primarily on private property. The project also includes improvements within the rights-of-way for U.S. Highway 160 and Montezuma County Roads 43, 41, G, and H.

The proposed pipeline alignment roughly follows the existing ditch, although the pipeline would leave the existing ditch alignment in several sections in order to create a straighter alignment and improve efficiency. Approximately 2.4 miles of the new pipeline would be located outside of the existing ditch easement. The existing ditch is in a prescriptive easement on private lands and crosses 42 separate parcels. The new pipeline would be located in dedicated easements negotiated with landowners.

The Root and Ratliff Ditch is located approximately 50 miles upstream located near the Town of Mancos, of the San Juan River and includes an historic depletion of approximately 4,144 acre-feet per year to the Mancos River in the San Juan River Basin. The new water depletions will be caused by mitigation efforts creating habitat replacement sites associated with wetlands loss from the proposed project, which are estimated at 0.95 acre-feet per year.

STATUS OF THE SPECIES AND CRITICAL HABITAT

Colorado Pikeminnow

The Colorado pikeminnow is the largest cyprinid (member of the minnow family, Cyprinidae) native to North America and it evolved as the top predator in the Colorado River system. It is an elongated pike-like fish that once grew as large as 1.8 m (6 ft) in length and weighed nearly 45 kg (100 lbs) (Behnke and Benson 1983); such fish were estimated to be 45-55 years old (Osmundson et al. 1997). Today, fish rarely exceed 1 m (approximately 3 ft) in length or weigh more than 8 kg (18 lbs). The mouth of this species is large and nearly horizontal with long slender pharyngeal teeth (located in the throat), adapted for grasping and holding prey. The diet of pikeminnow longer than 80 to 100 mm (3 or 4 in.) consists almost entirely of other fishes (Vanicek and Kramer 1969). Adults are strongly counter-shaded with a dark, olive back, and a white belly. Young are silvery and usually have a dark, wedge-shaped spot at the base of the caudal fin.

Based on early fish collection records, archaeological finds, and other observations, the pikeminnow was once found throughout warm water reaches of the entire Colorado River Basin down to the Gulf of California, including reaches of the upper Colorado River and its major tributaries, the Green River and its major tributaries, the San Juan River and some of its tributaries, and the Gila River system in Arizona (Seethaler 1978, Platania 1990). Pikeminnow apparently were never found in colder, headwater areas. Seethaler (1978) indicates that the species was abundant in suitable habitat throughout the entire Colorado River Basin prior to the 1850s. By the 1970s, they were extirpated from the entire lower basin (downstream of Glen Canyon Dam) and from portions of the upper basin as a result of major alterations to the riverine environment. Having lost approximately 75-80 percent of its former range, the pikeminnow was federally listed as an endangered species in 1967 (Service 1967, Miller 1961, Moyle 1976, Tyus 1991, Osmundson and Burnham 1998).

Critical habitat was designated in 1994 within the 100-year floodplain of the Colorado pikeminnow's historical range in the following areas of the upper Colorado River (59 F.R. 13374). Colorado pikeminnow now only occur in the upper Colorado River Basin (upstream of Lee Ferry just below the Glen Canyon Dam). The total designated miles is 1,148 and represents 29 percent of the historical habitat for the species.

> Colorado, Moffat County. The Yampa River and its 100-year floodplain from the State Highway 394 bridge in T. 6 N., R. 91 W., section 1 (6th Principal Meridian) to the confluence with the Green River in T. 7 N., R. 103 W., section 28 (6th Principal Meridian).
>
> Utah, Uintah, Carbon, Grand, Emery, Wayne, and San Juan Counties; and Colorado, Moffat County. The Green River and its 100-year floodplain from the confluence with the Yampa River in T. 7 N., R. 103 W., section 28 (6th Principal Meridian) to the confluence with the Colorado River in T. 30 S., R. 19 E., section 7 (Salt Lake Meridian).
>
> Colorado, Rio Blanco County; and Utah, Uintah County. The White River and its 100-year floodplain from Rio Blanco Lake Dam in T. 1 N., R. 96 W., section 6 (6th Principal Meridian) to the confluence with the Green River in T. 9 S., R. 20 E., section 4 (Salt Lake Meridian).
>
> Colorado, Delta and Mesa Counties. The Gunnison River and its 100-year floodplain from the confluence with the Uncompahgre River in T. 15 S., R. 96 W., section 11 (6th Principal Meridian) to the confluence with the Colorado River in T. 1 S., R. 1 W., section 22 (Ute Meridian).
>
> Colorado, Mesa and Garfield Counties; and Utah, Grand, San Juan, Wayne, and Garfield Counties. The Colorado River and its 100-year floodplain from the Colorado River Bridge at exit 90 north off Interstate 70 in T. 6 S., R. 93 W., section 16 (6th Principal Meridian) to North Wash, including the Dirty Devil arm of Lake Powell up to the full pool elevation, in T. 33 S., R. 14 E., section 29 (Salt Lake Meridian).

New Mexico, San Juan County; and Utah, San Juan County. The San Juan River and its 100-year floodplain from the State Route 371 Bridge in T. 29 N., R. 13 W., section 17 (New Mexico Meridian) to Neskahai Canyon in the San Juan arm of Lake Powell in T. 41 S., R. 11 E., section 26 (Salt Lake Meridian) up to the full pool elevation.

The Service identified water, physical habitat, and the biological environment as primary constituent elements of critical habitat. This includes a quantity of water of sufficient quality that is delivered to specific habitats in accordance with a hydrologic regime that is required for the particular life stage for the 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, which when inundated provide access to spawning, nursery, feeding, and rearing habitats, are included. Food supply, predation, and competition are important elements of the biological environment.

Life History

The life history phases that appear to be most limiting for Colorado pikeminnow populations include spawning, egg hatching, development of larvae, and the first year of life. These phases of pikeminnow development are tied closely to specific habitat requirements. Natural spawning of pikeminnow is initiated on the descending limb of the annual hydrograph as water temperatures approach the range of 16 ˚C (60.8 ˚F) to 20 ˚C (68 ˚F) (Vanicek and Kramer 1969, Hamman 1981, Haynes et al. 1984, Tyus 1990, McAda and Kaeding 1991). However the temperatures when spawning is initiated varies by river, 20-23 ˚C (68-73 ˚F) in the Green River; 16-23 ˚C (61-68 ˚F) in the Yampa River (Bestgen et al. 1998); 18-22 ˚C (64-72 ˚F) in the Colorado River (McAda and Kaeding 1991); and 16-22 ˚C (61-72 ˚F) in the San Juan River. Spawning, both in the hatchery and under natural riverine conditions, generally occurs in a 2-month period between late June and late August. However, sustained high flows during wet years may suppress river temperatures and extend spawning into September (McAda and Kaeding 1991). Conversely, during low flow years, when the water warms earlier, spawning may commence in mid-June.

Temperature also has an effect on egg development and hatching success. In the laboratory, egg development was tested at five temperatures and hatching success was found to be highest at 20 ˚C (68 ˚F), and lower at 25 ˚C (77 ˚F). Mortality was 100 percent at 5, 10, 15, and 30˚C (41, 50, 59, and 86 ˚F). In addition, larval abnormalities were twice as high at 25 ˚C (77 ˚F) than at 20 ˚C (68 ˚F) (Marsh 1985). Experimental tests of temperature preference of yearling and adult pikeminnow indicated that 25 ˚C (77 ˚F) was the most preferred temperature for both life phases (Bulkley et al. 1981, Black and Bulkley 1985a). Additional experiments indicated that optimum growth of yearlings also occurs at temperatures near 25 ˚C (77 ˚F) (Black and Bulkley 1985b).

Wild Colorado pikeminnow are reproductively mature by about age-7 and 500 mm (20 in.) in length (Vanicek and Kramer 1969, Seethaler 1978, Hamman 1981). Hatchery-reared Colorado pikeminnow become sexually mature faster than their wild counterparts, males at age-4 and

females at age-5. Fecundity of age-9 females (n = 24) was between 57,766-113,341eggs/kg and 11,977-91,040 eggs/kg for age-10 females (n = 9) (Hamman 1986).

Most information on pikeminnow reproduction has been gathered from spawning sites on the lower 20 miles (12.2 km) of the Yampa River and in Gray Canyon on the Green River (Tyus and McAda 1984, Tyus 1985, Wick et al. 1985, Tyus 1990). Colorado pikeminnow spawn after peak runoff subsides. Spawning is probably triggered by several interacting variables such as day length, temperature, flow level, and perhaps substrate characteristics. Known spawning sites in the Yampa River are characterized by riffles or shallow runs with well-washed coarse substrate, cobble containing relatively deep interstitial voids for egg deposition in association with deep pools or areas of slow non-turbulent flow used as staging areas by adults (Lamarra et al. 1985, Tyus 1990). Investigations at a spawning site in the San Juan River by Bliesner and Lamarra (1995) and at one site in the upper Colorado River (Service unpublished data) indicate a similar association of habitats. The most unique feature at the sites used for spawning compared with other sites is the lack of embeddedness of the cobble substrate and the depth to which the rocks are devoid of fine sediments; this appears consistent at the sites in all three rivers (Lamarra et al. 1985, Bliesner and Lamarra 1995).

Collections of larvae and young-of-year (YOY) downstream of known spawning sites in the Green, Yampa, and San Juan rivers demonstrate that downstream drift of larval pikeminnow occurs following hatching (Haynes et al. 1984, Nesler et al. 1988, Tyus 1990, Tyus and Haines 1991, Platania 1990, Ryden 2003a). Studies on the Green and Colorado rivers found that YOY used backwaters almost exclusively (Holden 2000). During their first year of life, pikeminnow prefer warm, turbid, relatively deep (averaging 0.4 m [1.3 ft]) backwater areas of zero velocity (Tyus and Haines 1991). After about 1 year, young are rarely found in such habitats, although juveniles and subadults are often located in large deep backwaters during spring runoff (Service, unpublished data; Osmundson and Burnham 1998).

Colorado pikeminnow often migrate considerable distances to spawn in the Green and Yampa rivers (Miller et al. 1982, Archer et al. 1986, Tyus and McAda 1984, Tyus 1985, Tyus 1990), and similar movement has been noted in the main stem San Juan River. A fish captured and tagged in the San Juan arm of Lake Powell in April 1987, was recaptured in the San Juan River approximately 80 miles upstream in September 1987 (Platania 1990). Ryden and Ahlm (1996) report that a pikeminnow captured at river mile (RM) 74.8 (between Bluff and Mexican Hat) made a 50-60 mile migration during the spawning season in 1994, before returning to within 0.4 miles of its original capture location. Although migratory behavior has been documented for adult pikeminnow in the San Juan River (Platania 1990, Ryden and Ahlm 1996), the majority of adult pikeminnow in the San Juan River appear to reside near the area in which they spawn (Ryden and Ahlm 1996, Miller and Ptacek 2000), in contrast to pikeminnow in the Green and Yampa rivers. Ryden and Ahlm (1996) and Miller and Ptacek (2000) documented pikeminnow in the San Juan River aggregating at the mouth of the Mancos River prior to spawning, a behavior not documented in other rivers in the upper Colorado River Basin. Movements of juvenile Colorado pikeminnow in the San Juan River, upstream from spring to summer and back downstream over winter, may be associated with maximizing growth along longitudinal and seasonal temperature regimes (Durst and Franssen 2014).

Historical spawning areas for the pikeminnow in the San Juan River are unknown; however, Platania (1990) speculated that spawning likely occurred upstream at least to Rosa, New Mexico. Two locations in the San Juan River have been identified as potential spawning areas based on radio telemetry and visual observations (Ryden and Pfeifer 1994, Miller and Ptacek 2000). Both locations occur within the "Mixer" (RM 133.4 to 129.8), a distinct geomorphic reach of the San Juan River. The upper spawning location is located at RM 132 and the lower spawning location at approximately RM 131.1. Both locations consist of complex habitat associated with cobble bar and island complexes. Substrate in the riffle areas is clean cobbles, primarily 7.6 to 10.2 cm (3 to 4 in.) in diameter (Miller and Ptacek 2000). An additional possible spawning location in the San Juan River has been documented in the vicinity of Four Corners Bridge (RM 118) based on the capture of adults in spawning condition over multiple years (Duran 2014)

During 1993, radio-tagged pikeminnow were observed moving to potential spawning locations in the Mixer beginning around July 1. Fish were in the spawning areas from approximately July 12 to July 25. During this period, flows in the San Juan River were on the descending limb of the spring runoff. Temperatures increased from approximately 20 to 25 ˚C (68 to 77 ˚F) during the same time period. While other years have similar patterns, specific spawning times and duration of the spawning period appear variable. Information on radio-tagged adult pikeminnow during the fall suggests that pikeminnow seek out deep water areas in the Colorado River (Miller et al. 1982, Osmundson and Kaeding 1989). Pools, runs, and other deep water areas, especially in upstream reaches, are important winter habitats for pikeminnow (Osmundson et al. 1995).

On the Green River, tributaries are an important habitat component for pikeminnow (Holden 2000). Both the Yampa River and White River were heavily used by pikeminnow subadults and adults, apparently as foraging areas (Tyus 1991). Adults return to tributaries after spawning. The Animas River, Mancos River, and McElmo Creek are the main perennial tributaries of the San Juan River. Pikeminnow utilized the Animas River in the late 1800s and the river could still provide suitable habitat. Pikeminnow aggregated at the mouth of the Mancos River prior to spawning in the early 1990s (Ryden and Ahlm 1996, Miller and Ptacek 2000). One individual was found almost 0.5 miles upstream in the Mancos River on two separate occasions (Ryden pers. obs.). Colorado pikeminnow were detected in Yellow Jacket Canyon (a tributary of McElmo Creek) each year from 2007 to 2010 (Fresques et al. 2013). All 11 pikeminnow (168-425 mm TL) detected in Yellow Jacket Canyon were thought to have originated from juvenile fish stocked in the mainstem San Juan River but only one was captured with a previously implanted PIT tag to confirm this (Fresques et al. 2013). The importance of tributaries in the San Juan River Basin to the life history of Colorado pikeminnow is unknown.

