

ENVIRONMENTAL ASSESSMENT
AND
FINDING OF NO SIGNIFICANT IMPACT
Farmers Mutual Ditch Rehabilitation

Farmington, San Juan County, New Mexico
Section 1113 Water Resources Development Act of 1986



June 2023

US Army Corps of Engineers
Albuquerque District
4101 Jefferson Plaza NE
Albuquerque, New Mexico, 87109

(This page is intentionally left blank)

U.S. ARMY CORPS OF ENGINEERS
ALBUQUERQUE DISTRICT

FINDING OF NO SIGNIFICANT IMPACT

Farmers Mutual Ditch Rehabilitation

**Section 1113 Water Resources Development Act of 1986
Farmington, San Juan County, New Mexico**

The U.S. Army Corps of Engineers, Albuquerque District (USACE) has conducted an environmental analysis in accordance with the National Environmental Policy Act of 1969, as amended. The Environmental Assessment (EA), dated June 2023, for the Farmers Mutual Ditch Rehabilitation addresses acequia rehabilitation in the Farmers Mutual Ditch (Acequia, ditch), Farmington, San Juan County, New Mexico. The USACE recommendation is contained in Section 4 of this EA.

The EA, incorporated herein by reference, evaluated various alternatives that would provide a reliable, efficient, low-cost, and low-maintenance system for the continued distribution of water for use by the members of the Farmers Mutual Ditch Association in the project area. In addition to a “no action” plan, one other alternative was evaluated, the Buried Pipe Alternative (recommended plan). The recommended action includes:

- Rehabilitation of approximately two miles of earthen channel by placing a 6-foot diameter irrigation pipe.
- Use of an approximately 1.5-acre area located on private land on the north side of the ditch as a staging area.
- Removal of loose rock from the bluff above the ditch (rock scaling) for worker safety prior to pipe installation.

For all alternatives, the potential effects were evaluated, as appropriate. A summary assessment of the potential effects of the recommended plan are listed in Table 1:

Table 1: Summary of Potential Effects of the Recommended Plan			
Resources	Insignificant Effects	Insignificant Effects as a Result of Mitigation	Resource Unaffected By Action
Physical Landscape			
<i>Climate and Climate Change</i>			X
<i>Physiography, Geology, and Soils</i>			X
<i>Water Resources and Water Quality</i>	X		
<i>Floodplains and Wetlands</i>			X
<i>HTRW</i>			X
Air Quality	X		
Noise	X		
Biological Resources			
<i>Vegetation</i>	X		
<i>Fish and Wildlife</i>	X		
<i>Invasive/Exotic Species</i>	X		
<i>Special Status Species</i>	X		
Cultural Resources		X	
Socioeconomic Considerations			
<i>Socioeconomics</i>			X
<i>Land Use</i>			X
<i>Environmental Justice and Protection of Children</i>			X

All practicable and appropriate means to avoid or minimize adverse environmental effects were analyzed and incorporated into the recommended plan. Best management practices (BMPs) as detailed in the EA will be implemented, if appropriate, to minimize impacts and are listed below:

- Project activity would occur between November and the end of February, outside the migratory bird nesting season and most reptiles and amphibians are less active during this timeframe.
- If a bald eagle is present within 0.5 mile of the work in the morning before the project activity starts, or following breaks, the contractor would suspend all activity until the bird leaves of its own volition. However, if a bald eagle arrives during construction activities or if an eagle is beyond that distance, construction would not be interrupted.

- The contractor would be required to cover trenches at the end of each work day to prevent entrapment of small animals.
- Sediment and erosion controls would be in place during the construction period. Following construction, the soil would be stabilized, and all disturbed areas would be revegetated with appropriate native species.
- All construction equipment would be cleaned before entering and upon leaving the study area to prevent introduction or spread of invasive species. Equipment that was previously used in a waterway or wetland would be disinfected to prevent spread of aquatic disease organisms. Any disinfectant or other pesticide product used would be actively registered with the US Environmental Protection Agency and used as directed on the label.
- Access roads and disturbed soil will be wetted. Stockpiles of debris, soil, sand, or other materials that could produce dust will be wetted or covered. All fill material, rubble, and spoil will be covered while being transported to or from the project site.
- All servicing and fueling of equipment would be conducted in a designated area hydrologically isolated from surface waters. Emergency spill kits will be placed in the designated fueling area.
- A Spill Control Plan will be required for this project. All heavy equipment will carry a spill kit and the operator shall be knowledgeable in the use of spill containment equipment.
- All General, Regional, and Water Quality Conditions applicable to Nationwide Permits within the State of New Mexico and to this project will be adhered to.

Indirect impacts of piping the ditch include potential loss of ditch bank riparian vegetation as seepage from the ditch would be eliminated. We estimate that indirect loss of approximately 2,400 feet of ditch bank willows and 2-3 mature cottonwoods may result from elimination of seepage. This minimal loss of vegetation would be partially offset by the decreased need for maintenance with the ditch placed into pipe. Native vegetation would be reseeded in disturbed areas, such as the staging area, once construction is completed.

The recommended plan will result in unavoidable adverse impact to the aesthetic of Farmers Mutual Ditch. The current state of the Farmers Mutual Ditch is an open earthen ditch along its entire length, with the exception of a short section which has already been piped near the diversion structure at the east end. The undertaking involves the removal and replacement of several of the Farmers Mutual Ditch associated features, and the conversion of the acequia from an earthen ditch to partially piped ditch. The original materials, design, and workmanship will be compromised by the use of pipe in the ditch. The feeling of water running openly through an earthen ditch system in the rural countryside will also be compromised by the partial piping of the ditch. The piping will look modern. For all of these reasons, it was determined by USACE and New

Mexico State Historic Preservation Office via e-mail dated 20 April 2020, that the proposed project will have an adverse effect on the aesthetic of Farmers Mutual Ditch.

To mitigate for the unavoidable adverse impacts to the ditch a full Class III cultural resource inventory and photo documentation of the Area of Potential Effect for the current project, and oral history interviews regarding historic use of the ditch will be conducted.

Public review of the Draft EA and FONSI was completed from 14 August 2020 to 14 September 2020. A comment-response table is included in Appendix E of this Final EA and FONSI.

Pursuant to Section 7 of the Endangered Species Act of 1973, as amended, the USACE has determined that the recommended plan may affect but is not likely to adversely affect federally listed species or their designated critical habitat.

Pursuant to section 106 of the National Historic Preservation Act of 1966, as amended, the USACE determined that historic properties will be adversely affected by the recommended plan. A Memorandum of Agreement was signed with the SHPO on February 16, 2021. Two Class III cultural resources inventories (NMCRIS Activity Nos. 147384 and 151375) were conducted and submitted to the New Mexico State Historic Preservation Office (SHPO) by the USACE who is acting as the lead agency for all National Historic Preservation Act, Section 106 responsibilities.

Pursuant to the Clean Water Act of 1972, as amended (CWA), the discharge of dredged or fill material associated with the recommended plan has been found to be compliant with section 404(b)(1) Guidelines (40 CFR 230). The Clean Water Act Section 404(b)(1) Guidelines evaluation is found in Appendix D of the EA.

A water quality certification pursuant to section 401 of the Clean Water Act was obtained from the New Mexico Environment Department. All conditions of the water quality certification shall be implemented in order to minimize adverse impacts to water quality.

All applicable laws, executive orders, regulations, and local government plans were considered in evaluation of alternatives. Implementation of the proposed action is expected to economically benefit the Farmers Mutual Ditch Association community members by reducing long-term maintenance costs.

The planned action is being coordinated with Federal, State, and local agencies with jurisdiction over the biological and cultural resources of the project area. Based upon these factors and others discussed in the following Environmental Assessment, the proposed action is recommended and would have negligible effects on the human environment. Therefore, an Environmental Impact Statement will not be prepared for the proposed rehabilitation work on the Farmers Mutual Ditch.

Date

Jerre V. Hansbrough.
Lieutenant Colonel, U.S. Army
District Commander

ENVIRONMENTAL ASSESSMENT

Farmers Mutual Ditch Rehabilitation

TABLE OF CONTENTS

1. BACKGROUND	1
1.1. PURPOSE AND NEED FOR ACTION	1
1.2. PROJECT LOCATION.....	2
1.3. AUTHORITY AND FEDERAL REQUIREMENTS	3
2. DESCRIPTION OF ALTERNATIVES.....	4
2.1. ALTERNATIVE A: NO ACTION ALTERNATIVE	4
2.2. ALTERNATIVE B: BURIED PIPE	4
3. EXISTING ENVIRONMENT AND FORESEEABLE EFFECTS	9
3.1. PHYSICAL ENVIRONMENT	9
3.1.1. <i>Climate and Climate Change</i>	9
3.1.2. <i>Physiography, Geology, and Soils</i>	10
3.1.3. <i>Water Resources and Water Quality</i>	13
3.1.4. <i>Floodplains and Wetlands</i>	15
3.1.5. <i>Hazardous, Toxic and Radioactive Waste</i>	15
3.2. AIR QUALITY.....	16
3.3. NOISE	17
3.4. BIOLOGICAL RESOURCES	18
3.4.1. <i>Vegetation</i>	18
3.4.2. <i>Fish and Wildlife</i>	20
3.4.3. <i>Invasive/Exotic Species</i>	23
3.4.4. <i>Special Status Species</i>	24
3.5. CULTURAL RESOURCES	27
3.6. SOCIOECONOMIC CONSIDERATIONS AND LAND USE	31
3.6.1. <i>Socioeconomics</i>	31
3.6.2. <i>Land Use</i>	32
3.6.3. <i>Environmental Justice and Protection of Children</i>	33
4. RECOMMENDED ALTERNATIVE AND CUMULATIVE IMPACTS	34
5. CONCLUSIONS	35
5.1. SUMMARY OF FINDINGS AND IMPACTS	35
5.2. SUMMARY OF CONDITIONS TO MINIMIZE POTENTIAL ADVERSE IMPACTS.....	36
6. CONSULTATION AND COORDINATION	37
7. LIST OF PREPARERS.....	42
8. REFERENCES	43

LIST OF APPENDICES

APPENDIX A – Climate Change
APPENDIX B – Environmental Resources
APPENDIX C – Cultural Resources
APPENDIX D – Clean Water Act 404(b)(1) Analysis and Water Quality Certification
APPENDIX E – Coordination, Public Comments & USACE Responses

LIST OF FIGURES

Figure 1: Project location map..... 2
Figure 2: Irrigation pipe drawings 5
Figure 3: Manhole plan drawing 5
Figure 4: Proposed access routes for rock scaling on BLM managed public land. 8
Figure 5: Soil Survey for the Study Area 12

LIST OF TABLES

Table 1: Plant names and seeding rates used for reclamation on access routes..... 7
Table 2: Typical Noise Levels and Impressions. 17
Table 3: Plant species observed in the Project Area 19
Table 4: Birds observed in the Project Area 21
Table 5: Characteristics of fish species found in wadeable streams in the San Juan watershed..... 22
Table 6: Federal and state endangered and threatened species 24
Table 7: 2018 American Community Survey 5-Year Estimates of Race (US Census Bureau, 2020). 31
Table 8: Median household income and poverty status of San Juan County residents (US Census Bureau, 2020) 31
Table 9: Summary of Findings and Impacts. 35

LIST OF ACRONYMS USED

APE	Area of Potential Effect
ARMS	New Mexico Archaeological Record Management Section
BDANWR	Bosque del Apache National Wildlife Refuge
BMPs	Best Management Practices
CAR	Coordination Act Report
CPR CoP	Climate Preparedness and Resilience Community of Practice
CWA	Clean Water Act
EA	Environmental Assessment
EO	Executive Order
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FONSI	Finding of No Significant Impact
HCPI	Historic Cultural Properties Inventory
HTRW	Hazardous, Toxic, and Radioactive Waste
IPaC	Information for Planning and Consultation system
ISC	New Mexico Interstate Stream Commission
LERRDs	Lands, Easements, Rights-of-way, Relocations, and Disposal Areas
MOA	Memorandum of Agreement
MRGCD	Middle Rio Grande Conservancy District
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NM EMNRD	New Mexico Energy, Minerals, and Natural Resources Department
NMCRIS	New Mexico Cultural Resources Inventory System
NMDGF	New Mexico Department of Game and Fish
NMED	New Mexico Environment Department
NMOSE	New Mexico Office of the State Engineer
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NRHP	National Registry of Historic Places
SHPO	State Historic Preservation Office
SWPPP	Storm Water Pollution Prevention Plan
TCP	Traditional Cultural Property
THPO	Tribal Historic Preservation Office
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WOTUS	Waters of the United States
WRDA	Water Resources Development Act

1. BACKGROUND

Section 1113 of the Water Resources Development Act (WRDA) of 1986 (Public Law 99-662), as amended, authorizes the Acequia Rehabilitation Program for the restoration and rehabilitation of irrigation ditch systems (acequias) in New Mexico. Under Section 1113, Congress has found that New Mexico's acequias date from the eighteenth century and, due to their significance in the settlement and development of the western United States, should be restored and preserved for their cultural and historic values to the region. The Secretary of the Army, therefore, has been authorized and directed to undertake, without regard to economic analysis, such measures as are necessary to protect and restore New Mexico's acequias. The Act also recognized community acequias as public entities, allowing acequia officials to serve as local sponsors of water related projects through the Department of Defense. The program is a multi-year program that is designed to promote the continued operation of these important agricultural facilities.

The Farmers Mutual Ditch (Acequia, ditch) was chartered in the 1880s and supplies irrigation water for 600 users located along its approximate 22-mile length as it courses through the north floodplain of the San Juan River beginning at Farmington, New Mexico (see Figure 1). The Farmers Mutual Ditch is a part of the Acequia Rehabilitation Program and managed by the Farmers Mutual Ditch Association (Association). Acequias are "ditch" type irrigation systems, consisting of a diversion and a simple earthen-ditch conveyance channel.

The ditch has two diversion points: one on the Animas River south of Farmington just below the municipal sewage treatment plant; the second diversion point is on the San Juan River about ½ mile downstream of the State Highway 371 bridge. The Acequia irrigates 4,200 acres of land at an allotted rate of 3.1 acre-feet per acre, annually. Two previous USACE projects rehabilitated the ditch heading (diversion) below the State Highway 371 bridge (USACE 1988) and improved conveyance on 3.2 miles of the ditch in the vicinity of Kirtland by lining it with concrete and replacing gates (USACE 2002).

1.1. Purpose and Need for Action

Currently, a portion of Farmers Mutual Ditch that runs along steep, unstable bluffs close to the river is affected by rock and debris slides. In the past, the rock slides have completely filled the irrigation ditch, reducing the water supply to Association members and necessitating frequent, expensive maintenance.

