



**Final Supplemental Watershed Plan No. 4 and
Environmental Assessment for the Santa Cruz
River Watershed - Site 1 Dam
Rehabilitation Project**

Santa Cruz River Watershed
Rio Arriba County, New Mexico



Lead Federal Agency:
United States Department of Agriculture
Natural Resources Conservation Service

Sponsoring Local Organization:
Santa Fe-Pojoaque Soil and
Water Conservation District

January 2020

Title and Document Status: Final Supplemental Watershed Plan No. 4 and Environmental Assessment (Plan-EA) for the Santa Cruz River Watershed - Site 1 Dam Rehabilitation

Lead Agency: United States Department of Agriculture Natural Resources Conservation Service (NRCS)

Cooperating Agency: None

Sponsoring Local Organization: Santa Fe-Pojoaque Soil and Water Conservation District (SFPSWCD)

Authority: The original watershed work plan was prepared, and works of improvement have been installed, under the authority of the Watershed Protection and Flood Prevention Act of 1954 (Public Law 83-566) as amended. The rehabilitation of the Santa Cruz River Watershed - Site 1 Dam is authorized under Public Law 83-566 (as amended), and as further amended by Section 313 of Public Law 106-472.

Abstract: Santa Cruz River Watershed - Site 1 Dam (also referred to as the Cañada Ancha Floodwater Retarding Structure) was built in 1962 as a high hazard dam for the authorized purpose of flood prevention (flood damage reduction) for the Village of Chimayó, New Mexico. The dam is currently classified as a high hazard structure and is not currently meeting state and NRCS engineering safety standards. The purpose of the action is to provide continued flood protection preventing runoff, erosion, and sediment damage in the currently protected area downstream of the dam, and to meet current New Mexico (19.25.12 NMAC) and NRCS engineering safety standards. There is a need for continued protection to land, community structures, and community infrastructure from flooding related damages, and to decrease the risk of dam failure for the people and property within the breach inundation area. Approximately 1,038 people, 326 structures, agricultural lands, and 15 roads/highways are located within the breach inundation area.

The “Dam Raise 71-Year Sediment Life” Alternative is the Preferred Alternative as well as the National Economic Development (NED) Alternative. This Alternative would require the following modifications: raise the dam and widen the dam crest; raise and reconstruct a concrete auxiliary spillway with riprap toe; replace the existing two principal spillway risers with one riser and raise the crest elevation; slipline the principal spillway conduit; reconstruct the plunge pool at the principal spillway conduit outlet; restore connectivity from the principal spillway conduit outlet to the natural drainage channel; reconstruct the retaining dike; and install a stabilized access road to the dam. The estimated installation cost estimate for the Alternative is \$19,022,900, which includes a construction cost of \$15,473,000 with additional engineering, real property rights, administrative, and permitting costs totaling \$3,549,900.

Comments and Inquiries: NRCS has completed this Draft Plan-EA in accordance with National Environmental Policy Act (NEPA) and NRCS guidelines and standards. Reviewers should provide their comments to NRCS during the allotted Draft Plan-EA review period. Comments need to be submitted by February 25, 2020 to become part of the Administrative Record. Please send comments to:

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SUPPLEMENTAL WATERSHED PLAN AGREEMENT NO. 4
(TO BE INCLUDED IN FINAL PLAN-EA)

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SUMMARY

OFFICE OF MANAGEMENT AND BUDGET FACT SHEET

S-1.0 Title of Proposed Action

Final Supplemental Watershed Plan No. 4 and Environmental Assessment (Plan-EA) for the Santa Cruz River Watershed - Site 1 Dam Rehabilitation

S-2.0 County, State

Rio Arriba County, New Mexico

S-3.0 Congressional District

New Mexico Congressional District 3

S-4.0 Sponsoring Local Organization

Santa Fe-Pojoaque Soil and Water Conservation District (SFPSWCD)

S-5.0 Authority

This Plan-EA has been prepared under the authority of United States Department of Agriculture Natural Resources Conservation Service (NRCS) Watershed Rehabilitation Amendments, which authorize funding and technical assistance to rehabilitate aging flood control dams built under the Watershed Protection and Flood Prevention Act [Public Law 83-566 Stat. 666 as amended (16 U.S.C Section 1001 et. Seq.) 1954; Rehabilitation under Public Law 83-566 as amended by Section 313 of Public Law 106-472] and in accordance with Section 102(2)(c) of the National Environmental Policy Act of 1969, Public Law 91-190, as amended.

S-6.0 Cooperating Agency

None.

S-7.0 Purpose and Need for Action

The purpose of the action is to provide flood protection (flood damage reduction) preventing runoff, erosion, and sediment damages in the currently protected area downstream of the dam up to the 100-year event, and to meet current New Mexico Office of the State Engineer, Dam Safety Bureau and NRCS engineering safety standards. There is a need for continued protection to land, community structures, and community infrastructure from flooding related damages, and to decrease the risk of dam failure for the people and property within the breach inundation area. Approximately 1,038 people, 326 structures, agricultural lands, and 15 roads/highways are located within the breach inundation area.

S-8.0 Description of the Preferred Alternative

The “Dam Raise 71-Year Sediment Life” Alternative (Structural Rehabilitation Alternative) is the Preferred Alternative for the project. The Structural Rehabilitation Alternative would include the following measures:

raise the dam 10.6 feet and widen the dam crest 6 feet; reconstruct and raise the concrete auxiliary spillway 11.1 feet and install a new riprap toe; replace the existing two principal spillway risers with one riser and raise the crest elevation 17.8 feet; slipline the principal spillway conduit; reconstruct the plunge pool at the principal spillway conduit outlet; restore connectivity from the principal spillway conduit outlet to the natural drainage channel; reconstruct the retaining dike and raise 10.6 feet; and install a new stabilized access road to the dam.

S-9.0 Resource Information

Table S-1 lists the relevant resource information for Site 1 Dam:

Table S - 1. Existing Resource Information

Resource	Description
Latitude / Longitude	36.010071 ° N, 105.917548 ° W
Hydrologic Unit Number	13020101 (Upper Rio Grande)
Climate	July average high/low: 90°F / 56°F January average high/low: 46°F / 15°F
Topography	Mountainous / Desert
Annual Precipitation / Snowfall	9.9 inches / 11.7 inches
Santa Cruz River Watershed Area	183.1 square miles
Drainage Area	8.34 square miles
Sediment Storage Remaining	13.2 acre-feet (ac-ft)
Flood Storage	325.8 ac-ft
Recreation Storage	0 ac-ft
Irrigation Storage	0 ac-ft
Total Basin Capacity (at auxiliary spillway crest)	339 ac-ft
Land Uses	BLM – grazing and limited recreation Public lands - no designated use
Land Ownership	Public (BLM)
Population (Rio Arriba County) ¹	Population 39,159
Demographics (Rio Arriba County) ^{1,3}	White: 77.4% Black/African American: 0.8% American Indian and Alaska Native: 19% Asian: 0.6% Native Hawaiian or Pacific Islander: 0.2% Two or More Races: 1.9%
Farms Present (Rio Arriba County) ²	1,892
Land in Farms (Rio Arriba County) ²	1,432,897 acres
Average Farm Size (Rio Arriba County) ²	757 acres

¹ Based on 2017 U.S. Census; 2017 Estimates

² Based on 2012 NRCS Census of Agriculture

³ In Rio Arriba County approximately 71.3% of the total population from any race were reported to be Hispanic or Latino

S-10.0 Alternative Plans Considered

The No [Federal] Action, Decommissioning, Structural Rehabilitation, and National Economic Development (NED) Alternatives were evaluated to extend the life of the structure. Alternatives evaluated in detail included the No [Federal] Action Alternative and the Structural Rehabilitation Alternative. The

NED Alternative was determined to be the Structural Rehabilitation Alternative. Several other alternatives were considered during the planning process, but were eliminated from detailed study due to environmental impacts, if they were infeasible, had exorbitant costs, did not meet the purpose and need of the action, or other critical factors. The Dam Decommissioning Alternative was determined to be unreasonable due to environmental impacts, costs, and logistics and was eliminated from detailed study. Seven other Rehabilitation Alternatives were considered during the planning process but were determined to be unreasonable and eliminated from further study, along with the Dam Decommissioning Alternative. Descriptions, installation costs, and operation and maintenance (O&M) costs for the alternatives studied in detail are included below. O&M costs include materials, equipment, services, and facilities needed to operate the project and make repairs and replacements necessary to maintain structural measures in sound operating condition during the evaluated life of the project (72 years). The installation costs for the alternatives are conceptual level cost estimates only with an estimated range of accuracy at $\pm 30\%$, and are intended to reflect the maximum level of cost that could be associated with alternative measures. Installation costs include costs for installing the works of improvement to be incurred after the project is authorized for installation. Installation costs are to include, as applicable, construction, engineering, real property rights, natural resource rights, permitting, "replacement in-kind" relocation payments, and project administration costs (NRCS 2015).

No [Federal] Action Alternative – In discussions with the Sponsor, their most likely course of action would be to bring the dam up to current state design standards. To bring the dam up to current state design standards, the Sponsor would widen the dam crest from 18 feet to 21.4 feet and level grade it to a constant elevation of 6,354.4 feet with a cross slope. The existing retaining dike would be reconstructed and raised to match the dam crest elevation and embankment slopes. The dam embankment slopes would be maintained. A concrete reinforced auxiliary spillway would be constructed at a crest elevation of 6,349.6 feet and riprap placed at the toe of the spillway. The existing principal spillway risers would be demolished and replaced with one riser and the principal spillway conduit sliplined. The plunge pool at the principal spillway conduit outlet would be reconstructed and connected to the existing downstream natural drainage channel. The existing access road would be decommissioned and restored to native vegetative conditions, and a new access road would be constructed at a grade not to exceed 10% along a new alignment to the top of the dam crest. This alternative would not extend the sediment life of the basin and the Sponsor would need to perform sediment excavation activities to extend the structure life and ensure proper operation of the dam. On average approximately 7.51 acre-feet of sediment deposits in the basin annually and the Sponsor would need to excavate 520 acre-feet of sediment from the basin over the course of the 71-year evaluation period (assuming the basin has 13 acre-feet of remaining sediment capacity). The estimated installation cost for this alternative is \$12,922,300. O&M for sediment excavation alone is estimated at \$253,300 annually and standard O&M activities at \$4,000 annually, totaling approximately \$257,300 annually or \$18,268,300 for the evaluated life of the project.

Structural Rehabilitation Alternative – This alternative consists of raising the structure components to increase capacity in the basin, and allows for 71-years of sediment life. The dam crest would be raised 10.6 feet to elevation 6,365.0 feet, widened from 18 feet to 24 feet, and level graded with a cross slope. The existing retaining dike would be reconstructed and raised 10.6 feet to match the dam crest elevation and embankment slopes. The dam embankment and retaining dike would be covered with a gravel blanket (1-foot-thick) for erosion protection and the existing embankment slopes would be maintained. A concrete reinforced auxiliary spillway would be constructed and raised 11.1 feet to a crest elevation of 6,360.7 feet, and riprap placed at the toe of the spillway. The existing principal spillway risers would be demolished and replaced with one riser with a raised crest elevation at 6,354.4 feet. The principal spillway conduit would be sliplined. The plunge pool at the principal spillway conduit outlet would be reconstructed and connected to the existing downstream natural drainage channel. The existing access road would be decommissioned and restored to native vegetative conditions, and a new access road would be constructed at a grade not to

exceed 10% along a new alignment to the top of the dam crest. The estimated installation cost for this alternative is \$19,022,900. O&M is estimated at \$4,000 annually or \$284,000 for the evaluated life of the project.

The National Economic Development (NED) Alternative and the Preferred Alternative are the Structural Rehabilitation Alternative.

S-11.0 Project Costs and Funding Source

The breakdown of the estimated installation cost for the Structural Rehabilitation Alternative is summarized in Table S-2. NRCS design engineering, construction management, and NRCS incurred administration costs are not cost-shared by the Sponsor. Any costs incurred for administration or real property rights by the Sponsor would not be cost-shared by NRCS. Real property rights include Sponsor costs to obtain easements to incorporate additional BLM and private lands for the raised dam crest elevation and new access road. Natural resource rights, relocation payments, and road and utility modifications have not been included in the table because there are no anticipated costs associated with these components based on the project alternative. O&M costs are estimated at \$4,000 annually and would be the responsibility of the Sponsor.

Table S- 2. Estimated Project Costs

Item	PL 83-566 Funds		Other Funds		Total	
	Amount	Percentage	Amount	Percentage	Amount	Percentage
Construction	\$10,071,100	65%	\$5,405,000	35%	\$15,473,000	81.3%
Engineering	\$3,481,400	100%	\$0	0%	\$3,481,400	18.3%
Permits	\$0	0%	\$20,000	100%	\$20,000	0.1%
Project Administration	\$27,500	63%	\$16,500	37%	\$44,000	0.2%
Real Property Rights	\$0	0%	\$4,500	100%	\$4,500	0.1%
Total	\$13,580,000	71%	\$5,442,900	29%	\$19,022,900	100%

S-12.0 Project Benefits

Project benefits are derived from assuring the continued performance of the Site 1 Dam by meeting current safety and performance standards. Benefits are based on continuing flood protection (floodwater, sediment damage reduction benefits) to the downstream area and avoiding costs associated with implementing the No [Federal] Action Alternative. Total average annual flood damage reduction benefits are estimated to be \$524, which include benefits to cropland and pastureland (\$29), roads and bridges (\$23), and urban properties (\$473). By rehabilitating Site 1 Dam, the Sponsor would not incur costs of implementing the No [Federal] Action Alternative, equating to an annual avoidance and savings (benefit) of \$673,300. Project benefits, costs, and the benefit-cost ratio are provided in Table S-3 below.

There are an estimated 1,038 people, 326 homes and businesses, numerous agricultural properties, and multiple roads downstream of the Site 1 Dam that would be at risk during a breach.

S-13.0 Net Economic Benefits

The estimated annual project economic benefits for the preferred alternative (Structural Rehabilitation Alternative) are summarized in Table S-3. This Structural Rehabilitation Alternative is also the NED Alternative for the project since it has the greatest net economic benefit.

Table S-3. Estimated Annual Net Economic Benefits

Item	Total Annual Benefits	Total Annual Costs	Benefit Cost Ratio	Net Annual Economic Benefit
Santa Cruz Site 1 Dam Rehabilitation	\$673,824	\$616,400	\$673,524 : \$616,400 (1.1)	57,424

S-14.0 Period of Analysis

The standard period of analysis for rehabilitation under PL 83-566 is a minimum of 50 years and a maximum of 100 years. Santa Cruz Site 1 was analyzed for a period of 72 years (life of the structure is 71 years and installation period is 1 year).

S-13.0 Project Life

The life of the Site 1 Dam would be extended to 71 years once construction of the Structural Rehabilitation Alternative is complete.

S-14.0 Environmental Impacts

Table S-4 lists the resources of concern and impacts associated with the Structural Rehabilitation Alternative. Resources that would not be impacted are not listed in this table.

Table S-4. Summary of Resource Concerns and Impacts

Resource of Concern	Summary of Concern	Effects Summary for Structural Rehabilitation Alternative
Soils		
Upland Erosion and Sedimentation	Disturbance to soils from proposed project actions and sediment accumulation in the basin	Proper Best Management Practices (BMPs) will be installed during and after construction to prevent and control soil erosion. Aerated sediment would continue to accumulate in the floodwater-retarding pool, but the basin would have the capacity to accommodate 71 years of sediment accumulation.
Water		
Surface Water Quality	Construction activities to occur in and near drainages	Surface water quality would not change after rehabilitation of the structure. Construction activities may temporarily impact surface water quality, but BMPs would be in place during construction and impacts would be minimal.
Clean Water Act (CWA) - Waters of the U.S.	Waters of the U.S. within the construction footprint	Approximately 68 feet of the principal spillway conduit outlet channel would be armored, 60 feet of the Acequia de la Cañada Ancha (the acequia) would be piped, and 375 feet of the Cañada de Ojito would be modified through ground disturbance and/or armoring.
Wetlands	Wetlands located within the construction footprint	Removal of 0.05-acres of scrub-shrub wetland would occur to reconstruct the plunge pool. Impacts would be minor, and

Resource of Concern	Summary of Concern	Effects Summary for Structural Rehabilitation Alternative
		compensatory mitigation is not anticipated since impacts are less than the 0.1-acre threshold.
Floodplain Management	The existing dam attenuates flooding in the downstream community	Moderate beneficial impact that would increase flood protection to downstream communities and infrastructure and reduce the frequency of flooding from the structure.
Sole Source Aquifers	Project is within Española Basin Aquifer System (sole source aquifer)	No impacts anticipated.
Air		
Air Quality	Emissions from construction activities	Construction activities are not expected to violate air quality standards based on the implementation of BMPs and the short duration of construction.
Plants		
Special Status Species (federal, state listed)	Potential habitat for BLM-listed plant species within the project area	No impacts to U.S. Fish and Wildlife Service (USFWS)- or state-listed plant species. Potential impact to suitable habitat for BLM sensitive species Santa Fe cholla (<i>Cylindropuntia viridiflora</i>) and the gramma grass cactus (<i>Sclerocactus papyracanthus</i>).
Noxious Weeds Invasive Plant Species	Increased potential for establishment of invasive plants	This alternative would put the project area at risk for future invasion of noxious weeds. Construction BMPs would be implemented to minimize the short-term impacts associated with construction activities and a Post-Construction Rehabilitation Plan (PCSRP) would be developed.
Riparian Areas	Riparian corridor located within construction footprint	Minor impacts from removal of 0.24 acres of riparian vegetation for the new access road and reconstruction of the plunge pool.
Animals		
Wildlife and Wildlife Habitat	Disturbance to wildlife and wildlife habitat from construction activities	Approximately 3.8 acres of permanent impact from adding concrete to the auxiliary spillway and constructing the new access road. Approximately 28.5 acres of temporary impacts. Temporary disturbed areas would be restored to preconstruction conditions upon construction completion and minor impacts are anticipated.
Fish and Fish Habitat	Potential limited fish habitat along acequia	Modification consisting of piping 60 feet of the acequia and associated temporary construction disturbance would impact potential fish habitat in the acequia. If construction activities occur when the acequia is flowing, fish salvage will be performed in any areas dewatered to facilitate construction. The acequia will be piped around the construction area to maintain flows downstream and avoid any temporary impacts to fish or fish habitat downstream. These impacts would be minor since habitat is low quality, limited, and BMPs would be in place.
Special Status Species (federal, state listed)	Potential habitat for BLM sensitive species and state-listed animal species within the project area	No impacts to USFWS-listed species except for Mexican spotted owl and southwest willow flycatcher that have a may affect, but not likely to adversely affect determination (Appendix A). USFWS concurred with this determination on November 9, 2018 (Appendix A). Minor impacts to BLM sensitive species Gunnison's prairie dog and pinyon jay, and BLM sensitive species/state-listed bald eagle (if present) and associated habitat. Based on the duration of construction, avoidance/minimization measures, restoration

Resource of Concern	Summary of Concern	Effects Summary for Structural Rehabilitation Alternative
		of disturbed areas, and abundant suitable habitat in the surrounding area, the impacts to these species (if present) and associated habitat would be temporary and minimal.
Migratory Birds / Bald and Golden Eagles	Potential for migratory birds to occur in project area	Preconstruction surveys will be performed, and spatial buffers will be established as necessary in coordination with USFWS and NRCS. Impacts to migratory birds and associated habitat would be temporary and minimal based on the duration of construction, restoration of disturbed areas, abundant suitable habitat in the surrounding area, and avoidance/minimization measures in place.
Human		
Socioeconomics	Implications to community downstream	Minor temporary beneficial impact from additional employment requirements for project construction. Decreased risk of dam failure and associated threat to life and property.
Historic Properties / Cultural Resources	Archaeological sites and historic landscape features are known to exist in the project area	Construction activities would avoid archaeological sites determined to be eligible for the NRHP. Unavoidable impacts are anticipated to a NRHP eligible historic landscape feature (Acequia de la Cañada Ancha) from piping two section for an access crossing and to bypass principal spillway flows. Impacts are anticipated to be negligible because short segments would be piped, modifications would eliminate existing adverse disturbance to the acequia and acequia operations, and historic aesthetic design features would be incorporated. New Mexico Historic Preservation Division concurred with a no adverse effect determination on April 29, 2019. (Appendix A)
Hazardous Materials	During construction, equipment and associated fuels would be working/stored onsite	All federal, state, and local laws and regulations will be followed pertaining to pollution and contamination of the environment to prevent pollution of surface water, groundwater, soil, and air with any hazardous materials. Impacts would be negligible based on adherence to applicable laws and regulations.
Public Health and Safety	Inhabitants located downstream of a dam that does not meet current engineering safety standards	Reduces the risk of dam failure and associated loss of life.
Recreation	Project area is on public lands where general recreation activities occur	Project area would be temporarily closed for construction and the area would be reopened after construction completion. Minimal temporary impacts based on scope and duration of construction and abundant opportunity for the same recreation activities directly adjacent to the project area.
Visual Resources and Scenic Beauty	Construction disturbance and equipment working in project area during construction	Temporary impacts would occur during construction, but disturbed areas would be restored according to the visual management objectives and associated reclamation standards outlined in the BLM Resource Management Plan (BLM 2012). Impacts would be minimal based on duration of construction and restoration of disturbed areas.
Transportation Infrastructure	Highways and improved community roads located downstream of a dam that	Minor beneficial impact that would decrease the risk of dam failure and associated damage to roads and highways located within the breach inundation area. Indirect minor

Resource of Concern	Summary of Concern	Effects Summary for Structural Rehabilitation Alternative
	does not meet current engineering safety standards	benefit from reduced flooding for 24-hour/ 100-year and greater events, reducing associated damage to downstream transportation infrastructure.
Noise	Several residences located with a ½ mile of the project area	Impacts would be temporary and minimal based on the duration of construction and implementation of BMPs.

S-17.0 Major Conclusions

The Structural Rehabilitation Alternative is the most practical and environmentally-friendly alternative and also has the greatest net economic benefits of all alternatives analyzed. This alternative is both the Preferred Alternative and the NED Alternative.