Very little information is available how turbidity influences the endangered Colorado River fishes. Osmundson and Kaeding (1989) found that turbidity allows relatively shallow habitats to be used for foraging or resting by providing cover from avian or terrestrial predators. Tyus and Haines (1991) found that young pikeminnow in the Green River preferred backwaters that were turbid. Clear conditions in these shallow waters might expose young fish to predation from wading birds or nonnative sight-feeding piscivorous fish. It is not known if the river was as turbid historically as it is today. It is assumed that Colorado River endemic fishes evolved under conditions of high turbidity. Therefore, retention of turbid conditions is probably an important

factor allowing these fish to compete with nonnatives that did not evolve under similar conditions.

Population Dynamics

In the upper Colorado River Basin, declines in Colorado pikeminnow populations occurred primarily after the 1960s, when the following dams were constructed: Glen Canyon Dam on the main stem Colorado River, Flaming Gorge Dam on the Green River, Navajo Dam on the San Juan River, and the Aspinall Unit dams on the Gunnison River. Some native fish populations in the upper basin have managed to persist, while others are nearly extirpated. River reaches where native fish have declined more slowly, more closely resemble pre-dam hydrologic regimes, where adequate habitat for all life phases still exists. The ability of the pikeminnow to withstand adverse impacts to its populations and its habitat is difficult to discern given the longevity of individuals and their scarcity within the San Juan River Basin. Younger life stages are considered the most vulnerable to predation, competition, toxic chemicals, and habitat degradation.

Between 1991 and 1995, 19 (17 adult and 2 juvenile) wild pikeminnow were collected in the San Juan River by electrofishing between RM 142 (the former Cudei Diversion) and Four Corners at RM 119 (Ryden 2000a, Ryden and Ahlm 1996). The multi-threaded channel, habitat complexity, and mixture of substrate types in this area of the river appear to provide a diversity of habitats favorable to pikeminnow on a year-round basis (Holden and Masslich 1997).

Successful Colorado pikeminnow reproduction was documented in the San Juan River in 1993, 1995, 1996, 2001, 2004, 2007, 2009-2011, and 2013 (Farrington et al. 2014). A total of 58 larval Colorado pikeminnow were collected since 1993 (Farrington et al. 2014). The majority of the YOY pikeminnow were collected in the San Juan River in Reaches 1 and 2, the most downstream stretches of the river upstream of Lake Powell (Farrington et al. 2014).

Tissue samples from pikeminnow caught during research conducted under the Recovery Program have been analyzed as part of a basin-wide analysis of endangered fish genetics. The results of that analysis indicate that the San Juan River fish exhibit less genetic variability than the Green River and Colorado River populations, likely due to the small population size, but were very similar to pikeminnow from the Green, Colorado, and Yampa rivers (Morizot in litt. 1996). These data suggest that the San Juan population is probably not a separate stock (Holden and Masslich 1997).

Competition and Predation

Pikeminnow in the upper Colorado River Basin live with about 20 species of warm-water nonnative fishes (Tyus et al. 1982, Lentsch et al. 1996) that are potential predators, competitors, and vectors for parasites and disease. Backwaters and other low-velocity habitats in the San Juan River are important nursery areas for larval and juvenile pikeminnow (Holden 1999) and pikeminnow recruitment is limited because of nonnative fish abundance in these habitats (Bestgen 1997, Bestgen et al. 1997, McAda and Ryel 1999). Osmundson (1987) documented predation by black bullhead (*Ameiurus melas*), green sunfish (*Lepomis cyanellus*), largemouth

bass (*Micropterus salmoides*), and black crappie (*Pomoxis nigromaculatus*) as a significant mortality factor for YOY and yearling pikeminnow stocked in riverside ponds along the upper Colorado River. Adult red shiners (*Cyprinella lutrensis*) are known predators of larval native fish in backwaters of the upper basin (Ruppert et al. 1993). In laboratory experiments on behavioral interactions, Karp and Tyus (1990) observed that red shiner, fathead minnow, and green sunfish shared activity schedules and space with young pikeminnow and exhibited antagonistic behaviors to smaller pikeminnow. Young pikeminnow exhibit high spatial overlap in habitat use with red shiner, sand shiner (*Notropis stramineus*), and fathead minnow (*Pimephales promelas*); pikeminnow may be at a competitive disadvantage in an environment that is resource limited.

Channel catfish (*Ictalurus punctatus*) have been identified as a threat to juvenile, subadult, and adult pikeminnow in the San Juan River. Channel catfish were first introduced in the upper Colorado River Basin in 1892 (Tyus and Nikirk 1990) and are now considered common to abundant throughout much of the upper basin (Tyus et al. 1982, Nelson et al. 1995). The species is one of the most prolific predators in the upper basin and is thought to have the greatest adverse effect on endangered fishes due to predation on juveniles and resource overlap with subadults and adults (Hawkins and Nesler 1991, Lentsch et al. 1996, Tyus and Saunders 1996). Adult channel catfish predation of stocked juvenile Colorado pikeminnow has been documented in the San Juan River (Jackson 2005). Stocked juvenile and adult pikeminnow that have preyed on channel catfish have died from choking on the pectoral spines (McAda 1983, Pimental et al. 1985, Ryden and Smith 2002, Lapahie 2003). Although mechanical removal (electrofishing, seining) of channel catfish began in 1995, intensive efforts covering limited portions of the San Juan River (10 trips/year) did not begin until 2001. Intensive removal efforts expanded to include nearly all critical habitat in the San Juan River starting in 2006. Mechanical removal has not yet led to a positive population response in pikeminnow but attributing a population response to nonnative fish removal would be extremely difficult (Davis 2003). Additionally, positive responses of native fishes as a result of nonnative fish removal has not been clearly demonstrated (Franssen et al. 2014).

Status and Distribution

The pikeminnow was designated as endangered prior to the ESA; therefore, a formal listing package identifying threats was not prepared. Construction and operation of main stem dams, nonnative fish, and local eradication of native minnows and suckers in the early 1960s were recognized as early threats (Miller 1961, Holden 1991). The pikeminnow recovery goals (Service 2002a) summarize threats to the species as follows: stream regulation, habitat modification, competition with and predation by nonnative fish, and pesticides and pollutants.

Major declines in pikeminnow populations occurred in the lower Colorado River Basin during the dam-building era of the 1930s through the 1960s. Behnke and Benson (1983) summarized the decline of the natural ecosystem, pointing out that dams, impoundments, and water use practices drastically modified the river's natural hydrology and channel characteristics throughout the Colorado River Basin. Dams on the main stem fragmented the river ecosystem into a series of disjunct segments, blocked native fish migrations, reduced water temperatures

downstream of dams, created lake habitat, and provided conditions that allow competitive and predatory nonnative fishes to thrive both within the impounded reservoirs and in the modified river segments that connect them. The highly modified flow regime in the lower basin coupled with the introduction of nonnative fishes decimated populations of native fish.

Until recently, due to the low numbers of pikeminnow collected in the San Juan River, it was not possible to quantify population size or trends. Estimates during a seven-year research period between 1991 and 1997 suggested that there were fewer than 50 adults in a given year (Ryden 2000a). Riverwide population estimates for age-2+ pikeminnow that have been in the San Juan River at least one year was approximately 4,600 and 5,400 individuals in 2009 and 2010, respectively (Duran et al. 2011). However, because few adult Colorado pikeminnow were detected in the San Juan River, this population estimate largely consists of juveniles. Other Colorado pikeminnow abundance estimates exhibit substantial annual variation, likely due to the effects of short-term retention from recent stocking events, but no clear population trends were evident (Durst 2014).

Successful Colorado pikeminnow reproduction has been documented in the San Juan River with the collection of 58 larval Colorado pikeminnow between 1993 and 2013 (Farrington et al. 2014); however, there has been little to no recruitment documented in the San Juan River. A total of 48 age-1+ Colorado pikeminnow were collected in 2013; all presumably the result of augmentation efforts (Farrington et al. 2014). Since 1998, Colorado pikeminnow were collected during small-bodied monitoring every year except 2001-2003; however, YOY Colorado pikeminnow were stocked in each of these years prior to monitoring efforts so these fish were likely hatchery-reared (Gilbert 2014).

At total of 24 Colorado pikeminnow were collected in the San Juan arm of Lake Powell in 2011 and four were of adult size. All of the Colorado pikeminnow detected in Lake Powell were likely the result of stocking efforts in the San Juan River (Francis et al. 2013). These results indicate at least some of the fish stocked in the San Juan River are moving into the reservoir and surviving. Additional sampling is planned to determine the status of the species in Lake Powell.

A factor not considered when the pikeminnow was listed was water quality. Surface and ground water quality in the Animas, La Plata, Mancos, and San Juan River drainages have become concerns in recent years (Abell 1994). Changes in water quality and contamination of associated biota are known to occur in Bureau of Reclamation (Reclamation) projects in the San Juan drainage (i.e., irrigated lands on the Pine and Mancos Rivers) where return flows from irrigation make up a portion of the river flow (Sylvester et al. 1988). Increased loading of the San Juan River and its tributaries with contaminants such as selenium, salts, polycyclic aromatic hydrocarbons (PAHs), and pesticides has degraded water quality of the San Juan River in critical habitat (Abell 1994, Wilson et al. 1995, Holden 1999). Mercury contamination is also a concern due to the high mercury deposition in the Upper Colorado River Basin and risk of mercury bioaccumulation in long-lived piscivores like Colorado pikeminnow (Osmundson and Darnall 2007). Mercury toxicity thresholds were exceeded in 64 percent of Colorado pikeminnow sampled, indicating possible brain and nervous system injury and reproductive impairment (Osmundson and Lusk 2010).

The ability of the pikeminnow to withstand adverse impacts to its populations and its habitat is difficult to discern given the longevity of individuals and their status within the San Juan River Basin. Younger life stages are considered the most vulnerable to predation, competition, toxic chemicals, and habitat degradation. The ability of a population to rebound from these impacts may take several years or more.

Razorback Sucker

Like all suckers (family Catastomidae, meaning "down mouth"), the razorback sucker has a ventral mouth with thick lips covered with papillae and no scales on its head. In general, suckers are bottom browsers, sucking up or scraping off small invertebrates, algae, and organic matter with their fleshy, protrusible lips (Moyle 1976). The razorback sucker is the only sucker with an abrupt sharp-edged dorsal keel behind its head. The keel becomes more massive with age. The head and keel are dark, the back is olive-colored, the sides are brownish or reddish, and the abdomen is yellowish white (Sublette et al. 1990). Adults often exceed 3 kg (6 lbs) in weight and 600 mm (2 ft) in length. Like pikeminnow, razorback suckers may live 40-plus years.

Historically, razorback suckers were found in the main stem Colorado River and major tributaries in Arizona, California, Colorado, Nevada, New Mexico, Utah, Wyoming, and in Mexico (Ellis 1914; Minckley 1983). 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. In the upper Colorado River Basin, razorback suckers were reported to be very abundant in the Green River near Green River, Utah, in the late 1800s (Jordan 1891). An account in Osmundson and Kaeding (1989) reported that residents living along the Colorado River near Clifton, Colorado, observed several thousand razorback suckers during spring runoff in the 1930s and early 1940s. In the San Juan River drainage, the first documented razorback sucker from the river was documented in 1988 (Platania 1990); however, two adults were also collected from an irrigation pond attached to the river by a canal in 1976 (Platania 1990) and it is very likely that razorback sucker once occurred in the main stem as far upstream as Rosa, New Mexico (Koster 1960, Ryden 1997).

A marked decline in populations of razorback suckers can be attributed to construction of dams and reservoirs, introduction of nonnative fishes, and removal of large quantities of water from the Colorado River system. Dams on the main stem Colorado River and its major tributaries have fragmented populations and blocked migration routes. Dams also have drastically altered flows, water temperatures, and channel geomorphology. These changes have modified habitats in many areas so that they are no longer suitable for breeding, feeding, or sheltering. Major changes in species composition have occurred due to the introduction of nonnative fishes.

On March 14, 1989, the Service was petitioned to conduct a status review of the razorback sucker. Subsequently, the razorback sucker was designated as endangered under a final rule published on October 23, 1991 (Service 1991). The final rule stated that "Little evidence of natural recruitment has been found in the past 30 years, and numbers of adult fish captured in the last 10 years demonstrate a downward trend relative to historic abundance. Significant changes have occurred in razorback sucker habitat through diversion and depletion of water, introduction of nonnative fishes, and construction and operation of dams (Service 1994)." Recruitment of

larval razorback suckers to juveniles and adults continues to be a problem. Reasons for decline of most native fishes in the Colorado River Basin have been attributed to habitat loss due to construction of mainstream dams and subsequent interruption or alteration of natural flow and physio-chemical regimes, inundation of river reaches by reservoirs, channelization, water quality degradation, introduction of nonnative fish species and resulting competitive interactions or predation, and other man-induced disturbances (Miller 1961, Joseph et al. 1977, Behnke and Benson 1983, Carlson and Muth 1989, Tyus and Karp 1989). These factors are almost certainly not mutually exclusive; therefore, it is often difficult to determine exact cause and effect relationships.

Critical habitat was designated in 1994 within the 100-year floodplain of the razorback sucker's historical range in the following areas of the upper Colorado River (59 F.R. 13374). The primary constituent elements are the same as critical habitat for Colorado pikeminnow described previously. Critical habitat for razorback suckers has been designated for 15 reaches in the Colorado River system. These reaches total 1,724 miles as measured along the center line of the river within the subject reaches. The designation represents approximately 49 percent of the historical habitat for the species and includes reaches of the Green, Yampa, Duchesne, Colorado, White, Gunnison and San Juan rivers.