The purpose of this Environmental Assessment (EA) is to evaluate the environmental impacts of the proposed construction project, which will improve approximately two miles of the Acequia and prevent rock and debris slides from filling the irrigation canal.

Additionally, analysis is provided for any resources that may potentially be affected by the rock scaling described in section 2.2.

1.2. Project Location

The project is located west of the City of Farmington along the edge of the San Juan River floodplain in San Juan County, New Mexico (Figure 1). The ditch closely follows the contour of the San Juan River and changes in elevation range from approximately 5,480 ft to 5,200 ft from west to east and approximately 5,523 ft to 5,220 ft from south to north. The ditch is fed by two diversion points: one on the Animas River south of Farmington just below the municipal sewage treatment plant and the second diversion point on the San Juan River about ½ mile downstream of the State Highway 371 bridge.

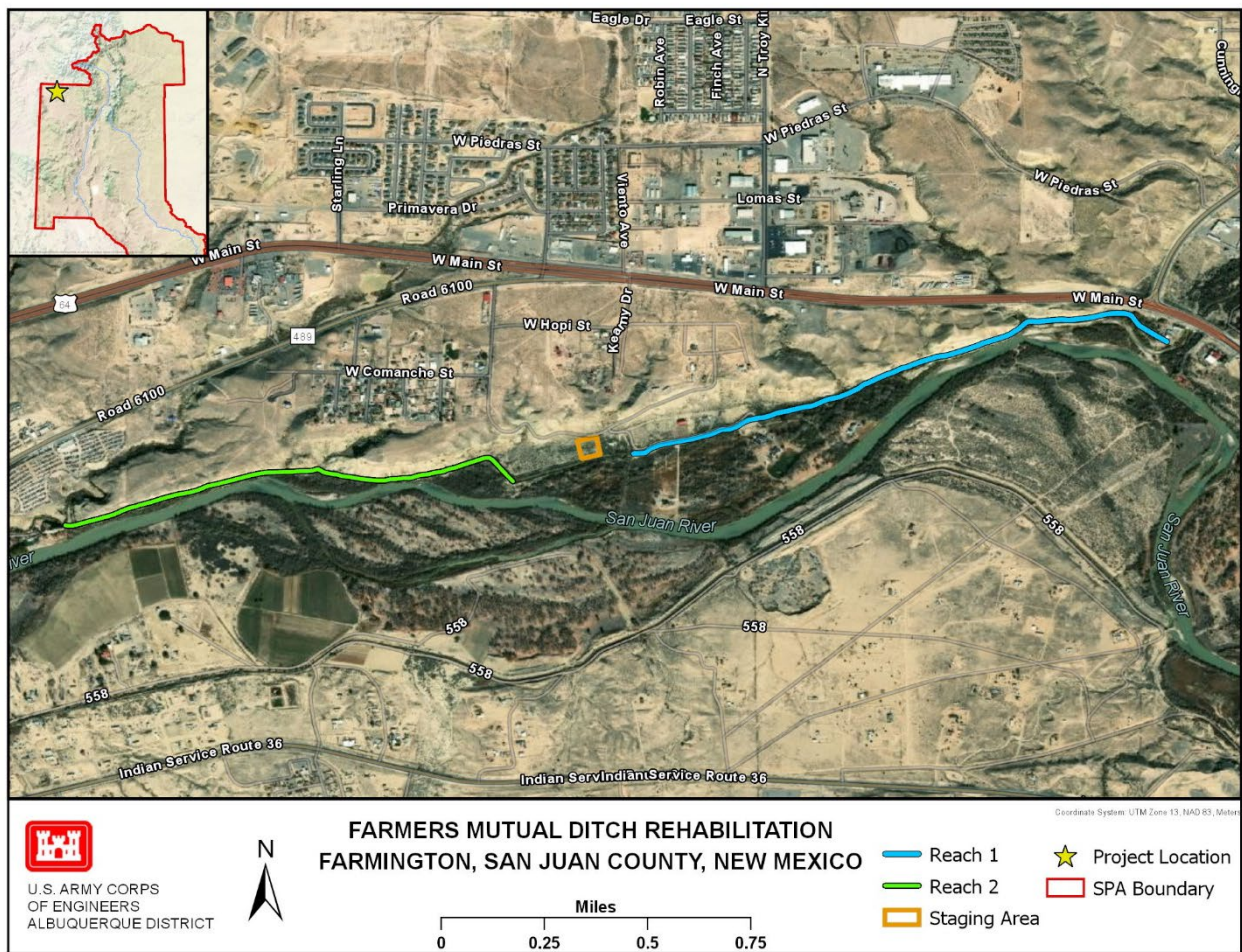


Figure 1: Project location map.

1.3. Authority and Federal Requirements

This EA has been prepared consistent with the following authorities as provided by Congress.

Section 1113 of the WRDA 1986 (P.L. 99-662), as amended, authorizes the Acequia Restoration Program and directs the Secretary of the Army:

...to undertake, without regard to economic analysis, such measures as are necessary to protect and restore the river diversion structures and associated canals attendant to the operations of the community ditch and Acequia systems in New Mexico that are declared to be a political subdivision of the State of New Mexico...The non-Federal share of any work undertaken under this section shall be 25 percent.

[and] ...to consider the historic Acequia systems (community ditches) of the southwestern United States as public entities, if these systems are chartered by the respective State laws as political subdivisions of that State. This public entity status will allow the officials of these Acequia systems to enter into agreements and serve as local sponsors of water related projects of the Secretary.

This EA was prepared by the USACE in compliance with all applicable Federal statutes, regulations, and Executive Orders (EO), as amended, including, but not limited to, the following:

- Migratory Bird Treaty Act of 1918 (16 U.S.C. § 703 *et seq.*)
- Fish and Wildlife Coordination Act of 1934 (48 Stat. 401; 16 USC § 661 *et seq.*)
- Clean Water Act of 1948, 1966, 1972, Sec. 10 Rivers & Harbors Act of 1899
- Watershed Protection and Flood Prevention Act of 1954 (16 U.S.C. § 1001 *et seq.*)
- Flood Control Act of 1958 (P.L. 85-500), 1962 (P.L. 87-874, Sec. 101)
- National Historic Preservation Act of 1966 (16 U.S.C. § 470 *et seq.*)
- National Environmental Policy Act of 1969 (NEPA) (42 U.S.C § 4321 *et seq.*)
- EO 11593: Protection and Enhancement of the Cultural Environment, 1971
- Clean Air Act of 1972 (42 U.S.C. § 7401 *et seq.*)
- Endangered Species Act of 1973 (16 U.S.C. § 1531 *et seq.*)
- Federal Noxious Weed Act of 1975 (7 U.S.C. § 2814)
- EO 11988: Floodplain Management, 1977
- EO 11990: Protection of Wetlands, 1977
- Archaeological Resources Protection Act of 1979 (16 U.S.C. §§ 470aa-470mm)
- Farmland Protection Policy Act of 1981 (7 U.S.C. § 4201 *et seq.*)
- Native American Graves Protection and Repatriation Act of 1990 (25 U.S.C. § 3001 *et seq.*)
- EO 12898: Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, 1994
- American Indian Religious Freedom Act (42 U.S.C. § 1996)

- EO 13112: Invasive Species, 1999
- Water Resource Development Act of 1986 (P.L. 99-662, Sec. 1113)
- Plant Protection Act of 2000 (7 U.S.C § 7701 et seq.)
- EO 13186, Responsibilities of Federal Agencies to Protect Migratory Birds (2001)
- Energy and Water Resources Development Appropriations Act of 2004 (P.L. 108-137, Sec. 117)
- Protection of Historic and Cultural Properties (36 CFR Part 800 et seq.)
- CEQ Regulations for Implementing the Procedural Provisions of NEPA (40 CFR Part 1500 et seq.)
- U.S. Army Corps of Engineers' Procedures for Implementing NEPA (33 CFR Part 230; ER 200-2-2)
- EO 13751: Safeguarding the Nation from Impacts of Invasive Species, 2016
- EO 13834: Efficient Federal Operations, 2018
- Federal Land Policy and Management Act (43 U.S.C. 1701, 1976)

2. DESCRIPTION OF ALTERNATIVES

This section describes the two alternatives considered for NEPA analysis, a No Action Alternative and a Buried Pipe Alternative.

2.1. Alternative A: No Action Alternative

No work would be performed to address the current problems associated with the existing open, earthen irrigation ditch. Rockfalls and a drier climate, due to climate change, will continue to compromise the water delivery through the ditch.

Under the No Action Alternative, access to the Martin Mesa bluffs between the ditch and Highway 64 would not be needed, therefore a right-of-way would not be required.

2.2. Alternative B: Buried Pipe

Under Alternative B, approximately two (2) miles of earthen ditch would be replaced with an irrigation pipe. The two miles are split between a Reach 1 and a Reach 2 (see Figure 1). Irrigation pipe eliminates material eroding into and blocking the ditch, public safety concerns associated with open ditches, and channel blockages from external debris. Pipe provides for more efficient distribution of irrigation water to the users and reduces the current amount of maintenance required to keep the system clear of debris.

Construction would occur from November to the end of February, when the ditch is dry. The existing channel would be replaced with a 6-foot diameter irrigation pipe. The pipe would be installed in the existing channel alignment to the greatest extent possible. All pipe would be placed within the Ditch Association easement. (Figure 2)

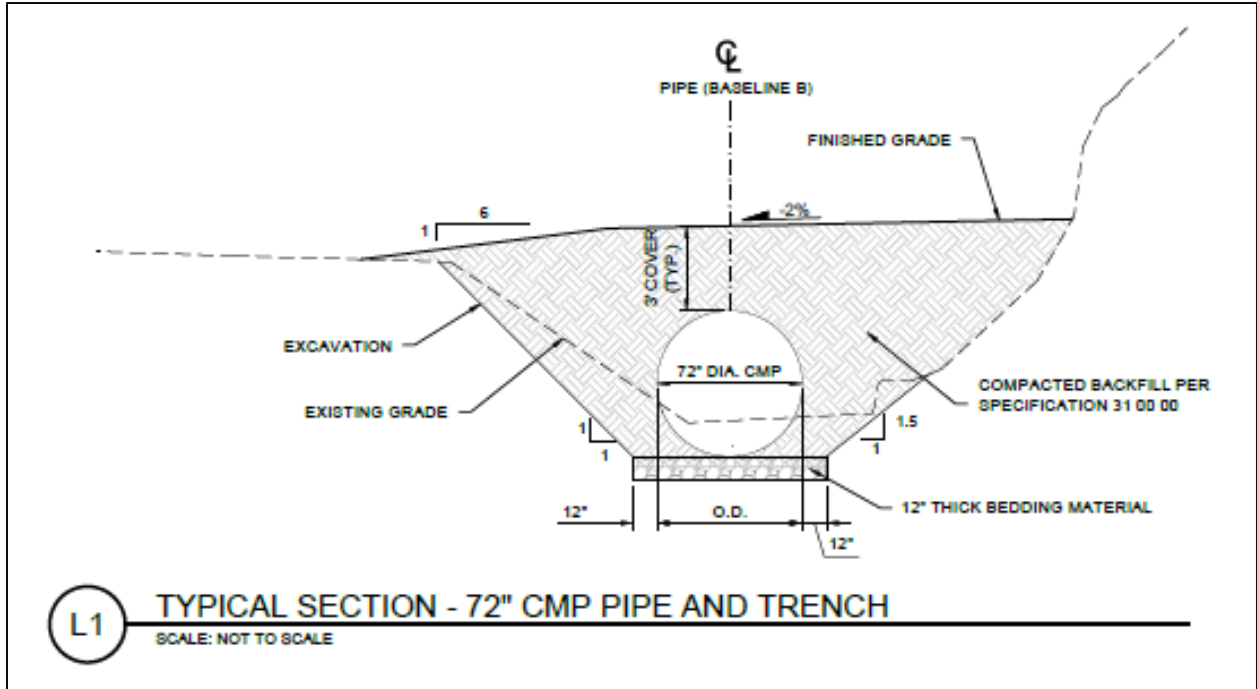


Figure 2: Irrigation pipe drawings

Existing sluice gates would be replaced by a new manhole with sluice gate and pipe that would tie into the existing sluice structure. A minimum of 15 new manholes would be installed along the alignment to allow access into the pipe for future maintenance purposes (Figure 3).

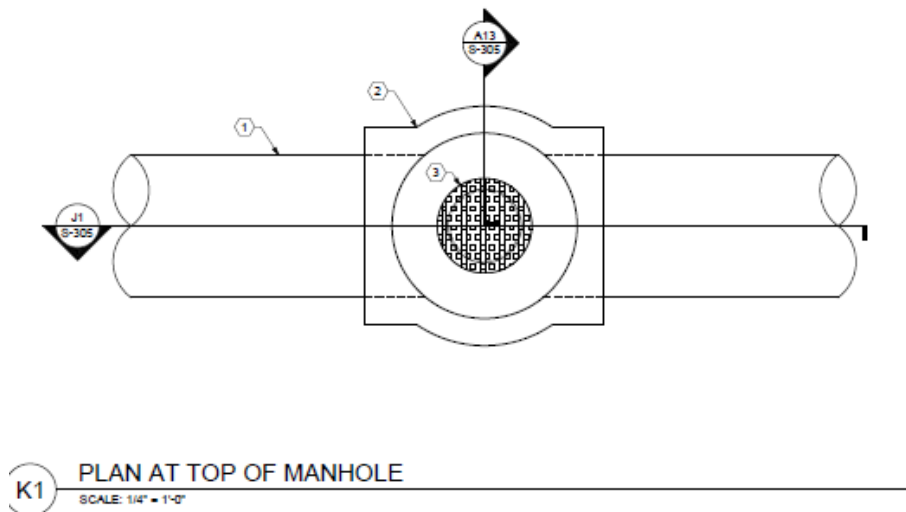


Figure 3: Manhole plan drawing

The Area of Potential Effects (APE) for this proposed alternative includes a 100-foot easement centered on the Farmers Mutual Ditch center line for a combined distance of approximately 2.5 miles, including the section between Reaches 1 and 2 and one 1.5-acre staging area located on private land on the north side of the ditch in between the two reaches (Figure 1). Equipment would access the ditch by paved roads, existing unpaved maintenance roads paralleling the ditch, or on the adjacent graded ditch berm.

Public Land Project Area

To provide safe working conditions, for installation of the irrigation pipe, rock scaling is required on the Martin Mesa bluffs in T29N R14W Section 12 (lots 7 and 8). Accessing the bluffs will occur at multiple points which have been proposed in order to meet the needs of the rock scaling crew and to fulfill Occupational Safety and Health Administration (OSHA) requirements. Figure 4 illustrates the proposed access routes symbolization is based on disturbance type. Culverts will be placed as needed to address water flow as well as prevent erosional issues during construction activities. Access routes located on public land managed by the Bureau of Land Management (BLM) amounts to approximately 1.70 acres. A 100' x 100' (0.436 acre) staging area is proposed for equipment and vehicle parking, loading/unloading, and jersey barrier storage (Figure 4).