S-18.0 Areas of Controversy

There are no known areas of controversy.

S-19.0 Issues to be Resolved

The following are issues to be resolved for the Santa Cruz Site 1 Rehabilitation:

- Agency Coordination – BLM Land Rights/Right-of-Way permit needed.
- Property Access – construction access would be required on/through privately owned properties downstream of the dam.
- A new Operation and Maintenance (O&M) Agreement would be developed with the SFPSWCD for the 71-year project life of the structure. The new O&M Agreement would be signed before the Project Agreement is signed.
- The Sponsor would be responsible for updating the Emergency Action Plan (EAP) prior to construction and would review and update annually with local emergency response officials.

S-20.0 Evidence of Unusual Congressional or Local Interest

None.

S-21.0 In Compliance

Is this report in compliance with executive orders, public laws, and other statutes governing the formulation of water resource projects? X YES NO

SECTION 1

CHANGES REQUIRING PREPARATION OF A SUPPLEMENT

1.1 Introduction

Santa Cruz River Watershed - Site 1 Dam (Site 1 Dam) is located within the Santa Cruz River Watershed upstream of Chimayó, in Rio Arriba County, New Mexico (Appendix B-Map 1). The United States Department of Agriculture Natural Resources Conservation Service (NRCS) as the lead federal agency, along with the Santa Fe-Pojoaque Soil and Water Conservation District (SFPSWCD) as the Sponsor and dam operator, are proposing to rehabilitate the Site 1 Dam. The dam does not meet current NRCS and New Mexico Office of the State Engineer, Dam Safety Bureau (NM Dam Safety) regulations (NM Dam Safety 2010) and engineering safety standards for a high hazard dam (NRCS 2005) as described in Section 2.3.

This Supplemental Watershed Plan No. 4 and Environmental Assessment (Plan-EA) was prepared by the NRCS to comply with the requirements of the National Environmental Policy Act (NEPA) of 1969 and its implementing regulations, which are set forth in the Council on Environmental Quality regulations 40 CFR Parts 1500-1508; the Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies (March 10, 1983) established pursuant to the Water Resources Planning Act of 1965 (PL 89-80) as amended by Executive Order 12322 (September 17, 1981); and NRCS policy and guidelines (NRCS 2010 and 2011). The format of this document follows the plan format outline that must be followed for all Watershed Project Plans as outlined in the NRCS National Watershed Program Manual (NWPM) (NRCS 2015) Parts 500 through 506, and as guided by the NRCS National Watershed Program Handbook (NRCS 2014), Parts 600 through 606. The Plan-EA assists NRCS in determining if the selected alternative would have a significant impact on the quality of the environment and if preparation of an Environmental Impact Statement is required.

1.1.1 Changes Requiring the Preparation of a Supplemental Watershed Plan

The Site 1 Dam was designed and built in 1962 to reduce flood damages to the downstream community. It was designed to attenuate runoff from rainfall events, and slowly release the stored water through the principal spillway discharge pipe, up to a limited storm event. The structure is not meeting current NM Dam Safety and NRCS engineering safety standards for a high hazard dam. Additionally, sediment has infilled the basin and the structure is within 2 years of the end of its sediment design life. Rehabilitation measures would be required to bring the structure into compliance with current NRCS design criteria and NM Dam Safety rules and regulations, and to extend the structure life.

This Plan-EA addresses any identified NRCS and NM Dam Safety deficiencies by evaluating alternatives, including a structural rehabilitation of the existing dam structure to meet current engineering safety criteria. The changes required, as outlined in this Plan-EA, will serve to provide benefits for continued flood prevention while meeting current applicable local, state, and federal regulations.

SECTION 2

PURPOSE AND NEED FOR ACTION

2.1 Purpose and Need Statement

The purpose of the action is to provide continued flood protection (flood damage reduction) preventing runoff, erosion, and sediment damages in the currently protected area downstream of the dam up to the 100-year event, and to meet current New Mexico Dam Safety Bureau and NRCS engineering safety standards. There is a need for continued protection to land, community structures, and community infrastructure from flooding related damages, and to decrease the risk of dam failure for the people and property within the breach inundation area. Approximately 1,038 people, 326 structures, agricultural lands, and 15 roads/highways are located within the breach inundation area.

2.1.1 Goals and Objectives for Purpose and Need

The existing capacity of the dam can partially attenuate flood flows for a 100-year event, but the auxiliary spillway begins to activate at this event (assuming full aerated sediment storage). The outflow during the 100-year event is reduced from a peak of approximately 2,823 cubic feet per second (cfs) for a no dam condition down to a peak of approximately 270 cfs for the existing dam condition. The dam provides attenuation for the 500-year event as well, but to a lesser extent. The outflow during the 500-year event with full aerated sediment storage is reduced from approximately 4,383 cfs for a no dam condition to 1,499 cfs for the current dam condition. The 100-year and 500-year 24-hour storms were routed through the dam under current conditions and the resulting flood extents can be seen in Appendix C – Maps 7 and 8. There are no critical facilities classified as schools, hospitals, and nursing homes within the 500-year event flood extents. Critical facilities producing or storing hazardous, toxic, or water-reactive materials, specifically gas stations, may be located within the 500-year flood extents, but additional modeling, as noted above, would need to be performed to make that determination.

In addition to flood attenuation, the existing structure also provides aerated sediment retention. On average approximately 7.51 acre-feet of aerated sediment is captured in the basin per year. If the dam were not in place this aerated sediment would continue downstream and deposit within the areas flooded for each storm event. The land, residential structures, farm structures, and city infrastructure (roads, utilities, etc.) in flooded areas would be exposed to damage from aerated sediment deposition in addition to other flood damages if the dam were not in place. The dam is at the end of its aerated sediment life and there is only enough sediment storage capacity remaining to accommodate 2 years or less of deposition. Measures are needed for continued protection to downstream structures, infrastructure, and lands from sediment damage.

The structure has been classified by NRCS and NM Dam Safety as high hazard. There is an estimated population at risk of 1,038 people, with a loss of life of approximately 886 people if a dam failure were to occur. The breach inundation area downstream of the dam occupies approximately 3.2 square-miles (sq mi) that extends through numerous roads, residential and commercial properties, and other infrastructure (Appendix C-Map 6).

2.2 Watershed Problems

2.2.1 Existing Dam Conditions

The Site 1 Dam project area is identified in the Existing Conditions map (Appendix B-Map 3). This area encompasses the construction limits that would be utilized during rehabilitation of the dam and lands in the basin within the planned top of dam embankment elevation. The dam consists of the following components, which are described in detail in Sections 1.5.1 through 1.5.6 below. Note that all elevations provided in this document are North American Vertical Datum 1988 (NAVD88), unless otherwise noted. Elevations for structure components are based on 2015, 1-meter resolution LiDAR data, and 2010 survey data (URS Corp. 2010).

- Basin
- Dam Embankment
- Principal Spillway
- Auxiliary Spillway
- Retaining Dike
- Access Road

2.2.1.1 Basin

The basin is located upstream of the dam embankment and has a volume of approximately 548.7 ac-ft at the dam crest elevation of 6,354.4 feet. The upstream drainage area feeding into the basin is approximately 8.34 square-miles. The basin is normally empty except during seasonal high runoff and extreme weather events. Figure 1-1 below depicts the existing basin conditions.



Figure 1-1. Basin
(Standing on the dam embankment looking east across the basin)

2.2.1.2 Dam Embankment

The dam embankment is constructed of earthfill and sits at an approximate elevation of 6,354.4 feet (Figure 1-2). It has a structural height of approximately 67 feet, a crest width of approximately 18 feet, and is about 1,082 feet long. The embankment has 3H:1V side slopes upstream and 2H:1V side slopes downstream. The dam embankment has stability berms that have a 4H:1V side slope on the upstream side and a 2.5H:1V side slope on the downstream side. Rill erosion has been observed near the groins on the downstream embankment face (Figure 1-3).

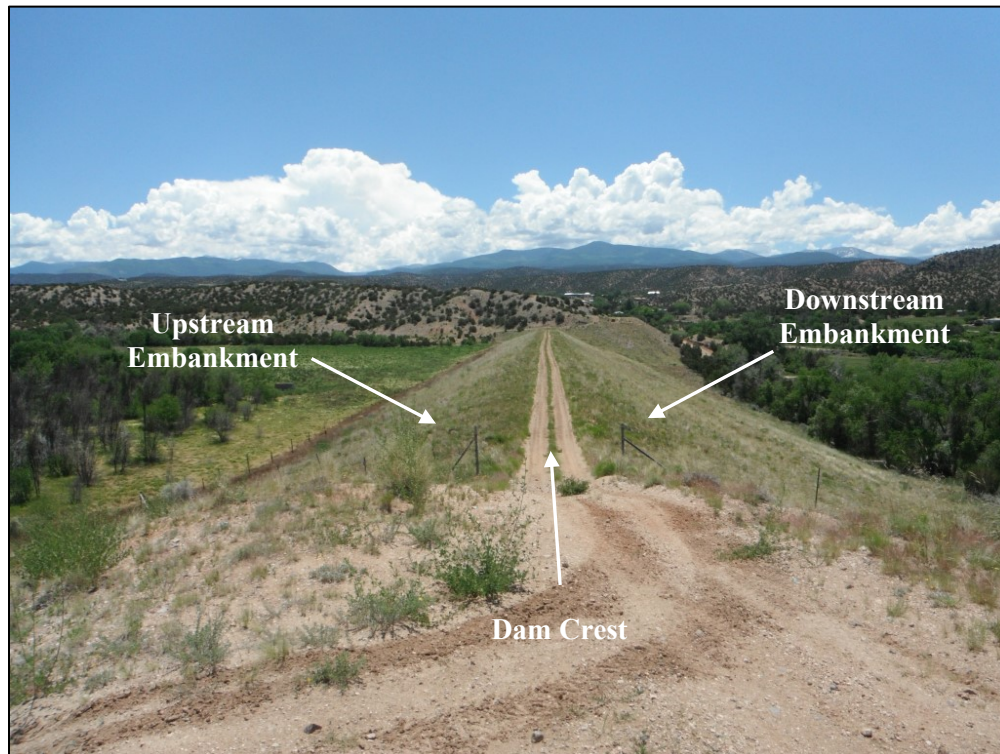


Figure 1-2. Dam Embankment
(Standing on the dam embankment looking southeast across the dam crest)



Figure 1-3. Embankment Groin Rill Erosion
(Looking at rill erosion on one of the downstream embankment groins)

2.2.1.3 Principal Spillway

The principal spillway consists of two connected concrete risers with one conduit through the dam embankment. The risers are in series and the upper riser (Riser 1) is a 2.5-foot by 2.5-foot structure that is approximately 11 feet tall (invert to crest) with a crest elevation of 6,316.8 feet. Riser 1 is connected to Riser 2 with a 24-inch-diameter corrugated metal pipe (CMP). Riser 2 is a 2.5-foot by 7.5-foot structure that is approximately 34 feet tall with a crest elevation of 6,339.5 feet (Figure 1-4). A 30-inch-diameter reinforced concrete conduit extends approximately 350 feet from Riser 2 through the dam embankment, and discharges on the downstream side (Figure 1-5). A plunge pool exists at the discharge point, and a channel extends approximately 85 feet from the plunge pool to the Acequia de la Cañada Ancha (the acequia) (defined also as a water irrigation ditch) downstream (Figure 1-6). When the dam was constructed, pipes were installed to bypass flows from the plunge pool over the acequia and into the natural drainage channel (arroyo) located downstream of the acequia. These bypass pipes have since been removed by acequia group members and flows from the plunge pool now enter directly into the acequia.

In 2015 sediment in the basin was shown to be at an average elevation of 6,334 feet. At this sediment elevation Riser 1 is buried under approximately 17 feet of sediment and was not operable. The aerated sediment elevation of the structure is approximately 6,336.6 feet, and sediment was only about 2.6 feet lower than the sediment pool elevation in 2015. In 2017 a pit was excavated from the area around Riser 1 to locate and expose the riser crest and around Riser 2 to expose additional ports. Approximately 75% of the excavated area was infilled with sediment during a rain event in August 2018.



Figure 1-4. Principal Spillway Riser 2
(Looking east at principal spillway Riser 2)



Figure 1-5. Principal Spillway Conduit Outlet
(View of principal spillway conduit discharge point and plunge pool)



Figure 1-6. Principal Spillway Conduit Outlet Channel
(Looking at the channel from the plunge pool to the Acequia de la Cañada Ancha)

2.2.1.4 Auxiliary Spillway

The existing auxiliary spillway is an earthen spillway that is approximately 600 feet wide with a crest elevation at approximately 6,349.6 feet (Figure 1-7). It extends down approximately 150+ feet before intersecting with the Cañada de Ojito drainage. The purpose of the auxiliary spillway is to prevent dam embankment overtopping and relieve additional forces on the dam embankment during high water and flood conditions. Based on a hydrology analysis conducted for the structure (Attachment 2 of Appendix D), the auxiliary spillway can currently discharge approximately 10,250 cfs without overtopping the dam embankment. Rill erosion and erosion from the Cañada de Ojito drainage has been observed along the auxiliary spillway exit slope (Figure 1-8).



Figure 1-7. Auxiliary Spillway
(Looking northeast across the auxiliary spillway)



Figure 1-8. Auxiliary Spillway Rill Erosion
(Standing in the Cañada de Ojito drainage looking southeast at auxiliary spillway exit slope erosion)

2.2.1.5 Retaining Dike

A retaining dike extends approximately 550 feet north from the north end of the auxiliary spillway (Figure 1-9). The retaining dike acts like a saddle dam, which is a dam constructed in a low spot or “saddle” to contain a reservoir. This dike is at an approximate elevation of 6,354.0 feet and helps confine flood flows in the basin. The dike has 3H:1V side slopes upstream and 2H:1V side slopes downstream. Rill erosion has been observed on the downstream and upstream dike embankment faces.



Figure 1-9. Retaining Dike
(Looking north across the retaining dike crest)

2.2.1.6 Access Road

Access to the basin is obtained from a dirt access road extending approximately 2,300 feet generally northeast from Road 100 to the top of the dam. A portion of the access road extending from the base of the dam to the top of the dam is at a grade that is not traversable by most vehicles. Additionally, the condition of the road in that portion combined with the grade makes the road impassable to most 4-wheel drive vehicles (Figure 1-10). The access road crosses the acequia and is not equipped with a stabilized crossing point. The access road crossing through the acequia is also not traversable by most 4-wheel drive vehicles (Figure 1-11).



Figure 1-10. Access Road
(Looking south (downhill) at the access road)



Figure 1-11. Access Road at Acequia
(Looking north (uphill) at the access road crossing at the acequia)

2.2.2 Existing Dam Conditions Deficiencies

Based on a review of the existing conditions (Appendix D, Section D.11), the dam and other appurtenances are not meeting the following current NRCS and NM Dam Safety regulations and engineering safety standards for a high hazard dam. A detailed analysis of NRCS and NM Dam Safety regulation and engineering safety standards was completed and documented in a Design Criteria Technical Memorandum included as Attachment 7 to Appendix D. The dam was found to have the following high-hazard-dam deficiencies.

1. **Embankment - Height (NRCS Criteria):** TR-60 (NRCS 2005) requires that the height of the embankment be sufficient to prevent overtopping during passage of either the freeboard hydrograph (FBH¹) or spillway design hydrograph (SDH²), whichever is higher. The FBH overtops the dam by 4.8 feet.
2. **Embankment – Surface Erosion (NRCS and New Mexico Criteria):** TR-60 and New Mexico Dam Safety require that sufficient surface erosion protection be included on the upstream and downstream faces. Embankment surfaces are not currently protected from erosion and surface erosion and gullies have been observed on the upstream and downstream embankment faces.
3. **Embankment - Crest Width (New Mexico Criteria):** New Mexico Dam Safety requires the top width to be equal to the structural height of the dam divided by 5, plus an additional 8 feet (21.4 feet for Santa Cruz Site 1). The existing embankment has a top width of 18 feet.
4. **Principal Spillway – Trash Racks (NRCS and New Mexico Criteria):** TR-60 and New Mexico Administrative Code 19.25.12.8g require that all intake structures be provided with trash racks or grates to prevent clogging. The risers at Santa Cruz Site 1 do not have trash racks or grates.
5. **Principal Spillway - Structural Design of Risers (NRCS Criteria):** TR-60 requires that all risers be structurally designed to withstand all water, earth, ice, and earthquake loads to which they may be subjected. The existing riser has not been seismically evaluated. This has not been evaluated and should be part of final design.
6. **Principal Spillway – Antivortex Devices (NRCS Criteria):** TR-60 requires that all conduits designed for pressure flow must have antivortex devices. The principal spillway is not equipped with an antivortex device.
7. **Principal Spillway – Conduit Material (New Mexico Criteria):** New Mexico Administrative Code 19.25.12.7b states that metal conduits are not acceptable for dams classified as high hazard potential or dams classified as significant hazard potential with permanent water storage except as interior forms for cast-in-place concrete conduits. A corrugated metal conduit extends between the upper riser and lower riser structure.
8. **Principal Spillway – Outlet Protection (New Mexico Criteria):** The design of the outlet works terminal structure shall address energy dissipation to prevent erosion. Energy dissipation and erosion protection measures do not appear to currently exist at the principal spillway conduit outlet.
9. **Principal Spillway – Conduit (NRCS and New Mexico Criteria):** The conduit through the dam embankment is required to be watertight for both NRCS and New Mexico design standards. Minor

¹ FBH stands for Freeboard Hydrograph and is developed from a probable maximum precipitation event.

² SDH stands for Spillway Design Hydrograph and is used to evaluate the stability of the auxiliary spillway.

cracking and associated leaking was observed along the principal spillway conduit during a video pipe inspection, indicating that the conduit is not currently watertight.

10. **Auxiliary Spillway – Design Storms (NRCS Criteria):** TR-60 requires that auxiliary spillways be proportioned so they will pass the SDH and FBH at safe velocities and at or below the dam crest elevation. The existing auxiliary spillway would experience unsafe velocities, leading to a breach while routing the SDH and FBH. Additionally, the FBH overtops the dam.
11. **Auxiliary Spillway – Stability (NRCS and New Mexico Criteria):** TR-60 requires that auxiliary spillways maintain stability during passage of design flows without blockage or breaching. New Mexico Administrative Code 19.25.12.5 states that damage to a spillway during the design flood event is acceptable; however, a breach of the spillway is unacceptable. The existing auxiliary spillway breaches during passage of the design flows (SDH and FBH).
12. **Auxiliary Spillway – Capacity (New Mexico Criteria):** New Mexico Administrative Code 19.25.12.5 states that the spillway must have adequate capacity to pass the spillway design flood without failure of the dam. The existing spillway does not have capacity to pass the spillway design flood without overtopping (failing) the dam.
13. **Retaining Dike (New Mexico Criteria):** The existing retaining dike appears to contain granular materials susceptible to seepage and not consistent with standard embankment materials. New Mexico Dam Safety requires that this retaining dike meet state design standards for a dam embankment because it would be impounding water.

SECTION 3

SCOPE OF THE PLAN-EA

3.1 Scoping

A scoping process was performed to identify relevant resources or environmental concerns to be analyzed in detail, and to determine which could be eliminated from detailed study. Resource concerns were identified for the project based on required scoping concerns outlined in the National Watershed Program Manual Section 501.24 B (NRCS 2015), and from any additional concerns identified by the public, the sponsoring local organization (SFPSWCD), or agencies during the scoping meeting and/or other planning or public meetings.

A scoping meeting was held on March 18, 2015 at La Arboleda Community Center in Chimayó. The meeting provided opportunity for the public, the SFPSWCD, and interested government or private agencies to express any specific concerns and their relevance to the proposed action. Twelve comments were received during the scoping period (March 5 through April 5, 2015) for the project, and a Scoping Report was completed that provided a summary of the scoping process (Appendix E).

A summary of resource concerns and their relevancy to the proposed action is provided in Table 1-1 below. Resource items determined to not be relevant to the proposed action have been eliminated from detailed study. Resource items determined to be relevant to the proposed action have been included in detailed studies described in this report.

Table 1-1. Summary of Scoping

Item/Concern	Relevant to the proposed action?		Rationale
	Yes	No	
Soils			
Upland Erosion and Sedimentation	X		Eroding sediment in the watershed is decreasing the sediment capacity of the basin.
Prime and Unique Farmland		X	Prime farmland and farmland of statewide importance are not located in the project area based on a review of web soil survey data (NRCS 2017).
Water			
Surface Water Quality	X		Minor temporary impacts. BMPs would be in place during construction. Note that surface water is only present within the project area during precipitation events.
Groundwater Quantity		X	There are no groundwater recharge areas located in or near the project area and there would be no change to groundwater recharge from existing conditions.
Clean Water Act (CWA) - Waters of the U.S	X		Project actions proposed in potential waters of the U.S.
Regional Water Mgt. Plans and Coastal Zone Management Areas		X	None present in or near project area.
Floodplain Management	X		The structure was constructed for flood protection. The area below the dam is managed by local floodplain regulations.