Colorado, Moffat County. The Yampa River and its 100-year floodplain from the mouth of Cross Mountain Canyon in T. 6 N., R. 98 W., section 23 (6th Principal Meridian) to the confluence with the Green River in T. 7 N., R. 103 W., section 28 (6th Principal Meridian).

Utah, Uintah County; and Colorado, Moffat County. The Green River and its 100-year floodplain from the confluence with the Yampa River in T. 7 N., R. 103 W., section 28 (6th Principal Meridian) to Sand Wash in T. 11 S., R. 18 E., section 20 (6th Principal Meridian).

Utah, Uintah, Carbon, Grand, Emery, Wayne, and San Juan Counties. The Green River and its 100-year floodplain from Sand Wash at river mile 96 at T. 11 S., R. 18 E., section 20 (6th Principal Meridian) to the confluence with the Colorado River in T. 30 S., R. 19 E., section 7 (6th Principal Meridian).

Utah, Uintah County. The White River and its 100-year floodplain from the boundary of the Uintah and Ouray Indian Reservation at river mile 18 in T. 9 S., R. 22 E., section 21 (Salt Lake Meridian) to the confluence with the Green River in T. 9 S., R. 20 E., section 4 (Salt Lake Meridian).

Utah, Uintah County. The Duchesne River and its 100-year floodplain from river mile 2.5 in T. 4 S., R. 3 E., section 30 (Salt Lake Meridian) to the confluence with the Green River in T. 5 S., R. 3 E., section 5 (Uintah Meridian).

Colorado, Delta and Mesa Counties. The Gunnison River and its 100-year floodplain from the confluence with the Uncompahgre River in T. 15 S., R. 96 W., section 11 (6th

Principal Meridian) to Redlands Diversion Dam in T. 1 S., R. 1 W., section 27 (Ute Meridian).

Colorado, Mesa and Garfield Counties. The Colorado River and its 100-year floodplain from Colorado River Bridge at exit 90 north off Interstate 70 in T. 6 S., R. 93 W., section 16 (6th Principal Meridian) to Westwater Canyon in T. 20 S., R. 25 E., section 12 (Salt Lake Meridian) including the Gunnison River and its 100-year floodplain from the Redlands Diversion Dam in T. 1 S., R. 1 W., section 27 (Ute Meridian) to the confluence with the Colorado River in T. 1 S., R. 1 W., section 22 (Ute Meridian).

Utah, Grand, San Juan, Wayne, and Garfield Counties. The Colorado River and its 100-year floodplain from Westwater Canyon in T. 20 S., R. 25 E., section 12 (Salt Lake Meridian) to full pool elevation, upstream of North Wash, and including the Dirty Devil arm of Lake Powell in T. 33 S., R. 14 E., section 29 (Salt Lake Meridian).

New Mexico, San Juan County; and Utah, San Juan County. The San Juan River and its 100-year floodplain from the Hogback Diversion in T. 29 N., R. 16 W., section 9 (New Mexico Meridian) to the full pool elevation at the mouth of Neskahai Canyon on the San Juan arm of Lake Powell in T. 41 S., R. 11 E., section 26 (Salt Lake Meridian).

Life History

McAda and Wydoski (1980) and Tyus (1987) reported springtime aggregations of razorback suckers in off-channel habitats and tributaries; such aggregations are believed to be associated with reproductive activities. Tyus and Karp (1990) and Osmundson and Kaeding (1991) reported off-channel habitats to be much warmer than the main stem river and that razorback suckers presumably moved to these areas for feeding, resting, sexual maturation, spawning, and other activities associated with their reproductive cycle.

While razorback suckers have never been directly observed spawning in turbid riverine environments within the upper Colorado River Basin, ripe males and females have been captured in the Yampa, Green, Colorado, and San Juan rivers (Valdez et al. 1982, McAda and Wydoski 1980, Tyus 1987, Osmundson and Kaeding 1989, Tyus and Karp 1989, Tyus and Karp 1990, Osmundson and Kaeding 1991, Platania 1990, Ryden 2000b, Jackson 2003, Ryden 2005). Because of the relatively steep gradient in the San Juan River and lack of a wide flood plain, razorback sucker likely spawn in low velocity, turbid, main channel habitats.

Sexually mature razorback suckers are generally collected on the ascending limb of the hydrograph from mid-April through June and are associated with coarse gravel substrates. Both sexes mature as early as age-4 (McAda and Wydoski 1980). Fecundity, based on ovarian egg counts, ranged from highs of 75,000-144,000 eggs (Minckley 1983) while McAda and Wydoski (1980) reported an average fecundity (N=10) of 46,740 eggs/fish (27,614–76,576). Several males attend each female and no nest is built. The adhesive eggs drift and hatch at the bottom of the substrate (Sublette et al. 1990). In laboratory experiments, the percentage of egg hatch was

greatest at 20 ˚C (68 ˚F) and all embryos died at incubation temperatures of 5, 10, and 30 ˚C (41, 50, and 86 ˚F) (Marsh 1985).

Because young and juvenile razorback suckers are rarely encountered, their habitat requirements in the wild are not well known. However, it is assumed that low-velocity backwaters and side channels are important for YOY and juveniles, as it is to the early life stages of most riverine fish. Prior to construction of large main stem dams and the suppression of spring peak flows, low velocity, off-channel habitats (seasonally flooded bottomlands and shorelines) were commonly available throughout the upper Colorado River Basin (Tyus and Karp 1989, Osmundson and Kaeding 1991). Modde (1996) found that on the Green River, larval razorback suckers entered flooded bottomlands that are connected to the main channel during high flow. However, as mentioned earlier, because of the relatively steep gradient of the San Juan River and the lack of a wide flood plain, flooded bottomlands are probably much less important in this system than are other low velocity habitats such as backwaters and secondary channels (Ryden 2004a).

Reduction in spring peak flows eliminates or reduces the frequency of inundation of off-channel and bottomland habitats. The absence of these seasonally flooded riverine habitats are believed to be a limiting factor in the successful recruitment of razorback suckers in other upper Colorado River streams (Tyus and Karp 1989, Osmundson and Kaeding 1991). Wydoski and Wick (1998) identified loss of floodplain habitats that provide adequate zooplankton densities for larval food as one of the most important factors limiting recruitment; low zooplankton densities in the main channel result in starvation of larval razorback suckers. Maintaining low velocity habitats is important for the survival of larval razorback suckers.

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 (Tyus 1987, Tyus and Karp 1989, Osmundson and Kaeding 1989, Valdez and Masslich 1989, Osmundson and Kaeding 1991, Tyus and Karp 1990). The diet consists primarily of algae, plant debris, and aquatic insect larvae (Sublette et al. 1990).

Population Dynamics

Because wild razorback sucker are rarely encountered and they are a long-lived fish, it is difficult to determine natural fluctuations in their population. The existing scientific literature and historic accounts by local residents strongly suggest that razorback suckers were once a viable, reproducing member of the native fish community in the San Juan River drainage. Currently, wild razorback sucker are rare throughout their historic range and extremely rare in the main stem San Juan River, although over 130,000 hatchery-reared razorback sucker have been stocked into the San Juan River since the mid-1990s (Furr 2014). While wild-produced larval razorback sucker have been collected every year since 1998 (Farrington et al. 2014), there is limited evidence indicating natural recruitment to any population of razorback sucker in the Colorado River system (Bestgen 1990, Platania 1990, Platania et al. 1991, Tyus 1987, McCarthy and Minckley 1987, Osmundson and Kaeding 1989, Modde et al. 1996). Although, age-0 razorback

suckers in the juvenile ontogenetic stage are regularly captured during larval fish monitoring (Farrington et al. 2014). In 2003 two juvenile (age-2) razorback sucker, 249 and 270 mm (9.8 and 10.6 in.), thought to be wild-produced from stocked fish, were collected in the lower San Juan River (RM 35.7 and 4.8) (Ryden 2004a) and at least four wild juvenile razorback sucker were collected downstream of RM 37.4 in 2004 (Golden and Holden 2006).

Competition and predation

Many species of nonnative fishes occur in occupied habitat of the razorback sucker. These nonnative fishes are predators, competitors, and vectors of parasites and diseases (Tyus et al. 1982, Lentsch et al. 1996, Pacey and Marsh 1999, Marsh et al. 2001). Many researchers believe that nonnative species are a major cause for the lack of recruitment and that nonnative fish are the most important biological threat to the razorback sucker (e.g., McAda and Wydoski 1980, Minckley 1983, Tyus 1987, Service 1998, Muth et al. 2000). There are reports of predation of razorback sucker eggs and larvae by common carp (*Cyprinus carpio*), channel catfish, smallmouth bass (*Micropterus dolomieui*), largemouth bass, bluegill (*Lepomis macrochirus*), green sunfish, and red-ear sunfish (*Lepomis microlophus*) (Jonez and Sumner 1954, Marsh and Langhorst 1988, Langhorst 1989). Marsh and Langhorst (1988) found higher growth rates in larval razorback sucker in the absence of predators in Lake Mohave, and Marsh and Brooks (1989) reported that channel catfish and flathead catfish were major predators of stocked razorback sucker in the Gila River. Juvenile razorback sucker (average total length [TL] 171 mm [6.7 in.]) stocked in isolated coves along the Colorado River in California, suffered extensive predation by channel catfish and largemouth bass (Langhorst 1989). Predation upon a recently-stocked razorback sucker by an adult channel catfish was documented in the San Juan River (Jackson 2005). Aggressive behavior between channel catfish and adult razorback sucker has been inferred from the presence of distinct bite marks on the dorsal keels of four razorback suckers that match the bite characteristics of channel catfish (Ryden 2004a).
Lentsch et al. (1996) identified six species of nonnative fishes in the upper Colorado River Basin as threats to razorback sucker: red shiner, common carp, sand shiner, fathead minnow, channel catfish, and green sunfish. Smaller fish, such as adult red shiner, are known predators of larval native fish (Ruppert et al. 1993). Large predators, such as walleye (*Stizostedion vitreum*), northern pike, and striped bass (*Morone saxatilis*), also pose a threat to subadult and adult razorback sucker (Tyus and Beard 1990).

Status and Distribution

Currently, the largest concentration of razorback sucker remaining in the Colorado River Basin is in Lake Mohave. Estimates of the wild stock in Lake Mohave have fallen precipitously in recent years from 60,000 as late as 1991, to 25,000 in 1993 (Marsh 1993, Holden 1994), to about 9,000 in 2000 (Service 2002b). Until recently, efforts to introduce young razorback sucker into Lake Mohave have failed because of predation by nonnative species (Minckley et al. 1991, Clarkson et al. 1993, Burke 1994). While limited numbers of razorback suckers persist in other locations in the Lower Colorado River, they are considered rare or incidental and may be continuing to decline.

In the upper Colorado River Basin, above Glen Canyon Dam, razorback suckers are found in limited numbers in both lentic (lake-like) and riverine environments. Lanigan and Tyus (1989) estimated a population of 948 adults (95 percent CI: 758-1,138) in the upper Green River. Eight years later, the population was estimated at 524 adults (95 percent CI: 351-696) and the population was characterized as stable or declining slowly with some evidence of recruitment (Modde et al. 1996). They attributed this suspected recruitment to unusually high spring flows during 1983-1986 that inundated portions of the floodplain used as nurseries by young. In the Colorado River, most razorback suckers occur in the Grand Valley area near Grand Junction, Colorado; however, they are increasingly rare. Osmundson and Kaeding (1991) reported that the number of razorback sucker captures in the Grand Junction area has declined dramatically since 1974. Between 1984 and 1990, intensive collecting effort captured only 12 individuals in the Grand Valley (Osmundson and Kaeding 1991). The wild population of razorback sucker is considered extirpated from the Gunnison River (Burdick and Bonar 1997). While the role of Lake Powell in the recovery of razorback sucker is unclear, 75 individuals were detected in the San Juan arm of Lake Powell in 2011 (Francis et al. 2013).

Scientifically documented records of wild razorback sucker adults in the San Juan River are limited to two fish captured in a riverside pond near Bluff, Utah in 1976, and one fish captured in the river in 1988, also near Bluff (Platania 1990). Large numbers were anecdotally reported from a drained pond near Bluff in 1976, but no specimens were preserved to verify the species. No wild razorback suckers were found during the 7-year research period (1991-1997) of the Recovery Program (Holden 1999). Hatchery-reared razorback sucker, especially fish greater than 350 mm (13.8 in.), introduced into the San Juan River in the 1990s have survived and reproduced, as evidenced by recapture data and collection of larval fish (Ryden 2000b). Riverwide razorback sucker population estimates of 268 in October 2000 (Ryden 2001) have since grown to 1,200 in October 2004 (Ryden 2005b), and to about 2,000 and 3,000 in 2009 and 2010, respectively (Duran et al. 2011). Additional mark-recapture data indicates increasing razorback sucker abundance estimates (Durst 2014). Since there is little to no documented recruitment in the San Juan River, this increase should be attributed almost entirely to the population augmentation with hatchery-reared razorback sucker.

The razorback sucker recovery goals identified streamflow regulation, habitat modification, predation by nonnative fish species, and pesticides and pollutants as the primary threats to the species (Service 2002b). Within the upper Colorado River Basin, recovery efforts include the capture and removal of razorback suckers from all known locations for genetic analyses and development of brood stocks. In the short term, augmentation (stocking) may be the only means to prevent the extirpation of razorback sucker in the upper Colorado River Basin. However, in the long term it is expected that natural reproduction and recruitment will occur. A genetics management plan and augmentation plan have been written for the razorback sucker (Crist and Ryden 2003, Ryden 2003).