After routes are developed, the rock scaling crew will use a telehandler forklift to transport jersey barriers to the edge of the bluff and placed anywhere along the proposed access routes for anchoring points. Placement of the Jersey barriers is expected to occur every 50 feet but may be closer or farther apart based on crew needs. The rock scaling crew will rappel over the edge of the bluff and use pry bars to remove loose rocks that could pose a threat to the safety of the pipe installation crew. An air bladder will be used to dislodge rocks that are too large for a pry bar. During use of the air bladder, the equipment will be placed in a crevice directly behind the rock that will be removed. An air compressor will be used to inflate the bladder which will be safely mounted on a truck or a trailer. Rock scaling will only occur when the ditch water is turned off to prevent sediment transport through the ditch into the San Juan River.

After rock scaling is complete, all sediment and rock material removed from the bluff will be stockpiled on the FMCD ROW until the ditch piping is complete. Upon completion of ditch piping, the stockpiled material will be used to backfill the pipe in order to protect the pipe from future rockslides and debris falling from the bluffs. All access routes will be reclaimed by recontouring to the previous natural slope. After recontouring, drill seeding with the native plants listed in Table 1 will occur at the rates shown. Seeding will occur on all access routes except where the overland move of the bulldozer for access to the east side of the project area (disturbance is not expected only overland travel will occur), this route is indicated by a black line on the attached map (Figure 4). These rates were determined based on Natural Resources Conservation Service Plant Guide recommendations. After seeding, straw wattles will be placed across any

disturbed area that may present erosional issues while the seed is establishing. Additionally, rocks greater than 12” will be placed strategically to prevent future unauthorized use of the access routes.

Table 1: Plant names and seeding rates used for reclamation on access routes.

Common Name	Scientific Name	Seeding Rate (lbs of pure live seed per acre)
Sand dropseed	<i>Sporobolus cryptandrus</i>	0.5
Galleta	<i>Pleuraphis jamesii</i>	12
Indian ricegrass	<i>Oryzopsis hymenoides</i>	8
Annual sunflower	<i>Helianthus annuus</i>	4
Total acres of access routes requiring seeding: 1.59 acres ^a		

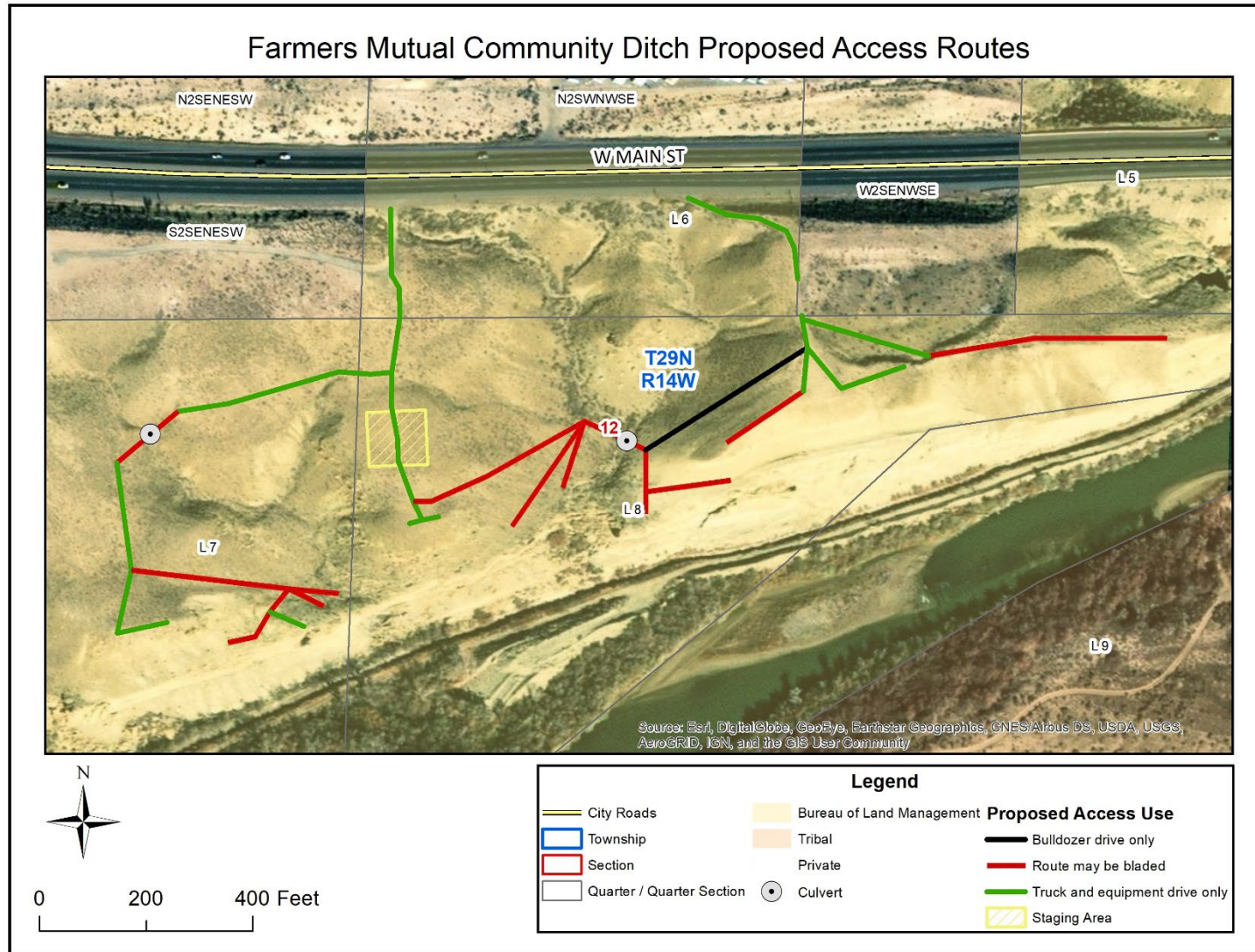


Figure 4: Proposed access routes for rock scaling on BLM managed public land.

3. EXISTING ENVIRONMENT AND FORESEEABLE EFFECTS

3.1. Physical Environment

3.1.1. Climate and Climate Change

The Project Area is located in the northwestern corner of New Mexico within the Colorado Plateau physiographic province. Located almost a mile above sea level, it has a temperate desert climate characterized by cool summers (mean maximum temperatures below 90°F), mild winters (average temperature of the coldest month is 30.5°F) and mean annual precipitation of 8.6 inches (National Climatic Data Center 1981-2010 Monthly Normals for the Farmington Agricultural Science Center Cooperative Observer site (<https://wrcc.dri.edu/cgi-bin/cliMAIN.pl?nm3142>)). During the July-October wet season, monthly precipitation averages about one inch, typically falling during localized convective storms; winter precipitation is generally sparse.

Over recent decades, warming is evident in the project area: average temperatures have increased more than 1.8°F between 1910 and 2009, with most of this rise occurring after 1993 (Nydick et al. 2012). Warming has occurred in all seasons. There has been no trend in the quantity of precipitation received (Bennett et al. 2019). However, warmer winter and spring temperatures and dust on snow have contributed to reductions in snowpack snow water equivalence in the adjoining San Juan Mountains, and an advance in the timing of spring runoff by two weeks (Clow 2010, Painter et al. 2007, Nydick et al. 2012).

These trends are anticipated to continue into the foreseeable future. Temperatures are anticipated to increase by as much as 6°F over present values by the mid-21st Century but precipitation is likely to remain similar to today (Bennett et al. 2019). Warmer temperatures are likely to contribute to smaller spring snowpack volumes both directly by causing snowpack melt in the winter months and indirectly by causing a greater share of winter precipitation in mountain regions to fall as rain rather than snow, especially at lower elevations (Bennett et al. 2019).

The net result may be significant reductions in water availability in the project area, especially in the summer months. Warmer temperatures are also likely to increase surface water evaporation rates and increase plant water demand, and therefore reduce available soil moisture. See Appendix A for more information on climate and climate change.

Alternative A: No Action Alternative

Under the No Action Alternative, the negative impacts of climate change, including reduced flows and increased evaporation in the ditch, would be further exacerbated by rockfalls and other erosion issues.

Alternative B: Buried Pipe

Under the Buried Pipe Alternative, the negative impacts of climate change, including reduced flows and increased evaporation in the ditch, would be reduced by enclosing the water flow in a pipe thus reducing evaporation and the chance of sediment or rocks blocking the flow.

3.1.2. Physiography, Geology, and Soils

The project is located within the Colorado Plateau Physiographic Province of northwestern New Mexico (Williams 1986). This region is characterized by erosional landscapes carved on relatively undeformed sequences of sedimentary and volcanic rocks. The San Juan Basin of the Navajo Section contains thick sequences of gently dipping Mesozoic and lower Cenozoic sedimentary rocks, mainly shale, mudstone, and sandstone with extensive coal seams. The Basin lies between the Southern Rockies, the Four Corners platform, and the Zuni-Defiance uplift. The Shiprock volcanic neck is situated west of the project site. This prominent formation results from exhumation of feeder conduits at middle Cenozoic volcanic centers. Another prominent feature west of the project site, the Hogback, is a sharp ridge comprised of more resistant Cretaceous sedimentary rocks (Pictured Cliff Sandstone, Lewis Shale, Point Lookout Sandstone, Menefee Formation and Cliff House Sandstone) (New Mexico Bureau of Geology and Mineral Resources 2003). The City of Farmington and the San Juan valley downstream through Fruitland are situated on the Fruitland and Kirtland formation, which is an important fossil-bearing formation (Hunt and Lucas 1992).

Aside from narrow hogback belts eroded on steeply dipping strata of monoclines flanking major structural upwarps, this Section is characterized by broad rolling plains carved on easily eroded rocks, and cuestas and tablelands capped by gently dipping resistant sandstone beds. Canyonlands and escarpments of moderate local relief occur mainly in the eastern part of the San Juan Basin. However, most stream valleys are broad, with relatively short canyon reaches; areas of high cliffs and escarpment are of limited extent. The lowest part of the New Mexico portion of the Navajo Section is the San Juan River channel near the Four Corners area at the boundary between the Navajo and Canyonlands sections of the Colorado Plateau. The major perennial streams in the Navajo Section are the San Juan, the Animas, and La Plata rivers, and the upper Rio Chama (Williams 1986).

The Farmers Mutual Ditch is situated at the upper limit of the San Juan River floodplain on the north side of the river at an elevation of 5,200 feet. The project area is within the San Juan/Chaco Tablelands and Mesas subdivision of the Arizona/New Mexico Plateau U.S. Environmental Protection Agency (EPA) Level III ecoregion (Griffith et al., 2006). The Arizona/New Mexico Plateau ecoregion occupies a significant portion of the southern half of the Colorado Plateau and is covered predominantly in a mosaic of sparse semiarid grassland and desert scrub vegetation (Ruhlman et al. 2012). The San

Juan/Chaco Tablelands subdivision (Level IV ecoregion) of plateaus, valleys, and canyons contains a mix of desert scrub, semi-desert shrub-steppe, and semi-desert grasslands. Typical vegetation is shadscale, fourwing saltbush, mormon tea, Indian ricegrass, galleta, and blue and black gramas. It is more arid, has generally lower elevations, and less pinyon-juniper than the other subdivisions of the Arizona/New Mexico Plateau. It is mostly composed of gently dipping Tertiary and Cretaceous sedimentary rocks. Oil and gas production occurs mostly in the northern part of the region. It contains the upper reaches of the Rio Puerco, an area of severe erosion due to geology, topography, and human influences (Griffith et al., 2006).

Two general vegetation assemblages dominate the Farmington area - a riparian community in the floodplain, and the desert, basin, and plains community in the adjacent uplands. Vegetation is described in more detail in section 3.4.1.

Soils in the floodplain fall within the Riverwash and Werlog loam soil series (Figure 5). Riverwash is a hydric soil derived from stream alluvium from igneous and sedimentary rock and has sandy, clayey and gravelly components. It is poorly drained and frequently flooded. Werlog loam is classified as farmland of state importance. It is a deep soil that does not flood or pond and is very slightly to slightly saline and somewhat poorly drained (Soil Survey Staff, Natural Resources Conservation Service (NRCS), 2020).

Soils above the floodplain fall in the Fruitland series and the very steep Haplargids-Blackston-Torriorthents complex. Fruitland loam, 1-3 percent slopes and Fruitland sandy loam, 2-5 percent slope are deep, well-drained soils derived from sandstone and shale alluvium. These soils are nonsaline to very slightly saline and are also classified as farmland of state importance. The Haplargids-Blackston-Torriorthents complex consists of very well drained cobbly sandy clay loam derived from alluvium. It is nonsaline to slightly saline, well-drained, and is not suitable for farming because of its steepness (slopes of 8 to 50 percent) (Soil Survey Staff, USDA-NRCS, 2020). The soil survey classifies the bluffs that confine one side of Farmers ditch as Haplargids-Blackston-Torriorthents complex; however, these bluffs appear to consist of bedrock outcrops more than soil.