Item/Concern	Relevant to the proposed action?		Rationale
	Yes	No	
Wetlands	X		Project actions proposed in wetlands.
Wild and Scenic Rivers		X	None in or near the project area according to National Wild and Scenic Rivers System (NWSRS) Map (NWSRS 2017).
Sole Source Aquifers	X		The project area is located within the Española Basin Aquifer System according to the U.S. Environmental Protection Agency (EPA) Region 6 Sole Source Aquifer Map (EPA 2008). Review by the EPA will be required.
Air			
Air Quality	X		Temporary increase in emissions during construction.
Clean Air Act		X	Permits not required.
Plants			
Special Status Species (federal, state listed)	X		There are no USFWS-listed plant species for Rio Arriba County. Potential habitat for BLM sensitive species and state-listed plant species within the project area.
Forest Resources		X	None present in or near the project area.
Noxious Weeds Invasive Plant Species	X		Construction disturbance increases the risk of noxious weeds and invasive species becoming established.
Natural Areas		X	The project is located within disturbed lands constructed with a dam and basin and natural areas are not present.
Riparian Areas	X		Project actions proposed in riparian areas.
Animals			
Essential Fish Habitat		X	None present in the project area.
Wildlife and Wildlife Habitat	X		Disturbance to wildlife and wildlife habitat is anticipated during construction activities.
Fish and Fish Habitat	X		Acequia de la Cañada Ancha (the acequia) provides limited fish habitat.
Coral Reefs		X	None present in the project area.
Special Status Species (federal, state listed)	X		Potential for BLM sensitive species and/or state-listed species/habitat to be present within the project area.
Invasive Species		X	No potential for introduction of invasive animal species.
Migratory Birds/Bald and Golden Eagles	X		Potential for Migratory Birds of Conservation Concern to be present in the project area.
Human			
Socioeconomics	X		Project measures would reduce the risk of dam failure and also provides agricultural, residential, and commercial flood damage reduction benefits.
Historic Properties/Cultural Resources	X		Historic properties near the project.
Hazardous Substances, Materials, and Waste	X		None present or within the vicinity of the project. Equipment and associated fuels would be working/stored onsite during construction.
Environmental Justice	X		The project would continue to provide flood prevention to the population located downstream including low income and minority groups. Project costs could impact minority and low income populations.
Public Health and Safety	X		Project measures would reduce the risk of dam failure for the public downstream.

Item/Concern	Relevant to the proposed action?		Rationale
	Yes	No	
Recreation	X		No designated recreation areas or trails are located in the project area. Project area is on public lands where general recreation activities occur.
Land Use		X	Land use designations or zoning designations are not anticipated to change for project actions.
Visual Resources and Scenic Beauty	X		Disturbed grounds and heavy equipment would be present during construction.
Parklands		X	No National or State parks located in or near project area according to National Parks Map (NPS 2015a) and New Mexico State Parks map (New Mexico Energy, Minerals and Natural Resources Department [EMNRD] 2014).
Transportation Infrastructure	X		Project measures would reduce the risk of dam failure for transportation infrastructure downstream.
Noise	X		Temporary construction related noise.
Ecological Critical Areas		X	The project area is an existing earthen dam with supporting functional appurtenances. There are no ecological critical areas located within the project footprint. The BLM Sombrello Area of Critical Environmental Concern (ACEC) is located 0.5 miles to the west of the project area (BLM 2012), but no impacts to the ACEC are anticipated.
National Parks, Monuments and Historical Sites		X	None located in or near project area based on Historic Sites Map (New Mexico Department of Cultural Affairs 2017), National Parks Map (NPS 2015a), National Natural Landmarks Map (NPS 2015b) and National Monuments Map (NPS 2015c).
Scientific Resources		X	None present in the project area.

3.2 Project Background

The Site 1 Dam was constructed within the Santa Cruz River Watershed under authority of NRCS's Watershed Protection and Flood Prevention Act (PL 83-566). The structure was built in 1962 to reduce flood damages to downstream communities, cropland, roads, and irrigation infrastructure. The authorized purpose for the structure is flood prevention, which includes flood damage reduction efforts to reduce runoff, erosion, and sediment. The structure was designed to attenuate flood flows and prohibit a significant amount of sediment from within the watershed from moving further downstream and causing damage to the downstream community. The 1959 Santa Cruz River Watershed Work Plan (U.S. Department of Agriculture Soil Conservation Service [SCS]) proposed the Site 1 Dam with a total planned storage capacity of 812 acre-feet (ac-ft) (418 ac-ft for sediment storage and 394 ac-ft for floodwater retarding storage). The dam was constructed in 1962 with this proposed storage capacity. Based on a review of the As-Built Drawings, 2010 survey data (URS Corp. 2010), and 2015 Light Detection and Ranging (LiDAR) data, the elevations of specific dam components and associated capacities for the structure appear to have been incorrect. Incorporating the new elevation data, the actual As-Built capacity of the structure appears to have been approximately 744 ac-ft (418.2 ac-ft for sediment storage and 325.8 for floodwater retarding storage).

In 2015 the structure had 339 ac-ft of capacity at the auxiliary spillway crest, with 13.2 ac-ft for sediment storage and 325.8 ac-ft of floodwater retarding capacity. The floodwater retarding pool of the basin (325.8 ac-ft) is not able to contain a 24-hour/100-year storm event without activation of the auxiliary spillway. The auxiliary spillway begins to activate at approximately the 24-hour/100-year event, which has a 1%

chance of occurring in any given year. Refer to Appendix D Sections D.2 and D.8 for a summary of the sedimentation and hydrologic analysis completed for the dam. A Sedimentation Analysis Technical Memorandum and a Hydrology and Inundation Analysis Technical Memorandum were completed for the structure and are included in Attachments 1 and 2 of Appendix D.

SECTION 4 AFFECTED ENVIRONMENT

The purpose of this section is to describe the resources that could be affected by the proposed alternatives. The purpose of describing the affected environment is to define the context in which impacts could occur. The environmental consequences to each of the resources discussed in this section are included in Section 4.0.

The project area for this Plan-EA is identified in the Existing Conditions map (Appendix B-Map 3). The dam is located within the Cañada Ancha Drainage, which encompasses approximately 8.34 square-miles, and is within the 183.1-square-mile Santa Cruz River Watershed. Table 2-1 summarizes the physical setting within the project area.

Table 2-1. Physical Setting Summary

Physical Setting Information		Information Source
Location		
The project area is located along Arroyo de la Cañada Ancha, just upstream of the Village of Chimayó, in Rio Arriba County, New Mexico.		N/A
Topography		
Project Area Elevation Range	Approximately 6,220 to 6,460 feet	United States Geologic Survey ([USGS] 2011)
General Topographic Gradient	Sloping west-southwest	
Geology¹		
Geologic Units	Qay (Younger alluvium) Qao (Older alluvium) Ttam (Middle lithesome A unit in Tesuque Formation) Ttbn1 (Fine No. 1 unit of the lithesome B of the Nambe Member) Ttbn2 (Coarse No. 1 unit of lithesome B of the Nambe Member) Ttan4 (Coarse No. 2 unit of lithesome A of the Nambe Member) Ttan5 (Fine No. 2 unit of lithesome A of the Nambe Member) Ttnr2 (No. 2 mixed provenance, reddish, fluvial unit of the Nambe Member)	New Mexico Bureau of Geology and Mineral Resources Geologic Map of the Chimayo Quadrangle (Koning 2003)

Physical Setting Information		Information Source
Geologic Unit Descriptions	<p>Qay (Holocene) – Sand, silty sand, gravelly sand, and sandy gravel that underlie modern valley floors and contain minor silt beds. Generally exceeds 2 meters (6.5 feet) in thickness.</p> <p>Qao (middle to upper Pleistocene) – Terrace deposits of sand and gravel that are light yellowish brown to very pale brown. Generally comprised of channel-fill deposits from tributary drainages. Deposit is loose with local calcium carbonate-cemented zones and is up to 9 meters (30 feet) thick.</p> <p>Ttam (lower to middle Miocene) – Pink to light brown sandstone with minor siltstone and claystone extra-channel and overbank deposits with coarse channel fills of pebbly sandstone and sandy pebble conglomerate. Deposit is 120-170 meters (394-558 feet) thick.</p> <p>Ttbn2 (lower Miocene) – Sandy conglomerate to pebbly sandstone channel fill that is strongly cemented in areas, with discontinuous cementation. Deposit is 1-2 meters (3.3-6.5 feet) thick.</p> <p>Ttbn1 (lower Miocene) – siltstone, mudstone and sandstone that is light brown. Deposited on the floodplain adjacent to and beneath Ttbn2. Deposit is 13-16 meters (43-52 feet) thick.</p> <p>Ttan4 (upper Oligocene to lower Miocene) – Extra-channel deposits consisting of pink to reddish yellow to brown silty arkosic arenite sandstone that is moderately to well consolidated and weakly cemented. Deposit is 10-70 meters (33-230 feet) thick.</p> <p>Ttan5 (lower Miocene) – Silty very fine to medium grained arkosic arenite sandstone and siltstone to mudstone that is light brown with some reddish yellow. Generally underlies Tbn1 and Tbn2 and interfingers with Ttan4. Deposit is 10-60 meters (33-197 feet) thick.</p> <p>Ttnr2 (Upper Oligocene to lower Miocene) – arenite pebbly sandstone to sandy pebble-conglomerate channel-fill deposits with cobbles locally comprising up to 60% of the gravel. Deposit is red to light reddish brown and 75-90 meters (246-295 feet) thick.</p>	New Mexico Bureau of Geology and Mineral Resources Geologic Map of the Chimayo Quadrangle (Koning 2003)
Soil Characteristics		
Soil Type	Fruitland sandy loam (39), Yarts sandy loam (149), Florita-Rock outcrop complex (241)	Web Soil Survey (NRCS 2017)
Description	See Section 2.1.	
Land Information		
Land Ownership	BLM and private	Rio Arriba County Maps
Land Use	BLM – grazing and limited recreation Private – not designated	Rio Arriba County Maps

4.1 Upland Erosion and Sedimentation

4.1.1 Erosion

Soils information presented in this section has been summarized from NRCS Web Soil Survey data (NRCS 2017). Soils found within the project area are depicted in Appendix C-Map 9 and listed in Table 2-2.

Note that the dam embankment, auxiliary spillway, and associated retaining dike consist of engineered fill and may not be consistent with the soil descriptions listed below or depicted in Appendix C-Map 9.

Table 2-2. Soil and Erosion Hazard Rating

Name	Landform	Ecological Site ¹	Slope (%)	Description	Erosion Hazard ²
Fruitland sandy loam (39)	Alluvial fans, stream terraces	Sandy	3-5	Fan alluvium and/or stream alluvium derived from sandstone	Slight
Yarts sandy loam (149)	Stream terraces	Pinus edulis/rhus trilobata/ bouteloua gracilis	1-4	Stream alluvium derived from sandstone and shale	Slight
Florita-Rock outcrop complex (241)	Hills	Gravelly hills	15-45	Eolian deposits over slope alluvium derived from sandstone	Moderate

¹ Ecological sites comprise a land classification system that describes ecological potential and ecosystem dynamics of land areas. They are used to stratify the landscape and organize ecological information for purposes of monitoring, assessment, and management (USDA 2014).

² Ratings indicated the hazard of soil loss from off-road and off-trail areas after disturbance activities that expose the soil surface.

Most of the project area is located on soils that have a “slight” erosion hazard from off-road and off-trail areas after disturbance to the soil surface has occurred. A small portion of the project area where minimal disturbance would occur is located on soils that have a “moderate” erosion hazard. According to NRCS Web Soil Survey erosion data (NRCS 2017), a “slight” erosion hazard rating indicates that erosion is unlikely under ordinary climatic conditions and a “moderate” rating indicates that some erosion is likely and that erosion control measures may be needed.

4.1.2 Sedimentation

The 1959 Watershed Work Plan noted that the high silt content of the soil, the rugged topography, and the sparse vegetative cover are conducive to severe erosion in the watershed. Grasses and other herbaceous plant species have difficulty establishing due to severe erosion and very little precipitation, leaving the soft soils exposed to wind and water surface erosion. The area also experiences heavy, intense rainfall events during the monsoon season that can cause extreme erosion and sediment deposition damage in one event.

The dam was designed with a sediment storage capacity of 418.2 ac-ft. A sediment deposition rate of approximately 7.51 ac-ft per year was determined as the actual and future rates for rehabilitation planning (see Appendix D, Section D.2 for the original planning rates). In 2015 the structure had approximately 13.2 ac-ft of sediment storage remaining. Considering 7.51 ac-ft of sediment deposition per year for the last 2 years, there would be no remaining sediment storage capacity left in the basin. A detailed description of the sedimentation analysis is presented in Appendix D, Section D.2, and a Sedimentation Analysis Technical Memorandum has been included as Attachment 1 to Appendix D. In 2017, the Sponsor removed sediment from the basin to expose the buried principal spillway Riser 1 and to expose additional ports on Riser 2. Approximately 75% of the excavated area was infilled with sediment during a rain event in August 2018.

4.2 Water Resources

4.2.1 Surface Water Quality

The project area is located within the Upper Rio Grande Hydrologic Unit (13020101). There are intermittent surface waters in or near the project area associated with the Arroyo de la Cañada Ancha. The basin and upstream drainages are dry except during precipitation events or from seasonal flash flood runoff. Arroyo de la Cañada Ancha drains into the Santa Cruz River approximately 1.5 miles downstream of the project area. Currently all water entering the basin either infiltrates into the basin soil or flows through the principal spillway to the plunge pool then into the acequia.

4.2.2 Waters of the U.S.

McMillen Jacobs Associates wetland specialists performed a waters of the U.S. and wetlands delineation for the project. Site visits and surveying were conducted in September 2016 and December 2017. The Arroyo de la Cañada Ancha, Acequia de la Cañada Ancha, Cañada de Ojito, and redirected Cañada de Ojito were determined to be potentially jurisdictional waters of the U.S. Permanent surface waters were not present within the downstream wash but the ordinary high water mark (OHWM) was delineated. Refer to Appendix C – Map 10 for location of the waters of the U.S. identified from the delineation. A copy of the Wetland Delineation Memorandum is provided in Appendix E. The wetlands, classification, and length of delineated waters of the U.S. are summarized in Table 2-3 below. The waters of the U.S. were classified according to the Cowardin classification system (Cowardin and others 1979). Note that it is the responsibility of the U.S. Army Corps of Engineers (USACE) to make the final determination of jurisdictional waters of the U.S.

Table 2-3. Potential Jurisdictional Waters of the U.S. Delineated within the Project Area

Water of the U.S.	Cowardin Classification			Length in Survey Area (ft)
	System	Subsystem	Class	
Arroyo de la Cañada Ancha	Riverine (R)	Intermittent (4)	Streambed (SB)	68
Cañada de Ojito	R	4	SB	750
Acequia de la Cañada Ancha	R	4	SB	2,089
Redirected Cañada de Ojito	R	4	SB	760

4.2.3 Wetlands

McMillen Jacobs Associates wetland specialists performed a waters of the U.S. and wetlands delineation for the project. Site visits and surveying were conducted in September 2016 and December 2017. Two wetlands were identified (A and B) during the delineation. Refer to Appendix C – Map 10 for location of the wetlands identified from the delineation. A copy of the Wetland Delineation Memorandum is provided in Appendix E. The wetlands, classification, and size of delineated wetlands are summarized in Table 2-4 below.

Table 2-4. Wetlands Delineated within the Project Area

Wetland	Cowardin Classification			HGM	Size (Acres)
	System	Class	Water Regime		
A	P	Scrub/Shrub (SS)	Seasonally Flooded (C)	Depressional	0.05
B	Palustrine (P)	SS	A	Depressional	0.84

4.2.4 Floodplain Management

The Site 1 Dam was originally constructed for flood prevention measures. Federal Emergency Management Agency (FEMA) flood insurance maps for the project area (FEMA 2012) indicate the presence of a 100-year flood zone (Zone A) along the upstream and downstream drainages, and within the basin upstream of the dam (FEMA 2012). Zone A flood zones do not have established base flood elevations. The debris basin's current authorized purpose is flood prevention (flood damage reduction). The 100- and 500-year 24-hour storms (determined in the hydrologic analysis) were routed through the dam under existing conditions to determine the associated flood extents downstream. The flood extents determined from this routing can be seen in Appendix C – Maps 7 and 8. Note that due to model stability constraints, model grid spacing, and data resolution, the inundation extents appear to cover a larger area than what would be expected for floods of these magnitudes. These model constraints result in flood areas that cover similar extents for both the 100- and 500-year events with little to no difference between the existing and proposed conditions. Additional modeling will be performed during final design to identify the flooding extents.

4.2.5 Sole Source Aquifers

The project is located within the Española Basin Aquifer, which is considered a Sole Source Aquifer. Sole Source Aquifers are protected under 1424(e) of the Safe Drinking Water Act of 1974 (42 U.S.C. 201,300 et Seq., and 21 U.S.C. 349) that requires protection of drinking water systems that are the sole or principal drinking water source of and area which, if contaminated, would create a significant hazard to public health. The Española Basin Aquifer covers approximately 3,000 square-miles and supplies approximately 85% of the drinking water for that area. A Notice of Sole Source Aquifer Petition Determination for the Española Basin Aquifer was approved by the United States Environmental Protection Agency (EPA) on January 10, 2008 (EPA 2008).

4.3 Air Quality

4.3.1 National Ambient Air Quality Standards

Gases that trap heat in the atmosphere are called greenhouse gases (GHG). Data regarding GHGs, regulations, and emissions sources are summarized from the EPA website (EPA 2013). GHGs include carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), and fluorinated gases such as hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. These GHGs are introduced into the atmosphere by a variety of sources including production of electricity, private and commercial transportation, industry practices, commercial and residential practices, agriculture, land use, and forestry.

Monitoring of National Ambient Air Quality Standards (NAAQS) pollutants in New Mexico is delegated to the New Mexico Environment Department Air Quality Bureau. Two fixed air quality monitoring stations

are in the general vicinity: (1) the Taos station monitors particulate matter less than 10 microns (PM₁₀) in length and less than 2.5 microns (PM_{2.5}) in diameter; and (2) the Santa Fe station measures both PM and ozone. There are no fixed monitoring stations in Española or Chimayó, and neither county is listed as a NAAQS nonattainment or maintenance area.

4.4 Plants

4.4.1 Special Status Plant Species

No federal plant species are listed or proposed for listing under the Endangered Species Act (ESA) in Rio Arriba County. New Mexico maintains a list of endangered plant species in the state (New Mexico 2018). Two state-listed plants were included in the New Mexico State Endangered Plant Species List for Rio Arriba County. BLM maintains a list of sensitive species, which are species not protected under the ESA but warrant special attention and management to keep them from becoming listed in the future (BLM 2018). The BLM Taos Field Office maintains a list of Special Status Species in Rio Arriba County. The list includes six BLM sensitive plant species. Table 2-5 below includes a list of the state-listed and BLM sensitive species and their potential to occur in the project area. Plant species determined to not have suitable habitat available or with no known occurrence in or near the project area were determined as not likely to occur in the project area. Plants determined to likely occur in the project area are discussed in more detail below the table.

Table 2-5. BLM Sensitive Species and State-Listed Species

Common Name	Scientific Name	State Status	BLM Status	Likely to Occur in Project Area (Yes/No)
Brack's cactus	<i>Sclerocactus cloverae</i> ssp. <i>brackii</i>	E		No
Clipped wild buckwheat	<i>Eriogonum lachnogynum</i> var. <i>colobum</i>		S	No
Galisteo sand verbena	<i>Arbronia bigelovii</i>		S	No
Gamma grass cactus	<i>Sclerocactus papyracanthus</i>		S	Yes
Lady tresses orchid	<i>Spiranthes magnicamporum</i>	E		No
Ripley's milkvetch	<i>Astragalus ripleyi</i>		S	No
Santa Fe cholla	<i>Cylindropuntia viridiflora</i>		S	Yes
Taos springparsley	<i>Cymopterus spellenbergii</i>		S	No

S = Sensitive, E = Endangered

The BLM sensitive species list for the Taos Resource Management Plan (RMP) (BLM 2012) identifies plant species that are known or thought to occur on public lands administered by the BLM Taos Field Office. Two species, the Santa Fe cholla (*Cylindropuntia viridiflora*) and the gamma grass cactus (*Sclerocactus papyracanthus*), are documented within the Taos Field Office Planning Area for the RMP.

Santa Fe cholla is only known from three areas in Santa Fe County occurring between Santa Fe and Chimayó. They inhabit gravelly rolling hills in pinyon-juniper woodlands at elevations between 5,800 and 7,200 feet (New Mexico Rare Plant Technical Council 2018).

Gamma grass cactus is found in southern juniper-pinyon woodlands, Great Plains grasslands, and Chihuahuan Desert grasslands usually on sandy soils with a calcareous or gypseous component. They are found on open flats or gentle slopes from 4,900 to 7,200 feet in elevation (Nature Serve Explorer 2016).

4.4.2 Noxious Weeds and Invasive Plants

Executive Order 13122 states that “a federal agency shall not authorize, fund, or carry out actions that it believes are likely to cause or promote the introduction and spread of invasive species in the U.S. or elsewhere.” Noxious weeds and invasive plants are non-native plant species designated by state law or county ordinance because they cause, or have the potential to cause, extraordinary negative economic and ecological impacts.

New Mexico has identified 50 plant species to be targeted as noxious weeds for control or eradication (New Mexico Department of Agriculture 2016). The noxious weeds are separated into Class A, Class B, Class C, and watch list species. There are 20 Class A species, which are species not present in New Mexico or have limited distribution. New infestations of Class A species should be prevented and are the highest priority to eradicate for any existing infestations. There are 11 Class B species that are limited in distribution to portions of the state. Areas with severe infestations of Class B species should be managed to contain the infestation and stop any further spread. There are 12 Class C species that are widespread in the state. Management for Class C species should be determined at the local level, based on feasibility of control and the level of infestation. Watch list species are species of concern that have the potential to become problematic in the state. More information is needed for these species to determine if they should be listed as noxious, and documentation and reporting of occurrence should occur (New Mexico Department of Agriculture 2016).

The BLM Taos Field Office focuses on five “Strategic Goals” for management of invasive and noxious plant species on BLM lands. These include prevention, early detection and rapid response, control and management, restoration, and organizational collaboration (BLM 2012).

Noxious weeds and invasive plants occur within the project area. The project area is located primarily on public lands where general public recreation activities occur in addition to grazing. Soil disturbance and seed dispersal from vehicles, foot traffic, livestock, wildlife, and other onsite activities increase risk for invasion of noxious weeds and invasive plants.

4.4.3 Riparian Areas

Riparian areas generally consist of long strips of vegetation adjacent to streams, rivers, lakes, reservoirs, and other inland aquatic systems that affect or are affected by the presence of water (Fischer and others 2000). The riparian area exists in the transitional area between the aquatic and terrestrial ecosystems. Riparian areas have a different vegetative species than the adjoining ecosystems and exhibit more vigorous growth due to shallow groundwater interaction. These areas typically harbor a large number of wildlife species and perform numerous ecological functions.