Summary of status and distribution for both razorback sucker and Colorado pikeminnow

Colorado pikeminnow and razorback sucker remain in danger of extinction in the wild. Both fish species evolved in large, unregulated river systems that have been modified by human

activities. Dams have inundated habitat, blocked movements, changed water temperature and river morphology, altered flow regimes, trapped sediment, and enabled nonnative species to flourish (Service 1998). Despite concerted efforts to recover populations, the long-term prognosis for both pikeminnow and razorback sucker remains unknown. Rangewide, progress toward pikeminnow recovery has occurred in the Yampa and Green rivers. Razorback sucker have spawned every year since 1998 in the San Juan River (Farrington et al 2014). Capture of juvenile razorback suckers in 2003 and 2004 were the first indication of possible recruitment in the San Juan River (Ryden 2005b, Golden and Holden 2006). Larval pikeminnow have been documented in the San Juan River, indicating that spawning is occurring. Recruitment to reproductive age remains limited for all populations.

ENVIRONMENTAL BASELINE

The environmental baseline includes the past and present impacts of all Federal, State, and private actions and other human activities in the action area; the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal section 7 consultation; and the impact of State or private actions contemporaneous with the consultation process.

In formulating this opinion, the Service considered adverse and beneficial effects likely to result from cumulative effects of future State and private activities that are reasonably certain to occur within the Project area, along with the direct and indirect effects of the Project and impacts from actions that are part of the environmental baseline (50 CFR 402.02 and 402.14 (g)(3)).

Status of the Species Within the Action Area

Colorado pikeminnow

Platania and Young (1989) summarized historic fish collections in the San Juan River drainage that indicate that pikeminnow once inhabited reaches upstream of what is now the Navajo Dam and Reservoir near Rosa, New Mexico. Lake Powell and Navajo Reservoir resulted in the direct loss of approximately 161 km (100 miles) of San Juan River habitat for the two endangered fishes (Holden 2000). Since closure of Navajo Dam in 1963, the accompanying fish eradication program, physical changes associated with the dam, and barriers to movement, wild pikeminnow have been eliminated from the upper San Juan River upstream of Navajo Dam. The 10 km (6.2 miles) below the dam are essentially sediment free, resulting in the clearest water of any reach (Miller and Ptacek 2000). The cool, clear water has allowed development of an intensively managed blue-ribbon trout fishery to the exclusion of the native species (Miller and Ptacek 2000).

Between 1987 and 1996, no wild pikeminnow adults were caught above Shiprock (approximately RM 148). Radio telemetry studies conducted from 1991 to 1995 indicated that pikeminnow remained within a relatively small area of the river, between RM 110 to RM 142 (Holden 2000). During the seven-year research period (1991 to 1997), it was estimated that there were fewer than 50 adults in the San Juan River in any given year (Ryden 2000a). The removal

of the diversion at Cudei (RM 142), construction of non-selective fish passage at the Hogback Diversion (RM 158.6), and the completion of the Public Service Company of New Mexico (PNM) (RM 166.7) selective fish passage ladder in 2003 has restored fish access to about 38 miles of critical habitat on the San Juan River for pikeminnow. In 2004, 5 pikeminnow (226-250 mm TL [8.9-9.8 in.]) were caught in the lower few miles of the Animas River (Ryden 2005a). These were all age-2 fish that had been stocked in June 2004 about 0.3 RMs downstream of the Animas River confluence (Ryden 2005a, Zimmerman 2005). Colorado pikeminnow have been stocked in the San Juan River upstream of PNM fish passage since its completion and in the lower Animas River since 2011 (Furr 2013b). Riverwide population estimates done for age-2+ pikeminnow in the San Juan River were approximately 4,600 and 5,400 individuals in 2009 and 2010, respectively (Duran et al. 2011). Colorado pikeminnow abundance estimates varied substantially by year and population trends are difficult to discern but most pikeminnow in the San Juan River are recently stocked individuals (Durst 2014).

Razorback sucker

From 1991 to 1997, no wild adult razorback suckers were collected in the San Juan River and only one was caught during studies conducted in the late 1980s (Holden 2000). In 1987, a total of 18 adult razorbacks were collected (six were captured twice) on the south shore of the San Juan River arm of Lake Powell (Platania 1990, Platania et al. 1991). These fish were captured near a concrete boat ramp at Piute Farms Marina and were believed to be either a spawning aggregation or possibly a staging area used in preparation for migration to a spawning site. Of the 12 individual razorback suckers handled in 1987, 8 were ripe (expressing milt) males while the other 4 specimens were females that appeared gravid.

In 1988, a total of 10 razorback suckers were handled at the same general location and 5 were in reproductive condition and 6 were recaptures from 1987 (Platania et al. 1991). Also in 1988, a single adult tuberculate male razorback sucker was captured in the San Juan River near Bluff, Utah (RM 80) (Platania 1990, Platania et al. 1991). This was the first confirmed record of this species from the main stem San Juan River. The presence of this reproductively mature specimen suggested that razorback suckers were attempting to spawn within the riverine portion of the San Juan drainage. However, no wild razorback suckers have been collected on the San Juan River since 1988 (Ryden 2002a). A Schnabel multiple-census population model estimated that there were 1,215 razorback suckers in the San Juan River from RM 158.6 to 2.9 in the fall of 2004 (Ryden 2005) and Program MARK was used to generate riverwide population estimates of about 2,000 and 3,000 in 2009 and 2010, respectively (Duran et al. 2011). Riverwide razorback sucker abundance estimates have generally increased since 2008 (Durst 2014). These population estimates are for hatchery-reared razorback sucker in the San Juan River and include both adult and subadult fish.

Factors Affecting Species Environment within the Action Area

The San Juan River is a tributary to the Colorado River and drains a basin of approximately 25,000 miles^2 (65,000 km^2) located in Colorado, New Mexico, Utah, and Arizona (Reclamation 2003). From its origins in the San Juan Mountains of southwestern Colorado (at an elevation

exceeding 13,943 ft) (4,250 m), the river flows westward through New Mexico, Colorado, and into Lake Powell, Utah. The majority of water that feeds the 345 miles (570 km) of river is from the mountains of Colorado. From a water resources perspective, the area of influence for the proposed project begins at the inflow areas of Navajo Reservoir, and extends west from Navajo Dam approximately 224 miles (359 km) along the San Juan River to Lake Powell. The dam is operated and maintained by Reclamation (Reclamation 2003). The major perennial tributaries in the project area are the Los Pinos, Piedra, Navajo, Animas, La Plata, and Mancos rivers, and McElmo Creek. There are also numerous ephemeral arroyos and washes that contribute little flow to the San Juan River, but large sediment loads.

As recognized in the Draft Environmental Impact Statement for Navajo Reservoir Operations (Reclamation 2002) (DEIS), changes in biodiversity associated with the historical San Juan River occurred when Navajo Dam was placed into operation. The reservoir physically altered the San Juan River and surrounding terrain and modified the pattern of flows downstream. Similar to rivers downstream of other dam operations in the southwestern United States, the San Juan River downstream of the dam became clearer due to sediment retained in the reservoir, and the water became colder, because it is released from the hypolimnion. The DEIS states that all species of plants and animals that existed along the river channel were affected to varying degrees. The disruption of natural patterns of flow caused changes to the vegetation along the river banks by altering the previously established conditions under which the plants reproduced and survived.

Navajo Dam regulates river flows, provides flood control and contributes to recreational and fishery activities (Reclamation 2002). In addition to the changes caused to the river by dam operations, the DEIS (Reclamation 2002) recognized that there were changes to how the lands in the area were used. Irrigation water provided by Navajo Dam contributed to agriculture being practiced on a large scale. The reservoir stores water for the Navajo Indian Irrigation Project (biological opinion consultation numbers 2-22-91-F-241, 2-22-92-F-080, and 2-22-99-F-381), the Hammond Irrigation Project, and various municipal and industrial uses making it possible to nearly double the amount of irrigation in the basin. At the present time, the Navajo Indian Irrigation Project diverts an annual average of approximately 160,000 acre-feet from the reservoir for irrigation south of Farmington (Reclamation 2002). In the future, this use is expected to approximately double (Reclamation 2002). This will further affect the river and the native species dependent on the river both directly, through flow diversions, and indirectly, through changes in water quality, as a result of the water acquiring salts, pesticides, and fertilizers from the irrigated lands' return flows to the river (Reclamation 2002).

In addition to the effects of operating Navajo Dam, over the last century, the San Juan River has experienced diversions for municipal use, resulting in a variety of return flows to the river, including industrial waste, storm water runoff, and discharges from sewage treatment plants. Compounding these changes has been the appearance of nonnative species of fish and plants, creating competition with native species (Reclamation 2002).

Although there are impacts to the river ecosystem from dam construction itself, dams have many impacts that continue after the structure is complete. Dams affect the physical, chemical, and

biological components of a stream ecosystem (Williams and Wolman 1984, Collier et al. 1996, Service 1998, Mueller and Marsh 2002). Some of these effects include a change in water temperature, a reduction in lateral channel migration, channel scouring, blockage of fish passage, transformation of riverine habitat into lake habitat, channel narrowing, changes in the riparian community, diminished peak flows, changes in the timing of high and low flows, and a loss of connectivity between the river and its flood plain (e.g., Sherrard and Erskine 1991, Power et al. 1996, Kondolf 1997, Polzin and Rood 2000, Collier et al. 1996, Shields et al. 2000). Of these, change in water temperature, blockage of fish passage, transformation of riverine habitat into lake habitat, changes in the timing and magnitude of high and low flows and changes in channel morphology are discussed in greater detail.

Water temperature

The cold water below Navajo Dam limits the potential spawning habitat of the endangered fishes in the San Juan River. Prior to dam construction water temperatures at Archuleta (approximately 10 km [6.1 miles] below the dam) were above the threshold spawning temperature of 20ºC (68ºF) for approximately 2 months (Holden 1999). Since dam construction, water temperature is rarely over 15ºC (59ºF) and is too cold for successful pikeminnow spawning (Holden 1999, Miller, Recovery Program Biology Committee, pers. comm. 2004). The threshold temperatures for spawning at Shiprock (approximately 125 km [78 miles] below the dam) occur about 2 weeks later on average than pre-dam (Holden 1999). Consequently, spawning is unlikely to occur in the San Juan River between Navajo Dam and the confluence of the Animas River (approximately 72 km [45 miles] below the dam) and spawning would be delayed for two weeks or more from between the confluence with the Animas River and Shiprock.

Water temperatures at Shiprock before the construction of Navajo Dam were above 20ºC (68ºF) from approximately mid-June until mid-September (three months) (Holden 1999). Projected temperatures at Shiprock from 1993-1996 were above 20ºC (68ºF) for only one month (August) (Holden 1999). Because fish are cold-blooded, their metabolism and growth decrease and time to sexual maturity increase with cold temperatures (Lagler et al. 1977). Development time of pikeminnow and razorback sucker embryos is inversely related to temperature and survival is reduced at temperatures that depart from 20ºC (68ºF) (Bulkley et al. 1981, Hamman 1982). Marsh (1985) found that for razorback suckers, time to peak hatch was 216 hours (9 days) at 15ºC (59ºF) and 84 hours (3.5 days) at 25ºC (77ºF) and that the percent of eggs hatched was highest at 20ºC (68ºF). All the pikeminnow eggs tested died at incubation temperatures lower than 15ºC (59ºF) (Marsh 1985). Marsh (1985) indicated that survival and hatching success were maximized near 20ºC (68ºF). Reducing the number of days water temperature is near 20ºC (68ºF) is expected to have a negative impact on the hatching success and growth of razorback sucker and pikeminnow.

Because the combination of suitable spawning bars (an area of sediment-free cobbles) and suitable temperatures occur so far downstream on the San Juan (at the Mixer [RM 133.4 to RM 129.8]), there is a greater chance that larval fish will drift into Lake Powell and be lost from the population. Dudley and Platania (2000) found that, based on a neutral buoyancy bead study, drifting larval pikeminnow would be transported from the Mixer to Lake Powell in as little as

three days. For those larval fish not carried into Lake Powell, a delay in spawning (which reduces the amount of time YOY have to grow before winter) and overall colder water temperatures (resulting in slower growth) could reduce overwinter survival. While this reasoning is biologically sound, the consequences of lower water temperatures on survival and recruitment of pikeminnow have not been tested because there are so few pikeminnow in the San Juan River. There is speculation that the large volume of cold water in the upper Green River may be a major reason why larval pikeminnow drift so far downstream (Holden 2000). The same pattern may also occur on the San Juan River.

In conclusion, cold water released from Navajo Dam has the following effects on razorback sucker and pikeminnow; water temperatures that were once suitable for spawning for pikeminnow near Archuleta are no longer suitable; and if spawning were to occur near Shiprock, it would be delayed by approximately 2 weeks compared to pre-dam conditions. A delay in spawning reduces the amount of time that larval fish have to grow before winter.

Blockage of fish passage

Like other major dams on the Colorado River and its tributaries, Navajo Dam blocked all fish passage. While native fish once could move unimpeded from the San Juan River into the Colorado River and its tributaries, they are now confined to a relatively short reach of 362 km (225 mi) between Lake Powell and Navajo Dam. If adverse conditions occur (extreme low flow, extreme high flow, unfavorable temperatures, or water quality) the fish cannot escape or seek refuge in the Colorado River as they once could. Razorback sucker and pikeminnow that may have been trapped above the reservoir have all died or were killed during treatment with rotenone (Olson 1962, Holden 1999). In addition to the major dams, diversion structures constructed in the San Juan River have also created barriers to fish passage.

Ryden and Pfeifer (1993) identified five diversion structures between Farmington, New Mexico, and the Utah state line that potentially acted as barriers to fish passage at certain flows (Cudei, Hogback, Four Corners Power Plant, San Juan Generating Station (PNM Weir), and Fruitland Irrigation Canal). When radio telemetry studies were initiated on the San Juan River in 1991, only one radio-tagged pikeminnow was recorded moving upstream past one of the diversions. In 1995, an adult pikeminnow moved above the Cudei Diversion and then returned back downstream (Miller and Ptacek 2000). Other native fish had been found to move either upstream or downstream over all five of the diversions (Buntjer and Brooks 1997, Ryden 2000a).