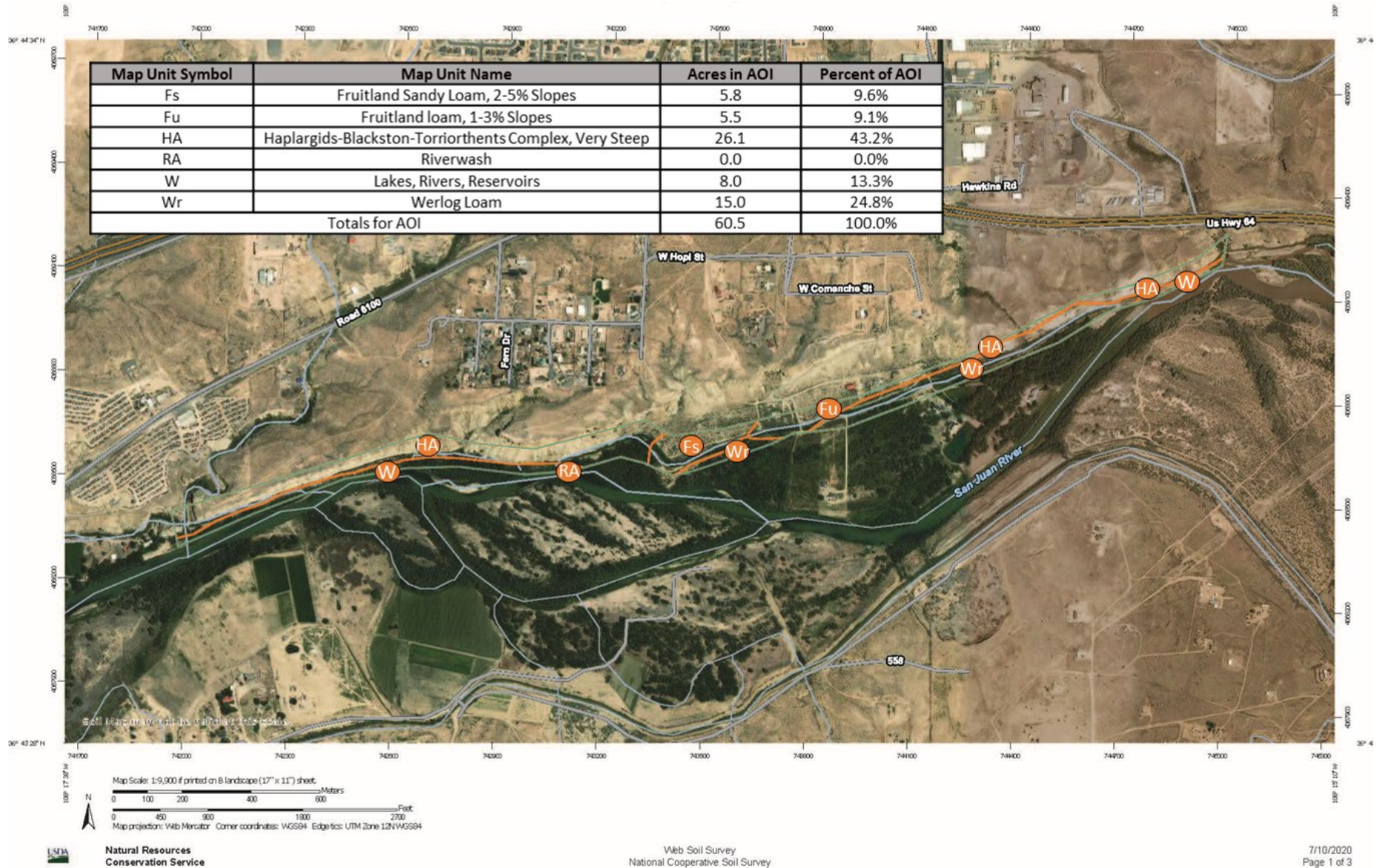


Figure 5: Soil Survey for the Study Area

Alternative A: No Action Alternative

The No Action Alternative would not address or resolve the problems outlined in section 1.2. Rockfalls and erosion would continue to be an issue along the project area.

There would be no significant impacts to the local physiography, geology, or soils from a No Action Alternative.

Alternative B: Buried Pipe

Ditch bank erosion and infilling of the ditch with sediment are maintenance problems associated with the existing irrigation system. The Buried Pipe Alternative eliminates these problems and reduces maintenance by replacing the earthen ditch with varying degrees of buried pipe. This alternative would not alter the processes of erosion nor decrease the frequency of rockfall but would alleviate the human problems caused by these processes.

As determined necessary, the contractor shall use Best Management Practices (BMPs), such as mulch application, straw/hay bales, and silt fences to retard erosion from contractor use areas. To protect soils from wind and water erosion, areas with plant cover that are disturbed by project activities would be evaluated as to the feasibility of re-establishing native vegetation by seeding. Areas disturbed by project activities would be seeded if the evaluation determines that seeding could significantly reduce the time for re-establishment of native vegetation. In this event, the species to be seeded, seeding rates, and seeding methods, and if needed, fertilizer regimes, would be determined by site characteristics and potential ability to bind the soil.

There would be no significant impacts to the local physiography, geology, or soils from a Buried Pipe Alternative.

3.1.3. Water Resources and Water Quality

The closest surface water resource near the Project Area is the San Juan River, which feeds the ditch through a diversion. Designated uses of the San Juan River include public water supply, industrial water supply, irrigation, livestock watering, wildlife habitat, primary contact, marginal coldwater aquatic life, and warmwater aquatic life (New Mexico Administrative Code §20.6.4.405). The sampling standard states temperature must not exceed 32.2 degrees centigrade (90 degrees F).

Section 404 of the Clean Water Act (CWA) provides for the protection of waters and wetlands of the United States from impacts associated with discharges of dredged or fill material into waters of the United States (WOTUS), including wetlands. The proposed action does not meet the conditions of a general permit; therefore, the discharge of fill

material associated with the action has been evaluated pursuant to section 404(b)(1) Guidelines (40 CFR 230). The Clean Water Act Section 404(b)(1) Guidelines evaluation is found in Appendix D of the EA.

A water quality certification pursuant to section 401 of the Clean Water Act was obtained from the New Mexico Environment Department. All conditions of the water quality certification shall be implemented in order to minimize adverse impacts to water quality. All general, regional, and water quality conditions applicable to Nationwide Permits in New Mexico, as well as specific conditions of this water quality certification, will be implemented to minimize adverse impacts to water quality.

Section 402(p) of the CWA regulates point source discharges of pollutants into WOTUS and specifies that storm-water discharges associated with construction activity be conducted under National Pollutant Discharge Elimination System (NPDES) guidance. Storm-water discharge associated with "construction activity" includes discharges from construction activities (clearing, grading, and excavation) that result in disturbance to one (1) or more acres of land. The NPDES guidance would apply to this project because the construction zone is more than five acres. Project construction would comply with the general conditions of NPDES, a Notice of Intent would be filed, and a Storm Water Pollution Prevention Plan (SWPPP) for the project would be developed and be kept on file at the construction site and become part of the permanent project record. The Corps would provide NPDES guidance to the contractor.

Alternative A: No Action Alternative

Because the existing open ditch is prone to bank erosion, debris blockages, and sediment infilling, some of these materials are discharged into the San Juan River in the return water from the system.

The No Action Alternative would allow the continued transport and discharge of sediments to the river and potentially adversely affect water quality. The No Action Alternative would result in long-term negative impacts to water quality.

Alternative B: Buried Pipe

The NPDES guidance would apply to the Buried Pipe Alternative because the construction zone would be more than one acre. Project construction would comply with the general conditions of NPDES, a Notice of Intent would be filed, and a SWPPP for the project would be developed and be kept on file at the construction site and become part of the permanent project record. USACE would provide NPDES guidance to the contractor.

During construction there is the possibility of increased sediment transport, which could adversely affect water quality of the receiving waters. However, with BMPs in place, this is not likely to happen and overall, the completion of the Buried Pipe Alternative would

reduce sediment transport in the system and positively affect water quality in the receiving waters.

Implementation of the Buried Pipe Alternative would result in short-term negative impacts to water quality. These impacts would be *de minimis*. No permanent negative impacts to water quality would occur.

3.1.4. Floodplains and Wetlands

Executive Order 11990 (Protection of Wetlands) requires the avoidance, to the extent possible, of long- and short-term adverse impacts associated with the destruction, modification, or other disturbances of wetland habitats.

Executive Order 11988 (Floodplain Management) provides Federal guidance for activities within the floodplains of inland and coastal waters. Preservation of the natural values of floodplains is of critical importance to the nation and the State of New Mexico. Federal agencies are required "to ensure that its planning programs and budget requests reflect consideration of flood hazards and floodplain management."

Wetlands are not present within the project area; therefore, E.O. 11990 does not apply to this project site.

None of the alternatives would have a significant effect on the San Juan River floodplain. The proposed work is a rehabilitation of an existing irrigation system without expanding its facilities. The activities would not contribute to or result in any additional development within the San Juan River floodplain; therefore, the project is in compliance with E.O. 11988.

3.1.5. Hazardous, Toxic and Radioactive Waste

The objective of a Phase I Environmental Site Assessment (Phase 1 ESA) is to identify, to the extent feasible pursuant to the processes prescribed in American Society for Testing and Materials (ASTM) E 2247-16, recognized environmental conditions in connection with the rural property. The Phase 1 ESA consists of records review, site reconnaissance, interviews, and reporting. The information below documents the records review, site reconnaissance, and interviews conducted by environmental professional possessing sufficient training and experience necessary to conduct a Phase 1 ESA. Due to the similarities in reporting requirements, a separate Phase 1 ESA report was not generated.

Environmental regulatory records, historic aerial photographs, site reconnaissance, and an interview were used to assess the historic and existing environmental conditions within the project area and buffer. The investigation has revealed no evidence of recognized environmental concerns within or near the proposed construction project. The investigation did not identify the presence or likely presence of any hazardous

substance, or petroleum products on or near the property that indicate an existing release, a past release, or threat of a release into the ground, groundwater, or surface water of the property.

Alternative A: No Action Alternative

The No Action Alternative will have no effect on known hazardous, toxic, or radioactive waste (HTRW), as there are no recognized environmental concerns within or near the proposed construction project.

Alternative B: Buried Pipe

The Buried Pipe Alternative will have no effect on known HTRW, as there are no recognized environmental concerns within or near the proposed construction project. If areas of concern or contaminants are identified, construction shall be postponed and USACE will coordinate with the Ditch Association to determine the appropriate course of action. No HTRW releases are expected from the proposed action; therefore, no significant effects are expected.

3.2. Air Quality

San Juan County, New Mexico, is in attainment status for State and Federal Ambient Air Quality Standards for criteria pollutants (particulate matter less than 10 microns, sulfur dioxide, nitrogen dioxide, carbon monoxide, ozone and lead; NMED 2020). In the State's Prevention of Significant Deterioration (PSD) program administered by the New Mexico Environment Department (NMED), the project is located within an area designated as Class II, which allows for moderate development and its associated air emissions. There are no PSD Class I (pristine) areas near the project area.

Alternative A: No Action Alternative

Implementation of the No Action Alternative would not result in any impacts to air quality.

Alternative B: Buried Pipe

Implementation of the Buried Pipe Alternative result in the operation of vehicles and construction equipment, which may produce localized and ephemeral increases in concentrations of dust and combustion emissions. BMP's for air quality would include keeping heavily trafficked areas and materials stockpiles watered using truck mounted sprinkler equipment to reduce dust from heavy vehicle traffic. All construction vehicles would be required to have emissions controls. Because future maintenance would be reduced, there would be a minor long-term benefit to air quality.

Implementation of the Buried Pipe Alternative would have short-term negative impacts to air quality. These impacts would be *de minimis*. No permanent impacts to air quality would occur.

3.3. Noise

For purposes of regulation, noise is measured in A-weighted decibels (dBA). This unit uses a logarithmic scale to weigh sound frequencies. Table 2 shows typical noise levels and corresponding impressions.

Table 2: Typical Noise Levels and Impressions.		
Source	Decibel Level	Subjective Impression
Normal breathing	10	Threshold of hearing
Soft whisper	30	---
Library	40	Quiet
Normal conversation	60	---
Television audio	70	Moderately loud
Ringing telephone	80	---
Snowmobile	100	Very loud
Shouting in ear	110	---
Thunder	120	Pain threshold

Ambient noise levels at the project site are typical of undeveloped, rural areas. The major noise producers include the running water from the river and the ditch, birds, occasional people, and adjacent residential and commercial areas.

Alternative A: No Action Alternative

Implementation of the No Action Alternative would not result in any impacts from noise.

Alternative B: Buried Pipe

Implementation of the Buried Pipe Alternative may result in some increase in the ambient noise levels from construction-related activities. However, noise levels would remain below State and Federal standards for public safety and would not persist beyond completion of the planned action. While any increase in noise levels would be temporary, the implementation of BMP's would insure they would be minimized to the maximum extent practicable.

Implementation of the Buried Pipe Alternative would result in short-term negative impacts from noise. These impacts would be *de minimis*. No permanent impacts from noise would occur.

3.4. Biological Resources

3.4.1. Vegetation

The ditch banks of the Acequia are vegetated to varying degrees, with patches of sparse to dense coyote willow (*Salix exigua*) intermixed with sparse small tamarisk (*Tamarix* sp.) and Russian olive (*Elaeagnus angustifolia*) trees in a narrow band (less than 10 feet wide), particularly along the bluff side of the ditch. A few large cottonwoods (*Populus deltoides* subsp. *wislizeni*) grow on the spoil bank berm between the ditch bank and the floodplain riparian zone below.

Large stretches of the ditch banks are nearly bare from recent maintenance or have young resprouting growth of willows, or are heavily infested with Russian knapweed (*Acroptilon repens*) and hoary cress (*Lepidium* or *Cardaria* sp.), highly invasive species listed by the State of New Mexico as noxious weeds. A few sections of ditch bank have perennial herbaceous vegetation, including sedges (*Carex* sp.), non-native creeping bentgrass (*Agrostis stolonifera*), showy milkweed (*Asclepias speciosa*), goldentop (*Euthamia occidentalis*), licorice (*Glycyrrhiza lepidota*) and dogbane (*Apocynum cannabinum*). Upland shrubs, including rabbitbrush or chamisa (*Ericameria nauseosa*) and fourwing saltbush (*Atriplex canescens*) are common on the ditch berm slopes.

The adjacent floodplain riparian habitat patches are dominated by Russian olive beneath a mature cottonwood gallery; overstory cottonwood canopy cover is less than 20%. There are occasional Goodding's willows (*Salix gooddingii*), New Mexico olive (*Forestiera pubescens*) and tamarisk in the shrub layer.

On 8 June 2020, tamarisk leaf beetle larvae were observed in tamarisk shrubs along the ditch. By 8 July 2020, about 50 percent of the tamarisk in the project area was brown. Table 3 lists the plant species observed in the Project Area.