The upstream drainage is a dry wash and only conveys water during precipitation or runoff events. Riparian corridors are not present within the project area upstream of the dam. An acequia runs along the downstream side of the dam and conveys water more regularly than the upstream drainage. A narrow riparian corridor exists along the man-made acequia alignment. Another riparian corridor is present downstream of the dam in a low-lying area that appears to be the former alignment of the Arroyo de la Cañada Ancha. Riparian vegetation along these corridors consists primarily of willows, cottonwoods, and Russian olive. There is approximately 3.9 acres of riparian area within the project area extents (Appendix C-Map 11).

4.5 Animals

4.5.1 Wildlife and Wildlife Habitat

The project area is not located within a special designation area for wildlife habitat management. Wildlife likely pass through the project area traveling from the valley bottom to higher terrain. The project area is ranked as a “most crucial” area for wildlife corridors (New Mexico Game & Fish and Natural Heritage New Mexico 2013). Mammal species known to occur in the pinyon-juniper habitat in the general area include coyote, mule deer, elk, bear, raccoon, porcupine, and pocket gopher. The project area is likely home to a variety of bird species and provides foraging habitat for the species that pass through or reside in the general vicinity. Various species of reptiles and amphibians including toads, frogs, lizards, and snakes could be found within the project area.

4.5.2 Fish and Fish Habitat

The natural drainages and basin within the project area are dry washes and only convey water during precipitation events. Fish or fish habitat does not exist within these natural drainages or within the basin itself. A man-made ditch (acequia) exists downstream of the dam embankment that conveys flows when water is available for irrigation purposes. When the acequia is flowing it may offer limited habitat for fish. There has been known occurrence of cutthroat trout within the acequia upstream of the project area in higher quality habitat and along the natural stream segments that flow into the acequia (National Heritage New Mexico 2017); however, the segment of the acequia that flows through the project area offers little habitat and does not have documented occurrence of fish.

4.5.3 Special Status Animal Species

Seven federally-listed ESA animal species were identified for consideration from project actions (Table 2-6). A Biological Evaluation (BE) has been completed for the project and was submitted to the U.S. Fish and Wildlife Service (USFWS) on September 21, 2018 to comply with Section 7 of the ESA (Appendix A). The BE concluded that there would be no effect to federally-listed ESA species, except for Mexican spotted owl and southwest willow flycatcher which had a may affect, but not likely to adversely affect determination. Concurrence was received from the USFWS on November 9, 2018.

The State of New Mexico wildlife of concern list (Biota Information System of New Mexico [BISONM] 2018) identifies 20 threatened and endangered animal species in Rio Arriba County. The BLM sensitive species list for Rio Arriba County (BLM 2018) identifies 13 species including amphibians, birds, mammals, and fish.

Table 2-6 provides a list of special status animal species included in the USFWS, BLM, and State lists, and their likely occurrence within the project area. Additional discussion is provided below the table for species determined to have a historic distribution and/or suitable available habitat within the project area.

Table 2-6. Special Status Species for Consideration

Common Name	Scientific Name	State Status	BLM Status	USFWS Status	Potential to Occur in Project Area ¹ (Yes/No)
Arctic Peregrine Falcon	<i>Falco peregrinus tundrius</i>	T	-	-	No
Baird's Sparrow	<i>Ammodramus bairdii</i>	T	-	-	No

Common Name	Scientific Name	State Status	BLM Status	USFWS Status	Potential to Occur in Project Area ¹ (Yes/No)
Bald Eagle	<i>Haliaeetus leucocephalus</i>	T	S	-	Yes
Bendire's Thrasher	<i>Toxostoma bendirei</i>	-	S	-	No
Boreal Toad	<i>Anaxyrus boreas boreas</i>	E	-	-	No
Boreal Owl	<i>Aegolius funereus</i>	T	-	-	No
Brown Pelican	<i>Pelecanus occidentalis</i>	E	-	-	No
Canada Lynx	<i>Lynx canadensis</i>	-	-	T	No
Chestnut-Collard Longspur	<i>Calcarius ornatus</i>	-	S	-	No
Common Black Hawk	<i>Buteogallus anthracinus</i>	T	-	-	No
Gray Vireo	<i>Vireo vicinior</i>	T	-	-	No
Gunnison's Prairie Dog	<i>Cynomys gunnisoni</i>	-	S	-	Yes
Jemez Mountains Salamander	<i>Plethodon neomexicanus</i>	E	-	E	No
Least Tern	<i>Sternula antillarum</i>	E	-	E	No
New Mexico Meadow Jumping Mouse	<i>Zapus hudsonius luteus</i>	E	S	E	Yes
Mexican Spotted Owl	<i>Strix occidentalis lucida</i>	-	-	T	Yes
Pacific Marten	<i>Martes caurina</i>	T	-	-	No
Peregrine Falcon	<i>Falco peregrinus</i>	T	-	-	No
Pinyon Jay	<i>Gymnorhinus cyanocephalus</i>	-	S	-	Yes
Rio Grande Chub	<i>Gila pandora</i>	-	S	-	Yes
Rio Grande Cutthroat Trout	<i>Oncorhynchus clarki virginalis</i>	-	S	-	Yes
Rio Grande Sucker	<i>Catostomus plebeius</i>	-	S	-	Yes
Roundtail Chub	<i>Gila robusta</i>	E	-	-	No
Southwestern Willow Flycatcher	<i>Empidonax traillii extimus</i>	E	-	E	Yes
Spotted Bat	<i>Euderma maculatum</i>	T	S	-	No
Townsend's Big-Eared Bat	<i>Corynorhinus townsendii</i>	-	S	-	No
Western Burrowing Owl	<i>Athene cunicularia hypugea</i>	-	S	-	No
White-tailed Ptarmigan	<i>Lagopus leucura</i>	E	-	-	No
Yellow-billed Cuckoo	<i>Coccyzus americanus</i>	-	S	T	No

1 – Historic distribution and/or available suitable habitat within the project area.
E = Endangered, T = Threatened, S=Sensitive

Bald Eagle

Bald eagles are state-listed as threatened and BLM sensitive species. Bald eagles have the potential to be present in the project area while foraging. Refer to Section 2.5.4 Migratory Birds/Bald and Golden Eagles for additional information.

Gunnison's Prairie Dog

Gunnison's prairie dog (*Cynomys gunnisoni*) is listed as a BLM sensitive species and the project area is located within the approximate distribution for the species. Gunnison's prairie dog typically occupy habitat that is characterized predominantly by graminoid and herbaceous plant cover with few or no trees and variable shrub density. In New Mexico, the species is found in montane grassland, juniper savanna, plains-mesa grassland, Great Basin desert scrub, plains-mesa sand scrub, desert grassland, and in urban cultivated areas between approximately 4,500 and 10,000 feet in elevation. Prairie dog towns in northern New Mexico are located on the sides and tops of ridges, rather than in the bottoms of drainages, probably to avoid flooding (New Mexico Department of Game and Fish [NMDGF] 2008). It is not likely that prairie dog would be found within the structure basin or drainages, since those areas frequently flood. There is a potential for prairie dog to inhabit other spaces in the project area that are outside of the basin and drainages. Information for known occurrence of the species was requested from the National Heritage New Mexico (NHNM 2017). No known occurrence of Gunnison's prairie dog was identified in or near the project area.

New Mexico Meadow Jumping Mouse

The New Mexico meadow jumping mouse (*Zapus hudsonius luteus*) is listed by the State of New Mexico and by the USFWS as endangered, and sensitive by BLM. The species is endemic to New Mexico, Arizona, and a small area of southern Colorado (USFWS 2018a). Requirements for habitat include tall (averaging at least 24 inches), dense riparian herbaceous vegetation primarily composed of sedges and forbes (Endangered Status for the New Mexico Meadow Jumping Mouse 2014). The jumping mouse utilizes moist, streamside, dense riparian/wetlands vegetation, but nests in dry soils. The species can be found up to an elevation of about 8,000 feet (USFWS 2018a). The project area contains very little wetland habitat (<1 acre) that consists primarily of willow species. No sedges were observed during wetland delineation surveys performed for the project (Appendix E). No known occurrence of the species was identified in data provided by NHNM (NHNM 2017). Based on the lack of suitable habitat and no known occurrence of the species in or near the project area, this species is not likely to occur in the project area.

Mexican Spotted Owl

The Mexican spotted owl (*Strix occidentalis lucida*) is listed as threatened by the USFWS. The project area is within the Southern Rocky Mountains Ecological Management Unit (EMU) for the Mexican spotted owl, but there is no critical habitat in or near the project site. The species is found primarily in canyons in the EMU, and they also occupy forest habitat types. The canyon habitat often has mature Douglas-fir, white fir, and ponderosa pine in canyon bottoms and on the north- and east-facing slopes. This type of vegetation do not exist in the project area or within 2 miles of the project area. The predominant vegetation within 2 miles of the project area consist of pinyon-juniper woodlands, dry shrubland, and dry grassland. A small area of cliff, scree, and rock habitat is within the project area, but would not be disturbed by project actions. Cliff, scree, and rock habitat is a known nesting habitat type utilized by Mexican spotted owl. It is not likely that the species are utilizing the habitat for nesting since it is not consistent with forested suitable habitat. Additionally, there is no known occurrence of the species in or nearby the project area. Even though suitable habitat is not available the species has the potential to be present while passing through during dispersal or possibly foraging while passing through.

Pinyon Jay

Pinyon jay is listed as a BLM sensitive species and the project area is located within the approximate distribution for the species. Pinyon jay can be found in pinyon-juniper woodland, sagebrush, scrub oak, and chaparral communities (USFWS 2018b). One documented occurrence of the species occurs within 2 miles of the project area (eBird 2018). The species are year-round residents in the area. Nesting occurs from late February to April and nests are built in pinyon, western juniper, and ponderosa pine trees (U.S. Forest Service 2018). Nesting and foraging habitat for the species occurs in the project area and pinyon jay have the potential to be present at the site based on distribution, suitable habitat availability, and known occurrence of the species within 2 miles of the project area.

Rio Grande Cutthroat, Sucker, and Chub

The project area is within the historic native range of the Rio Grande cutthroat (*Oncorhynchus clarki virginalis*), Rio Grande Sucker (*Catostomus plebeius*), and Rio Grande Chub (*Gila pandora*). Based on a distribution map from the Rio Grande Cutthroat Trout Rangelwide Database, the current distribution of the species and conservation populations are not located in or near the project area (USFWS 2016). Information for known occurrence of species was requested from NHPM (NHPM 2017). A known occurrence for cutthroat trout (*Oncorhynchus clarki*) was reported on July 11, 1994 upstream of the project area, but not for the Rio Grande cutthroat (*Oncorhynchus clarki virginalis*). Species observation maps have not identified any of the three species in or near the project area (USGS 2018). Based on the current distribution of the Rio Grande cutthroat and no known occurrence in or near the project area, this species is not likely to occur in the project area.

Southwestern Willow Flycatcher

The southwestern willow flycatcher is listed as endangered by the State of New Mexico and by the USFWS. The Southwestern willow flycatcher is a summer breeder in the United States and winters in Central America. Nesting habitat require dense riparian habitats with microclimatic conditions dedicated by the local surroundings. The species feed primarily on flying insects (USFWS 2017). There is not critical habitat or known occurrence of the species in or near the project area. The project area contains small patches of riparian habitat, but it is not consistent with listed critical habitat constituent elements. Suitable habitat is located downstream along the Rio Grande, approximately 8 miles away. Even though no suitable habitat is present and there is no known occurrence of the species in or near the project area, the species has the potential to be present during dispersal and/or migration utilizing the habitat as stop over habitat.

4.5.4 Migratory Birds/Bald and Golden Eagles

Migratory birds are afforded protection under authority of the Migratory Bird Treaty Act (MBTA) (16 U.S.C 703-712). Under the MBTA, it is unlawful to take, kill, or possess migratory birds, their parts, nests, or eggs. “Take” is defined as any attempt or success at pursuing, hunting, shooting, wounding, killing, trapping, capturing, or collecting. Migratory Bird Permits must be obtained through the USFWS Migratory Bird Permit Office for any requested waiver or exception to the MBTA.

According to the USFWS Resource List (USFWS 2018c) for the project area, there are three Migratory Birds of Conservation Concern (MBCC) listed for this area. The limited amount of wetlands and lack of surface water in the project area indicates that the immediate project area provides little in the way of important habitat for the migratory bird populations known in the region. Based on species habitat requirements and species distribution, three MBCC included on the Resource List could be present within the project area (see Table 2-7 below). The MBCC provided in the Resource List is not a comprehensive list of migratory birds that have the potential to occur in the project area. There are other protected migratory birds that may be present, but the MBCC list focuses on those species of particular USFWS concern.

Table 2-7. MBCC with Potential to be Present in the Project Area

Species Name	Seasonal Occurrence in Project Area	Potential Nesting Habitat in Project Area	Potential Foraging Habitat in Project Area	Known Occurrence within 2 miles of Project Area
Bald Eagle <i>Haliaeetus leucocephalus</i>	Breeding (January) ¹	Yes	Yes	Yes
Lewis’s Woodpecker <i>Melanerpes lewis</i>	Year-round (December) ¹	No	Yes	Yes
Rufous Hummingbird <i>Seasphorus rufus</i>	Migrating (August & September) ¹	No	Yes	Yes

¹ – Relative probability of presence during the year reported in the USFWS Resource List (USFWS 2018c)

There are five occurrences of Lewis’s Woodpecker within 2 miles of the project area sighted primarily in December, which is outside of the breeding season (eBird 2018). The closest sighting is over 1 mile from the project area. Sightings follow the Santa Cruz River corridor, which offers better riparian habitat for the species. There is potential for the species to be present in the project area for foraging. If present, the most likely occurrence would be in December.

Rufous hummingbirds pass through the area during migration only. There are four documented occurrences of the species within 2 miles of the project area, mostly in August and September (eBird 2018). There is potential for Rufous hummingbirds to be present in the project area while foraging during migration only (primarily in August and September).

Bald and golden eagles are afforded protection under two separate Acts of Congress: the MBTA (as described above Table 2-7) and the Eagle Protection Act. The Eagle Protection Act (16 U.S.C 668) provides specific protection for bald and golden eagles. The act makes it illegal to take, possess, sell, purchase, barter, or transport any bald or golden eagle, alive or dead, or any part, nest, or egg thereof. “Take” includes pursuing, shooting, shooting at, poisoning, wounding, killing, capturing, trapping, collecting, molesting, or disturbing.

Bald eagles inhabit areas near water bodies including estuaries, lakes, reservoirs, rivers, and seacoasts. They require tall trees for nesting and spotting prey. Bald eagles feed primarily on fish but will also feed on waterfowl, turtles, rabbits, snakes, and other small animals and carrion (USFWS 2007). According to the

Resource List, bald eagles would likely be in the area during breeding season and the probability of presence is listed only in January (USFWS 2018c). There have been two documented occurrences of the species within 2 miles of the project area (one in 2008 and another in 2010) both occurring in January (eBird 2018). Bald eagles have the potential to be present in the project area while foraging, but foraging habitat is limited due to lack of permanent surface water that supports habitat for their primary prey (fish). If present, the most likely occurrence would be in January.

Golden eagles inhabit many areas from forest to desert. They nest on cliffs or in the largest trees of forested stands. Golden eagles are aerial predators and feed on small to mid-sized reptiles, birds, and mammals up to the size of mule deer fawns and coyote pups (USFWS 2011). Golden eagles are not anticipated to inhabit the project area as cliffs and tall trees are not located in the project area. There are no cliffs within 1 mile of the project area that could provide suitable nesting habitat for the species and there are no documented occurrences of the species within 3 miles of the project area (eBird 2018).

4.6 Human

4.6.1 Socioeconomics

The socioeconomic area of consideration surrounding the project area can be assessed on a state, county, and local scale. For the purposes of this study, socioeconomic condition is presented for the state of New Mexico, Rio Arriba County, and Chimayó (where available) for comparison. The following sections and tables describe the current demographic, employment, income, and economic conditions that have a potential to be affected by rehabilitation of the dam.

4.6.1.1 Population and Demographics

Table 2-8 compares population and demographic estimates for the Village of Chimayó, Rio Arriba County, and the State of New Mexico.

Table 2-8. Demographic Profile Comparison

Socioeconomic Criteria		Chimayó	%	Rio Arriba County	%	New Mexico	%
Total Population		2,369	100	39,949	100	2,084,117	100
Gender	Female	1,070	45	19,625	49	1,032,414	49
	Male	1,299	55	20,324	51	1,051,703	51
Age	Under 18	466	20	9,723	24	506,690	24
	18 & over	1,903	80	30,226	76	1,577,427	76
Race	White	1,824	77	24,974	63	1,524,911	73
	African American	0	0	210	1	43,738	2
	American Indian or Alaska Native	114	5	6,115	15	190,528	9
	Asian	0	0	144	0	28,761	1
	Native Hawaiian and other Pacific Islander	0	0	3	0	1,276	1
	Two or More Races	0	0	911	2	68,053	3
	Other	431	18	7,592	19	226,850	11

Source: U.S. Census Bureau (USCB 2015)

In Chimayo, approximately 86% of the total population from any race were reported to be Hispanic or Latino, and approximately 14% of the total population from any race were reported to be not Hispanic or Latino. Rio Arriba County was reported to have 71.5% Hispanic or Latino from any race and 28.5% not Hispanic or Latino from any race (USCB 2015).

4.6.1.2 Employment and Income

Table 2-9 shows employment status from the U.S. Census 5-Year 2011-2015 American Community Survey for Chimayó, Rio Arriba County, and the State of New Mexico.

Table 2-9. Employment Status

Characteristic	Chimayó	Rio Arriba County	New Mexico
Population 16 years and older	1,981	31,467	1,633,310
Civilian labor force	1,051	17,245	964,959
Employed	832	15,272	876,035
Unemployed	219	1,973	88,924
Percent unemployed	11.1%	6.3%	5.4%
Median Household Income	\$25,469	\$36,098	\$44,963
Mean Household Income	\$36,664	\$50,772	\$62,215

Source: USCB 2015

Based on the U.S. Census 5-Year 2011-2015 American Community Survey (USCB 2015), approximately 34% of the people in Chimayó and 24% of the people in Rio Arriba County have an income below the poverty level.

4.6.2 Historic Properties/Cultural Resources

Section 106 of the National Historic Preservation Act of 1966 (NHPA) requires federal agencies to take into account the effects of their undertakings on cultural resources and historic properties, and afford the Advisory Council on Historic Preservation a reasonable opportunity to comment. An archaeological survey for the project area was conducted, in accordance with both NRCS and BLM standards. A literature review of known and recorded cultural resources was conducted from records maintained by the New Mexico Cultural Resource Information System, BLM Management Government Land Office Homestead Records database, and the National Register of Historic Places. No surveys or previously recorded sites were identified within the project area during the literature review.

A preliminary archaeological survey report was prepared (Brown 2018) and identified and documented five archaeological sites and three historic landscape features. The historic landscape features consisted of the dam and spillway, upstream diversion dike, and Acequia de la Cañada Ancha. The Acequia de la Cañada Ancha was listed as eligible for listing in the National Register of Historic Places (NRHP), but the dam, spillway and diversion dike were not. Three of the archaeological sites were determined to be eligible for listing in the NRHP, one was not eligible, and one was pending determination of eligibility.

The archaeological survey report was submitted to the New Mexico Historic Preservation Division (HPD) for concurrence with a no adverse effect determination on April 22, 2019. The Report was also submitted to multiple agencies and tribes for review on August 5, 2019. The HPD concurrence was received on April 29, 2019 and has been included in Appendix A. No responses from other agencies and tribes were received.

4.6.3 Hazardous Substances, Materials and Waste

Hazardous materials, and hazardous and solid wastes, can include any liquid, solid, gas, or sludge that poses a hazard to human health or the environment because of its quantity, concentration, or physical or chemical characteristics. To determine whether hazardous or solid waste sites occur within the project area, an online review of hazardous sites was requested from Environmental Data Resources, Inc. (EDR 2015). The EDR radius search results show that there are no known hazardous, toxic, or radioactive waste (HTRW) sites within a 1-mile search radius from the dam. This comprehensive online survey of potential HTRW sites does not certify the current condition or location of named sites and does not verify that potentially hazardous sites are absent from the study area. There doesn't appear to be any operations occurring in the upstream drainage area that would cause hazardous materials to be washed downstream into the basin. Additionally, there are no pesticides or herbicides commonly utilized in the drainage area. Onsite surveys would be necessary to ensure the lack of potential HTRW sites prior to construction.

Even though there are no known HTRW sites within 1 mile of the project area, there are facilities downstream, specifically gas stations, adjoining the Santa Cruz River floodplain. The drainage that the Site 1 Dam intercepts (Arroyo de la Cañada Ancha) is a tributary of the Santa Cruz River. There are no HTRW facilities within the Arroyo de la Cañada Ancha 500-year floodplain, but there may be gas stations located within the 500-year floodplain downstream along the Santa Cruz River. Additional modeling with higher resolution elevation data would need to be performed to better define the 500-year floodplain boundary and determine if HTRW facilities are located within the 500-year floodplain along the Santa Cruz River.

4.6.4 Public Health and Safety

The Site 1 Dam is a high hazard dam, and there is a potential for loss of human life if the dam should fail. The structure does not currently meet engineering safety standards for a high hazard structure and there is an increased risk of dam breach during a flood event. The path of inundation in the event of dam failure extends from the dam generally west down the Acequia de la Cañada Ancha to the Santa Cruz River, and follows it to the Rio Grande. The flood extends through agricultural land, residential properties, businesses, and infrastructure adjoining the Acequia de la Cañada Ancha and Santa Cruz River (Appendix C-Map 6). The population at risk, in the case of a dam breach, is 1,038 people, with an estimated loss of life of 886 people. The breach inundation area includes approximately 3.2 square-miles. See Appendix D, Section D.3 and Attachment 2 to Appendix D for additional information on the dam breach inundation analysis conducted for the dam.

An Emergency Action Plan (EAP) is currently under development for the dam. EAPs provide emergency action planning to reduce property damage and protect lives during dam safety emergencies. EAPs define responsibilities and provide procedures for notification when flood releases may create major flooding and possible, impending, or actual dam failure.