In 2001, Cudei Diversion (RM 142) was removed from the river and Hogback Diversion (an earth and gravel berm structure that had to be rebuilt every year) was made into a permanent structure with non-selective fish passage. As of 2012, there have 81 razorback sucker and 273 Colorado pikeminnow movements upstream of the Hogback fish passage, indicating that the endangered fish are able to negotiate the ladder (Durst pers comm., 2013). The removal of Cudei Diversion and installation of the fish ladder at Hogback Diversion improved access for native fishes over 24.5 miles of river. Until 2003, the PNM Weir (RM 166) was a barrier to fish passage but a selective fish ladder was completed and has been operational since 2003. This has allowed passage past that structure by pikeminnow and razorback suckers. From April 1 to

October 31, 2011, 27,507 native fish used the passage including 707 Colorado pikeminnow and 39 razorback sucker (Morel 2012). The Four Corners Power Plant (Arizona Public Service) Diversion at RM 163.3 can still act as a fish barrier when the control gate for the structure is closed (Masslich and Holden 1996). Above the PNM Weir, the Fruitland Irrigation Canal Diversion (RM 178.5) may block pikeminnow access during flows less than 2,000 cubic per second (cfs) (typical for July-February). Fish may pass through a sluiceway during higher flows and during the winter at low flows when the sluice gates are left open (Masslich and Holden 1996).

Dams have fragmented razorback sucker and pikeminnow habitat throughout the Colorado River system. Within the San Juan River, fish passage was once impeded by five instream structures. One of these structures has been removed, two have been equipped with fish passage structures, and two remain as impediments to fish passage for part of the year depending on flow. However, no remaining structures are complete barriers within critical habitat. Pikeminnow and razorback sucker can potentially navigate from Lake Powell, past the Animas River, up to the Hammond Diversion Dam, a total of approximately 338 km (210 miles).

Transformation of riverine into lake habitat

Lake Powell inundated the lower 87 km (54 miles) of the San Juan River and Navajo Reservoir inundated another 43 km (27 miles). The two reservoirs reduced the potential range and habitat for the two endangered fishes from about 523 km (325 miles) to 362 km (225 miles) and inundated potential pikeminnow spawning areas in the upper San Juan River (Holden 2000). Although the loss of habitat is substantial, several other problems for native fishes resulted from the creation of lakes. The larvae of razorback sucker and pikeminnow drift downstream until they find suitable nursery habitat (backwaters or other low velocity areas) (Holden 2000). Because the river has been truncated 87 km (54 miles) on the lower end, there are many fewer stream miles available for nursery habitat. Some pikeminnow in the Green and Colorado River systems drift up to 322 km (200 miles) from spawning areas before finding nursery habitat, while others use nursery areas only a few miles below the spawning areas (Trammell and Chart 1999). The majority of larval Colorado pikeminnow have been collected in the lower two reaches of the San Juan River before it enters into Lake Powell (Farrington et al. 2013). Because of the many predators present and lack of suitable habitat, the survival rate of larvae in Lake Powell is not known. However, Colorado pikeminnow and razorback sucker of both unknown origin and hatchery-reared fish stocked into the San Juan River have been detected in the San Juan River arm of Lake Powell (Francis et al. 2013). Additionally, larval razorback sucker have been documented in Lake Powell indicating that successful spawning has occurred within the lake (Francis et al. 2013).

In 1961, prior to the filling of Navajo Dam, New Mexico Department of Game and Fish used rotenone “to eliminate trash fish species” from the Pine River (24 km [15 miles]), the Navajo River (9.6 km [6 miles]), and the San Juan River (120 km [75 miles]) (Olson 1962). Fourteen species of fish were eliminated in the treated section of river (Olson 1962). There were three drip stations on the San Juan River that effectively killed the majority of the fish from the Colorado state line, near Rosa, New Mexico, down to Fruitland, approximately 64 km (40 miles)

below Navajo Dam (Olson 1962). Included in the list of fish eliminated was pikeminnow (Olson 1962). The number of fish killed was not recorded because of the large scale of the project (Olson 1962). The intent of the project was to reduce competition and predation between native fish and the nonnative trout fishery that was to be established.

In 2003, a waterfall formed at Piute Farms in the lower San Juan River at the Lake Powell inflow when the water elevation of the reservoir declined below about 3,660 feet. This waterfall is an impediment to upstream movement of native and endangered fish, but also impedes nonnative fish from moving upstream from the reservoir (Recovery Program 2011). When water levels in Lake Powell rise and the waterfall is inundated, predators will again have access to the river. Reclamation assessed the risk of this occurring and concluded there is a 60 to 75 percent chance that the waterfall will be inundated for a total of 30 months (not necessarily continuously) between 2008 and 2030 (Mckinstry pers. comm., 2007). On July 30, 2011, Lake Powell water levels reached a high for the year of 3,660.85 feet with levels staying above 3,660 for 19 days from July 22 to August 9 (http://lakepowell.water-data.com). During this period, fish were able to pass over the waterfall into the river for several weeks to a month. During subsequent monitoring within the San Juan River, four razorback suckers were encountered that were previously detected in Lake Powell, indicating that these fish successfully negotiated the inundated waterfall (Francis et al. 2013). By the end of 2011, lake levels had dropped about 20 feet and it is unknown when the waterfall will be inundated again giving native and nonnative fish access to the river.

Lake Powell is populated by several fish species not native to the Colorado River that are predators of native fish. As mentioned earlier, larval native fish that drift into Lake Powell may be lost to predation by largemouth bass, smallmouth bass, striped bass, walleye, or crappie (*Pomoxis* spp.). Striped bass have migrated up the San Juan River as far upstream as the PNM Weir (RM 166) in some years (Davis 2003). Adult striped bass are piscivorous (Moyle 1976). In 2000, 432 striped bass were captured during monitoring trips for pikeminnow and during trips to remove nonnative fishes (Davis 2003). The contents of 38 stomachs were analyzed and native suckers were found in 41 percent (Davis 2003). This migratory predator is a threat to both YOY and juvenile native fish.

In conclusion, the transformation of riverine habitat into lake habitat had the following impacts on razorback sucker and pikeminnow:

1) Approximately 128 km (80 miles) of river was inundated and no longer provide suitable habitat. However, critical habitat for both species extends into the San Juan River arm of Lake Powell and both species have been documented within Lake Powell (Francis et al. 2013).
2) Nursery habitat for both species was inundated when Lake Powell was created (and filled), although larval razorback sucker have been documented in the lake (Francis et al. 2013).

3) The emphasis of fisheries management shifted to game fish production. Consequently, riverine habitat that supported native fish, including razorback sucker and pikeminnow, was treated with rotenone (after Navajo Dam was constructed) so that game fish production in the reservoirs could be promoted (Olson 1962, Holden 1991, Quartarone and Young 1995).
4) Nonnative game fish were stocked in Lake Powell and Navajo Reservoir. Nonnative fish are believed to limit the success of pikeminnow and razorback sucker recruitment and are considered biological threats to the species (McAda and Wydoski 1980, Minckley 1983, Osmundson 1987, Tyus 1987, Ruppert et al. 1993, Bestgen 1997, Bestgen et al. 1997, Service 1998, McAda and Ryel 1999, Muth et al. 2000).

Changes in the timing and magnitude of flows

Typical of rivers in the Southwest, the San Juan was originally characterized by large spring snowmelt peak flows, low summer and winter base flows, and high-magnitude, short-duration summer and fall storm events (Holden 1999). Historically, flows in the San Juan River were highly variable and ranged from a low of 44 cfs in September 1956, to a high of 19,790 cfs in May 1941 (mean monthly values) at the U.S. Geological Survey (USGS) Station gauge near Shiprock, New Mexico. The flows for this period of time do not necessarily represent a "natural" condition because water development began in the basin near the turn of the century and many irrigation projects that diverted and depleted water from the San Juan River were already in place. For the 49 years of record prior to Navajo Dam, a peak spring flow greater than 15,200 cfs occurred 13 times (25 percent of the time). The highest spring peak flow recorded (daily mean) was 52,000 cfs (June 30, 1927).

The completion of Navajo Dam in 1962, and subsequent dam operations through 1991, altered the natural hydrograph of the San Juan River substantially (Holden 1999). There was an appreciable reduction in the magnitude and a change in timing of the annual spring peak. In wet years, dam releases began early to create space in the reservoir to store runoff (Holden 1999). The peak discharge averaged 54 percent of the spring peak of pre-dam years. The highest mean monthly flow was 9,508 cfs (June 1979), a decrease of more than 10,000 cfs compared to pre-dam years. Base flows were substantially elevated in comparison to pre-dam years. The median monthly base flow (August-February) averaged 168 percent of the pre-dam period (Holden 1999). Minimum flows were elevated and periods of near-zero flow were eliminated with a minimum monthly flow during base-flow periods of 250 cfs compared to 65 cfs for the pre-dam period (Holden 1999).

During the 1991 to 1997 research period, Navajo Dam was operated to mimic a natural hydrograph to determine fish population and habitat responses (Holden 1999). Flow Recommendations were developed based on these managed flows. The research flow period was more similar to the years that followed (1998 to present) than they were prior to 1991. For this reason, the years from 1991 to present were used to analyze the effects of the Flow Recommendations on physical habitat and endangered fish populations.

Since the Flow Recommendations were developed, a natural hydrograph has been mimicked, although the pre-Navajo Dam peak magnitudes are no longer possible because of outlet restrictions at the dam. Higher peak flows could be beneficial in maintenance of desirable channel morphology, but because the river is truncated by Lake Powell, higher peak spring flows would carry more larval fish into Lake Powell. The more natural hydrograph created by the Flow Recommendations is an improvement over the pre-1991 hydrograph in that native fish receive cues at the proper times to trigger spawning, more suitable habitat is available at the proper times for young fish, and those suitable physical habitat characteristics will be maintained. Although the magnitude of flows that once existed on the San Juan cannot be duplicated because of the existence of Navajo Dam, the timing of natural peak flows can be closely approximated. The implementation of the Flow Recommendations is an important improvement over the dam operations that were in effect from 1962-1991.

Changes in channel morphology

The quantity and timing of flows influence how the channel and various habitats are formed and maintained. It is hypothesized that the channel was much wider during the 1930s than the historical condition as large amounts of sediment entered the river in response to upland habitat degradation and erosion caused by overgrazing (Holden 1999). Channel narrowing is a problem because as the channel width decreases, water velocity increases, leading to decreases in the amount of low velocity habitats important to the early life stages of the fish (Service 1998). Between the 1930s and 1950s the channel narrowed by an average of 29 percent between the present day site of Navajo Dam (RM 224) and RM 67 (Holden 1999). From 1930 to 1942, suspended sediment load was approximately 47,200,000 tons/year (Holden 1999). Between 1943 and 1973, suspended load dropped by half to 20,100,000 tons/year (Holden 1999). The 1930's aerial photography shows a sand-loaded system and the river was broad during high flows and braided during low flows in areas where the channel was not confined, (Holden 1999). Channel narrowing before 1962 was most likely due primarily to the reduction in sediment load. Channel narrowing in later years (after 1962) corresponds to the modification of flows by Navajo Dam and the introduction and encroachment of Russian olive (Holden 1999). Indications are that the trend towards a narrower channel ceased by 1988 (Bliesner 2004).

Reduced peak flows after Navajo Dam was completed (1962 to 1991), exacerbated the growth of nonnative riparian vegetation (primarily salt cedar and Russian olive). These trees armored the channel banks and contributed to the creation of a narrower channel (Bliesner and Lamarra 1994). Modification of flows and nonnative vegetation led to more stabilized channel banks, a deeper, narrower main channel, and fewer active secondary channels (Holden 1999).

Since 1992, when a natural hydrograph was mimicked, peak flows have been higher than in the pre-experimental research flow period (prior to 1991). However, the total backwater area measured each fall from 1996-2007 except 2002 and again in 2011 and 2012 was lower than fall and winter of 1995 and 1996, respectively (Lamarra and Lamarra 2014). The base years used to track backwater habitat (1962-1991) may have had an unusually large amount of backwater habitat as a result of several above average wet years (Bliesner 2004). Other low velocity habitat (i.e., pools, eddies), slackwater, and shoal areas have not changed significantly between 1992

and 2002 (Bliesner 2004). Because backwaters are an important habitat for young native fishes, loss of backwaters remains a concern. The drought and lack of high flows may also be contributing to the loss of backwater habitat that is currently being observed.

Channel complexity is another important component of razorback sucker and pikeminnow habitat. One measure of channel complexity is the number and area of islands present. Between 1950 and 1960 there was a large decrease in island area (Bliesner 2004). But since 1995 island area has fluctuated between 6 and 12 million square meters (Lamarra and Lamara 2014). Vegetation encroached on the channel and long secondary channels were cut off as the floodplain stabilized. The increase in vegetation during this period coincided with a long-term drought, which contributed to channel simplification (Bliesner 2004). Between 1960 and 1988, island area increased to the historic levels that were present in 1934 (Bliesner 2004). The 10 years prior to 1988 were the wettest on record, so although vegetation continued to increase in the floodplain, the large flows opened secondary channels, creating large islands. During this period, Russian olive invaded the system and spread rapidly (Bliesner 2004). There has been no loss of bank full channel complexity since 1992. The period of monitoring has been short and confirmation of these trends is tentative until there is another hydrologic wet period (Bliesner 2004).

Large flows (bank full and above) are most effective at moving sediment through the system and long duration of high flows appears to maintain backwater and low velocity habitats and assist in maintaining channel complexity. Flows above 8,000 cfs are effective in maintaining backwater habitat, while flows in the range of 5,000 cfs are not (Bliesner 2004). While manipulation of the hydrograph through dam releases can maximize the utilization of available water for habitat maintenance, some periodic swings in the availability of particular habitats are likely to occur in response to natural hydrologic cycles. At current population levels, habitat does not appear to be a limiting factor for either the razorback sucker or pikeminnow adults (Holden 2000). However, the habitat needs of larval fish have not been thoroughly explored and further research may find specific habitat needs that are not being met or that are limiting (Holden 2000).