Table 3: Plant species observed in the Project Area		
Common Name	Scientific Name	Native or Non-native*
Trees and Shrubs		
Rio Grande Cottonwood	<i>Populus deltoides</i> subsp. <i>wislizeni</i>	Native
New Mexico olive	<i>Forestiera pubescens</i>	Native
Coyote willow	<i>Salix exigua</i>	Native
Gooddings willow	<i>Salix gooddingii</i>	Native
Russian olive	<i>Elaeagnus angustifolia</i>	NM Class C
Tamarisk/Saltcedar	<i>Tamarix</i> sp.	NM Class C
Siberian elm	<i>Ulmus pumila</i>	NM Class C
Woods' Rose	<i>Rosa woodsii</i>	Native
Four-wing Saltbush	<i>Atriplex canescens</i>	Native
Chamisa/rabbitbrush	<i>Ericameria nauseosa</i>	Native
Big sagebrush	<i>Artemisia tridentate</i>	Native
Wolfberry	<i>Lycium</i> sp.	Native
Drummond's clematis	<i>Clematis drummondii</i>	Native
Virginia creeper	<i>Parthenocissus quinquefolia</i>	Native
Herbaceous Plants, Grasses and Forbs		
Navajo/Hopi tea	<i>Thelesperma megapotamicum</i>	Native
Showy milkweed	<i>Asclepias speciosa</i>	Native
Dogbane	<i>Apocynum cannabinum</i>	Native
Licorice	<i>Glycyrrhiza lepidota</i>	Native
Globemallow	<i>Sphaeralcea</i> sp.	Native
Russian thistle	<i>Salsola tragus</i>	Non-native
Yellow sweetclover	<i>Melilotus officinalis</i>	Non-native
Russian knapweed	<i>Acroptilon repens</i>	NM Class B
Bull thistle	<i>Cirsium vulgare</i>	NM Class B
Bindweed	<i>Convolvulus arvensis</i>	Non-native
Hoary cress or perennial pepperweed	<i>Cardaria</i> sp. or <i>Lepidium</i> sp.	NM Class A
Halogeton	<i>Halogeton glomeratus</i>	NM Class B
Horsetail/ scouring rush	<i>Equisetum</i> sp.	Native
Creeping bentgrass	<i>Agrostis repens</i>	Non-native
Sedge	<i>Carex</i> sp.	Native
Saltgrass	<i>Distichlis spicata</i>	Native
Squirreltail	<i>Elumus elymoides</i>	Native
<p>*New Mexico Noxious Weed Class</p> <p>Class A Species: Currently not present in New Mexico, or have limited distribution. Preventing new infestations of these species and eradicating existing infestations is the highest priority.</p> <p>Class B Species: Limited to portions of the state. In areas with severe infestations, management should be designed to contain the infestation and stop any further spread.</p> <p>Class C Species: Wide-spread in the state. Management decisions for these species should be determined at the local level, based on feasibility of control and level of infestation.</p>		

Alternative A: No Action Alternative

Under the No Action Alternative, no vegetation would be disturbed, and riparian vegetation would continue to grow along the ditch banks, supported by seepage from the ditch. However, periodic rockfall and debris slides cause disturbance to both sides

of the ditch. The maintenance required to clear rock and debris from the ditch disturbs vegetation, resulting in large bare stretches along the ditch. Periodic disturbance of vegetation would continue under this alternative and may be more disruptive of the environment than maintaining a buried pipe would be.

Alternative B: Buried Pipe

Under the Buried Pipe Alternative, there would be minor disturbance and loss of riparian vegetation along the ditch when the buried pipe is installed. Indirect impacts of piping the ditch include potential loss of ditch bank riparian vegetation as seepage from the ditch would be eliminated. USACE estimates that indirect loss of approximately 2,400 feet of ditch bank willows and two to three mature cottonwoods may result from elimination of seepage. This loss of vegetation would be offset by the decreased need for maintenance with the ditch placed into pipe. The top of the spoil bank ditch berm would continue to serve as a maintenance/access road, and the sloping sides of the berm would revegetate with upland species as ground-disturbing maintenance decreases. Additionally, the ditch runs adjacent to the riparian corridor where vegetation is able to access groundwater and higher quality habitat exists that would be unaffected by the project. Because the need for maintenance using heavy machinery would be reduced by the buried pipe alternative, USACE determined that overall adverse effects to vegetation would be minimal and compensatory mitigation is not required.

3.4.2. Fish and Wildlife

Birds observed during two surveys (20 June and 8 July 2020) are listed below in Table 4. Most of the bird activity was observed in the floodplain riparian area, with incidental use of the ditch banks vegetation. No bird nests were observed in vegetation on the ditch banks. During the July survey, fledglings of a few species were observed. No proposed work will be conducted during the nesting season. No proposed work will be conducted during the migratory bird nesting season.

Table 4: Birds observed in the Project Area		
Common Name	Scientific Name	Notes
Spotted Towhee	<i>Pipilo maculatus</i>	Common
Black phoebe	<i>Sayornis nigricans</i>	Pair on 6/8, fledglings 7/8
Says' phoebe	<i>Sayornis saya</i>	Adult w-fledglings 7/8/20
Black headed Grosbeak	<i>Pheucticus melanocephalus</i>	--
Blue grosbeak	<i>Passerina caerulea</i>	Pair
Lazuli bunting	<i>Passerina amoena</i>	Pair
Yellow breasted Chat	<i>Icteria virens</i>	Common
Yellow warbler	<i>Setophaga petechia</i>	--
Western wood-pewee	<i>Contopus sordidulus</i>	--
Cliff swallow	<i>Petrochelidon pyrrhonota</i>	nesting colonies on cliffs
Mourning dove	<i>Zenaida macroura</i>	--
American Robin	<i>Turdus migratorius</i>	Adult w-fledglings 7/8/20
Brown-headed Cowbird	<i>Molothrus ater</i>	--
Red-tailed hawk	<i>Buteo jamaicensis</i>	--
Cooper's hawk	<i>Accipiter cooperii</i>	--
Black-chinned Hummingbird	<i>Archilochus alexandri</i>	--
White-breasted Nuthatch	<i>Sitta carolinensis</i>	--

Mammals were not formally surveyed in the project area. Mule deer (*Odocoileus hemionus*) is probably the largest mammal that would frequent the area. Among medium-sized carnivores, coyotes (*Canis latrans*) are well adapted to human presence, and red or gray fox (*Vulpes vulpes*, *Urocyon cinereoargenteus*) may occur. Raccoons (*Procyon lotor*) and striped or Western spotted skunks (*Mephitis mephitis*, *Spilogale gracilis*) are likely residents. Porcupine (*Erethizon dorsatum*) and beaver (*Castor canadensis*) frequent riparian areas. Small mammals may include jackrabbit (*Lepus californicus*), desert and Nuttall's cottontail rabbits (*Sylvilagus audubonii*, *S. nuttallii*), a variety of mice, woodrats, and gophers, and Ord's or Banner-tailed kangaroo rats (*Dipodomys ordii*, *D. spectabilis*). Several species of bats have potential to occur in the project area and would find abundant food resources due to proximity to the San Juan River and large populations of insects supported by the riparian area. The cliffs that would be impacted by proposed project activities support roosting areas for bats. Bats often use cliff habitat for maternity roosting, breeding and feeding. Typically, cliff habitat in Farmington area is used from May-August. No known caves, known for hibernacula, are located within proposed project area. No proposed work will be conducted during the bat maternity roosting season. While it is possible that bats may be using the cliffs during proposed work during winter months, it is unlikely that proposed work would result in mortality. Opportunities for roosting habitat is not expected to change significantly from proposed work.

Amphibians and reptiles expected to occur include Woodhouse's and red-spotted toads (*Anaxyrus woodhousii*, *A. punctatus*), New Mexico and plains spadefoot (*Spea multiplicata*, *S. bombifrons*); gophersnake (*Pituophis catenifer*), prairie rattlesnake

(*Crotalus viridis*), California kingsnake (*Lampropeltis californiae*), garter snakes (*Thamnophis cyrtopsis*, *T. elegans*), whiptails (*Aspidoscelis* species) and several other species of lizards.

Fish were surveyed as part of the NMED Surface Water Quality Bureau’s San Juan and Animas rivers watershed survey (NMED SWQB 2012). Fish found in the San Juan River watershed are listed below in Table 5. Additionally, a survey prior to the Corps’ 1988 Farmers Ditch Heading project found Colorado pike minnow downstream of the project area (USACE 1988)

Table 5: Characteristics of fish species found in wadeable streams in the San Juan watershed with survey results for 2010 sites: La Plata River (La Plata) at Farmington, Navajo River (Navajo) upstream of Jicarilla boundary (NMED SWQB 2012)							
Scientific Name	Common Name	ID’ed in 2010 Survey	Native	Temp.	Gravel Spawner	Primary Feeding Guild	Water Quality Tolerance
<i>Salmo trutta</i>	brown trout	Navajo	No	Cold	Yes	Invertivore/ Insectivore	Intermediate
<i>Cyprinella lutrensis</i>	red shiner	La Plata	No	Warm	No	Omnivore	Tolerant
<i>Gila robusta</i>	roundtail chub	--	Yes	Cool	No	Omnivore	Sensitive
<i>Rhinichthys osculus</i>	speckled dace	Navajo; La Plata	Yes	Cool	Yes	Invertivore/ Insectivore	Intermediate
<i>Pimephales promelas</i>	fathead minnow	--	No	Warm	No	Omnivore	Tolerant
<i>Catostomus commersoni</i>	white sucker	Navajo	No	Cool	Yes	Omnivore	Tolerant
<i>Catostomus discobolus</i>	bluehead sucker	Navajo; La Plata	Yes	Cool	Yes	Herbivore	Tolerant
<i>Catostomus latipinnis</i>	flannelmouth sucker	La Plata	Yes	Cool	Yes	Omnivore	Intermediate
<i>Ameiurus melas</i>	black bullhead	--	No	Warm	No	Invertivore/ Insectivore	Tolerant
<i>Fundulus zebrinus</i>	plains killifish	La Plata	No	Warm	No	Invertivore/ Insectivore	Tolerant
<i>Lepomis machrochirus</i>	bluegill	--	No	Warm	No	Invertivore/ Insectivore	Tolerant
<i>Cottus bairdi</i>	mottled sculpin	Navajo	Yes	Cool	No	Invertivore/ Insectivore	Intermediate

Alternative A: No Action Alternative

There would be no effects to wildlife from the No Action Alternative. Wildlife in the area are presumably habituated to the proximity to human activity and able to adjust to the ongoing disturbance from ditch maintenance.

Alternative B: Buried Pipe

Implementation of the Buried Pipe Alternative would occur during the late fall to late winter/early spring when migratory birds are not in the area and most reptiles and amphibians are less active. The contractor would be required to cover trenches at the end of each workday to prevent entrapment of small animals. Bats are generally either hibernating during the winter or have migrated away from the project area. Therefore, there would be no direct adverse effects to migratory birds or other wildlife.

Indirect adverse impacts to wildlife may occur as riparian vegetation along the ditch is lost, as described above. Elimination of seepage from the ditch would result in a minor loss of riparian foraging habitat from this alternative.

Project construction would take place when the ditch is dry and would not affect the river channel or aquatic habitats. There would be no alteration in the diversion, flow, or circulation of water. Therefore, there would be no adverse impacts to fish or other aquatic species.

In summary, implementation of the Buried Pipe Alternative would result in minor loss of riparian foraging habitat but overall would not result in long term negative impacts to fish or wildlife species.

3.4.3. Invasive/Exotic Species

As noted in the plant list above (Table 3), 11 non-native species were recorded during botanical surveys of the ditch. Seven of these species are listed by the State of New Mexico as noxious weeds. A particularly large infestation of Russian knapweed exists on the ditch berm throughout the Project Area.

Alternative A: No Action Alternative

There would be no change in invasive species populations from the No Action Alternative. Repeated soil disturbance from ditch maintenance and clearing of debris probably contributes to the spread of noxious/invasive species.

Alternative B: Buried Pipe

Although the Buried Pipe Alternative does not specifically target invasive species, construction disturbance would remove some of the noxious weed population. Because these species are widespread in the area, it is likely that they will re-establish on the ditch berm following construction. To help prevent establishment of noxious weeds, USACE would re-seed the project area with suitable native grass and forb species and would work with the Ditch Association to educate members about the invasive species present.

Implementation of the Buried Pipe Alternative would result in no appreciable change in populations of noxious weeds and invasive species.

3.4.4. Special Status Species

The Information for Planning and Consultation System (IPAC 2023) lists twenty species in San Juan County that are protected under the Endangered Species Act (Table 6). Of these 20 species, seven species (2 birds, 2 plants, 2 fish, and one invertebrate) may potentially occur within the proposed project area. Of these seven species, four have been identified as species to be further analyzed in this document: razorback sucker (*Xyrauchen texanus*), Colorado pikeminnow (*Ptychocheilus lucius*), Southwestern willow flycatcher (SWWF) (*Empidonax traillii extimus*) and the yellow-billed cuckoo (YBCU) (*Coccyzus americanus*). Critical habitat for the Colorado pikeminnow is present in the action area, in the river channel. No other critical habitats are present. Another listed riparian species with potential to occur within proposed project is the New Mexico meadow jumping mouse (NMMJM). The BLM/FFO conducted a habitat survey for NMMJM along San Juan and no suitable habitat was documented; therefore, the species was eliminated from analysis (John Kendall, BLM T&E Biologist, pers com). The ditch is situated at the bottom of a cliff that divides two different habitat areas: riparian and upland. The upland habitat does not contain suitable habitat for any federally listed species and, thus, no impacts are expected to any other listed species.

Table 6: Federal and state endangered and threatened species			
Common Name	Scientific Name	Federal Status	State of NM Status
Canada Lynx	<i>Lynx canadensis</i>	T	---
New Mexico Meadow Jumping Mouse (NMMJM)	<i>Zapus hudsonius luteus</i>	E	---
Spotted Bat	<i>Euderma maculatum</i>		T
Southwestern Willow Flycatcher (SWWF)	<i>Empidonax traillii extimus</i>	E	E
Yellow-billed Cuckoo (YBCU)	<i>Coccyzus americanus</i>	T	---
Broad-billed Hummingbird	<i>Cynanthus latirostris</i>		T
Least Tern	<i>Sternula antillarum</i>	E	E
Brown Pelican	<i>Pelecanus occidentalis</i>	E	
Bald Eagle	<i>Haliaeetus leucocephalus</i>	T	
Common Black Hawk	<i>Buteogallus anthracinus</i>	T	
Mexican Spotted Owl	<i>Strix occidentalis lucida</i>	T	
Gray Vireo	<i>Vireo vicinior</i>	T	
Baird's Sparrow	<i>Centronyx bairdii</i>	T	
Peregrine Falcon	<i>Falco peregrinus</i>	T	
Colorado Pikeminnow	<i>Ptychocheilus lucius</i>	E	E
Razorback Sucker	<i>Xyrauchen texanus</i>	E	---
Zuni Bluehead Sucker	<i>Catostomus discobolus yarrowi</i>	E	---
Roundtail Chub (upper basin populations)	<i>Gila robusta</i>	E	
Knowlton's Cactus	<i>Pediocactus knowltonii</i>	E	---
Mancos Milk-vetch	<i>Astragalus humillimus</i>	E	---
Mesa Verde Cactus	<i>Sclerocactus mesae-verdae</i>	T	---
Zubi fleabane	<i>Erigeron rhizomatus</i>	T	E

Impacts to all federally listed species under ESA were analyzed for the 2003 Farmington BLM Resource Management Plan (RMP) (BLM 2003). The 2002 biological assessment for 2003 RMP analyzed impacts to all federally listed species, including SWWF and the two fish species here, to address the disparity in future development for next 20 years. In 2002, the USFWS concurred with the analysis that concluded that development outlined in 2003 RMP would have a “may affect, not likely to adversely affect” determination on all listed species protected under ESA. Since 2003, two riparian species have been listed under ESA by USFWS: the YBCU and NMMJM.