4.6.5 Recreation

BLM lands are located within the project area, which are open to the public for recreation activities and grazing in areas (Appendix C-Map 12). General recreation activities may include hiking, biking, and Off Highway Vehicle (OHV) use, among others. There are no officially constructed permanent trails or recreation areas within the project area.

According to the Taos Field Office Resource Management Plan (RMP), the project area is located within an area designated as an extensive recreational management area (ERMA). ERMAs consist of any BLM-administered lands that are not delineated as a Special Recreation Management area (SRMA), where management is generally limited to custodian actions only. ERMAs offer a variety of dispersed recreation

activities through custodial recreation management to resolve the use conflicts and provide for visitor safety and resource protection (BLM 2012).

Various site visits have verified that the basin is used by OHVs and other motorized vehicles. Unauthorized trail routes have been carved throughout the basin outside of existing roads and trails; however, these unauthorized trail routes have not appeared to cause any damage to the embankment. Note that repairs for damage to the dam caused by OHV use is the responsibility of the SFPSWCD.

4.6.6 Visual Resources and Scenic Beauty

According to the Taos Field Office RMP, the project area is located within a Class II Visual Resource Management (VRM) area. The Class II objective is to retain the existing character of the landscape. The level of change to the characteristic landscape should be low. Management activities may be seen, but should not attract the attention of the casual observer. Any changes must repeat the basic elements of form, line, color, and texture found in the predominant natural features on the characteristic landscape (BLM 2012).

The existing dam, basin, and associated appurtenances consist of a disturbed area altered from its natural state. The natural topography and landscape were modified for construction of the dam in 1962. The structure consists of a dam embankment, basin, principal spillway, auxiliary spillway, and retaining dike as described in detail in Section 1.5.

4.6.7 Transportation Infrastructure

There are no established transportation roads at the dam other than SFPSWCD access roads. The breach inundation area of the dam covers 3.2 square-miles and includes approximately 15 improved roads and highways, as well as many unimproved community roads. The path of inundation in the event of a dam breach intersects State Highway 76 at four locations as it heads west between Chimayó and Santa Cruz. The path continues west from there to the Rio Grande crossing over State Highway 68 and U.S. Highway 84. The structure does not currently meet engineering safety standards for a high hazard structure and is at the end of its sediment life. Therefore, there is an increased risk of damage to downstream transportation infrastructure from a dam breach during a flood event.

4.6.8 Noise

Applicable noise laws for the project area are provided in the Noise Control Act of 1972 (42 U.S.C 4901 et seq.), amended by the Quiet Communities Act of 1978 (42 U.S.C. 4913), which promotes the development of state and local noise control programs.

Ambient noise in the study area has not been measured, and therefore no baseline is available. Generally, there is an abundance of noise sources in the study area including vehicle traffic, agricultural users, recreational users, and general town operational noises.

Noise-sensitive receptors are those facilities, land areas, or wildlife populations that require lower noise levels for health and function. Examples include residential neighborhoods, medical facilities, schools, churches, research facilities, parks, and open space. Lands located within ½ mile of the project area are occupied with rural residences and do not contain medical facilities, schools, churches, parks, etc. The closest rural residence to the project area is located approximately 100 feet away from the access road.

4.7 Current Dam Status

4.7.1 Status of Operation and Maintenance

The SFPSWCD is responsible for the operations and maintenance (O&M) of Site 1 Dam. The following actions and/or maintenance and repair items for the structure were identified in the 2017 Informal Dam Safety and O&M Inspection Report (dated October 13, 2017):

- Difficult to access site due to recent flooding changing the road grade
- Rodent holes and vehicular damage on the dam embankment
- Rill erosion on the east and west groin of the downstream dam embankment
- The trash rack is missing and needs to be replaced on the principal spillway riser
- Rill erosion on the auxiliary spillway
- Small woody plant species are located on the auxiliary spillway
- The drain filter needs repair and cleaning
- Fencing is not adequate, and/or loose or damaged

The Report noted that excavation was performed to expose six ports on the larger principal spillway riser, and to expose the top of the smaller principal spillway riser. The access road was noted to have been repaired twice due to severe flooding of the acequia below the dam, and a video pipe inspection of the principal spillway was conducted. Action needed for the structure included filling rills on the downstream embankment, repairing fences, repairing the CMP foundation drain pipe outlet, rodent control measures, repairing bullet pock marks on the principal spillway riser, and capping ports near the base of the larger principal spillway riser.

The items bulleted above are O&M items that should be addressed by the Sponsor (SFPSWCD). The maintenance needs will be addressed by the Sponsor, who has O&M responsibility prior to signing the Watershed Agreement and commencing design.

4.8 Breach Analysis and Hazard Classification

The FLO-2D dam breach model was used for the Site 1 Dam breach analysis, which is a hydrodynamic model capable of simulating unsteady free surface flow through open-channel systems. The following parameters and data were used to develop the FLO-2D model. The assumptions and detailed information on the analysis performed are included in the Hydrology and Inundation Analysis Technical Memorandum (Attachment 2 of Appendix D).

- Floodplain roughness coefficient of 0.04.
- Upstream boundary condition – breach hydrograph.
- Downstream boundary condition – outflow (no hydrograph).
- Grid size – 200 feet.
- Grid elevations – LiDAR based.

In developing the model domain, the intent is to extend to the domain beyond the point at which the breach wave is fully attenuated. The FLOD-2D model domain extends approximately 11.2 miles generally west from the dam. The total area of inundation covers approximately 3.2 square-miles and contains numerous roads, residential and commercial properties, and other infrastructure (Appendix C-Map 6). A risk analysis was performed, which estimated a population at risk of 1,038 people with a loss of life of 886 people if a

dam failure were to occur. Site 1 Dam is classified as a high hazard dam by the State of New Mexico and NRCS, meaning there is a potential for loss of human life if the dam should fail. Please refer to the Hydrology and Inundation Analysis Technical Memorandum (Attachment 2 of Appendix D) for detailed information on the breach routing analysis performed for the dam.

4.9 Potential Modes of Dam Failure

Both NRCS and the State of New Mexico concur that Santa Cruz River Watershed - Site 1 Dam is a high hazard dam, according to their individual agency criteria for dam classifications. Several potential modes of failure were examined and are described below.

4.9.1 Sedimentation

The dam has reached its designed sediment life. As sediment continues to infill the basin, it will decrease the available capacity of the floodwater retarding pool and result in more frequent operation of the auxiliary spillway. The auxiliary spillway currently activates at a 24-hour/100-year storm event and would begin to activate at lesser events as sediment fills the basin. Over time, the auxiliary spillway would be subject to more frequent erosion. A potential failure mode exists as the auxiliary spillway continues to degrade, and the depth and frequency of flow increases. This could lead to an erosive headcut within the auxiliary spillway and ultimately to a breach. This possibility is supported by the NRCS Water Resources Site Analysis Program (SITES) erosion model developed for this project, which indicates that significant erosion and breaching of the auxiliary spillway would occur during routing of the design storms (Appendix D, Section D.9 and Appendix D, Attachment 5). Therefore, there is potential for failure and breach of the auxiliary spillway from sedimentation.

4.9.2 Hydrologic Capacity

Hydrologic failure of a dam can occur by breaching the auxiliary spillway or overtopping the dam during a storm event. The integrity and stability of both the auxiliary spillway and the embankment crest are dependent on the depth, velocity, and duration of flow, the vegetative cover, and the soils' resistance to erosion.

The Freeboard Hydrograph (FBH), which is determined from a probable maximum precipitation (PMP) event, was routed through the USACE Hydrologic Engineering Center Hydrologic Modeling System (HEC-HMS). To meet NRCS and New Mexico engineering safety standards the dam must not be overtopped during routing of the FBH. The results of the modeling show that the dam embankment would be overtopped by 4.8 feet during routing of the FBH under existing conditions. Refer to Appendix D, Section D.8 for a summary of the hydrology analysis that was conducted for the dam. The Hydrology and Inundation Analysis Technical Memorandum is included as Attachment 2 of Appendix D. During such an event, water would overtop the dam crest, causing erosion and a likely breach. Because the FBH is based on the probable maximum precipitation event, the theoretical maximum precipitation the environment is capable of producing, the potential for hydrologic failure from overtopping the dam embankment is high.

A SITES erosion model was performed for the auxiliary spillway for passage of the SDH and FBH. Based on the analysis, the auxiliary spillway was shown to be susceptible to erosion and breaching during passage of the FBH under current conditions. Rill erosion and erosion from the Cañada de Ojito drainage have been observed along the auxiliary spillway exit slope (see Section 1.5.4), and the soils on the auxiliary spillway appear to be susceptible to erosion. The auxiliary spillway would activate for a 24-hour/100-year event under current conditions and would begin to activate at lesser events over time, from sediment reducing the

flood capacity. Therefore, there is potential for failure and breach of the auxiliary spillway from hydrologic conditions.

4.9.3 Seepage

Despite the fact that the structure does not impound water on a permanent basis, during storm events or during periods of longer-term wet weather (e.g., monsoon), water may be impounded behind the dam for a period of several days. During this period, seepage into the dam is inevitable. Seepage may daylight on the downstream face of the dam. Embankment and foundation seepage can contribute to failure of an embankment by removing (piping) soil material through the embankment or foundation. As the soil material is removed, voids can be created, allowing ever-increasing amounts of water to flow through the embankment or foundation until the dam collapses due to the internal erosion. Seepage that increases with an increase in pool elevation is an indication of a potential problem, as is stained or muddy water exiting the dam on the downstream side. Foundation and embankment drainage systems can alleviate the seepage problem by removing the water without allowing soil particles to be transported away from the dam, but these systems must be working properly. These systems were designed and included in the construction of this dam. The most recent inspections performed with NRCS and/or the NM Dam Safety Bureau show that the foundation drain pipe outlet is partially crushed where it daylights at the principal spillway conduit plunge pool. This section of the pipe should be replaced, but is not expected to have an increase for a piping failure because there have been no visible signs of seepage on the downstream dam embankment.

Site 1 Dam shows no visible signs of seepage along the toe of the dam or downstream face. The local Sponsor is also required by the State to maintain the dam, ensuring that the embankment is clear of brush and woody vegetation. No sloughing or any other indications of embankment instability have been noted during dam inspections. Therefore, seepage currently presents a low potential failure mode.

4.9.4 Seismic

The integrity and stability of an earthen embankment are dependent on the presence of a stable foundation. Foundation movement through consolidation, compression, or lateral movement can create weak zones or voids within an embankment, separation of the principal spillway conduit joints, or, in extreme cases, complete collapse of the embankment. The dam embankment was found to not be subject to liquefaction or loss of strength during or after a seismic event. The current dam embankment meets all state and NRCS slope stability criteria.

The deterministic peak ground acceleration (PGA) for a 1,000-year return period is 0.12 g. This is based on an earthquake magnitude of 6.22. Although the probability of such an event occurring over the remaining useful life of the dam is low, should it occur, damage would likely be observed at the dam. The likelihood of this magnitude earthquake occurring while the dam is impounding water is considered extremely low. Therefore, seismic activity creates only a small potential for failure of Site 1 Dam.

4.9.5 Embankment Slope Failure

An embankment slope failure allows increased saturation and weakens the integrity of the dam during storm events and could result in a catastrophic failure. Slope failure can also create slides and sloughing that lower the top of the dam elevation so that overtopping may occur during the FBH.

The existing dam embankment has been exposed to wind and water erosion and exhibits signs of surface erosion. Rill erosion has been observed along the dam embankment, but the Site 1 Dam shows no visible signs of slope failure, sloughing, or any other noticeable indications of instability on the embankment. The dam embankment meets all state and NRCS minimum safety factors for slope stability criteria.

Embankment slope failure presents a low potential mode of failure, but it should continue to be monitored in the future.

4.9.6 Material Deterioration

Materials used in the principal spillway system and fences are normal, common construction materials, but they are subject to weathering and chemical reaction due to natural elements within the soil, water, and atmosphere. Concrete components can deteriorate and crack, metal components can rust and corrode, and leaks can develop. Embankment failure can occur from internal erosion caused by these leaks.

Based on available information and field observations, the dam structure and associated components appear to be in good condition with evidence of only minor deterioration (crushed foundation drain pipe outlet and pitting in principal spillway riser) of any of the materials that would require structural repair at this time. The principal spillway conduit outlet was observed to have minor leaking during a video pipe inspection. Based on the condition of the existing dam components, the likelihood of failure of the existing dam due to deteriorating components is judged to be low. However, the dam should continue to be monitored annually and after significant storm events for signs of further deterioration.

4.10 Consequences of Dam Failure

The Site 1 Dam does not meet current engineering safety standards, and there is a risk of the dam failing from the potential modes of dam failure listed in Section 2.9 above.

The breach area downstream of the dam includes approximately 3.2 square-miles and extends generally west through numerous roads, residential and commercial properties, and other infrastructure (Appendix C-Map 6). Table 2-10 below lists the community structures and transportation infrastructure within the breach inundation area and the associated population at risk. The loss of life from such an event is estimated to be 886 people.

Table 2-10. Structures and Population at Risk within Inundation Area

Structure	Number of Structures	Population at Risk
Homes	296	708
Commercial Buildings	30	300
Roads and Highways	15	30
Total		1,038

SECTION 5 ALTERNATIVES

5.1 General

5.1.1 Decision Matrix

The NRCS must identify the federally assisted alternative with the greatest net benefits, otherwise known as the National Economic Development (NED) plan. The NRCS must also decide if the selected alternative would or would not constitute a major federal action significantly affecting the quality of the environment. If the NRCS State Conservationist (responsible federal official) determines that the selected alternative would not significantly affect the quality of the environment, then the NRCS State Conservationist will prepare and sign a Finding of No Significant Impact (FONSI), and the project may proceed. If the NRCS State Conservationist determines that the selected alternative would significantly affect the quality of the environment, then an Environmental Impact Statement (EIS) and a Record of Decision (ROD) must be prepared and signed before the project can proceed.

5.1.2 Project Scoping

Early in the scoping process, comments were requested from the public and government agencies. Comments were accepted both orally at a public meeting and via written submittal. The primary purpose of the scoping meeting was to gather input and feedback on the project's purpose and need statement, potential alternatives for consideration, environmental issues to be addressed in the Plan-EA, methodologies to be used to evaluate impacts, and the overall public participation process. Twelve oral and written comments were received during the scoping period. A description of the public scoping process is located in Section 1.3 and Appendix E contains a copy of the Scoping Report.

5.2 Formulation Process

The formulation process of alternatives for the rehabilitation of the dam followed procedures outlined in the NRCS National Watershed Program Manual (NRCS 2015) Parts 500 through 506; NRCS National Watershed Program Handbook (NRCS 2014), Parts 600 through 606; Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies (U.S. Water Resources Council [USWRC] 1983); and other NRCS watershed planning policy. Numerous alternatives were developed by the project team with consideration for issues and concerns discovered during the scoping process and, based on their ability to address the purpose and need of the action, were formulated in consideration of four criteria: completeness, effectiveness, efficiency, and acceptability. In accordance with NEPA (40 CFR 1502.14), some initial alternatives were eliminated from further analysis due to high cost, logistics, environmental reasons, or other critical factors. All alternatives were analyzed using the same evaluated life of the structure which is limited by sediment storage available.

The project team analyzed one rehabilitation alternative and one No [Federal] Action Alternative in detailed study. Multiple additional alternatives were formulated, but were determined to be not feasible and eliminated from further study.

5.3 Alternatives and Options Considered but Eliminated from Detailed Study

The following alternatives and options were considered during the planning process, but were eliminated from detailed study due to environmental impacts, if they were considered infeasible, had exorbitant costs, did not meet the purpose and need of the action, or other critical factors.

Project costs described for alternatives eliminated from detailed study, if noted, include construction and O&M costs. Construction costs include expenses incurred during the installation period for labor, material, equipment, and services; contractor's overhead and profit; and other direct costs associated with items such as earthwork removal or replacement, purchase and installation of materials and appurtenances, plus a realistic contingency allowance. O&M costs include materials, equipment, services and facilities needed to operate the project and make repairs and replacements necessary to maintain structural measures in sound operating condition during the evaluated life of the project (72 years) (NRCS 2015). Installation costs were not determined for alternatives eliminated from detailed study, since a more detailed level of estimating was not necessary to support elimination of the alternatives, and economic analyses, requiring reporting of installation costs, are not performed for alternatives eliminated from detailed study. Installation cost is defined in Section 3.4, and these costs are included for alternatives considered for detailed study.

5.3.1 Dam Decommissioning Alternative

This alternative would require removal of the storage function of the dam and would reconnect, restore, and stabilize the stream and floodplain functions. Only partial removal of the embankment would be required, which would require excavating a breach in the dam of sufficient size to safely pass the 24-hour/100-year frequency flood event. This alternative would also require restoration of the natural stream channel grade, vegetation, and geomorphology within the basin. The remaining portion of the embankment and sediment pool would be re-contoured to reconnect the stream channel through the sediment pool. Riprap would be installed on the new channel and embankment cut slopes as needed for erosion control and to prevent headcutting. The channel lined with riprap would extend just beyond the acequia, and the acequia would be piped in this area to allow continued irrigation use. The principal spillway riser would be demolished and removed and the principal spillway conduit would be capped.

The Dam Decommissioning Alternative must meet the stated purpose and need and would require measures to maintain flood protection from runoff, erosion, and sediment that are currently provided by the dam. One alternative is to provide the flood protection upstream of the existing basin in the form of terracing and additional detention structures. Due to the large amount of area that would need to be modified, extensive structural measures, lack of existing access, and associated impacts to environmental resources, this alternative is not feasible.

Another alternative would be to provide flood protection measures downstream of the dam. This would require a combination of flood-proofing and relocation of structures. Downstream structures subject to flooding from a 24-hour/100-year event would need to be purchased, relocated, or demolished, and flood easements would need to be established. The number of homes inundated at a depth greater than 1 foot during the 24-hour/100-year event under conditions of dam decommissioning is approximately 80 homes. Land easement acquisition, relocation, and demolition costs for this alternative would be approximately \$10,550,000.

Removal of the dam also removes the sediment retention benefits and the downstream lands would see increased sediment loads with each flood event. On average approximately 7.51 ac-ft of additional sediment per year would continue downstream and have the potential to deposit within the areas inundated by each

storm. Additional sediment in the system would also reduce channel capacities, causing variations in drainage and river channel alignments that could impact adjoining properties and river crossing structures (utilities, bridges, culverts, etc.).

The estimated construction cost, including the land acquisition, relocation, and demolition costs for the Dam Decommissioning Alternative is approximately \$19,702,400 as detailed in Appendix D, Section D.14.1.1. This alternative would displace families located within approximately 80 homes, and the logistics of purchasing these properties is uncertain. Additionally, the demographics for the area show that minority and low income populations would be affected. Based on the extreme disturbance to the environment, logistics, impacts from increased sediment load in the channels, environmental justice impacts, and cost, this alternative was determined to be infeasible and was eliminated from further study.

5.3.2 Dam Raise 100-Year Sediment Life Alternative (Maximum Life)

Opportunities to provide 100 years of sediment storage for rehabilitation alternatives were explored. Measures to meet 100 years of sediment life would include all those listed for the “Dam Raise 71-Year Sediment Life” Alternative (Section 3.4.2) at a cost of \$15,473,000. A detailed cost estimate for the “Dam Raise 71-Year Sediment Life” Alternative is included in Appendix D, Table D.8 of Section D.14.2.2. In addition, approximately 347,675 cubic yards (215 ac-ft) of sediment removal within the basin would be required at an approximate cost of \$7,458,000. The total approximate construction cost for this alternative would be \$22,931,000. A large area of disturbance would be required to excavate and dispose of the required amount of sediment (approximately 40-50 acres). BLM maintains the mineral rights for onsite sediment and would require any sediment excavated to be disposed of on BLM lands upstream of the basin. This region is arid with severe erosion conditions (see Section 2.1) that would create an issue for stabilizing disturbed areas. Based on the logistics with excavating and disposing of such a large quantity of sediment, erosive and arid conditions creating issues with sediment stabilization measures, the large environmental impact, and very high cost, this alternative was considered infeasible and eliminated from further study.

5.3.3 Dam Raise 88-Year Sediment Life Alternative

The opportunity to provide 88 years of sediment storage for rehabilitation alternatives was explored. Measures to meet 88 years of sediment life would include all those listed for the “Dam Raise 71-Year Sediment Life” Alternative (Section 3.4.2) at a cost of \$15,473,000. In addition, approximately 211,350 cubic yards (131 ac-ft) of sediment removal within the basin would be required at an approximate cost of \$4,533,000. The total approximate construction cost for this alternative would be \$20,006,000. A large area of disturbance would be required to excavate and dispose of the required amount of sediment (approximately 30-40 acres). BLM maintains the mineral rights for onsite sediment and would prefer any sediment excavated to be disposed of on BLM lands upstream of the basin. This region is arid with extremely erosive soils that would create an issue for stabilizing disturbed areas. Based on the logistics with excavating and disposing of such a large quantity of sediment, erosive and arid conditions creating issues with sediment stabilization measures, the large environmental impact, and very high cost, this alternative was considered infeasible and eliminated from further study.

5.3.4 Dam Raise 50-Year Sediment Life Alternative (Minimum Life)

This alternative would include measures similar to those of the “Dam Raise 71-Year Sediment Life” Alternative (Section 3.4.2), except the principal spillway, auxiliary spillway, retaining dike, and dam crest would not be raised as high. The sediment pool and auxiliary spillway crest would be raised approximately 14.2 feet, the auxiliary spillway crest raised approximately 8.7 feet, the retaining dike raised approximately

8.1 feet, and the dam crest raised approximately 7.7 feet. The estimated construction cost for this alternative is approximately \$14,206,000. This alternative was compared to the “Dam Raise 71-Year Sediment Life” Alternative to compare the cost benefit over a 71-year evaluation period. The comparison concluded that O&M cost for sediment removal (157.7 ac-ft) to extend the life and meet 71 years would be approximately \$5,457,000. The construction and O&M cost for the project over a 71-year life would be over \$4,000,000 more than for the “Dam Raise 71-Year Sediment Life” Alternative. Based on the cost benefit comparison, it was determined that this alternative would not be the NED for the project. Additionally, there are logistical issues with excavating and disposing of such a large quantity of sediment, as mentioned for the alternatives above. Based on the sediment logistic issues and cost benefit comparison, this alternative was eliminated from further study.