In conclusion, the trend towards a narrower channel appears to have stopped and although the amount of backwater habitat has decreased, other important low velocity habitats and channel complexity have not changed significantly (Bliesner 2004). Channel morphology has been monitored for a relatively short time and the recent drought and lack of high flows may have an over-riding influence on channel-forming processes. Monitoring over a longer period with the inclusion of wet years and high flows will give a better picture of how the Flow Recommendations are maintaining favorable channel characteristics for the pikeminnow and razorback sucker. However, it appears that suitable channel morphology is being maintained and improved.

Water Quality

In addition to the physical changes from dams and water diversions, and biological changes from introduction of nonnative fish, chemical changes have occurred as a result of widespread irrigation and drainwater disposal in the Colorado River Basin (Finger et al. 1995, Thomas et al.

1997, Engberg et al. 1998, Hamilton 1998). Quartarone and Young (1995) interviewed 111 people who recounted numerous experiences from the 1920s to the early 1950s and noted that in the late 1940s and early 1950s, Colorado "whitefish" (as pikeminnow were called at the time) were becoming rare in the upper Colorado River Basin. They believed that this rarity was the result of pollution in the rivers from dumping of raw sewage, railroad oil, and wastewaters.

Surface and groundwater quality in the Animas, La Plata, Mancos, and San Juan River drainages have become significant concerns (Abell 1994). Changes in water quality and contamination of associated biota are known to occur in Reclamation projects in the San Juan drainage (specifically associated with irrigated lands on the Pine and Mancos rivers) where return flows from irrigation make up a portion of the river flow (Sylvester et al. 1988). Increased loading of the San Juan River and its tributaries with contaminants such as selenium, salts, polycyclic aromatic hydrocarbons (PAHs), and pesticides has degraded water quality of the San Juan River in critical habitat (Abell 1994, Wilson et al. 1995, Simpson and Lusk 1999). Mercury contamination is also a concern due to the high mercury deposition in the Upper Colorado River Basin and risk of mercury bioaccumulation in long-lived piscivores like Colorado pikeminnow (Osmundson and Darnall 2007).

Information on existing water quality in the San Juan River has been derived from data gathered by the U.S. Department of the Interior (DOI) as part of its National Irrigation Water Quality Program investigation of the San Juan River area in Colorado, New Mexico, and Utah; results from Reclamation's water quality data for the Animas-La Plata Project; and ongoing contaminant monitoring and research conducted as part of the Recovery Program. Some of this information has been presented in Blanchard et al. (1993), Abell (1994), Wilson et al. (1995), Thomas et al. (1998), and other references cited in Simpson and Lusk (1999). Thomas et al. (1998) found that concentrations of most potentially toxic elements analyzed from the San Juan River drainage in their study, other than selenium, were generally not high enough to be of concern to fish, wildlife, or humans but mercury toxicity thresholds were exceeded in 64 percent of Colorado pikeminnow sampled, indicating possible brain and nervous system injury and reproductive impairment (Osmundson and Lusk 2010).

PAHs are compounds that may reach aquatic environments in domestic and industrial sewage effluents, in surface runoff from land, from deposition of airborne particulates, and particularly from spillage of petroleum and petroleum products into water bodies (Eisler 1989). Wilson et al. (1995) reported that concentrations of PAHs were elevated in the Animas River, but no identification of source location or activity has been made. The San Juan River below Montezuma Creek also had elevated levels of PAHs and seasonal increases in PAH concentrations were detected in the Mixer area of the river (a potential spawning site for pikeminnow). PAH levels in the bile of common carp and channel catfish sampled were high in one fish and moderate in several other fish from the San Juan River. The presence of PAH metabolites in bile of every fish sampled suggested some level of exposure to hydrocarbons (Wilson et al. 1995). Service analyses of PAH contamination of aquatic biota of the San Juan River, and liver tissue examinations of fish in the river, raised concerns regarding the exposure of these organisms to contaminants introduced into the basin. However, PAHs do not appear to be a limiting factor to native fishes in the San Juan at this time (Holden 2000).

Selenium (a trace element) occurs naturally in many soil types, and is abundant in the drier soils of the West. Selenium enters surface waters through erosion, leaching, and runoff. In the San Juan River both anthropogenic and natural sources of selenium have been reported by O'Brien (1987), Blanchard et al. (1993), and Thomas et al. (1998). Selenium, although required in the diet of fish at very low concentrations (< 0.5 µg/g on a dry weight basis), is toxic at higher levels (> 3 µg/g), and may be adversely affecting endangered fish in the upper Colorado River Basin (Hamilton 1999, Hamilton et al. 2000, Hamilton et al. 2002). Excess dietary selenium causes elevated concentrations of selenium to be deposited into developing eggs, particularly the yolk (Buhl and Hamilton 2000). If concentrations in the egg are sufficiently high, developing proteins and enzymes become dysfunctional and lead to deformed embryos that may be at higher risk for mortality.

Selenium concentrations in the San Juan River Basin are of concern because of its documented effects on fish and wildlife reproduction and survival and high levels detected in some locations within the basin (Blanchard et al. 1993, Wilson et al. 1995, Thomas et al. 1998). Selenium concentrations can be elevated in areas where irrigation occurs on soils which are derived from or which overlie Upper Cretaceous marine sediments. Thomas et al. (1998) found that water samples from DOI project irrigation-drainage sites developed on Cretaceous soils contained a mean selenium concentration about 10 times greater than those in samples from DOI project sites developed on non-Cretaceous soils. Percolation of irrigation water through these soils and sediments leaches selenium into receiving waters. Other sources of selenium include power plant fly ash and oil refineries. Water depletions, by reducing dilution effects, can increase the concentrations of selenium and other contaminants in water, sediments, and biota (Osmundson et al. 2000).

Tributaries to the San Juan River carry higher concentrations of selenium than found in the main stem river immediately upstream from their confluence with the San Juan River. Increased selenium concentrations may also result from the introduction of ground water to the main stem of the river along its course. Although these levels are diluted by the flow of the San Juan River, the net effect is a gradual accumulation of the element in the river as it travels downstream. For example, concentrations of selenium in water samples collected from the main stem of the San Juan River exhibited a general increase in maximum recorded values with distance downstream from Archuleta, New Mexico, to Bluff, Utah, (less than 1 µg/L to 4 µg/L) (Wilson et al. 1995). The safe levels of selenium concentrations for protection of fish and wildlife in water are considered to be less than 2 µg/L and toxic levels are considered to be greater than 2.7 µg/L (Lemly 1993, Maier and Knight 1994, Wilson et al. 1995). However, dietary selenium is the primary source for selenium in fish (Lemly 1993, Buhl and Hamilton 2000). Thus, sediment and biotic analyses are necessary to understand the risk of selenium to fish and wildlife.

The Recovery Program arranged for toxicity tests to be conducted in order to determine the effects of environmental contaminants in water (Hamilton and Buhl 1997), and in diet and tissues (Buhl and Hamilton 2000) of the razorback sucker and pikeminnow in the San Juan River. The waterborne toxicity tests showed a potential threat to endangered fishes from waterborne concentrations of copper and contaminant mixtures created to simulate the water quality conditions of two irrigation drains (Hamilton and Buhl 1995, 1997). However, the

results of the dietary toxicity tests showed that dietary selenium (as opposed to water borne selenium) was the primary source of selenium accumulation in pikeminnow, accumulated selenium left the tissues slowly after exposure ended, and the selenium concentrations in eggs were significantly greater than concentrations in the parent (Buhl and Hamilton 2000). However, the concentrations in the eggs (9.8-11.6 µg/g) were lower than those in eggs linked with reproductive impairment in fish (Buhl and Hamilton 2000). Unfortunately, due to small sample size, the reproductive metrics (number of eggs expressed, egg weight, hatchability, time to hatch, and survival, growth, and deformities of the larvae) could not be statistically evaluated in this study (Buhl and Hamilton 2000).

Seethaler et al. (1979) and Quartarone and Young (1995) suggested that irrigation and pollution were contributing factors to razorback sucker and pikeminnow population declines. Hamilton (1999) hypothesized that historic selenium contamination of the upper and lower Colorado River Basins contributed to the decline of these endangered fish by affecting their overall reproductive success. However, because riverine systems are open systems where concentrations can vary considerably over time in relation to flow (as opposed to a closed system like a lake where concentrations tend to remain steady or increase), and because results from the 7-year research period were inconclusive, selenium concentrations are not currently seen as a limiting factor to native fishes in the San Juan River (Holden 2000). However, as recovery of the pikeminnow and razorback sucker proceeds, research should continue on this issue. These fish can live over 40 years (Behnke and Benson 1983), increasing their susceptibility to bioaccumulation of selenium and other contaminants. In addition, they often stage at tributary mouths such as the Mancos River before spawning, increasing their exposure to elevated levels of dietary selenium (Wilson et al. 1995). Therefore, the impact of selenium on reproductive success may become more important in coming years as adults survive and age in the river.

Mercury can be released from natural sources such as volcanic activity or from human activities like coal burning and gold mining (Seigneur et al. 2004, Lindberg et al. 2007). Atmospheric mercury deposits into aquatic ecosystems (Lorey 2001; Lindberg et al. 2007). Southwestern Colorado has among the highest concentration of mercury in precipitation in the United States (Weidner 2007). When mercury enters aquatic ecosystems bioaccumulation occurs in the food web (USEPA 1997, Cocca 2001, Engstrom 2007). Long-lived piscivores, like Colorado pikeminnow, are at the greatest risk for mercury exposure, accumulation, and toxicity (USEPA 1997, Lindberg et al. 2007). Because Colorado pikeminnow are a long-lived piscivore living in an area of high mercury deposition, there is concern about mercury contamination in this species (Osmundson and Darnall 2007). Osmundson and Lusk (2010) reported mercury concentrations of 0.49 mg/kg in Colorado pikeminnow and 64 percent were above threshold of concern for mercury toxicity (0.2 mg/kg). Toxicological studies linking mercury and biological effects are needed to infer levels of impairment for Colorado pikeminnnow. Because atmospheric mercury pollution can affect Colorado pikeminnow and its critical habitat, management strategies that control anthropogenic mercury emissions are needed.

Propagation and stocking

Colorado pikeminnow

Because of human impacts to the Colorado and San Juan Rivers, pikeminnow were thought to be extirpated from the San Juan River (Tyus et al. 1982). Surveys conducted from 1987-1989 revealed that pikeminnow were still present in the San Juan River, but in very low numbers (Platania et al. 1991). When the Recovery Program was established in 1992, one of the program elements was the protection of genetic integrity, management, and augmentation of populations of the endangered fish. Pikeminnow have been stocked every year since 1996 and a formal augmentation plan was started in 2002 (Furr 2013b). Over 3.5 million age-0 and about 40,000 age-1+ Colorado pikeminnow were stocked into the San Juan River since 2002 and 2003, respectively (Durst 2014). Over 900 individual Colorado pikeminnow from multiple stocking events have been captured each year since 2009 indicating that pikeminnow in multiple age classes are persisting in the San Juan River; however most of these individuals were not reproductive adults and few persist three years post-stocking (Durst 2014). The Recovery Program's augmentation program has been successful in increasing the number of pikeminnow in the San Juan River in a relatively short time, increasing the number of fish much faster than if augmentation had not taken place.

Razorback sucker

Although evidence suggests that razorback suckers were once abundant in the San Juan River at least up to the confluence with the Animas River (Platania and Young 1989), wild razorback suckers, if they still exist, are extremely rare in the river. Even with intensive sampling from 1987- 1989 only one adult was captured and no larval razorback sucker were detected (Platania et al. 1991). Because of the limited number of razorback sucker and the lack of recruitment, a stocking program was initiated to supplement the population. Between 1994 and 2013, over 130,000 razorback suckers were stocked into the San Juan River (Furr 2014). Over 500 individual razorback sucker have been captured every year since 2006 (Durst 2014). Each year since 2010 over 100 razorback sucker that have been in the river at least five years post-stocking were detected, suggesting that many older fish have been able to persist in the San Juan River many years post-stocking (Durst 2014). The augmentation program has been successful in increasing the number of razorback sucker in the San Juan River in a relatively short time, increasing the number of fish much faster than if augmentation had not taken place.

Water depletions

Significant depletions and redistribution of flows of the San Juan River have occurred as a result of other major water development projects, including the Navajo Indian Irrigation Project and the San Juan-Chama Project. At the current level of development, average annual flows at Bluff, Utah, already have been depleted by 30 percent (Holden 1999). By comparison, the Green and Colorado rivers have been depleted approximately 20 percent (at Green River) and 32 percent (at Cisco) (Holden 1999). These depletions have likely contributed to the decline in pikeminnow and razorback sucker populations (Service 1998). Depletions are expected to increase as full development of water rights and water projects occurs. Water that is exported out of the basin (San Juan-Chama Project), consumptively used, or lost through evaporation is not available to maintain flows within the river. Maintenance of streamflow is essential to the ecological integrity of large western rivers (Service 1998).

Water depletion projects that were in existence prior to November 13, 1992, are considered to be historic depletions because they occurred before the initiation of the Recovery Program. Projects that began after this date are considered new projects. On May 21, 1999, the Service determined that new depletions of 100 acre-feet or less, up to a cumulative total of 3,000 acre-feet, would not: 1) limit the provision of flows identified for the recovery of the pikeminnow and razorback sucker, 2) be likely to jeopardize the endangered fish species, or 3) result in the destruction or adverse modification of their critical habitat (BO R2/ES-TE CL 04-054). Consequently, any new depletions under 100 acre-feet, up to a cumulative total of 3,000 acre-feet, may be incorporated under the May 21, 1999, biological opinion, but still require consultation. As water development projects are fully implemented, the amount of water available for operational flexibility will decrease.