The potential for these four species to occur in the proposed action area was evaluated. Habitat along the ditch was deemed marginally suitable for any federally listed riparian bird species, and likely not utilized for nesting. However, SWWFs have been detected in ditches, like the Farmer’s ditch, during the migration (April/May, August/September). Most of the riparian habitat immediately outside of the ditch area is managed by BLM/FFO and is protected under an Area of Critical Environmental Concern (ACEC) designation (BLM 2003). This ACEC contains nesting habitat for SWWF and marginally for YBCU. No observations for either species were documented (See Appendix B). The proposed project area contains patches of riparian habitat in the San Juan River floodplain while adjacent to but below the ditch, the habitat (incl. ACEC) is moderately suitable for nesting SWWF but lacks the constituent habitat elements for YBCU (lack of cottonwood trees). However, there is suitable nesting habitat within the action area. No riparian vegetation will be removed outside of Farmers ditch from proposed project activities. Noise from proposed activities could impact any nesting within action area during nesting season. Since proposed work will remove no riparian vegetation and would occur outside of the nesting period for both bird species, no impacts are expected. Based on the proximity of habitat patches along the ditch to floodplain riparian habitat, and the potential for utilization as foraging (and possible nesting) habitat, exploratory surveys for yellow-billed cuckoo and willow flycatcher were conducted on 20 June and 8 July 2020. These species were not detected (Appendix B). Since suitable nesting, foraging and migration habitat can be found all along the San Juan River, any impacts to any riparian bird species would be indirect and temporary.

The only potential impacts to the two fish species would come from excessive sedimentation from the falling rock work. Sedimentation often impacts the breeding behavior of fish if occurring during certain times of the year. Excessive sedimentation from proposed project activities is expected to be low. The proposed work will occur within the Farmer’s ditch ROW, the cliffs, and the uplands above. There are some already disturbed areas, on private and BLM managed land, below the ditch where spoils will be stored and contained. Any rocks or excessive sedimentation from proposed work is expected to stay within ditch with no direct deposition into San Juan River. Once proposed rock work is complete, the ditch will be cleared, and spoils removed or stockpiled away from San Juan River to reduce potential excessive

sedimentation. Water from Farmers Ditch does not directly enter the San Juan River until approximately 10 river miles downstream, thus, reducing impacts from sedimentation and erosion. Any disturbance from the uplands above will be reclaimed with sediment fences/traps to reduce erosion.

The San Juan River has been noted as wintering habitat for bald eagles, which are listed as Threatened by the State and protected federally under the Bald and Golden Eagle Protection Act. No impacts are expected due to lack of roost areas for bald eagles and no golden eagle nest within 1/2 mile. Both species may occasionally be found passing through the proposed project area. Cliffs also have no known nesting for any raptor species, including peregrine falcons, which typically nest in similar cliff habitat.

For this proposed project, no additional impacts are expected for any species listed under the Endangered Species Act due to:

- Proposed work will occur outside of April 1 – September 1. A new determination/analysis will be required before any work continues into April.
- SWWF or YBCU nesting has never been documented within action area from past survey efforts.
- Sedimentation from proposed work is not expected to be excessive to where it would impact the Colorado pikeminnow and razorback sucker
- No suitable habitat for New Mexico meadow jumping mouse.
- The proposed work would reduce the need for continual maintenance within Farmers ditch and surrounding riparian area from falling rocks and debris.

Alternative A: No Action Alternative

There would be no effects to listed species from the No Action Alternative.

Alternative B: Buried Pipe

The USACE has determined that the Buried Pipe Alternative may affect but is not likely to adversely affect the Southwestern willow flycatcher and yellow-billed cuckoo due to project timing outside of nesting season and minor indirect impacts to riparian vegetation along the ditch. A Biological Assessment was submitted to the USFWS and Informal consultation has been completed (Appendix B)

Bald eagles may occur in the project area during winter when the project is being constructed. If a bald eagle is present within 0.5 mile of the work in the morning before the project activity starts, or following breaks, the contractor would suspend all activity until the bird leaves of its own volition. However, if a bald eagle arrives during construction activities or if an eagle is beyond that distance, construction would not be interrupted. Therefore, there would be no adverse impacts to eagles from this alternative.

There may be minor indirect loss of foraging habitat for State-listed birds that utilize riparian habitats (gray vireo, broad-billed hummingbird). Other State-listed bird species would not be affected by this alternative.

The project would have no effect on other Federally or State-listed species, with potential to occur in the project area, or their critical habitats. The project would not affect endangered plants due to absence of suitable habitat (Knowlton's cactus, Mesa Verde cactus, Mancos milk-vetch, Zuni fleabane); would not affect endangered fishes or critical habitat due to project and location outside aquatic habitat (Colorado pikeminnow, razorback sucker, Zuni bluehead sucker, roundtail chub); and would not affect endangered mammals due to absence of suitable habitat (Canada lynx, New Mexico meadow jumping mouse).

Spotted bats may occur in the project area. This species prefers roosting in cliffs near water and the bluffs along the ditch could provide roosting habitat. A status assessment did not find this species in the northwestern part of the state (Geluso 2006). A NMDGF biologist confirmed that this species likely utilizes cliffs and forages in the San Juan Valley but would not be affected by construction at the base of the bluff (personal communication, M. Conway, NMDGF email to D. Price, USACE, 22 July 2020).

3.5. Cultural Resources

The Farmers Mutual Ditch brings water to approximately 600 users and irrigates approximately 4,200 acres of farmland (Everhart 2002). Prior cultural resources work on the Farmers Mutual Ditch included a Class III cultural resources inventory survey for the rehabilitation of the ditch's San Juan River diversion, upstream from the current project areas (Rayl 1988). During consultation for that rehabilitation, the New Mexico State Historic Preservation Officer (SHPO) concurred with the USACE determination that the Farmers Mutual Ditch system was potentially eligible for nomination to the National Register of Historic Places (NRHP) under criteria "c" and "d." The Advisory Council on Historic Preservation (ACHP) concurred with that finding and suggested that the Ditch system may also be eligible under criterion "a" (Everhart 2002). In 2001, USACE archaeologist Gregory Everhart conducted a cultural resource survey to the west of the current project area for the proposed conversion of a 3.2-mile segment of Farmers Mutual Ditch from an earthen ditch to a concrete-lined one with new screw-lift field gates. The Everhart investigations found no new archaeological sites or historic properties in that 3.2-mile segment of the ditch, and that project was determined to have no adverse effect to historic properties (Everhart 2002). New Mexico SHPO concurred with that determination on 17 September 2002 (HPD Log 65839). In 2012, the ditch was recorded as part of a survey for a transmission line by Marron and Associates for the Bureau of Land Management (Walley and Connor 2012). Marron and Associates recommended the ditch eligible for the NRHP under criteria "a" and "c". New Mexico SHPO concurred with that determination on 17 September 2014 (HPD Log 99794). In 2018, the ditch was given a Historic Cultural Properties Inventory (HCPI) number and

recorded on HCPI forms by the NRCS, who again determined that the ditch should be eligible to the NRHP (Murrell 2018).

A review of USACE records and an online records check of the New Mexico Office of Cultural Affairs' Historic Preservation Division NMCRIS database was conducted on 15 January 2020. In addition to the ditch itself, which has been determined eligible to the NRHP, there is one known archaeological site near the western end of the APE, a petroglyph panel (LA 10952), which has not been evaluated for eligibility to the NRHP. On July 28, 2020, USACE and the SHPO agreed that the rehabilitation project would have an adverse effect on the Ditch (LA No. 68213/ HCPI No 44824; HPD Log 113444) and entered into a Memorandum of Agreement (MOA) to resolve these adverse effects. USACE contracted with BRIC, LLC. to fulfill the terms of the MOA, which included a Class III inventory, recordation of LA 10952 and the portion of the Farmer's Mutual Ditch within the area of potential effect (APE), and a report detailing the fulfillment of the stipulations of the MOA. BRIC, LLC. documented one new site (LA 198490), two previously recorded sites (LA 10952 & LA 68213/ HCPI 44824), and three isolated occurrences (IOs) within the project area. LA 198490 is a recent historic (c. 1950s- c. 1980s) trash dump. LA 198490 was determined ineligible for inclusion on the National Register of Historic Places (NRHP). Site LA 10952, a prehistoric petroglyph site, was previously recorded but not evaluated for eligibility to the NRHP. BRIC, LLC. recommended that LA 10952 is eligible for NRHP inclusion under criterion (d), and USACE concurred, but also determined that the site is eligible under criterion (a). Site LA 68213/HCPI 44824, the Farmer's Mutual Ditch, was previously determined eligible to the NRHP in 2018 (HPD Log 108490). The footprint of LA 10952 falls outside of the project APE for reach one and will therefore be avoided by all project activities. USACE determined that LA 198490 is not eligible to the NRHP and will therefore not be affected by project activities. The report (NMCRIS No. 147384) was submitted for SHPO review on 16 June 2021. The SHPO concurred with USACE's determinations on 29 June 2021 (HPD Log 115375). The report fulfilled the stipulations of the MOA between the SHPO and USACE intended to mitigate the adverse effect to LA 68213/HCPI 44824.

Later in project planning, it was determined that rockfall from the cliffs above the Farmer's Mutual Acequia will pose a significant danger to the construction crews during implementation. It was determined that rock scaling will need to be performed on the cliffs above reach one of the acequia. Access will need to occur from above the cliff across BLM Land. The Corps consulted with the SHPO on the APE for the rockfall project at the BLM's request. Because specific locations for rock scaling have not yet been selected, a large APE was identified that will encompass all potential rock scaling areas and access points. The APE measures 59.3 acres. The SHPO signed off on the APE on 4 November 2022 (HPD Log 118332).

No previous surveys have occurred within the APE for the rock scaling portion of the project, and there are no known sites. Corps archaeologists Jessica Gisler and

Jonathan Van Hoose performed a Class III inventory of the rock scaling APE on November 2nd and 3rd. The archaeologists performed an intensive survey by walking 15m E-W transects. The APE for the rock scaling portion of the project measured 59.3 acres. The Corps archaeologists were only able to survey 47.2 acres of the APE due to the need to stay within a safe distance of the cliff edge. The Corps archaeologists also walked a transect along the base of the cliffs next to the Farmer's Mutual Acequia and scanned the cliffs with binoculars to locate any rock art. The surface visibility ranged between 51 and 75%, with large patches of the soil visible between tufts of grass. The survey area contained a large degree of gravel. The understory was a mix of grasses and forbs with the occasional cholla. There was no overstory present. The BLM asked the Corps to buffer the survey area by 100ft on all sides. The Corps archaeologists attempted to do this wherever possible without crossing property lines, entering the highway corridor, or walking too close to the cliff edge. The northern boundary of the survey area is bordered by U.S. Hwy 64, and a portion of the western boundary is a fence line that marks private property. The southern boundary of the survey area is the edge of the cliff.

The survey area was littered with modern trash that has been dumped from cars on U.S. Hwy 64. The Corps archaeologists noted one small modern trash scatter in the northwest corner of the survey area. The trash scatter consisted of a few cinder blocks, pieces of siding from a trailer, asphalt shingles, a "Fix-a-Flat" can, and a sleeping bag. It appeared that the trash may have been dumped over the property line by the neighboring landowners. The Corps archaeologists observed a dilapidated trailer with the same type of siding that was observed in the trash scatter on the neighboring private property. The trash scatter was too recent to be recorded, but the Corps archaeologists did take a boundary around it with the GPS. No cultural resource sites or rock art were located during this survey, but 18 isolated occurrences were recorded. One isolated occurrence (IO #10) will need to be avoided during project implementation. IO #10 is a Descanso consisting of a white cross with the inscription "RIP Gilo". The cross is located on a high point overlooking the San Juan River. A hunting knife and some coins had been placed at the foot of the cross. The Corps determined that the Farmer's Mutual Rock Scaling project would result in no historic properties affected. The SHPO concurred with this determination on 30 December 2022 (HPD Log 118691).

Alternative A: No Action Alternative

Without the implementation of a Federal project, the known cultural resources within the proposed project's APE, the Farmers Mutual Ditch itself and the petroglyph panel (LA 10952) would be expected to remain in approximately the current condition. Under the No Action Alternative, the ditch would not be subjected to the adverse effects to certain aspects of site integrity anticipated from construction of the ditch rehabilitation alternative. However, if the project is not implemented, the ditch will be subject to

landslide and rock fall activity that will adversely impact its function as a community water-delivery system, which is its primary aspect of integrity.

Alternative B: Buried Pipe

The APE for the current project includes a 100-foot easement centered on the Farmers Mutual Ditch center line for the ditch remodeling work along with block areas along the cliffs for the rock scaling.

The current state of the Farmers Mutual Ditch is an open earthen ditch along its entire length, apart from a short section which has already been piped near the diversion structure at the east end. The undertaking involves the removal and replacement of several of the Farmers Mutual Ditch associated features, and the conversion of the Acequia from an earthen ditch to partially piped ditch. The proposed undertaking will not affect the Acequia's location or setting, or association of the Acequia with its community. In many ways, the proposed undertaking is beneficial in that it allows the Farmers Mutual Ditch Association and surrounding communities to continue their way of life while lowering acequia maintenance costs. That being said, the original materials, design, and workmanship will be compromised by the use of pipe in the ditch. The feeling of water running openly through an earthen ditch system in the rural countryside will also be compromised by the partial piping of the ditch. The piping will look modern. For these reasons, it was determined by USACE and New Mexico SHPO via e-mail dated 20 April 2020, that the proposed project will have an adverse effect on the aesthetic of Farmers Mutual Ditch. The Advisory Council on Historic Preservation (ACHP) was notified of the adverse effect and invited to participate in the Section 106 consultation process for the proposed project on October 2, 2020. The ACHP declined to participate in a letter dated 3 November 2020. Tribal consultation letters were sent on 28 July 2020, 18 November 2022, and 5 December 2022 (see Consultation and Coordination, Section 6, below).

Typically, mitigations for this kind of acequia work include survey and documentation of the acequia length, including preparation of HCPI and Acequia Detail forms, archival photo documentation, and oral history interviews with ditch association members. The Farmers Mutual Ditch has not had a previous cultural resource survey within the APE. Therefore, mitigations for the adverse effect to the ditch included a full Class III cultural resource inventory and photo documentation of the APE for the current project, and oral history interviews regarding historic use of the ditch. Future ditch improvement projects will require further cultural resource inventory and photo documentation. A Memorandum of Agreement with these stipulations was signed by SHPO and USACE command on February 16, 2021. The Class III Inventory report (NMCRIIS No. 147384) was submitted for SHPO review on 16 June 2021. The SHPO concurred with USACE's determinations on 29 June 2021 (HPD Log 115375). The report fulfilled the stipulations of the MOA between the SHPO and USACE intended to mitigate the adverse effect to LA 68213/HCPI 44824.