5.3.5 Dam Raise Sediment Excavation Combo for 50- to 71-Year Life

Alternatives were evaluated to determine if a raise to dam features and sediment excavation could be combined to produce a lower cost and increase the cost benefit ratio for the project. This alternative would include measures similar to those for the “Dam Raise 50-Year Sediment Life” Alternative (Section 3.3.4.), but sediment excavation in the basin would also be conducted to extend the sediment life of the structure past 50 years. Sediment excavation amounts would vary depending on the amount of life added to the structure. Complications for sediment disposal on BLM lands and stabilizing sediment were identified similar to those for the Dam Raise 88-Year and 100-Year Alternatives (Sections 3.3.2 and 3.3.3). Construction costs varied depending on the amount of life added to the structure. Cost analysis determined that the costs associated with raising the structure were far less than those associated with removing sediment from the basin. Additional environmental disturbance would occur, and the area of disturbance varied from approximately 10 to 40 acres, depending on how much sediment excavation would be required. Based on the logistics with excavating and disposing of sediment, erosive and arid conditions creating issues with sediment stabilization measures, the environmental impact, and high cost associated with any sediment excavation, this alternative was considered infeasible and eliminated from further study.

5.3.6 Dam Raise Sediment Excavation Combo for 71- to 88-Year Life

Alternatives were evaluated to determine if a maximum possible dam raise could be combined with sediment excavation to produce a lower cost and increase the cost benefit ratio for the project. Measures for this alternative would include all those listed for the “Dam Raise 71-Year Sediment Life” Alternative (Section 3.4.2), with additional sediment excavation from the basin. Sediment excavation amounts varied depending on the amount of life added to the structure. Complications for sediment disposal on BLM lands and stabilizing sediment were identified similar to those for the Dam Raise 88-Year and 100-Year Alternatives (Sections 3.3.2 and 3.3.3). Construction costs varied depending on the amount of sediment to be excavated. Cost analysis determined that sediment excavation costs were excessive due to extreme stabilization measures that would be required for the arid and erosive conditions. Additional environmental disturbance would occur, and area of disturbance varied from approximately 10 to 35 acres, depending on how much sediment excavation would be required. Based on the logistics with excavating and disposing of sediment, erosive and arid conditions creating issues with sediment stabilization measures, the environmental impact, and high cost associated with any sediment excavation, this alternative was considered infeasible and eliminated from further study.

5.3.7 Return Sediment Storage to As-Built Condition Alternative

This alternative would consist of excavating approximately 405 ac-ft (653,400 cubic yards) of sediment from the basin to return it to As-Built sediment capacity. It would also include the same measures identified

in the No [Federal] Action Alternative (Section 3.4.1) at a cost of approximately \$10,510,000. This would provide approximately 56 years of sediment life. The cost for sediment excavation and relocation alone would be approximately \$14,015,000. Total cost for this alternative would be approximately \$24,525,000. Based on the exorbitant cost, environmental disturbance associated with sediment excavation and disposal, and logistics of sediment disposal, this alternative was eliminated from further study.

5.3.8 Riprap Auxiliary Spillway Alternative

Measures for this alternative would include all those listed for the “Dam Raise 71-Year Sediment Life” Alternative (Section 3.4.2), but the auxiliary spillway would be armored with riprap instead of concrete. The added roughness from riprap for this alternative would require the auxiliary spillway to be widened at least four times its existing width to pass the necessary design flows. The logistics and costs associated with widening the auxiliary spillway by this amount were determined to be infeasible. Costs for auxiliary spillway modifications alone would be greater than \$10,000,000, and there is not enough room at the structure to accommodate the proposed width. The total cost for this alternative would far exceed the cost of other alternatives analyzed. Based on the logistics and exorbitant costs associated with a riprap auxiliary spillway, this alternative was eliminated from further study.

5.4 Alternatives Considered for Detailed Study

Alternative analysis is required to determine feasible methods that can meet the purpose of providing continued flood protection in the currently protected area downstream of the dam, and to meet current NRCS and NM Dam Safety engineering safety standards. As part of the rehabilitation, the structure would be modified to include applicable modern construction techniques and technological advances that have become standard since the original construction of the dam. The No [Federal] Action Alternative must also be considered. The alternatives studied in detail include the No [Federal] Action Alternative, Dam Decommissioning, and the “Dam Raise 71-Year Sediment Life” Alternative (Structural Rehabilitation Alternative). A detailed description of each of the alternatives is provided in Sections 3.4.1 and 3.4.2 below.

The costs for the alternatives are conceptual level estimates only with an estimated range of accuracy at $\pm 30\%$, and are intended to reflect the maximum level of cost that could be associated with alternative measures. Project costs provided for alternatives selected for detailed study include installation and O&M costs. Installation costs include costs for installing the works of improvement to be incurred after the project is authorized for installation. Installation costs include, as applicable, construction, engineering, real property rights, natural resource rights, permitting, “replacement in-kind” relocation payments, and project administration costs (NRCS 2015). A further breakdown of project installation costs for alternatives included in detailed study is provided in Section 3.6, Table 3-1.

5.4.1 No [Federal] Action Alternative

The Sponsor’s most likely course of action, as indicated in discussions, would be to bring the dam up to current state design standards. Note that the construction measures to bring the dam into compliance with state standards do not include extending the sediment retention life of the structure. The Sponsor would need to perform sediment excavation O&M activities to extend the structure life and ensure proper operation of the dam. Currently, the structure is not meeting NM Dam Safety standards for a high hazard class dam. See Section 1.2 for a list of items not meeting current state standards. The Sponsor would likely perform the following measures to bring the dam up to current state design standards. The No [Federal] Action Alternative is depicted in Appendix B-Map 4.

Dam Embankment

The dam crest would be widened from 18 feet to 21.4 feet and level graded to 6,354.4 feet. The dam crest would be graded with a cross slope of no more than 3% to direct water back into the basin. The entire dam embankment would be covered with a gravel blanket (1-foot-thick) for erosion protection. The existing embankment slopes would be maintained.

Auxiliary Spillway

A new reinforced concrete auxiliary spillway would be constructed within the footprint of the existing earthen spillway with a crest elevation of 6,349.6 feet. Riprap would be installed at the downstream toe of the new concrete spillway to provide energy dissipation and erosion protection for flows entering the adjoining drainage.

Retaining Dike

The existing retaining dike would be reconstructed to meet the requirements for a water impounding structure up to a crest elevation matching the dam crest at 6,354.4 feet. The crest would have a minimum width of 10 feet and would be graded with a cross slope of no more than 3% to direct water back into the basin. The entire retaining dike would be covered with a gravel blanket (1-foot-thick) for erosion protection. The upstream embankment would be sloped at 3H:1V and the downstream embankment would be sloped at 2H:1V.

Principal Spillway

The existing principal spillway riser structures would be demolished and replaced with one new principal spillway riser. The crest elevation would be maintained at the existing sediment pool elevation of 6,336.6 feet. The new riser would be constructed of reinforced concrete with a steel trashrack, and designed to meet all current state engineering safety standards. The riser would be connected to the existing 30-inch reinforced concrete principal spillway conduit. The principal spillway conduit would be sliplined, which is a method that installs a smaller carrier pipe or material into a larger pipe, to repair leaks and restore structural stability.

The plunge pool at the principal spillway conduit outlet would be reconstructed with riprap for erosion protection and dissipation before discharging into the downstream channel. To allow connectivity to the existing downstream channel, an approximately 25-foot length of the existing acequia would be piped. The design of the piped section of the acequia would include aesthetically appropriate design features. An armored channel would extend over the piped section of the acequia and discharge into the existing downstream natural drainage channel.

Access Road and Staging

These measures would be the same as those listed for the Dam Raise 71-Year Life Alternative in Section 3.4.2.

The installation cost for the No [Federal] Action Alternative is estimated at approximately \$12,922,300 as detailed in Table 3-1 below. To evaluate the No [Federal] Action Alternative for the same duration as the Dam Raise 71-Year Life Alternative, the Sponsor would need to perform sediment excavation O&M activities to ensure proper operation of the dam. Approximately 520 ac-ft of sediment would need to be removed from the basin over the course of the next 71 years. O&M and sediment removal costs are estimated to be approximately \$18,268,300 over the evaluated life of the project. The total cost for the No [Federal] Action Alternative including O&M over the 71-year evaluation period would be approximately \$31,190,600. Refer to Appendix D, Section D.14.2.1 for cost estimate details.

5.4.2 Dam Raise 71-Year Sediment Life Alternative

The “Dam Raise 71-Year Sediment Life” Alternative (Structural Rehabilitation Alternative) would consist of measures to provide continued flood protection in the currently protected area downstream of the dam, meet current NM Dam Safety and NRCS engineering safety standards, and extend the structure life for 71 years. See Section 1.2 for a list of items not meeting current standards. Rehabilitating the structure would not modify the high hazard classification of the dam because the risk to property, residents, and infrastructure would not change downstream.

This alternative provides enough capacity to accommodate 71 years of sediment accumulation in the basin. A number of options were considered in determining a rational for the sediment life for the structure of between 50 and 100 years. Options to excavate sediment from the basin to increase the sediment capacity of the structure were determined to be infeasible due to logistics, stabilization of disturbed areas for the severe erosion conditions, the large area of impact from disturbance, and cost (refer to Section 5.3.7). Alternatives to raise the structure components to the maximum feasible extent were evaluated, but due to topographic constraints, the components could not be raised enough to meet the flood retarding capacity and 100 years of sediment capacity. The maximum capacity for sediment that could be obtained by raising is approximately 535.1 ac-ft, which provides capacity for approximately 71 years of sediment accumulation.

This alternative consists of raising the structure components to the maximum feasible extent allowed by topographic constraints to increase capacity in the basin. Optional fencing around the dam and retaining dike may be performed. The Structural Rehabilitation Alternative is depicted in Appendix B-Map 5 and would include the measures described below.

Dam Embankment

The dam crest would be raised approximately 10.6 feet to elevation 6,365.0 feet. The dam crest would be widened from 18 feet to 24 feet and graded with a cross slope of no more than 3% to direct water back into the basin. The entire dam embankment would be covered with a gravel blanket (1-foot-thick) for erosion protection. The upstream embankment slope would be maintained at 3H:1V and the downstream slope would be maintained at 2H:1V for the upper approximately 36 feet, and 2.5H:1V for the lower portion.

Auxiliary Spillway

The auxiliary spillway crest would be raised approximately 11.1 feet to elevation 6,360.7 feet. A new reinforced concrete auxiliary spillway would be constructed within the footprint of the existing earthen spillway to prevent erosion when the spillway is activated. The new concrete spillway would have an approximate 40-foot wide level control section. Riprap would be installed at the downstream toe of the new concrete spillway to provide energy dissipation and erosion protection for flows entering the adjoining drainage.

Retaining Dike

The existing retaining dike would be reconstructed to meet the requirements for a water impounding structure up to a crest elevation matching the dam crest at 6,365.0 feet (10.6-foot raise). The crest would have a minimum width of 12.5 feet and would be graded with a cross slope of no more than 3% to direct water back into the basin. The entire retaining dike would be covered with a gravel blanket (1-foot-thick) for erosion protection. The upstream embankment would be sloped at 3H:1V and the downstream embankment would be sloped at 2H:1V.

Principal Spillway

The existing principal spillway riser structures would be demolished and replaced with one new principal spillway riser. The crest elevation would be raised approximately 17.8 feet to accommodate capacity for 71 years of sediment accumulation. The new riser would be constructed of reinforced concrete with a steel trash rack, and designed to meet all current state and NRCS engineering safety standards. The riser would be connected to the existing 30-inch diameter reinforced concrete pipe conduit. The conduit would be sliplined to maintain structural stability.

The plunge pool at the principal spillway conduit would be reconstructed with riprap for erosion protection and energy dissipation before discharging into the downstream channel. To allow connectivity to the existing downstream channel, an approximate 25-foot length of the existing acequia would be piped. The design of the piped section of the acequia would include design features similar to the natural portions of the acequia. An armored channel would extend over the piped section of the acequia and discharge into the existing downstream natural drainage channel.

Access Road and Staging

An approximate 8.1-acre staging area would be located upstream of the dam embankment and an approximate 2.4-acre staging area would be located downstream of the dam embankment within the basin. The existing access road to the structure is in poor condition and has a grade that is not traversable by most vehicles. This access road would be decommissioned and restored to native vegetative conditions. To provide stabilized construction access to the basin, a new access road would be constructed at a grade not to exceed 10% along a new alignment to the top of the dam crest. The new access road would be approximately 14 feet wide and 1,200 feet long. After construction completion, the new access road would remain in place and serve as the new permanent access road to the basin.

Rock/Sediment Disposal

Any rock or soil materials excavated during construction activities that are not suitable for reuse would be hauled to an approximately 7.4-acre upland disposal location upstream of the structure and at an elevation above the proposed dam crest elevation (6,365.0 feet). The sediment would be evenly distributed and contoured to mimic the existing landscape. The sediment disposal area would be stabilized and restored upon construction completion. The need for environmental testing of the excavated material is not anticipated because there are no known hazardous waste sites and no naturally occurring or background contaminants in or near the dam or in the upstream drainage area. Likewise, pesticide or herbicides have not been commonly utilized in or near the structure.

Avoidance, Minimization, and Mitigation Measures

Compensatory mitigation would not be required for the Structural Rehabilitation Alternative. Refer to Section 6.4 for a detailed list of avoidance and minimization measures for this alternative.

Schedule

Construction activities for the Structural Rehabilitation Alternative would occur over the course of one year.

Cost Estimate

The installation cost estimate for this alternative is approximately \$19,022,900 as detailed in Table 3-1. O&M costs are estimated to be approximately \$284,000 over the 71-year evaluated life of the project. The total cost for the Structural Rehabilitation Alternative including O&M over the 71-year evaluation period would be approximately \$19,306,900. Refer to Appendix D, Section D.14.2.2 for cost estimate details

5.5 National Economic Development

The NED Alternative is the alternative or combination of alternatives that reasonably maximizes the net economic benefit of the project consistent with protecting the nation's environment. The net economic benefit is the benefit minus the cost. According to the NWPM Sections 502.2 and 505.35.B(1)(iv), when human life is potentially at risk, the NED Alternative is defined as the federally-assisted alternative with the greatest net economic benefits.

5.6 Summary and Comparison of Alternative Plans

The alternatives proposed for consideration and analyzed in detail in this Plan-EA have been compared against each other to discern the merits and disadvantages of each alternative. This comparison of environmental, social, and economic effects is summarized in Table 3-1.

Table 3-1. Summary and Comparison of Alternative Plans

Resource Concern	No Action	Rehabilitation
Soils Resources		
Upland Erosion and Sedimentation	Proper construction Best Management Practices (BMPs) will be installed during and after construction to prevent and control soil erosion. Aerated sediment would continue to accumulate in the floodwater-retarding pool and the structure is currently at the end of its sediment life.	Similar to the No [Federal] Action Alternative, but the basin would provide enough capacity for 71 years of sediment deposition.
Water		
Surface Water Quality	Surface water quality would not change after rehabilitation of the structure. Construction activities may temporarily impact surface water quality, but construction BMPs would be in place during construction and impacts would be minimal.	
Waters of the U.S.	Approximately 68 feet of the principal spillway conduit outlet channel downstream of the plunge pool would be armored, 60 feet of the acequia would be piped, and 375 feet of the Cañada de Ojito would be modified through ground disturbance and/or armoring.	
Wetlands	Removal of 0.05 acres of scrub-shrub wetland would occur to reconstruct the plunge pool. Impacts would be minor and compensatory mitigation is not anticipated since impacts are less than the 0.1-acre threshold.	
Floodplain Management	There would be no change from current conditions.	Moderate beneficial impact that would increase flood protection to downstream communities and infrastructure and reduce the frequency of flooding from the structure.
Sole Source Aquifers	No impacts anticipated	
Air Quality		
Air Quality	Construction activities are not expected to violate air quality standards based on the implementation of BMPs and the short duration of construction.	
Plants		
Special Status Plant Species	No impacts to ESA- or state-listed plant species. Potential impact to suitable habitat for BLM sensitive species Santa Fe cholla (<i>Cylindropuntia viridiflora</i>) and the gramma grass cactus (<i>Sclerocactus papyracanthus</i>).	

Resource Concern	No Action	Rehabilitation
Noxious Weeds and Invasive Plants	This alternative would put the project area at risk for future invasion of noxious weeds and invasive plants. Construction BMPs would be implemented to minimize the short-term impacts associated with construction activities.	Similar to the No [Federal] Action Alternative, but a Post Construction Rehabilitation Plan (PCSRP) would also be developed. Impacts would be minimal with implementation of BMPs and development of a PCSRP.
Riparian Areas	Minor impacts from removal of 0.24 acres of riparian vegetation for the new access road and reconstruction of the plunge pool.	
Animals		
Wildlife and Wildlife Habitat	Approximately 3.8 acres of permanent impact from adding concrete to the auxiliary spillway and constructing the new access road. Approximately 28.5 acres of temporary impacts including clearing and grubbing. Temporarily disturbed areas would be restored to preconstruction conditions upon construction completion, and minor impacts are anticipated.	
Fish and Fish Habitat	Modification consisting of piping 60 feet of the acequia and associated temporary construction disturbance would impact potential fish habitat in the acequia due to project actions. These impacts would be minor since habitat is low quality, limited, and is only available when the acequia is flowing.	Similar to the no action alternative, but if construction activities occur when the acequia is flowing, fish salvage would be performed in any areas dewatered to facilitate construction. The acequia would be piped around the construction area to maintain flows downstream and avoid any temporary impacts to fish or fish habitat downstream.
Special Status Animal Species	No impacts to USFWS-listed species (Appendix A). Minor impacts to BLM sensitive species Gunnison’s prairie dog and pinyon jay, and BLM sensitive species/state-listed bald eagle (if present) and associated habitat.	No impacts to USFWS-listed species except for Mexican spotted owl and southwest willow flycatcher that have a may affect, but not likely to adversely affect determination (Appendix A). Minor impacts to BLM sensitive species Gunnison’s prairie dog and pinyon jay, and BLM sensitive species/state-listed bald eagle (if present) and associated habitat. Based on the duration of construction, avoidance/minimization measures, restoration of disturbed areas, and abundant suitable habitat in the surrounding area, the impacts to Gunnison’s prairie dog, bald eagle and pinyon jay (if present), and their associated habitat would be temporary and minimal.
Migratory Birds/Bald and Golden Eagles	Impacts to migratory birds would be minor to moderate (if present) since construction activities have the potential to destroy nests and harm or kill species, if present. Impacts to suitable habitat for migratory birds would be temporary and minimal based on duration of construction, restoration of disturbed areas, and abundant suitable habitat in the surrounding area.	Preconstruction surveys would be performed and spatial buffers would be established as necessary in coordination with USFWS and NRCS. Impacts to migratory birds and associated habitat would be temporary and minimal based on the duration of construction, restoration of disturbed areas, abundant suitable habitat in the surrounding area, and avoidance/minimization measures in place.
Human		

Resource Concern	No Action	Rehabilitation
Socioeconomics	Sponsor would be responsible for paying approximately \$12,922,300 for installation and approximately \$257,300 annually after installation for O&M and to extend the sediment life of the structure. Long-term socioeconomic impacts to the taxed local community to pay for installation and O&M are anticipated and adverse impacts to minority and low income populations. Minor temporary beneficial impact from additional employment requirements for project construction. Minor indirect benefit from decreased risk of dam failure and associated threat to life and property.	Sponsor would be responsible for paying approximately \$5,422,900 for installation, which is anticipated to be primarily covered through state funding. O&M costs would be similar to existing costs at \$4,000 annually. No measurable impact is anticipated related to taxing the local community. Minor temporary beneficial impact from additional employment requirements for project construction. Minor indirect benefit from decreased risk of dam failure and associated threat to life and property.
Historic Properties/Cultural Resources	Construction activities would avoid archaeological sites determined to be eligible for the NRHP. Unavoidable impacts are anticipated to a NRHP eligible historic landscape feature (Acequia de la Cañada Ancha) from piping two section for an access crossing and to bypass principal spillway flows. Impacts are anticipated to be negligible because short segments would be piped, modifications would eliminate existing adverse disturbance to the acequia and acequia operations, and historic aesthetic design features would be incorporated. New Mexico Historic Preservation Division concurred with a no adverse effect determination (Appendix A).	
Hazardous Substances, Materials, and Waste	All federal, state, and local laws and regulations pertaining to pollution and contamination of the environment to prevent pollution of surface water, groundwater, soil, and air with any hazardous materials would be followed. Impacts would be negligible based on adherence to applicable laws and regulations.	
Public Health and Safety	Reduces the risk of dam failure and associated loss of life.	
Recreation	Project area would be temporarily closed for construction and area would be reopened after construction completion. Minimal temporary impacts based on scope and duration of construction and abundant opportunity for the same recreation activities directly adjacent to the project area.	
Visual Resources and Scenic Beauty	Temporary impacts would occur during construction, but disturbed areas would be restored according to the visual management objectives and associated reclamation standards outlined in the BLM Resource Management Plan (BLM 2012). Impacts would be minimal based on duration of construction and restoration of disturbed areas.	
Transportation Infrastructure	Minor beneficial impact that would decrease the risk of dam failure and associated damage to roads and highways (approximately 15) located within the breach inundation area.	Similar to the No [Federal] Action Alternative but also provides additional indirect benefit from reduced flooding for 24-hour/100-year and greater events, reducing associated damage to downstream transportation infrastructure.
Noise	Impacts would be temporary and minimal based on the duration of construction and implementation of BMPs.	
National Economic Development		
Construction Cost	\$10,510,000	\$15,473,000
Other Costs ¹	\$2,412,300	\$3,549,900
Total Project Cost (Installation Cost)	\$12,922,300	\$19,022,900
Cost Sharing (NRCS)	\$0	\$13,580,000

Resource Concern	No Action	Rehabilitation
Cost Sharing (Sponsor)	\$12,922,300	\$5,442,900
Annual Installation Cost	\$416,000	\$612,400
O&M Cost	\$257,300	\$4,000
Annual Sum Cost	\$673,300	\$616,400
Annual Benefit ²	\$0	\$673,824
Net Economic Benefit	-\$673,300	57,424
Benefit Cost Ratio	0	1.1

¹ Other costs include engineering, real property rights, permits, and project administration.