Diversion structures

There are numerous points of diversion on the San Juan River for irrigation and energy production. In addition to acting as fish passage impediments (as discussed earlier), most of these structures do not have screens or other devices to prevent fish from entering (Holden 2000). Although anecdotal, Quartarone and Young (1995) present many stories from senior citizens that recalled seeing or catching razorback suckers from irrigation ditches, sometimes in very large numbers. Trammell (2000) reported that after stocking 500,000 larval pikeminnow below Hogback Diversion structure, 63 larvae were collected from the Cudei Diversion canal, representing 0.013 percent of the total stocked. Catch rate was 4.39 pikeminnow/100 m^3 of water sampled.
In December 2004, 140 pikeminnow that were stocked in October 2004 were caught in the Hogback Diversion Canal between 0.5 and 17.8 miles from the diversion structure (Platania and Renfro 2005). Most of the individuals (92 percent) were under 100 mm standard length (SL) (4 in.) but some were over 200 mm SL (8 in.) (Platania and Renfro 2005). In 2005, recently-stocked Colorado pikeminnow were captured in the Hogback and Fruitland diversion canals. Pikeminnow that enter diversion structures face an uncertain fate though fish may find their way back to the river. Because the level of entrainment is unknown the Recovery Program is investigating all diversion structures and proposing means to address this issue. A fish weir designed to prevent entrainment was constructed in the Hogback Canal in 2013 but its effectiveness is yet to be evaluated.

Nonnative fish

Nearly 70 nonnative fish species have been introduced into the Colorado River system over the last 100 years (Service 1998). Nonnative fish in the San Juan River include rainbow trout (*Oncorhynchus gairdneri*), brown trout (*Salmo trutta*), striped bass, walleye, channel catfish, black bullhead, yellow bullhead, largemouth bass, smallmouth bass, green sunfish, long-ear sunfish (*Lepomis megalotis*), bluegill, white crappie, fathead minnow, red shiner, Western mosquitofish, common carp, white sucker, white sucker/flannelmouth sucker hybrids, white sucker/bluehead sucker hybrids, threadfin shad, grass carp, and plains killifish (Ryden 2000 Buntjer 2003). Channel catfish was first introduced in the upper Colorado River Basin in 1892 (Tyus and Nikirk 1990) and is thought to have the greatest adverse effect on endangered fishes

due to predation on juveniles and resource overlap with subadults and adults (Hawkins and Nesler 1991, Lentsch et al. 1996, Tyus and Saunders 1996). Adult and juvenile pikeminnow that have preyed on channel catfish and black bullhead have died from choking on the pectoral spines (McAda 1983, Pimental et al. 1985, Quartarone and Young 1995, Recovery Program 2003b, Ryden and Smith 2002, Lapahie 2003). Mechanical removal of nonnative fish (seining and electrofishing) from the San Juan River began in 1995, but was not instituted as a management tool until 1998 (Smith and Brooks 2000). Removal efforts have focused on channel catfish and common carp because they are the most abundant large-bodied nonnative fishes and are known predators on native fish and eggs (Davis 2003).

Nonnative fish removal efforts consist of multiple pass raft-mounted electrofishing among discreet reaches within the San Juan River, from PNM Weir to Hogback Diversion (RM 166.6-159.0), Hogback Diversion to Shiprock Bridge (RM 158.8-147.9), Shiprock Bridge to Mexican Hat (RM 147.9-52.9), and Mexican Hat to Clay Hills Crossing (RM 52.8-2.9) (Duran 2014, Hines 2014). Channel catfish catch-per-unit-effort (CPUE) significantly declined since intensive removal was initiated in the PNM Weir to Hogback Diversion reach but abundant newly recruited adult channel catfish from downstream section likely prevented declines in the Hogback Diversion to Shiprock Bridge reach (Duran 2014). Channel catfish CPUE have not declined in the longer, further downstream reaches (Duran 2014, Hines 2014). Shifts in the size structure of the channel catfish population could be important because catfish are not thought to be piscivorous until they reach a length of about 450 mm (17.7 in.), and fecundity (number of eggs) is much greater in larger fish (Davis 2003). While an increase in the number of smaller fish could potentially lead to an increase in competitive or aggressive interactions with native fish, it is expected that continued removal efforts will eventually reduce the numbers of smaller channel catfish as well (Davis 2003). Removal of catfish in all size classes should reduce their overall impact on the native and endangered fish community. However, positive responses of native fishes as a result of nonnative fish removal has not been clearly demonstrated (Franssen et al. 2014). Common carp have declined across all reaches and are now rarer than endangered Colorado pikeminnow and razorback sucker; however, it is not clear if the nonnative removal effort is solely responsible for this decline (Duran 2014, Hines 2014).

EFFECTS OF THE ACTION

Factors to be Considered

Water depletions contribute to reductions in the Colorado pikeminnow and razorback sucker populations. Other major impacts are dams, competition and predation from nonnative fishes, changes in flow and temperature regimes, changes in river channel morphology, and decreased water quality. The reductions in population and habitat warranted listing these species as endangered. In response to listing, the Service and other Federal agencies have implemented actions to conserve the species and encourage recovery. One such action is the reoperation of Navajo Dam to mimic the natural hydrograph by following the San Juan River Flow Recommendations (Holden 1999). Meeting the Flow Recommendations is expected to provide flows through designated critical habitat which will ensure the survival and promote recovery of the Colorado pikeminnow and razorback sucker.

In order to evaluate species progress toward recovery, a series of criteria were established (Reclamation 2001). Interim Response Criteria that were designed to evaluate species progress from 2002-2006 have been met for both species. For Colorado pikeminnow, these short-term criteria were: (1) collection of greater than 10 individuals larger than 350 mm during a standardized monitoring trip; (2) presence of wild larvae of YOY individuals in standardized monitoring collections in 2 of 5 years; and, (3) range expansion above Hogback Diversion. The Interim Response Criteria for razorback sucker were: (1) collection of greater than 20 individuals larger than 300 mm during the annual fall standardized trip; (2) collection of greater than 0.15 individuals per hour of electrofishing larger than 300 mm; and, (3) evidence of reproduction in standardized monitoring in at least 2 of 5 years.

To build on the Interim Response Criteria of 2002-2006, Positive Population Response Criteria was developed for 2007-2011 (Reclamation 2001). These criteria established expectations for improvements in Colorado pikeminnow and razorback sucker population demographics. Attainment of the population response criteria for 2007-2011 will depend of the successful implementation of various projects and will represent a significant step towards achieving self-sustaining populations in the San Juan River. These revised criteria are intended to determine whether the stocked fish are capable of any of the following: (1) attaining adult size; (2) successfully reproducing; or (3) recolonizing newly opened reaches of the river. In addition, these response criteria will determine if reproduction is occurring in sufficient numbers and nursery habitats are adequate to yield naturally produced YOY. The Positive Population Response Criteria for Colorado pikeminnow and razorback sucker are listed below. A new set of criteria will be developed to evaluate species progress toward recovery beyond 2012.

Colorado Pikeminnow

1) *Collection of 10 or more adult Colorado pikeminnow (≥ 450 mm TL [17.7 in.]) during a standardized monitoring trip.* In the five standardized monitoring trips conducted 2007-2011, a total of only 7 adult Colorado pikeminnow (≥ 450 mm TL) were collected and 4 adults was the most collected in a single year, 2010 (Ryden 2008, Ryden 2009, Ryden 2010, Ryden 2011, Service unpublished data). While Colorado pikeminnow are being captured during standardized monitoring trips, large reproductive fish that could contribute to a self-sustaining Colorado pikeminnow population are rarely captured. Due to past stocking efforts and predictions based on models, there should be more Colorado pikeminnow larger than 450 mm in the San Juan River then are being collected. These missing fish may fail to recruit to adulthood, avoid current sampling methodologies, or be present outside of the study area.

2) *A positive trend analysis of annual adult/sub-adult CPUE values from standardized monitoring that indicates increasing numbers of fish (regression analysis that results in a slope > 0 with a minimum of four data points), or a riverwide population estimate of adult (≥ 450 mm TL) that exceeds 400 individuals and is composed of multiple age classes*. River-wide (RM 166.6 – 2.9) population estimates of age-2+ Colorado pikeminnow in the river for at least one overwinter period were approximately 4,500 and 5,400 for 2009 and 2010, respectively (Duran et al. 2011). However, these estimates are primarily based on juveniles because so few adults are regularly detected in the San Juan River. Overall scaled CPUE of Colorado pikeminnow

indicate a positive trend through 2010 but insufficient numbers of adults are captured for a meaningful adult CPUE trend (Service unpublished data).

3) *Presence of larval or YOY pikeminnow in standardized monitoring collections in 3 of 5 years.* Larval Colorado pikeminnow have been collected in low numbers every year 2007-2011 except 2008 (Brandenburg et al. 2012).

4) *A density of 0.67/1000m^3 larval Colorado pikeminnow in standardized drift monitoring during years when monsoons do not have a negative effect on sampling efficiency. Or a density of 0.5/100m^2 wild young-of-year Colorado pikeminnow in low velocity habitat as detected during standardized monitoring.* Drift netting is no longer used in the larval fish sampling protocol, but a total of only 38 larval Colorado pikeminnow were collected from 2007-2011 using larval seines, approximately 0.05 larval pikeminnow per 100 m^2 of seining effort (Brandenburg et al. 2012). Both the larval and small-bodied monitoring program regularly capture YOY Colorado pikeminnow but these YOY fish are thought to be stocked individuals, nevertheless approximately 1.1 YOY Colorado pikeminnow were collected per 100 m^2 of larval seining effort but YOY Colorado pikeminnow has not exceeded 0.01/100 m^2 during small-bodied monitoring (Brandenberg et al. 2012, Gilbert et al. 2012).

5) *Range expansion above Hogback Diversion following removal of this and other fish barriers.* Since the Hogback Diversion was modified in 2002, there have been 54 documented cases of Colorado pikeminnow implanted with PIT tags that have moved upstream of non-selective fish passage (Service unpublished data from 2003-2011). Therefore, Colorado pikeminnow have clearly expanded their range following the removal of these barriers.

Razorback sucker

1) *Collection of 80 or more adult razorback sucker (> 400 mm [15.7 in.]) during a standardized monitoring program trip. Or an increase in the CPUE of adult razorback sucker (> 400 mm) to 0.6 fish/hour during a standardized monitoring program trip.* In each of the last two years there have been more than 80 adult razorback suckers collected during standardized monitoring trips with 83 and 114 collected in 2010 and 2011, respectively (Ryden 2011, Service unpublished data). This criteria was not attained in 2007-2009, only 69, 62, and 30 razorback suckers > 400 mm were collected in 2007, 2008, and 2009, respectively (Ryden 2008, Ryden, 2009, Ryden 2010). Scaled CPUE of razorback sucker with at least one overwinter period was approximately 0.75 fish/hour in 2010 and 2011 (Service unpublished data).

2) *A riverwide population estimate of adult razorback sucker of 2,900 or more fish.* River-wide (RM 166.6 – 2.9) population estimates of razorback sucker in the river for at least one overwinter period were approximately 2,000 and 3,000 for 2009 and 2010, respectively (Duran et al. 2011). These estimates include both sub-adult and adult razorback sucker while the criteria calls for 2,900 adult fish.

3) *Evidence of increased reproduction in at least 3 of 5 years based on standardized monitoring.* Razorback sucker larvae have been collected for the last 14 consecutive years (1998-2011;

Brandenburg et al. 2012). Over 1,000 larval razorback suckers have been collected in each of the last two years and although larval razorback sucker are not as abundant as other native suckers, the catch rates of all of these species have increased over the last three years (Brandenburg et al. 2012).

4) *Range expansion above Hogback Diversion following removal and/or modification of fish barriers.* Since the Hogback Diversion was modified in 2002, there have been 56 documented cases of razorback sucker implanted with PIT tags that have moved upstream of the non-selective fish passage (Service unpublished data from 2003-2011). Thus, razorback suckers are able to utilize new areas of critical habitat that become available once barriers to movement are removed.

From these data, we conclude that the razorback sucker and pikeminnow populations in the San Juan River are more secure today than they were through the 1980s and 1990s and that the threat of extinction has been reduced. Of the two species, the razorback sucker population currently appears to be benefiting more from management efforts. The number of razorback sucker larval fish caught appears to be increasing (Farrington et al. 2013) and in 2003 two juvenile razorback suckers were collected in the lower San Juan River and in 2004 at least four juvenile razorback sucker were collected, all of these fish were found downstream of RM 37.4 (Ryden 2005b, Golden and Holden 2006). Their size at time of capture and lack of a PIT tag strongly implies that these are likely wild-produced progeny of stocked razorback sucker, providing the first evidence of recruitment in the San Juan River. Between 1991 and 1995, 19 (17 adult and 2 juvenile) wild pikeminnow were collected in the San Juan River by electrofishing (Ryden 2000a). In 2012, 22 pikeminnow larger than 300 mm were caught during the fall standardized monitoring trips (Schleicher and Ryden 2013). While it is still too early to determine if these fish will survive to the adult stage and reproduce, the trend is encouraging. Because the effective riverine habitat in the San Juan River has been shortened by 87 km (54 miles) by inundation of Lake Powell and 150 km (93 miles) by cold water releases from Navajo Dam, it is unclear if truly self-sustaining populations of pikeminnow can be established without the presence of warmer water so that spawning can occur farther upstream. However, with continued management (e.g., adherence to the Flow Recommendations, removal of fish passage barriers, nonnative removal, and stocking/augmentation), it is expected that population numbers will increase and be maintained.