3.6. Socioeconomic Considerations and Land Use

3.6.1. Socioeconomics

San Juan County, New Mexico, had an estimated population in 2018 of 127,455 (U.S. Census Bureau, 2020). Over half the area of the County is within the New Mexico boundaries of the Shiprock Agency of the Navajo Indian Reservation. More than one-third of the population of the County is Native American Indian (Table 7). Approximately 23 percent of the population live at or below the poverty line and in March of 2020 the unemployment rate was 7.3 percent (Table 8; NM Workforce Connection, 2020).

Table 7: 2018 American Community Survey 5-Year Estimates of Race (US Census Bureau, 2020).		
Race	Number of People	% of Population
Total	127,455	
White alone	66,357	52.1%
Black or African American alone	816	0.6%
American Indian and Alaska Native alone	50,527	39.6%
Asian alone	988	0.8%
Native Hawaiian and Other Pacific Islander alone	75	0.1%
Some other race alone	5,319	4.2%
Two or more races	3,376	2.6%

Table 8: Median household income and poverty status of San Juan County residents (US Census Bureau, 2020)	
Median household income (in 2018 dollars), 2014-2018	\$50,582
Per capita income in past 12 months (in 2018 dollars), 2014-2018	\$23,206
Persons in poverty, percent	23.1%

The majority of the persons living in the county are employed in retail, construction, health care, mining, manufacturing, and accommodations and food. A significant mining industry is associated with deposits of coal, oil, natural gas, and sand and gravel. Since most of the county is arid, agriculture is restricted to the floodplains of the San Juan, Animas, and La Plata rivers and to irrigated land on the Navajo reservation.

Alternative A: No Action Alternative

The No Action Alternative would result in continued existing high maintenance expenses incurred with the earthen ditch.

Alternative B: Buried Pipe

The Buried Pipe Alternative would ensure the continued socioeconomic benefits currently accruing to the community from the crop production associated with the Farmers Mutual Ditch. The members of the Ditch Association would realize reduced long-term maintenance cost resulting from no longer having to clear the ditch of blockages caused by eroding hillsides.

3.6.2. Land Use

Historic and current land uses in the San Juan River watershed include mineral extraction, forestry, farming, ranching, and recreational activities. Land use/cover above the Hogback within New Mexico includes 56% forest, 42% rangeland, 1% agriculture, <1% urban/residential, and <1% barren soil. Land ownership within the New Mexico portion of the watershed is 46% tribal, 27% BLM, 14% private, 8% USFS, and 5% State (NMED SWQB 2012). The land area served by Farmers Mutual Ditch and in the immediate project area is predominantly agricultural with minor residential and light industrial uses.

Alternative A: No Action Alternative

The No Action Alternative would not directly affect land use; nevertheless, failure to address ongoing rock/debris slides and maintenance issues would pose a great challenge to the viability of agriculture in this part of the San Juan River valley. Without a reliable water supply, farming here would literally dry up, with adverse socioeconomic impacts as described in Section 3.6.1.

Alternative B: Buried Pipe

No changes in land use would result from the Buried Pipe Alternative. Implementation of this alternative would allow for the viable continuation of agriculture in the area served by Farmers Mutual Ditch.

3.6.3. Environmental Justice and Protection of Children

The goal of environmental justice is to ensure that all Americans are afforded the same degree of protection from environmental and health hazards and have equal access to the decision-making process to maintain a healthy environment in which to live, learn, and work. EO 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations (11 February 1994), directs federal agencies to make environmental justice part of their mission to the greatest extent practicable and permitted by law. In short, this document defines the approaches by which the EPA will ensure that disproportionately high environmental and/or socioeconomic effects on minority and low-income communities are identified and addressed. Further, it establishes agency wide goals for all Native Americans with regards to Environmental Justice issues and concerns.

EO 13045, Protection of Children from Environmental Health Risks and Safety Risks (21 April 1997), recognizes a growing body of scientific knowledge that demonstrates that children may suffer disproportionately from environmental health risks and safety risks. These risks arise because children's bodily systems are not fully developed; because children eat, drink, and breathe more in proportion to their body weight; because their behavior patterns may make them more susceptible to accidents. Based on these factors, the President directed each Federal agency to make it a high priority to identify and assess environmental health risks and safety risks that may disproportionately affect children. The President also directed each Federal agency to ensure that its policies, programs, activities, and standards address disproportionate risks to children that result from environmental health risks or safety risks.

The WRDA Section 1113 Acequia Program, under which the proposed project is authorized, is largely intended to provide needed technical and financial assistance to acequia and community ditch associations in which water resources are degrading and in need of improvement. Acequia associations find maintenance of these systems increasingly challenging.

Alternative A: No Action Alternative

The No Action Alternative would allow for continued erosion and filling of the ditch with sediment. San Juan County, New Mexico, residents have relatively lower incomes than the average for the State. The No Action alternative likely would adversely affect this low-income community.

The No Action Alternative would not disproportionately affect children's safety or environmental health risks to children or adults, including minority or low-income residents.

Alternative B: Buried Pipe

No changes in demographics, housing, or public services would likely occur as a result of the construction of the Buried Pipe Alternative. With respect to the protection of children, the likelihood of disproportionate risk to children is not significant. No anticipated impacts to low-income or minority populations are expected. Construction of The Buried Pipe Alternative would result in long-term positive affects for all Ditch Association members. The proposed project does not involve activities that would pose any disproportionate environmental health risk or safety risk to children or adults.

Implementation of the Buried Pipe Alternative would not result in any impacts in terms of environmental justice and the protection of children.

4. RECOMMENDED ALTERNATIVE AND CUMULATIVE IMPACTS

The recommended alternative for the proposed Farmers Mutual Ditch project is Alternative B: Buried Pipe.

NEPA defines cumulative effects as "...the impact on the environment which results from the incremental impact of the action when added to other, past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions."

Cumulative effects are analyzed individually for each resource area in Section 3. These analyses address the cumulative impact of the direct and indirect effects of the proposed action when added to the aggregate effects of past, present, and reasonably foreseeable future actions. For all resources, the aggregate effect of past and present actions was considered to be represented by the current, existing conditions of the resource (Council on Environmental Quality 2005). Therefore, the specific effects of individual past and present actions typically were not cataloged in the analysis. In order for direct or indirect effects to incrementally add to the effects of past, present, or reasonably foreseeable future actions, they must overlap with those effects in time or space (Council on Environmental Quality 1997).

The time frame for analysis of cumulative effects varied, depending on the duration of direct and indirect effects. For example, direct effects resulting from construction were expected to persist for relatively short periods of time (about four months). Conversely, indirect effects resulting from operation of the rehabilitated acequia system would persist for the life of the facility. Similarly, the geographic bounds for cumulative effects analysis varied with the resource under consideration, depending on zone of influence of the direct or indirect impact being analyzed.

The proposed project lies within a rural area in San Juan County, New Mexico (Figure 1). The proposed improvements to the ditch would not significantly impact the current conditions of the local environment and would help retain the farming practices of the

community. For these reasons, the proposed chosen alternative when combined with past, present, or future activities in the Farmers Mutual Ditch area would not significantly add to or raise local cumulative adverse environmental impacts to a level of significance.

5. CONCLUSIONS

This EA addresses the potential effects of the proposed rehabilitation of the Farmers Mutual Ditch. Impacts to the environment would be non-significant and short-term. Long-term benefits to the Ditch Association members would result from the proposed project. The proposed project would not result in any moderate or significant, long-term, or cumulative adverse effects. Therefore, construction of the proposed project, Alternative B: Buried Pipe, would not significantly affect the quality of the human environment and is recommended for implementation.

5.1. Summary of Findings and Impacts

Table 9 provides a summary comparison of the alternatives (Preferred Alternative and No Action Alternative) with respect to the resources discussed in this EA.

Table 9: Summary of Findings and Impacts.		
Resources	Alternative B: Buried Pipe (Preferred Alternative)	Alternative A: No Action Alternative
Physical Landscape		
<i>Climate and Climate Change</i>	No Impacts	No Impacts
<i>Physiography, Geology, and Soils</i>	No Impacts	No Impacts
<i>Water Resources and Water Quality</i>	Short-term Negative Impacts Long-term Positive Impacts	Long-term Negative Impacts
<i>Floodplains and Wetlands</i>	No Impacts	No Impacts
<i>HTRW</i>	No Impacts	No Impacts
Air Quality	Short-term Negative Impacts Long-term No Impacts	No Impacts
Noise	Short-term Negative Impacts Long-term No Impacts	No Impacts
Biological Resources		
<i>Vegetation</i>	Minor Impacts	No Impacts
<i>Fish and Wildlife</i>	No Impacts	No Impacts
<i>Invasive/Exotic Species</i>	No Impacts	No Impacts
<i>Special Status Species</i>	Minor Impacts	No Impacts
Cultural Resources	Long-term negative and positive impacts	Long-term Negative Impacts
Socioeconomic Considerations		

<i>Socioeconomics</i>	No Impacts	Long-term Negative Impacts
<i>Land Use</i>	No Impacts	Long-term Negative Impacts
<i>Environmental Justice and Protection of Children</i>	No Impacts	No Impacts

5.2. Summary of Conditions to Minimize Potential Adverse Impacts

As determined necessary, the contractor shall use BMPs, such as mulch application, straw/hay bales, and silt fences to retard erosion from contractor use areas. To protect soils from wind and water erosion, areas with plant cover that are disturbed by project activities would be evaluated as to the feasibility of re-establishing native vegetation by seeding. Areas disturbed by project activities would be seeded if the evaluation determines that seeding could significantly reduce the time for re-establishment of native vegetation. In this event, the species to be seeded, seeding rates, and seeding methods, and if needed, fertilizer regimes, would be determined by site characteristics and potential ability to bind the soil.

To avoid and minimize adverse impacts to water quality, all general, regional, and water quality conditions applicable to Nationwide Permits in New Mexico, as well as specific conditions of the project's Section 401 water quality certification, will be implemented.

BMPs for air quality would include keeping heavily trafficked areas and materials stockpiles watered using truck mounted sprinkler equipment to reduce dust from heavy vehicle traffic. All construction vehicles would be required to have emissions controls. Because future maintenance would be reduced, there would be a minor long-term benefit to air quality.

Construction would occur during the late fall to late winter/early spring when migratory birds are not in the area and most reptiles and amphibians are less active. The contractor would be required to cover trenches at the end of each workday to prevent entrapment of small animals.

To help prevent establishment of noxious weeds, USACE would re-seed the project area with suitable native grass and forb species and would work with the ditch association to educate members about the invasive species present.

If a bald eagle is present within 0.5 mile of the work in the morning before the project activity starts, or following breaks, the contractor would suspend all activity until the bird leaves of its own volition. However, if a bald eagle arrives during construction activities or if an eagle is beyond that distance, construction would not be interrupted. Therefore, there would be no adverse impacts to eagles from this alternative.

To mitigate for the adverse effects to the ditch, a full Class III cultural resource inventory and photo documentation of the APE for the current project, and oral history interviews regarding historic use of the ditch will be conducted.

6. CONSULTATION AND COORDINATION

NEPA Coordination for the construction of a concrete pipe in the Farmers Mutual Ditch was initiated in January 2020 with an email to USFWS, in May 2020 with an email to Bureau of Land Management and in July 2020 with an email to NMDGF. Agencies and entities contacted formally or informally in preparation of this EA include:

- Famers Mutual Ditch Association, Farmington, NM
- NM Department of Game and Fish, Santa Fe, NM
- NM State Historic Preservation Office, Santa Fe, NM
- U.S. Bureau of Land Management, Farmington, NM
- U.S. Fish and Wildlife Service, New Mexico Ecological Services Field Office, Albuquerque, NM

Coordination with Federal, Tribal, State, and Non-Government Agencies concluded on 2 November 2020.

USACE consulted with SHPO under Section 106 of the NHPA regarding the adverse effect determination for Alternative B: Buried Pipe and the effect to the staging area on 22 July 2020. USACE consulted with the SHPO under Section 106 of the NHPA for the added rock scaling section of the project on 30 December 2022.

Consistent with the Department of Defense's American Indian and Alaska Native Policy, signed by Secretary of Defense William S. Cohen on 28 October 1998, and based on the State of New Mexico Indian Affairs Department and Historic Preservation Division's 2019 Native American Consultation List, American Indian Tribes that have indicated they have concerns in this portion of San Juan County, New Mexico, were sent tribal consultation letters on 24 July 2020. These tribes include the Navajo Nation, Ohkay Owingeh, the Pueblo of Laguna, the Southern Ute Indian Tribe, the Ute Mountain Ute Tribe, the Hopi Tribe, and the Kiowa Tribe. Responses were received from the Navajo Nation, the Southern Ute Indian Tribe (SUIT), the Pueblo of San Ildefonso, and the Pueblo of Sandia (Appendix C). The Navajo Nation, the Pueblo of San Ildefonso, and the Pueblo of Sandia each indicated that there were no cultural resource concerns with the project. The results of this round of consultation are summarized in a table in Appendix C.

USACE sent additional tribal letters detailing the expansion of the project scope to include rock scaling on 18 November 2022 and 05 December 2022. The list of tribes sent tribal consultation letters was expanded after discussion with the BLM. These Tribe include Pueblo of Acoma, Pueblo of Cochiti, Pueblo of Isleta, Pueblo of Jemez, Kewa

Pueblo, Pueblo of Laguna, Pueblo of Nambe, Ohkay Owingeh, 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, Pueblo of Zia, Pueblo of Zuni, All Pueblos Council of Governors, Eight Northern Indian Pueblos Council Five Sandoval Indian Pueblos, Ten Southern Pueblos Council, Jicarilla Apache Tribal Council, Navajo Nation, Southern Ute Indian Tribe, The Hopi Tribe, Kiowa Tribe, and Ute Mountain Ute. The Pueblo of San Ildefonso, and the Pueblo of Sandia each indicated that there were no cultural resource concerns with the project.

On December 22, USACE received a response from the Southern Ute Tribal Historic Preservation Officer (THPO), expressing concern about a potential adverse effect to site LA 10952. LA 10952 is a large petroglyph panel on the southern side of the Farmer's Mutual Ditch. The THPO's recommendation was that LA 10952 be avoided by all ground-disturbing activities if possible. If avoidance is not possible, they recommended that the Corps engage in tribal consultation to develop a monitoring plan that is satisfactory to tribal concerns, with considerations for archaeological features at the site, most notably the fragility of the large prehistoric petroglyph panel. The THPO expressed concern that the rock scaling would cause the petroglyph panel to fall. Jessica Gisler conducted a phone call with SUIT Tribal Historic Preservation Officer, Cassandra Atencio on Monday, January 23, 2023. During this call, Gisler presented two maps that better depicted the location of LA 10952 in relation to Reach 2 of the Farmer's Mutual Ditch project (Appendix C). The maps showed that LA 10952 is located on the southern side of the Farmer's Mutual Ditch, and that the site is located approximately 100 meters west of the end of Reach 2. She also explained that the Corps will only be conducting rock scaling within Reach 1 at this time. Even if Rock Scaling is needed within Reach 2, LA 10952 is far enough outside of the Reach 2 corridor that it would not be impacted. No rock scaling will occur within the vicinity of LA 10952. At that time, Atencio asked for a formal letter summarizing the information presented on the phone call and agreed to send a letter stating that they agreed with the Corp's determination of no adverse effect after she reviewed it. USACE received this response via email on 14 February 2022 (Appendix C). The results of this round of consultation are summarized in a table in Appendix C.