² \$673,300 was added to the average annual flood damage reduction benefits (\$524) because the Sponsor would avoid the cost of implementing the No [Federal] Action Alternative.

SECTION 6

ENVIRONMENTAL CONSEQUENCES

NRCS has the responsibility under National Environmental Policy Act (NEPA) to identify and address the effects on the environment that may occur as a result of the alternative plans. These alternatives include the No Action and Structural Rehabilitation Alternatives. This section describes the potential effects of the alternatives within each resource category as defined in Section 2.0.

The following describes the type of effects and impacts analysis used in this section (NRCS 2015):

- **Direct Effect:** Impacts caused by a proposed action and occurring at the same time and place.
- **Indirect Effect:** Impacts caused by an action that are later in time or farther removed in distance but are still reasonably foreseeable.
- **Cumulative Effect:** The impact on the environment that 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 is undertaking such other action.
- **Temporary and Permanent Impacts:** Temporary impacts are impacts that are not lasting and the affected resource will return or be restored to its previous (pre-project) state. Permanent impacts are those in which the affected resource will not return to its previous state within one's lifetime.
- **Short- and Long-Term Impacts:** Short-term impacts are those that last during the duration of construction and shortly after (duration of impact is approximately 1 year or less). Long-term impacts are those that last for an extended duration of time. For this evaluation, long-term impacts extend beyond year 1 of the start of the project up the evaluated life of the project (approximately 72 years).

6.1 Upland Erosion and Sedimentation

Please refer to Section 2.1 for existing upland erosion and sedimentation conditions for the project area.

6.1.1 No [Federal] Action Alternative

Erosion may occur on disturbed and cleared areas within the project boundary during precipitation events. Proper BMPs would be installed during and after construction to prevent and control soil erosion. Sediment would continue to accumulate in the basin at an approximate rate of 7.51 ac-ft per year, and the basin is currently at the end of its sediment life.

6.1.2 Structural Rehabilitation Alternative

Erosion may occur on disturbed and cleared areas within the project boundary during precipitation events. Proper BMPs would be installed during and after construction to prevent and control soil erosion. Sediment would continue to accumulate in the basin at an approximate rate of 7.51 ac-ft per year, but the basin would have enough capacity for 71 years of sediment deposition. The 8.34 square-mile drainage area upstream of the structure is 96% BLM managed lands. BLM could implement rangeland management plans to better preserve land in the contributing watershed, but there is no such plan at this time.

6.2 Water Resources

Activities related to water resources are regulated by EPA, the USACE, and the New Mexico Environmental Department (NMED). Appropriate permits will need to be obtained for any activities regulated by the Clean Water Act (CWA), and include the following:

- Section 402 of the CWA for construction activities: National Pollutant Discharge Elimination System (NPDES) permit (for construction over 1 acre), as administered by the New Mexico Environment Department, Surface Water Quality Bureau.
- Section 404 Permit: for discharge of fill into waters of the U.S. (potential jurisdictional waters).

Coordination with appropriate agencies is ongoing. Specific area management plans may exist that the project would need to comply with to meet the requirements set forth as part of those plans.

6.2.1 Surface Water Quality

Please refer to Section 2.2.1 for existing surface water quality conditions for the project area.

6.2.1.1 No [Federal] Action Alternative

Project design elements, including BMPs, would be required to be implemented to reduce the quantity of sediment (1) entering drainages; and (2) flowing downstream and violating any federal or state water quality rules and regulations. This alternative would also meet New Mexico antidegradation requirements. Construction BMPs would include, but are not limited to, the following:

- A Storm Water Pollution Prevention Plan that contains erosion and sediment control and pollution prevention BMPs, such as, but not limited to, silt fences, fiber wattles, and/or earthen berms, would be required and implemented.
- Water bodies adjacent to construction and staging areas would be identified, and such measures as straw bales, silt fences, and other appropriate sediment control BMPs would be implemented to prevent the entry of sediment and other contaminants into waters.
- To ensure that accidental spills do not enter waters, the storage of petroleum-based fuels and the refueling of construction machinery would not occur outside of approved designated staging/batch plant areas. Furthermore, the project would comply with state and federal water quality standards and toxic effluent standards to minimize any potential adverse impacts from discharges to waters of the U.S.
- No construction materials would be stockpiled or deposited in or near any water bodies.

Note that the basin and associated drainages are normally dry, and surface water is only present in those features during precipitation events. Water flows more regularly down the acequia, but those flows are not year-round and are regulated. With the implementation of the BMPs listed above, there would only be minimal temporary impacts on water quality. Impacts may include short-term increases in sediment load in surface water. Impacts would be minimal with implementation of BMPs.

6.2.1.2 Structural Rehabilitation Alternative

This alternative would utilize the same BMPs and would have the same impacts as the No [Federal] Action Alternative.

6.2.2 Waters of the U.S.

Information was provided by email to the USACE regarding the proposed rehabilitation on February 25, 2015. The USACE responded by email on February 26, 2015 indicating that the dam was located on a water of the U.S. (Arroyo de la Cañada Ancha) and that an ordinary high water mark (OHWM) delineation should be conducted (Appendix A). It was indicated that if a 404 permit is required for project activities, there is a possibility that work may qualify for a Nationwide Permit 43, but the loss of waters cannot exceed 0.5 acres. A Scoping Notice dated March 5, 2015, was provided to the USACE. A response was not received from the USACE after the Scoping Notice was provided.

A waters of the U.S. and wetland delineation was completed for the project area. A summary of the waters of the U.S. located within the project area is included in Section 2.2.2 and the waters of the U.S. and wetland delineation memorandum has been included in Appendix E.

6.2.2.1 No [Federal] Action Alternative

This alternative includes reconstruction of the structure's principal spillway plunge pool and outlet channel. The new principal spillway outlet channel would reconnect the plunge pool to the natural downstream drainage by piping a 40-foot section of the Acequia de la Cañada Ancha (acequia). A new access road would be installed and would require a culvert crossing approximately 20 feet wide along the acequia. These modifications would permanently impact approximately 68 feet of the surveyed principal spillway outlet channel and approximately 60 feet of the acequia. Modification would also be made to the structure's auxiliary spillway that would impact approximately 375 linear feet of the Cañada de Ojito. The auxiliary spillway improvements would add riprap for erosion protection and dissipation at the spillway toe adjoining the drainage. These improvements would not remove any waters of the U.S., but would modify the existing channels and features to provide erosion protection, allow for stabilized access over the acequia, and also reestablish connectivity of flow from the principal spillway outlet channel to the natural downstream drainage.

6.2.2.2 Structural Rehabilitation Alternative

The impacts would be the same as those described for the No [Federal] Action Alternative.

6.2.3 Wetlands

Information was provided by email to the USACE regarding the proposed rehabilitation on February 25, 2015. The USACE responded by email on February 26, 2015 indicating that the dam was located on a water of the U.S. (Arroyo de la Cañada Ancha) and that an ordinary high water mark (OHWM) delineation should be conducted (Appendix A). It was indicated that if a 404 permit is required for project activities, there is a possibility that work may qualify for a Nationwide Permit 43, but the loss of waters cannot exceed 0.5 acres. A Scoping Notice dated March 5, 2015, was provided to the USACE. A response was not received from the USACE after the Scoping Notice was provided.

A waters of the U.S. and wetland delineation was completed for the project area. A summary of wetlands located within the project area is included in Section 2.2.3 and the waters of the U.S. and wetland delineation memorandum has been included in Appendix E.

6.2.3.1 No [Federal] Action Alternative

This alternative includes reconstruction of the structure's plunge pool including armoring where a wetland exists. Modifications to the plunge pool would require permanent removal of "Wetland A" consisting of a 0.05-acre scrub-shrub wetland. Impacts to wetlands would be minor based on the size and quality of the wetland, and compensatory mitigation is not anticipated since impacts are less than the 0.1-acre threshold.

6.2.3.2 Structural Rehabilitation Alternative

The impacts would be the same as those described for the No [Federal] Action Alternative.

6.2.4 Floodplain Management

Please refer to Section 2.2.4 for existing floodplain designations for the area upstream and downstream of the dam.

6.2.4.1 No [Federal] Action Alternative

Under this alternative, the auxiliary spillway would activate at the 24-hour/100-year event as it does currently. The aerated sediment volume of the structure is currently full and would not offer any additional capacity during flood events. There would be no anticipated change in downstream flooding from the existing conditions.

6.2.4.2 Structural Rehabilitation Alternative

This alternative would have a moderate beneficial impact that would increase flood protection to downstream communities and infrastructure. Rehabilitation measures would increase the aerated sediment volume of the structure and reduce flows traveling downstream up to the 100-year flood event. The proposed flood-retarding capacity of the structure would contain all storm events up to and including the 24-hour/100-year event (assuming a full aerated sediment volume at the end of 71 years) without activation of the auxiliary spillway. This storm event would activate the auxiliary spillway under current conditions. Rehabilitation of the structure would reduce the 24-hour/100-year peak outflow from 270 cubic feet per second (cfs) down to 125 cfs since the auxiliary spillway would not be activated.

For this alternative, the basin would also have capacity to contain 71 years of aerated sediment accumulation (341.8 ac-ft). Even though this capacity is designated for sediment, there would be the benefit of additional floodwater-retarding capacity until the sediment pool fills. Prior to any sediment accumulation, the basin would have a total capacity of 876.9 ac-ft. The 24-hour/500-year storm would create a total capacity of water of 562.1 ac-ft. Therefore, the basin would be able to contain the 24-hour/500-year event without activation of the auxiliary spillway for approximately 42 years until the basin fills with approximately 314.8 ac-ft of sediment. The outflow from the dam for a 24-hour/500-year event would be reduced from 1,499 cfs to 125 cfs for the first 42 years of the 71-year period of analysis. This would result in a considerable reduction to flooding extents during the 24-hour/500-year event. Flooding extents for the Structural Rehabilitation Alternative for the 24-hour/100- and 500-year events can be seen in Appendix C-Maps 7 and 8, but additional modeling with more robust software packages now available and with higher resolution data is needed to determine more accurate differences in flood extents between events.

6.2.5 Sole Source Aquifers

Please refer to Section 2.2.4 for existing information regarding sole source aquifers for the project area.

6.2.5.1 No [Federal] Action Alternative

This alternative would have no impact to sole source aquifers within the project area. Modifications would not change the existing infiltration conditions at the site. In addition, the project measures would not introduce any contaminants that would have the potential to infiltrate and influence the aquifer.

6.2.5.2 Structural Rehabilitation Alternative

The impacts would be the same as those described for the No [Federal] Action Alternative.

6.3 Air Quality

Please refer to Section 2.3 for existing information regarding air quality for the project area.

6.3.1 No [Federal] Action Alternative

Construction activities would temporarily emit several air pollutants. PM₁₀ emissions are associated with the dust created from demolition, land clearing, ground excavation, cut-and-fill operations, and road construction. All other pollutants (PM_{2.5}, carbon monoxide [CO], sulfur oxides (SO_x), nitrous oxides (NO_x, mobile source air toxics [MSATs], and GHGs) are generated from heavy-duty diesel engines used by the construction equipment. Construction emissions are greatest during the earthwork phases because of the dust associated with this activity. Fugitive dust can also be produced by winds blowing through the construction site and by trucks carrying uncovered loads. Additionally, mud tracked onto paved roads leading to and from the construction site creates a source of fugitive dust (i.e., road dust) after it dries.

Emissions from trucks and construction equipment powered by heavy-duty diesel engines would be temporary and concentrated around the construction site. Delays associated with travel through construction zones would increase emissions from on-road vehicles. However, these temporary delays would likely result in only a small amount of additional pollutant emissions when compared with the usual traffic experienced around the construction site.

Fugitive dust, MSAT, and GHG emission increases associated with construction would be minimized by implementation of applicable BMPs. These include the following:

- Spraying the soil onsite with water, or other similar approved dust suppressant/soil binder.
- Wetting materials hauled in trucks, providing adequate freeboard (space from the top of the material to the top of the truck), or covering loads to reduce emissions during material transportation/handling.
- Providing a stabilized construction entrance (track-out pad), wheel washers, and/or other similar BMPs at construction site access areas to reduce track-out of site materials onto the adjacent roadway network.
- Removing tracked-out materials deposited onto adjacent roadways.
- Wetting material stockpiles to prevent wind-blown emissions.
- Establishing vegetative cover on bare ground as soon as possible after grading to reduce wind-blown dust.
- Requiring appropriate emission-control devices on all construction equipment.
- Requiring the use of cleaner burning fuels.
- Using only properly operating, well-maintained construction equipment.

Construction activities are not expected to violate air quality standards, based on the implementation of BMPs and the short duration of construction.

6.3.2 Structural Rehabilitation Alternative

The impacts would be the same as those described for the No [Federal] Action Alternative.

6.4 Plants

This section describes the impacts of the proposed action on the plant resources in the project area. Refer to Section 2.4 for existing conditions of plant resources within the project area including special status plant species, invasive and noxious plants, and riparian areas.

6.4.1 Special Status Plant Species

There are no ESA-listed plant species within Rio Arriba County. BLM sensitive species and state-listed endangered plant species were listed for the county, but only two species, the Santa Fe cholla (*Cylindropuntia viridiflora*) and the gramma grass cactus (*Sclerocactus papyracanthus*), have the potential to be present within the project area. Both species are BLM sensitive species and no state-listed species were found to have the potential to be present within the project area. Please refer to Section 2.4.2 for existing information regarding listed plant species.

6.4.1.1 No [Federal] Action Alternative

There would be no impact to ESA-listed plant species since there are none listed for Rio Arriba County. Suitable habitat for state-listed plant species is not located within the project area and there would be no impacts to state-listed plant species. There is potential for BLM sensitive species Santa Fe cholla (*Cylindropuntia viridiflora*) and the gramma grass cactus (*Sclerocactus papyracanthus*) to be present in the project area. The Sponsor is required to consult with BLM prior to undertaking actions on BLM lands. Information was requested from BLM regarding known occurrence and documented occurrence for the species. Additional coordination with BLM will be required during the formal review process to determine potential impacts to the two BLM sensitive species.

6.4.1.2 Structural Rehabilitation Alternative

The impacts would be the same as those described for the No [Federal] Action Alternative.

6.4.2 Noxious Weeds and Invasive Plants

Please refer to Section 2.4.2 for existing information regarding noxious weeds and invasive plants.

6.4.2.1 No [Federal] Action Alternative

This alternative would put the project area at risk for future invasion of noxious weeds. BMPs would be implemented during construction to prevent the spread of noxious weeds/invasive plant species and comply with Executive Order 13112. During construction and until restoration areas are fully established, they would be maintained on a regular basis to prevent the establishment of noxious weeds and invasive plant species. Non-desirable plant species would be controlled by cleaning equipment prior to delivery to the project site, eradicating the species before the start and during construction as discovered.

6.4.2.2 Structural Rehabilitation Alternative

This alternative would put the project area at risk for future invasion of noxious weeds. BMPs would be implemented during construction to prevent the spread of noxious weeds/invasive plant species and comply with E.O. 13112. During construction and until restoration areas are fully established, they would be maintained on a regular basis to prevent the establishment of noxious weeds and invasive plant species. Non-desirable plant species would be controlled by cleaning equipment prior to delivery to the project site, eradicating the species before the start and during construction as discovered, and by routinely monitoring after construction completion. A PCSRP will be developed and will include mechanisms for addressing weed establishment and treatment. Impacts would be minimal with implementation of BMPs and development of a PCSRP.

6.4.3 Riparian Areas

The project area contains approximately 3.9 acres of riparian area. Refer to Section 2.4.3 for information regarding existing riparian areas within the project area.

6.4.3.1 No [Federal] Action Alternative

This alternative would include construction of a new access road and modifications to the structure's principal spillway plunge pool and outlet channel that would impact riparian areas. Approximately 0.14 acres of riparian area would be permanently removed for construction of the new access road. Reconstruction of the plunge pool and modifications to the principal spillway outlet channel for erosion protection and passage over the acequia would remove approximately 0.1 acres of riparian area. The total removal of riparian area would be approximately 0.24 acres. Based on the minimal amount of removal and quality of the riparian areas, impacts are anticipated to be minor.

6.4.3.2 Structural Rehabilitation Alternative

The impacts would be the same as those described for the No [Federal] Action Alternative.

6.5 Animals

Necessary consultation was performed as required by Section 7 of the ESA and related NRCS guidelines. Section 7(a)(2) of the ESA requires that all federal agencies ensure that their actions on a project do not jeopardize the continued existence of any threatened or endangered species or result in the destruction or adverse modification of critical habitat of listed species.

Biological resources include the presence and habitat of wildlife found in the project area. The Migratory Bird Treaty Act of 1918 made it illegal for people to "take" migratory birds, their eggs, feathers, or nests. "Take" is defined in the Act to include by any means or in any manner, any attempt at hunting, pursuing, wounding, killing, possessing, or transporting any migratory bird, nest, egg, or part thereof. In addition, the Bald and Golden Eagle Protection Act affords additional protection against "taking" of bald and golden eagles.

6.5.1 Wildlife and Wildlife Habitat

Please refer to Section 2.5.1 for information regarding the presence of wildlife and wildlife habitat in the vicinity of the project area.

6.5.1.1 No [Federal] Action Alternative

Approximately 32.6 acres of wildlife habitat would be impacted by construction activities. Approximately 3.8 acres of the 32.6 acres would be permanently impacted from removal of habitat for placement of concrete on the auxiliary spillway and construction of the new access road. The remaining 28.5 acres would be temporarily impacted through modifications of surface materials from excavation, fill, and grading activities. Table 4-1 below identifies the approximate impact calculated for each modification. The temporary disturbed areas would be restored to preconstruction conditions upon construction completion, with the exception of the riprap areas. An approximate 0.3-acre area that contains the existing access roads (from the acequia to the top of the dam) would be restored to native vegetative conditions. Wildlife species, if present, may be temporarily disturbed and displaced to adjacent habitats. Once construction is completed, they could return to the area. Impacts would be minor because abundant habitat is available in the surrounding area, there are no specially designated wildlife habitat management areas present, and temporarily disturbed areas would be restored upon construction completion.

Table 4-1. Wildlife Habitat Impact Summary

Feature	Impact (Acres)			Modification
	Permanent	Temporary	Total	
Retaining Dike	-	1.3	1.3	Reconstruct and add rock blanket
Auxiliary Spillway	3.4	0.7	4.1	Armor with reinforced concrete and riprap
Dam Embankment	-	6.7	6.7	Widen and add rock blanket
Principal Spillway Risers	-	0.5	0.5	Demo existing risers and replace with new riser
Construction Staging Areas	-	10.5	10.5	Construction staging for materials and equipment
Plunge Pool	-	0.7	0.7	Armor with riprap
Sediment Disposal Area	-	7.4	7.4	Place excess sediment and rock
Permanent Access Road	0.4	0.3	0.7	Construct new gravel access road
Temporary Access Road	-	0.4	0.7	Temporary access road to haul materials to sediment disposal area
Totals	3.8	28.5	32.6	-

6.5.1.2 Structural Rehabilitation Alternative

The impacts would be the same as those described for the No [Federal] Action Alternative.

6.5.2 Fish and Fish Habitat

Please refer to Section 2.5.2 for information regarding the presence of fish and fish habitat in the vicinity of the project area. A ditch, the Acequia de la Cañada Ancha (acequia), is the only feature in the project area with potential fish habitat. The acequia is intermittent and offers very limited and low quality fish habitat.

6.5.2.1 No [Federal] Action Alternative

The project would pipe an approximate 40-foot section of the acequia to reconnect the flows from the Arroyo de la Cañada Ancha to the natural associated drainage downstream of the acequia. An approximate 20-foot section of the acequia would also be piped for construction of the new access road. Currently, the access to the dam requires driving through the acequia. Disturbance to the acequia likely occurs daily as all-terrain vehicles (ATVs) and vehicles navigate the access road. The acequia is piped at several locations both upstream and downstream of the project area. Establishment of a stabilized access is anticipated to decrease the disturbance and associated sediment and contaminants that may enter the acequia from ATV and vehicles crossing the feature. Modification of potential habitat and temporary construction disturbance would occur in the acequia from project actions. These impacts would be minor since habitat is low quality, limited, and is only available when the acequia is flowing. The acequia is operated to flow generally from March through September, but operation is dependent on the precipitation amount and availability of water from year to year.

6.5.2.2 Structural Rehabilitation Alternative

The impacts would be similar to those described for the No [Federal] Action Alternative, but additional measures would be in place during construction. If construction activities occur when the acequia is flowing, fish salvage would be performed in any areas dewatered to facilitate construction. The acequia would be piped around the construction area to maintain flows downstream and avoid any temporary impacts to fish or fish habitat downstream.

6.5.3 Special Status Animal Species

A BE has been completed for the project and concluded that there would be no effect to federally-listed ESA species, except for Mexican spotted owl and southwest willow flycatcher which had a may affect, but not likely to adversely affect determination. The BE was submitted to the USFWS on September 21, 2018, to comply with Section 7 of the ESA (Appendix A). On November 9, 2018, the USFWS concurred with the determination for the project (Appendix A). BLM sensitive species Gunnison's prairie dog and pinyon jay, and BLM sensitive species/state-listed bald eagle have the potential to occur in the project area. Please refer to Section 2.5.3 for information on special status species in the vicinity of the project area. Impacts associated with bald eagles have been included in Section 4.5.4 Migratory Birds/Bald and Golden Eagles.

6.5.3.1 No [Federal] Action Alternative

There would be a direct impact to Gunnison's prairie dog, pinyon jay, and associated habitat, if present. This alternative would temporarily disturb suitable habitat for both species due to construction activities. The species, if present, may be temporarily disturbed and displaced to adjacent habitats. Once construction is completed, they could return to the area. There is no known occurrence or suitable habitat for Mexican spotted owl or southwestern willow flycatcher in or near the project area. The species (if present) could use the project area as stopover habitat during dispersal or migration. The species are not likely to be found in the project area, but if they were to pass through, they may be deterred from using the area for stopover

habitat during construction activities. This could result in a temporary minor disturbance to the species during construction.