The action that has probably led to the largest population response is stocking/augmentation because it has had the direct effect of increasing fish numbers. Because both species are long-lived it will take many years to determine whether the Recovery Program is successful. Other actions that have been taken by the Recovery Program that are intended or expected to have a positive population response are:

1) Removal of barriers. The amount of connected habitat available to the fish has been increased through installation of fish passage and removal of barriers. The more stream miles available to the fish, the greater the likelihood that they can find suitable habitat for all life stages.

2) Removal of nonnative fish. While a positive endangered fish population response cannot yet be linked to this effort, it is expected that the amount of predation and competition between native and nonnative fish is reduced, promoting the survival of native fish.

3) Implementation of the Flow Recommendations. With the Flow Recommendations in place, the annual hydrograph mimics the natural hydrograph closer than in the pre-Flow Recommendations period. We expect that creating a more natural hydrograph through implementation of the Flow Recommendations should have a beneficial effect on native species compared to the pre-Flow Recommendation conditions. However, because population numbers of the endangered fish were so low when the Flow Recommendations were implemented and because so many actions began occurring simultaneously, documenting a positive population response that is a direct result of any one particular action alone is not possible.

Effects to Endangered Species

The project would adversely affect Colorado pikeminnow, and razorback sucker, by reducing the amount of water in the river system upon which they depend, by 0.95 acre-feet/year. The effects to the species primarily result from the effects of the action upon their habitats. In general, the proposed action would adversely affect the listed fishes 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 habitat within their range.

Removing 0.95 acre-feet of water per year from the San Juan River would change 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 endangered fishes. The reduction of available habitats will directly affect individuals by decreasing reproductive potential and foraging and sheltering opportunities. Many of the habitats required for breeding become severely diminished when flows are reduced. As a result, individual fish within the action area may not be able to find a place to breed 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 that favor nonnatives.

The subject depletion would 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 San Juan River. The Project's depletion would cause a proportionate decrease in dilution, which in turn would cause a proportionate increase in heavy metal, selenium, salts, pesticides, and other contaminant concentrations. An increase in contaminant concentrations in the river would likely result in an increase in the bioaccumulation of these contaminants in the food chain which could adversely affect the endangered fishes, particularly the predatory Colorado pikeminnow. 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 suckers.

The proposed project would affect the physical condition of habitat for the listed fish by resulting in a reduction of water. This reduction would 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 a duration and at a frequency necessary to support all life stages of viable populations of all endangered fishes. To the extent that the 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 would reduce flows and contribute to further habitat alteration, the Project would 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.

Effects to Critical Habitat

Water Quantity

Water depletions cause discrete, identifiable, additive, adverse impacts to critical habitat of the Colorado pikeminnow and razorback sucker. The proposed action will result in a new and historic average annual depletion of 0.95 acre-feet in addition to the historic depletions of approximately 4,144 acre-feet to the Mancos River, a tributary of the San Juan River at the confluence of the River. The Project would not impact the ability for the San Juan River Flow Recommendations to be met.

Water Quality

The proposed project will not bring additional lands under irrigation; therefore, impacts to water quality from leaching of contaminants from irrigation are not expected to increase significantly. However, the project's depletion would cause a proportionate decrease in dilution, which in turn would cause a proportionate increase in heavy metal, selenium, salts, PAHs, pesticides, and other contaminant concentrations in the Colorado River. An increase in contaminant concentrations in the river would likely result in an increase in the bioaccumulation of these contaminants in the food chain which could adversely affect the endangered fishes, particularly the predatory Colorado pikeminnow. 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.

Physical Habitat

The flow targets outlined in the San Juan River Flow Recommendations are designed to provide

sufficient spring flows to create and maintain important habitats including: cobble bar construction; scouring of fine sediment from the interstitial spaces from the cobble so it is suitable for spawning; flushing sediments from backwaters; maintaining channel complexity; overbank flows to provide nursery habitat for razorback sucker; and appropriate water temperatures for spawning. Water depletions during spring runoff affect physical habitat in several ways. High spring flows are very important for creating and maintaining complex channel geomorphology and suitable spawning substrates, and in creating and providing access to off-channel habitats. Therefore, the depletions caused by the proposed project, with implementation of the Flow Recommendations, are not expected to impact the recovery of the Colorado pikeminnow or razorback sucker in the San Juan River.

Biological Environment

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. To the extent that it would reduce flows and contribute to further habitat alteration, the Project would contribute to an increase in nonnative fish populations. Endangered fishes would experience increased competition and predation as a result.

Species and Critical Habitat Response to the Proposed Action

The Project would cause water depletions to the San Juan River; however, the target flows outlined in the San Juan River Flow Recommendations would still be met with the proposed project in place. The operation of Navajo Dam to mimic the natural hydrograph by following the Flow Recommendations will result in flow patterns similar to those that occurred prior to 1962. Therefore, the anticipated response of the Colorado pikeminnow and the razorback sucker would be increased population size. The Service anticipates the response of designated critical habitat would be improved habitat conditions, including clean spawning bars, more backwater habitat, and the maintenance of channel complexity.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, Tribal, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act. Cumulative effects include:

1) Coalbed Methane Development

The San Juan Basin in southwestern Colorado and northwestern New Mexico is rich in coalbed methane and development of this resource has increased rapidly in the last ten years. There are currently more than 3,000 coalbed methane wells in the San Juan Basin in the Fruitland Coal Formation. Historically, one well per 320 acres was allowed in this area; however, the Colorado Oil and Gas Commission approved an increase of the well spacing to one well per 160 acres.

Potentially more than 700 additional wells may be drilled and approximately 250 of these could occur on private or State land. Coalbed methane development requires the extraction of groundwater to induce gas flow. In general terms, the groundwater used coalbed methane wells is recent recharge water that would discharge (under pre-coalbed methane conditions) to the Animas, Pine, Florida and Piedra Rivers, tributaries of the San Juan River. It was estimated that the wells would be drilled in about 10 years (by 2013) but, because of slow groundwater movement, water depletion effects would not be incurred until at least 2025.

The BLM prepared an Environmental Impact Statement (EIS) to address coalbed methane development on the Southern Ute Indian Reservation. The BLM also prepared a separate EIS to address coalbed methane development on Federal lands. Water depletions associated with coalbed methane development on Tribal and Federal lands will be addressed during future section 7 consultation with the BLM. There will not be future section 7 consultations for coalbed methane development on private or State lands if there is no Federal action associated with these wells. Therefore, water depletions associated with coalbed methane development on private and State lands are considered a cumulative effect that is reasonably certain to occur within the action area.

Modeling efforts were conducted to quantify the amount of depletion that could occur based on potential future coalbed methane development in the San Juan River Basin. The results of this modeling effort are summarized in Table 1 (Cox et al. 2001). The model results show that prior to coalbed methane development, the Fruitland Formation discharged approximately 205 acre-feet/year to the San Juan River. Modeling shows approximately 62.9 acre-feet/year is currently being depleted with existing wells and predicts the maximum depletions to be approximately 200 acre-feet/year. The additional future depletion of approximately 200 acre-feet/year from the San Juan River associated with coalbed methane development on State and private land, would not significantly impact the ability to meet the San Juan River Flow Recommendations.

Table 1. Surface water depletion summaries from Colorado Oil and Gas Conservation Commission modeling study.

River	Pre-CBM Discharge (AF/yr)	Current Depletion (AF/yr)	Maximum Depletion (AF/yr)	Year when Max Depletions Begin
Animas	66	35	66	2030
Pine	61	25	61	2030
Florida	17.5	3	13	2050
Piedra*	60	0	60	**
Total	204.5	62.9	200	

*Piedra River depletions are estimated based on discharges simulated from depletions modeled at other rivers.
**Maximum depletions at the Piedra will depend on the pace of coalbed methane development in the northeastern portion of the San Juan Basin.

2) *Future depletions and diversions from the San Juan River Basin that do not have a Federal nexus and therefore have not completed section 7 consultation*

We believe most of these depletions are accounted for and are therefore considered in meeting the Flow Recommendations. There are irrigation ditches and canals below Navajo Dam that could entrain pikeminnow and razorback sucker: Citizens, Hammond, Fruitland, San Juan Generating Station, Jewett Ditch, Four Corners Power Plant Diversion, and Hogback. Increased urban and suburban use of water, including municipal and private uses will increase demands for water. Further use of surface water from the San Juan River will reduce river flow and decrease available habitat for the razorback sucker and pikeminnow. Livestock grazing may adversely impact razorback sucker and pikeminnow by removal of water for drinking and the reduction in soil water holding capacity in the floodplain, and resulting reduction in base flows.

3) *Increases in development and urbanization in the historic floodplain that result in reduced peak flows because of the flooding threat*

Development in the floodplain makes it more difficult to transport large quantities of water that would overbank and create low velocity habitats that the razorback sucker and, pikeminnow need for their various life history stages.

4) *Contamination of the water (i.e., sewage treatment plants, runoff from feedlots, and residential development*

A decrease in water quality could adversely affect the razorback sucker and pikeminnow, and their critical habitat.

5) *Gradual change in floodplain vegetation from native riparian species to nonnative species (i.e., Russian olive)*

Channel narrowing leads to a deeper channel with higher water velocity. Pikeminnow and razorback sucker larvae require low velocity habitats for development. Therefore, there will be less nursery habitat available for both species.

6) *The presence of striped bass and walleye in Lake Powell constitutes a future threat to pikeminnow and razorback sucker in the San Juan River*

A waterfall between the San Juan River and Lake Powell formed in 2003 when Lake Powell elevation fell below about 3,660 feet. It currently serves as a barrier for nonnative fish moving from the lake to the river. This barrier is expected to persist into the near future; however, if lake level rise above 3,660 feet, nonnative fish from Lake Powell will have access to critical habitat in the San Juan River. This occurred in 2011 for about three weeks to a month.

7) *Increased boating, fishing, off-highway vehicle use, and camping in the San Juan River basin is expected to increase as the human population increases*

Potential impacts include angling pressure, non-point source pollution, increased fire threat, and the potential for harassment of native fishes.

CONCLUSION

After reviewing the current status of the Colorado pikeminnow 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, is not likely to jeopardize the continued existence of the Colorado pikeminnow or razorback sucker, and the proposed project is not likely to destroy or adversely modify designated critical habitat.

The Service recognizes that who depletes and the amount of water they deplete may vary from year to year. Consequently, water users assume the risk that the future development of senior water rights, including Tribal water rights, may result in shortages of water to junior users. Nothing in this biological opinion precludes any new depletion that results from the exercise of senior water rights within the action area. Based on this understanding, the Service believes that nothing in this biological opinion directly affects or impairs Tribal trust resources within the San Juan River Basin.

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 listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, 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 and razorback sucker are harmed from the reduction of water in their habitats resulting from the Project in the following manner: 1) individuals using habitats diminished by the proposed water depletions could be more susceptible to predation and competition from nonnative 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; 2) finding a dead or injured listed fish would be difficult, due to the large size of the Project area and because carcasses are subject to scavenging; 3) natural fluctuations in river flows and species abundance may mask Project effects; and, 4) effects that reduce fecundity are difficult to detect or quantify.

According to Service policy, as stated in the Endangered Species Consultation Handbook (Handbook)(Service 1998), some detectable measure of effect should be provided, such as the relative occurrence of the species or a surrogate species in the local community, or amount of habitat used by the species, to serve as a measure for take. Take also may be expressed as a change in habitat characteristics affecting the species, such as water quality or flow (Handbook, p 4-47 to 4-48). Because estimating the number of individuals of the four listed fishes that could be taken by the water depletions addressed in this biological opinion is difficult for the reasons stated above, we have developed a surrogate measure to estimate the amount of anticipate take to listed fish in the form of harm. The surrogate we are using is the reduction of water that would occur from the proposed action. We exempt all take in the form of harm that would occur from the removal of 0.95 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 Act.

The implementation of the Recovery Program is intended to minimize impacts of water depletions and, therefore, the reasonable and prudent alternatives outlined in the biological opinion will also serve as reasonable and prudent measures for minimizing the take that results from the 0.95 acre-feet/year water depletion. Any amount of water withdrawal above this level would exceed the anticipated level of incidental take.

REINITIATION NOTICE

This concludes formal consultation on the proposed Project. As provided in 50 CFR sec. 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: 1) the amount or extent of incidental take is exceeded; 2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; 3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; 4) a new species is listed or critical habitat designated that may be affected by the action; or, 5) if the SJRRIP ceases to exist or if funding levels are reduced so that critical deadlines for specified recovery actions are not met.

The Recovery Program is expected to result in a positive population response for the Colorado pikeminnow and razorback sucker in the San Juan River. If a positive population response for both species is not realized, as measured by the criteria developed by the Bureau of Reclamation dated July 6, 2001, this would be considered new information that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion. Therefore, reinitiation

of section 7 consultation would be required for all projects dependent on the Recovery Program, including the Project. If reinitiation is required, the Service will follow the procedures regarding reinitiation of consultation pursuant to the "Principles for Conducting Endangered Species Act Section 7 Consultations on Water Development and Water Management Activities Affecting Endangered Fish Species in the San Juan River Basin."

Thank you for your cooperation in the formulation of this opinion and your interest in conserving endangered species. If you have any questions regarding this consultation or would like to discuss it in more detail, please contact Kathie Gissing of our Western Slope Field Office at (970) 628-7183, Email: kathleen_gissing@fws.gov.

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Appendix E
Distribution List

Environmental Assessment Distribution List

All landowners adjacent to the Proposed Action
Colorado Department of Transportation
Colorado Division of Water Resources
Colorado Parks and Wildlife
Colorado River Water Conservation District
Colorado State Historic Preservation Office
Colorado Water Conservation Board
Montezuma County Planning Department
Montezuma County Public Works Department
Montezuma County Sheriff's Department
Navajo Nation
Root and Ratliff Ditch Company Board
Southern Ute Tribe
Town of Mancos
U.S. Army Corps of Engineers Durango Regulatory Office
U.S. Department of Housing and Urban Development
U.S. Fish and Wildlife Service Region 6
Ute Mountain Ute Tribe