Coordination with the public and interested parties has taken place throughout the preparation of this EA. The public was provided a Notice of Availability for a 30-day review period of the draft EA on 14 August 2020. A hardcopy of the draft EA was made available for public review in the Bloomfield City Government Library in Bloomfield, NM. An electronic copy of the draft EA was made available here –

<https://www.spa.usace.army.mil/Missions/Environmental/Environmental-Compliance-Documents/Environmental-Assessments-FONSI/>

The following agencies and stakeholders were directly contacted in the form of a Notice of Availability letter emailed out 14 August 2020.

Mailing List for Draft Environmental Assessment

Shawn Sartorius, Field Supervisor
USFWS - Ecological Services
2105 Osuna Road NE
Albuquerque, NM 87113

Mr. Rolf Schmidt-Peterson, Director
New Mexico Interstate Stream Commission
P.O. Box 25102
Santa Fe, NM 87504

Mr. Robert Houston
U.S. EPA
Region 6
1201 Elm Street, Suite 500
Dallas, TX 75270

Mr. Matt Wunder
Conservation Services Division
NM Department of Game and Fish
P.O. Box 25112
Santa Fe, NM 87504

Ms. Kelly Allen
Regulatory Division
U.S. Army Corps of Engineers
Albuquerque District
4101 Jefferson Plaza NE
Albuquerque, NM 87109

Ms. Shelly Lemon
NM Environment Department
Surface Water Quality Bureau
P.O. Box 5469
Santa Fe, NM 87502

Ms. Jennifer Faler
Bureau of Reclamation
555 Broadway Blvd. NE, Suite 100
Albuquerque, New Mexico 87102

Ms. Daniela Roth
State Botanist
Forestry and Resources Conservation
Division: Energy, Minerals, and Natural
Resources Department
P.O. Box 1948
Santa Fe, NM 87504

The following agencies were sent the Notice of Availability of the draft EA on 19 August 2020 and given an extended 30-day review period to 19 September 2020.

NM Office of the State Engineer
100 Gossett Drive, Suite A
Aztec, NM 87410

Comments during the public review period were received from USFWS, EMNRD, NMDGF, and the USEPA. A comment response table is provided below.

Commenter	Comment	Response
USFWS	The Service concurred with the Corps' determination of "may affect, is not likely to adversely affect" for the cuckoo and flycatcher based on the rationale and the conservation measures provided in emails and biological effects analysis documents.	Noted; thank you. We affirm that as described in the EA and biological analysis, construction will occur outside the breeding season. Details are provided in the consultation documents (Appendix B).

EMNRD - Forestry Division, Botany Program	Concurred with the Corps' determination that no state or federally listed plants will be affected by the project as proposed	Noted; thank you.
NMDGF (letter of 11 September)	The timing, reseeding efforts, and best management practices incorporated in the Environmental Assessment will help minimize negative impacts to wildlife.	Noted; thank you.
NMDGF (letter of 11 September)	The Department recommends conducting surveys for active burrows or cavities within the project area prior to initiating ground disturbance to avoid negative impacts to burrowing animals. Burrowing Owl (<i>Athene cunicularia</i>) is known to occur within San Juan County and could occur within the project area.	Habitat along the ditch does not appear to be well suited to burrowing owls. The construction will occur outside of the burrowing owl nesting season. If an active burrow is found during construction, the Corps will contact NMDGF for further coordination.
NMDGF (Environmental Review tool)	A list of special status species, including NMDGF- and USFWS-listed threatened and endangered species and Species of Greatest Conservation Need, was provided	Based on the species list provided from the ERT, the state-endangered Western Toad (<i>Anaxyrus boreas</i>) was considered for addition to the species list in the EA. The Western toad in NM occurs at higher elevations (BISON-M 2020) and suitable habitat is not present in the Farmers Ditch project area.
NMDGF (Environmental Review tool)	The project occurs within important habitats for wildlife, which could include fawning/calving or wintering areas for species such as deer and elk, or high wildlife movement and activity areas. Management recommendations include restrictions on noise-generating activities and taking actions to reduce wildlife-vehicle collisions.	Impacts to wildlife would be temporary and minor as described in the EA. The project area is close to urban development, highways and other human impacts. Noise from construction would only occur during daylight construction hours. Vehicles involved in construction will travel at low speeds due to the nature of the access roads and work area.
NMDGF (Environmental Review tool)	Because riparian areas are important wildlife habitats, the project footprint should avoid removing any riparian vegetation or creating ground disturbance either directly within or affecting the riparian area.	Disturbance will be limited to the ditch right-of-way which includes a few cottonwoods and willows that are disjunct from the San Juan River riparian corridor. The adjacent riparian corridor would not be disturbed.
USEPA	All Non-Road Engines should be certified as in compliance with EPA Tier 4 regulations found at 40 CFR Parts 89 and 1039, which include new and in-use nonroad compression-ignition engines.	Concur. This requirement will be included in contract specifications.

<p>USEPA</p>	<p>Should any land-clearing activities occur which result in the use of open burning to dispose of woody debris, coordination should be conducted with the New Mexico Environment Department to determine air quality conditions such as atmospheric inversions prior to performing open burning activities, and consider any expected air quality/visibility impacts to Class I Federal Areas identified in 40 CFR Part 81, Subpart D.</p>	<p>Concur. Open burning is not anticipated to occur. Should open burning be used, the project contractor will be required to coordinate with NMED.</p>
<p>USEPA</p>	<p>EPA recommends incorporating a Tribal Consultation Section in the EA with discussion as to how it complied with Executive Order 13175, Consultation and Coordination with Indian Tribal Governments (November 6, 2000), since the project has tribal implications. EPA recommends that the discussion includes, but not limited to any direct, indirect or cumulative adverse impacts associated with cost and tribal trust resources. In addition, EPA recommends that the discussion include tribal concerns and the mitigation measures being addressed.</p>	<p>Concur. Section 6 of the EA, Consultation and Coordination, describes Tribal consultation. We have also added a section specifically addressing Tribal consultation. As an agency of the Department of Defense, we follow the DoD's American Indian and Alaska Native Policy, which fulfills the requirements of EO 13175. We also adhere to 36CFR800.2, which describes federal agencies' responsibilities for tribal consultation.</p> <p>Consultation letters were sent to concerned Tribes as described in the DEA. Responses were received from the Navajo Nation and the Southern Ute Tribe, and both responses indicated that there were no cultural resource concerns with the project.</p> <p>There are no known cultural resources or traditional cultural properties concerns in the project APE. Therefore, no mitigation is necessary.</p>
<p>USEPA</p>	<p>Has a different alignment of the project been considered to be a practicable alternative that could result in less erosion and/or prevent potential compromise of the concrete pipe into the San Juan River?... EPA recommends that USACE consider different alignment of the project and assess it as an alternative</p>	<p>USACE considered other alignments but no practicable alternative alignments exists. Work cannot occur outside the ditch right-of-way, and the topography (with much of the ditch being adjacent to steep bluffs and cliffs) constrains the ditch alignment. Due to topography, property ownership constraints, and water right laws, there are no practicable off-site alternatives.</p>

USEPA	Regarding negative impacts to existing plants along the ditch bank when seepage from the ditch is eliminated by the project, USEPA asks that USACE discuss the environmental impacts of losing that leakage that feeds the surrounding vegetation (and foraging habitat) and what, if anything, is proposed to mitigate the impacts.”	USACE revised the discussion in the EA to improve consistency with the 404(b)(1) analysis and the Biological Assessment. Currently, frequent maintenance using machinery is required to clear rock and debris from the ditch. This disturbs vegetation, resulting in large bare stretches along the ditch. Periodic disturbance of vegetation would continue under the no-action alternative and may be more disruptive of the environment than maintaining the new pipe would be. We have determined that mitigation is not required for the minimal loss of vegetation.
USEPA	Regarding disinfection of equipment, EPA recommends that any disinfectant or other pesticide product used should be actively registered with EPA and used as directed on the label.	USACE concurs and will ensure that this requirement is included in the EA and contract specifications.

All comments and the USACE responses can be found in Appendix E.

7. LIST OF PREPARERS

This EA was prepared and reviewed for quality control by the USACE, Albuquerque District. Personnel primarily responsible for preparation and review are listed below.

Name	Affiliate	Discipline
Michael Martinez	USACE Project Management	Project Manager
Christopher Zayas	USACE Project Management	Project Manager
Corey Bowen	USACE Construction	Engineer
Sarah Moore	USACE Planning	Plan Formulator/Technical Writer
Ariane Pinson	USACE Planning	Climate Change
Dana Price	USACE Environmental	Biologist
Matthew Segura	USACE Geology	Env. Scientist
Christopher Carroll	USACE Geotechnical Eng.	Geologist
Christina Sinkovec	USACE Environmental	Archaeologist
Jessica Gisler	USACE Environmental	Archaeologist
J. Nolan Craun	BLM Realty	Natural Resources
Monica Tilden	BLM Realty	Right-of-ways
Adriano Tsinigine	USFWS Biologist	T&E Species & ESA Section 7
John Kendall	BLM Biologist	T&E Species
Whitney Thomas	BLM Planning and Environmental Coordinator	NEPA Review

Quality Control		
Mark Doles	USACE Planning	Reviewer
Kristen Long	USACE Project Management	Reviewer
Ryan Gronewold	USACE Planning	Reviewer
Summer Schultz	USACE Environmental	Reviewer
Danielle Galloway	USACE Environmental	Reviewer
Forrest Luna	USACE Regulatory	Reviewer
Christina Schroeder	USACE Regulatory	Reviewer

8. REFERENCES

Bennett, K.E., V.C. Tidwell, D. Llewellyn, S. Behery, L. Barrett, M. Stansbury and R.S. Middleton. 2019. Threats to a Colorado river provisioning basin under coupled future climate and societal scenarios. Environmental Research Communications 1 095001. <https://doi.org/10.1088/2515-7620/ab4028>

BISON-M [Biota Information System of New Mexico] 2020. BISON-M home page. <http://www.bison-m.org>. Accessed: July 13, 2020

Bureau of Land Management (BLM). 2002. Final Biological Assessment: Impacts to Threatened and Endangered Species Related to the Resource Management Plan Revision. Farmington Field Office. Farmington, New Mexico.

———. 2003. Farmington Proposed Resource Management Plan and Final Environmental Impact Statement: BLM-NM-PL-03-014-1610. Farmington, New Mexico: U.S. Department of the Interior, Bureau of Land Management.

Clow, D. W. (2010). Changes in the timing of snowmelt and streamflow in Colorado: a response to recent warming. *Journal of Climate*, 23(9), 2293-2306.

Geluso, K. 2006. Recurrence of the spotted bat and Allen's big eared bat in New Mexico. Share with Wildlife, New Mexico Department of Game and Fish, Contract #06-516.0000.0031.

Griffith, G.E., Omernik, J.M., McGraw, M.M., Jacobi, G.Z., Canavan, C.M., Schrader, T.S., Mercer, D., Hill, R., and Moran, B.C. 2006. Ecoregions of New Mexico (color poster with map, descriptive text, summary tables, and photographs): Reston, Virginia, U.S. Geological Survey (map scale 1:1,400,000). Available: www.epa.gov/wed/pages/ecoregions.htm (accessed 17 July 2020).

Hunt, A.P. and S.G. Lucas. 1992. Stratigraphy, paleontology and age of the Fruitland and Kirtland Formations (Upper Cretaceous), San Juan Basin, New Mexico. *in: San Juan Basin IV*, Lucas, S. G.; Kues, B. S.; Williamson, T. E.; Hunt, A. P.; [eds.], New Mexico Geological Society 43rd Annual Fall Field Conference Guidebook, 411 p. Downloaded from: <http://nmgs.nmt.edu/publications/guidebooks/43>

New Mexico Bureau of Geology and Mineral Resources. 2003. Geologic Map of New Mexico. 1:500,000. A division of New Mexico institute of Mining and Technology. Published in cooperation with the U.S. Geological Survey.

New Mexico Environment Department, Surface Water Quality Bureau. 2012. Water Quality Summary for the San Juan and Animas Watersheds (Navajo Nation at the Hogback to the Colorado border) 2010.

New Mexico Rare Plant Technical Council. 1999. Albuquerque, NM: New Mexico Rare Plants Home Page. <https://nmrareplants.unm.edu>. Accessed: 9 July 2020.

Nydick, K., Crawford, J., Bidwell, M., Livensperger, C., Rangwala, I., and Cozetto, K. 2012. Climate Change Assessment for the San Juan Mountain Regions, Southwestern Colorado, USA: A Review of Scientific Research. Prepared by Mountain Studies Institute in cooperation with USDA San Juan National Forest Service and USDOJ Bureau of Land Management Tres Rios Field Office. Durango, CO.

Ruhlman, J., L. Gass, and B. Middleton. 2012. Arizona/New Mexico Plateau Ecoregion. Chapter 26 in: Status and Trends of Land Change in the Western United States—1973 to 2000 Ed. B.M. Sleeter, T.S. Wilson, and W. Acevedo. U.S. Geological Survey Professional Paper 1794–A, 2012. <https://doi.org/10.3133/pp1794A26>

USACE [U.S. Army Corps of Engineers] 1988. Environmental Assessment: Acequias irrigation system, New Mexico. Farmers Mutual ditch heading, San Juan River and Eledge ditch heading, Animas River, San Juan County, New Mexico. U.S. Army Corps of Engineers Albuquerque District, June 1988.

USACE [U.S. Army Corps of Engineers] 2002. Finding of no significant impact and Environmental Assessment: Conveyance treatment for Farmers Mutual Ditch, San Juan County, New Mexico. U.S. Army Corps of Engineers Albuquerque District, November 2002.

USDA [U.S. Department of Agriculture], Soil Conservation Service, United State Department of Interior, Bureau of Indian Affairs and Bureau of Reclamation, and New Mexico Agricultural Experiment Station. 1977. Soil Survey of San Juan County, New Mexico, Eastern Part. 173 pp.

USDA-NRCS Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Web Soil Survey. Available online at: <http://websoilsurvey.sc.egov.usda.gov/>. Accessed June 23, 2020.

Williams, Jerry L. 1986. New Mexico in Maps. Second edition. University of New Mexico Press, Albuquerque. 409 pp.