Construction activities have the potential to destroy prairie dog burrows and nests, and injure or kill species, if present. Construction activities would occur during nesting season for pinyon jay (January to April) and have the potential to destroy nests and harm or kill species, if present. If surveys and avoidance/minimization measures are not required, potential harm could occur to prairie dog and pinyon jay. Impacts to the species would be minor to moderate (if present). Impacts to suitable habitat for Gunnison's prairie dog and pinyon jay would be temporary and minor based on duration of construction, restoration of disturbed areas, and abundant suitable habitat in the surrounding area.

6.5.3.2 Structural Rehabilitation Alternative

This alternative would have the same impacts to USFWS ESA species (Mexican spotted owl and southwestern willow flycatcher) as described for the No Action Alternative. There would be a direct impact to Gunnison's prairie dog, pinyon jay and associated habitat, if present. The project area would be surveyed by a qualified biologist within 30 days prior to construction for signs of Gunnison's prairie dog. If the species or their sign are encountered, appropriate BLM personnel would be contacted, and consultation initiated. Additionally, project employees would receive prairie dog awareness training prior to commencement of rehabilitation construction activities. If the species is found to be present, modifications could be made to avoid disturbance to occupied areas or relocations could be performed to avoid harm to the species. Avoidance and minimization measures would also be in place for migratory bird species including pinyon jay (see Section 4.5.4.2).

This alternative has the potential to temporarily disturb suitable habitat for Gunnison's prairie dog and pinyon jay, but surveys would be conducted. Once construction is completed, the species could return to the area. Based on the duration of construction, avoidance/minimization measures, restoration of disturbed areas, and abundant suitable habitat in the surrounding area, the impacts to Gunnison's prairie dog and pinyon jay (if present) and their associated habitat would be temporary and minimal.

6.5.4 Migratory Birds/Bald and Golden Eagles

Please refer to Section 2.5.4 for information regarding the presence of migratory birds, bald eagles, and golden eagles in the vicinity of the project area. Bald eagle, Lewis's woodpecker, and rufous hummingbird are the USFWS MBCC that have potential to be present in the project area. Other migratory birds are anticipated to inhabit and have suitable habitat available within the project area, but were not identified as MBCC.

6.5.4.1 No [Federal] Action Alternative

This alternative would have direct impacts to migratory birds, bald eagles, and associated habitat. These species, if present, may be temporarily disturbed and displaced to adjacent habitats. Once construction is completed, they could return to the area.

Construction activities would occur during nesting season for various migratory birds and have the potential to destroy nests and harm or kill species, if present. If surveys and avoidance/minimization measures are not required, potential harm could occur to migratory birds and nests. Impacts to the species would be minor to moderate (if present). Impacts to suitable habitat for migratory birds would be temporary and minimal based on duration of construction, restoration of disturbed areas, and abundant suitable habitat in the surrounding area.

6.5.4.2 Structural Rehabilitation Alternative

This alternative would have direct impacts to migratory birds, bald eagles, and associated habitat. These species, if present, may be temporarily disturbed and displaced to adjacent habitats. Once construction is completed, they could return to the area. If construction activities occur during migratory bird breeding/nesting periods, the project area (and surrounding habitats) would be surveyed by a qualified biologist for active nests no more than 5 days prior to the commencement of work. If active nests are found during surveys, spatial buffers would be established around such in coordination with USFWS and NRCS. Construction activities within the buffer areas would be prohibited until a qualified biologist confirms that all nests are no longer active. Impacts of this alternative to the migratory birds and associated habitat would be temporary and minimal based on the duration of construction, restoration of disturbed areas, abundant suitable habitat in the surrounding area, and avoidance/minimization measures in place.

6.6 Human

6.6.1 Socioeconomics

Please refer to Section 2.6.1 for information regarding current socioeconomic conditions in the vicinity of the project area. Executive Order (EO) 12898 issued actions to address environmental justice in minority and low income populations. The EO requires analysis of environmental effects on human health and economic/social effects of federal project actions.

6.6.1.1 No [Federal] Action Alternative

This alternative reduces the risk of dam failure and indirect threat to life and property over the long-term that could occur from a dam breach. Temporary direct socioeconomic benefits would be incurred from additional employment requirements that may be necessary during project construction. The Sponsor would be responsible for paying approximately \$12,922,300 to bring the dam up to current New Mexico engineering safety standards and \$257,300 per year after construction for O&M and to extend the sediment life of the structure. This cost is anticipated to be covered through taxing and state funding programs. This would have a direct long-term socioeconomic impact to the taxed local community that bears the cost. The local community is approximately 71.5% or more Hispanic/Latino and has an approximate 34% poverty rate. Taxing the local community would have an adverse impact to minority and low income populations.

6.6.1.2 Structural Rehabilitation Alternative

The impacts would be similar to those of the No [Federal] Action Alternative, but NRCS would provide funding for the majority of the project. The sponsors would be responsible for paying \$5,442,900 to bring the dam up to current NRCS and New Mexico engineering safety standards, which is anticipated to be primarily covered through existing state funding programs. After construction, the Sponsor would be responsible for \$4,000 per year for O&M, which is similar to the existing condition. Therefore, adverse economic impacts from taxing the local community are not anticipated and the project would have a minor indirect long-term benefit from reduced risk to life and property from a dam breach, and a direct temporary benefit from additional employment requirements for construction.

In addition, the dam would provide increased floodwater-retarding capacity until the sediment pool fills. This would result in reduced flooding downstream for events greater than and including the 24-hour/100-year event for the life of the structure until the sediment pool fills. Reduced flooding downstream provides a minor indirect benefit that would decrease damage and associated costs resulting from these flooding events.

6.6.2 Historic Properties/Cultural Resources

An archaeological survey report was prepared (Brown 2018) and identified and documented five archaeological sites and three historic landscape features. Of those, one historic landscape feature (Acequia de la Cañada Ancha) and three archaeological sites were determined to be eligible for listing in the NRHP. The archaeological survey report was submitted to the New Mexico HPD for concurrence with a no adverse effect determination on April 22, 2019. New Mexico HPD concurrence was received on April 29, 2019 and has been included in Appendix A. Please refer to Section 2.6.2 for additional information regarding historic properties and cultural resources within the project area.

6.6.2.1 No [Federal] Action Alternative

Archaeological sites determined to be eligible for the NRHP would be avoided applying a minimum 20-foot buffer during construction activities. If determined in final design that any of the archaeological sites cannot be avoided and a 20-foot buffer maintained, additional consultation would be conducted with the New Mexico HPD.

This alternative would pipe two short segments of the Acequia de la Cañada Ancha for an access road crossing and to bypass principal spillway flows from the structure. The current access road to the structure goes through the acequia and it is disturbed daily from public vehicles and OHVs driving through it to access BLM lands. A segment of the acequia is also proposed to be piped to convey principal spillway flows over it, avoiding damaging impacts to the acequia and water operations. Flows into the acequia from the principal spillway have caused debris/sediment issues and erosion to the acequia. Additionally, there is no water right in place to divert flows from the dam into the acequia for irrigation use. This alternative would have unavoidable impacts to the Acequia de la Cañada Ancha that would modify it to provide more appropriate access over the acequia instead of through it, and to ensure the flow from the basin does not adversely impact the acequia. Design of the piped sections would incorporate historic aesthetic features to mitigate for the modifications. Any areas of the acequia temporarily disturbed during construction would be returned to its original condition upon construction completion. Based on the short segments to be piped, improvements to avoid disturbance to the acequia and acequia operations, and incorporation of historic aesthetic design features, the modifications are anticipated to have a negligible impact to this historic landscape feature.

6.6.2.2 Structural Rehabilitation Alternative

The impacts would be the same as those described for the No [Federal] Action Alternative.

6.6.3 Hazardous Substances, Materials and Waste

Please refer to Section 2.6.3 for information regarding hazardous materials in the vicinity of the project area.

6.6.3.1 No [Federal] Action Alternative

This alternative would have no direct or indirect impacts on hazardous materials sites or solid waste storage areas. No sites have been identified in the immediate project vicinity that would be impacted by the project, directly or indirectly.

General construction impacts that could occur include potential impacts from contaminated soil or groundwater. There is also the potential impact to the environment from the release of a hazardous material brought onsite during construction activities. Contractors would comply with all federal, state, and local

laws and regulations pertaining to pollution and contamination of the environment to prevent pollution by hazardous materials. Construction activities are not expected to result in the release of hazardous materials based on adherence to applicable laws and regulations. Impacts would be negligible based on adherence to applicable laws and regulations.

6.6.3.2 Structural Rehabilitation Alternative

The impacts would be the same as those described for the No [Federal] Action Alternative.

6.6.4 Public Health and Safety

Please refer to Section 2.6.4 for information regarding the population at risk and breach inundation area downstream of the structure, hazard rating for the structure, and EAP established for the structure.

6.6.4.1 No [Federal] Action Alternative

Measures proposed for this alternative would have a long-term beneficial impact that would reduce the risk of potential dam failure for approximately 1,038 people and associated loss of life (886 people) within the 3.2 square-mile breach inundation area downstream of the dam.

6.6.4.2 Structural Rehabilitation Alternative

The impacts would be the same as those described for the No [Federal] Action Alternative.

6.6.5 Recreation

Please refer to Section 2.6.5 for information regarding current recreation in the vicinity of the project area.

6.6.5.1 No [Federal] Action Alternative

OHVs, other vehicles, and the public would not be able to access work areas during construction (approximately 1-year), but this area would be reopened after construction completion. The surrounding area (adjoining the basin) provides abundant opportunity for the same recreational activities that occur in the basin. Recreation impacts would be minimal based on the scope and duration of construction, and the abundant opportunity for the same recreation activities directly adjacent to the basin.

6.6.5.2 Structural Rehabilitation Alternative

The impacts would be the same as those described for the No [Federal] Action Alternative.

6.6.6 Visual Resources and Scenic Beauty

Please refer to Section 2.6.6 for information regarding visual resources and scenic beauty in vicinity of the project area.

6.6.6.1 No [Federal] Action Alternative

Temporary direct impacts to visual quality are anticipated as a result of construction equipment parked or operating in the project area. The visual management objectives and associated reclamation standards

outlined in the BLM Resource Management Plan (BLM 2012) will be adhered to. Impacts would be minimal as disturbance would be temporary and disturbed areas would be restored.

6.6.6.2 Structural Rehabilitation Alternative

The impacts would be the same as those described for the No [Federal] Action Alternative.

6.6.7 Transportation Infrastructure

Please refer to Section 2.6.7 for information regarding transportation infrastructure with the potential to be impacted from project actions.

6.6.7.1 No [Federal] Action Alternative

Measures proposed for this alternative would have a long-term beneficial impact that would reduce the risk of potential dam failure and damage from inundation of roads and highways (approximately 15) located in the approximate 3.2 square-mile breach inundation area downstream of the dam.

6.6.7.2 Structural Rehabilitation Alternative

The impacts would be the similar to those described for the No [Federal] Action Alternative, but the dam would provide additional floodwater-retarding capacity until the sediment pool fills. This would result in reduced flooding for the events greater than and including the 24-hour/100-year event for the life of the structure until the sediment pool fills. Reduced flooding downstream would provide a minor benefit that would decrease the associated risk of damage to transportation infrastructure.

6.6.8 Noise

Please refer to Section 2.6.8 for information regarding noise in the project area.

6.6.8.1 No [Federal] Action Alternative

During construction activities, noise could be generated that would constitute a nuisance to nearby residential and agricultural properties. This effect would be temporary in nature, and noise minimization efforts would be utilized. Temporary noise impacts would be minimal based on the duration of construction and implementation of BMPs.

6.6.8.2 Structural Rehabilitation Alternative

The impacts would be the same as those described for the No [Federal] Action Alternative.

6.7 Cumulative Effects

Approximately 96% of the 8.34 square-mile drainage area of the structure is undeveloped lands managed by BLM. There are no development plans and no reasonably foreseeable BLM projects within the drainage area or in the vicinity of the project area, except for the actions proposed for the Site 1 Dam Rehabilitation. No other actions are proposed by NRCS, BLM, or New Mexico Department of Transportation in the project vicinity. There is no new residential or commercial development activities occurring in the community downstream of the dam. Operations in and around the project area will be similar to those experienced currently with little change. The lands upstream of the structure are undeveloped with public recreation and

limited grazing use which would remain the same for the foreseeable future. The lands downstream of the structure are developed with rural residences with agricultural and residential uses and are not anticipated to change in the foreseeable future. Therefore, measurable cumulative impacts from other project actions are not anticipated.

6.8 Risk and Uncertainty

A variety of factors contributes to the potential for dam failure, including the intensity of a storm event, a damaging seismic event, construction materials and techniques, and O&M activities. The Site 1 Dam has operated for 55 years with few problems. There is no unusual risk or uncertainty that the dam would not continue to operate as intended. Dams are inherently hazardous structures, but with continued maintenance, they should continue to provide flood protection and sediment retention. Calculations and considerations in the report are based on a 71-year period of analysis.

Due to model stability constraints, model grid spacing, and data resolution, the inundation extents of flood events and dam breaches appear to cover a larger area than what would be expected for events of these magnitudes. These model constraints result in flood areas that cover similar extents for both the 100- and 500-year events with little to no difference between the existing and no dam conditions. Additional modeling with more robust software packages now available and with higher resolution elevation data would need to be performed to determine more accurate differences in flood extents. This analysis should be performed during final design to identify the limits of each event in greater detail.

Estimating project costs and benefits involves a certain degree of risk and uncertainty. Land use could change from existing conditions, as the area has grown in the past 55 years. During the rehabilitation planning process, decisions are made with information that is uncertain, including errors in measurements and climatic changes that could alter rainfall storm events. Assumptions made during the planning process are based on the best available science, technology, and information. Extended delays between the planning process and construction increase the degree of risk and uncertainty. Estimated project costs are based on computed work quantities multiplied by the appropriate unit cost for that type of work. Unit costs are based on current market prices from similar projects. Costs can be influenced by economic factors that cannot be predicted between the planning process and construction that could increase the actual cost and decrease the availability of materials.

Economic benefits from projects are based on material values of floodplain property, infrastructure, and agricultural land. Such property is expected to become more valuable in the future, but it can be difficult to predict future economic conditions. There is also uncertainty in estimating the social and environmental costs associated with each alternative because interested party values, judgments, and opinions may shift over time.

Additional risk and uncertainties associated with the project include the following:

- **Plants:** Due to construction disturbance in the project area, there is an increased risk that noxious weeds and invasive species would become established.
- **Upland erosion and sedimentation:** The sedimentation rate calculated for the basin was based on historic sediment accumulation rates. The sedimentation rate could vary based on conditions in the drainage area, including construction activity, storm events, wild fires, and OHV/pedestrian traffic.
- **Development trends:** There is always a risk and uncertainty associated with estimating development trends.

6.9 Irreversible and Irretrievable Resource Commitments

NEPA requires that environmental analysis include identification of "... any irreversible and irretrievable commitments of resource which would be involved in the Proposed Action should it be implemented." Irreversible and irretrievable resource commitments are related to the use of nonrenewable resources and the effects this use could have on future generations. Irreversible effects primarily result from the use or destruction of a specific resource (e.g., energy and minerals) that cannot be replaced within a reasonable time frame. Irretrievable resource commitments involve the loss in value of an affected resource that cannot be restored as a result of the action (e.g., extinction of a threatened or endangered species or the disturbance of a cultural resource).

6.9.1 No Action and Structural Rehabilitation Alternatives

Implementing either alternative would involve a commitment of a range of natural, physical, human, and fiscal resources. Considerable amounts of fossil fuels, labor, and construction materials would be expended. Additionally, large amounts of labor and natural resources would be used in the fabrication and preparation of construction materials. These materials are generally not retrievable. They are not, however, in short supply and their use would not have an adverse effect upon continued availability of these resources. Any construction would also require a substantial one-time expenditure of federal and cost-share funds that would not be retrievable.

The commitment of these resources would be based on the premise that residents in the immediate area, the state, and the region would benefit by the improved quality of the dam and the safety it provides. These benefits generally are anticipated to outweigh the permanent commitment of resources.

SECTION 7

CONSULTATION, COORDINATION, AND PUBLIC PARTICIPATION

This section describes the public and agency coordination efforts for the Site 1 Dam Rehabilitation project. The intent of the proposed action is to implement a solution that would upgrade the structure to meet current NRCS and New Mexico engineering safety standards for a high hazard dam, as well as extend the life of the structure.

7.1 Consultation

7.1.1 USFWS

The USFWS was invited to comment on the project during the scoping period but no comment was received. A BE was submitted to the USFWS on September 21, 2018 and determined that the project would have no effect to federally-listed ESA species, except for Mexican spotted owl and southwest willow flycatcher which had a may affect, but not likely to adversely affect determination (Appendix A). On November 9, 2018 the USFWS concurred with the determination for the project (Appendix A).

7.1.2 New Mexico Historic Preservation Division

A Cultural Resources Inventory Report was submitted to the New Mexico Historic Preservation Division (HPD) for concurrence with a determination no adverse effect on April 22, 2019. A HDP concurrence letter, dated April 29, 2019, was received and has been included in Appendix A. In the event that cultural/archaeological resources are found during construction activities, construction would stop and the appropriate agencies would be notified according to NRCS protocol.

7.1.3 Tribal

A Cultural Resources Inventory Report was submitted on August 5, 2019, to the Pueblo of Tesuque, Tribal Historic Preservation Officer (Appendix A). No response has been received to date of this Plan-EA.

7.1.4 USACE

The USACE has jurisdiction over work in waters of the U.S. under Section 404 of the Clean Water Act. Information was provided by email to the USACE regarding the proposed rehabilitation on February 25, 2015. The USACE responded by email on February 26, 2015 indicating that the dam was located on a water of the U.S. (Arroyo de la Cañada Ancha) and there is potential for wetlands to be present. The USACE indicated that an ordinary high water mark (OHWM) and wetland delineation should be conducted (Appendix A). It was indicated that if a 404 permit is required for project activities, there is a possibility that work may qualify for a Nationwide Permit 43, but the loss of waters cannot exceed 0.5 acres. The USACE was also invited to comment on the project during the scoping period, but no comment was received.

7.2 Coordination

7.2.1 BLM

The dam is located on property managed by the BLM Taos Field Office. BLM was invited to become a cooperating agency for the project by NRCS but declined on February 27, 2019 (Appendix A).

7.2.2 Santa Fe-Pojoaque Soil and Water Conservation District

The SFPSWCD requested financial assistance from NRCS through Standard Form 424-Application for Federal Assistance on May 14, 2003. Initial coordination was conducted with SFPSWCD and NRCS regarding the project and the proposed rehabilitation activities. Meetings were conducted throughout the planning process to discuss the project and identify potential concerns related to the project.

7.3 Public Participation

7.3.1 Public Participation Plan

The Public Participation Plan dated November 14, 2014 (McMillen, LLC 2014) was prepared to provide effective procedures that define outreach to the general public, recreationists, local businesses, associations, stakeholders, affected landowners, and affected government agencies. The main goal of public participation is to involve a diverse group of public and government agency participants to solicit input and provide timely information throughout the NEPA review process. As part of the public participation process, the plan seeks to meaningfully engage minority, low income, and traditionally under-represented populations during the NEPA review process. Outreach to all members of the public included the following, as outlined in the Scoping Report attached in Appendix E:

- Notice published in the Rio Grande Sun newspaper
- Notice posted on the NRCS project website
- 368 notices were sent:
 - 72 to government agencies via mail, and
 - 296 to the public via mail.

7.3.2 Project Scoping

The participation of the public is a vital component of the project, so that those who are interested in or potentially affected by proposed alternatives have an opportunity to share their concerns and provide input regarding the Plan-EA during the initial stages of the process. The Santa Cruz Site 1 Dam Scoping Report (see Appendix E) outlines the scoping efforts and comments received from the agencies and general public during the scoping process.

Project scoping questions, comments, and concerns were requested from the public and government agencies during the preliminary scoping period, both orally at public meetings and via written submittal of comments. The main goal of public participation during the scoping period was to involve a diverse group of public and government agency participants to solicit input and provide timely information regarding their concerns pertaining to the project and the proposed alternatives.

7.3.3 Public Outreach

Table 5-1 lists the project's public outreach activities. The public was notified of each activity listed below and provided with opportunities to comment on the project.

Table 5-1. Public Outreach Activities

Date	Purpose	Type
March 5, 2015	Scoping Notice Published and Comment Period Open	Scoping Notice Mailed and Posted to Website Public Notice Published in the Rio Grande Sun newspaper
March 12, 2015	Scoping Notice Published	Notice Published in the Rio Grande Sun newspaper
March 18, 2015	Scoping Meeting	Public Meeting Held at La Arboleda Community Center, 705 State Highway 76, Chimayo, NM 87522
April 5, 2015	Scoping Period Closed	
January 10, 2020	Notice of Draft Plan-EA Public Comment Period	Mailed, published in local newspapers (Santa Fe New Mexican and Rio Grande Sun) and LSO website, posted at library, posted to the BLM Environmental Notification Bulletin Board
January 10, 2020	Draft Plan-EA Public Comment Period Open	
January 25, 2020	Draft Plan-EA Public Meeting	Public Meeting to be held at La Arboleda Community Center, 705 State Highway 76, Chimayo, NM 87522
February 10, 2020	Draft Plan-EA Public Comment Period Closed	
March 1, 2021	Final Plan-EA	Published on NRCS Website

7.3.4 Agency Involvement

The Site 1 Dam Rehabilitation project stems from public and agency meetings and presentations held in 2014 and early 2015. As a result of these efforts, NRCS, the SFPSWCD, and county and local officials used public input to determine the conceptual design of the proposed action. McMillen Jacobs Associates (formerly McMillen, LLC) has managed the coordination and public involvement process for the project, together with the NRCS. The participating agencies are as follows:

- NRCS
- USFWS
- State of New Mexico
- BLM
- SFPSWCD
- Rio Arriba County
- New Mexico HPD
- Village of Chimayó

As part of the scoping process, a 31-day comment period was provided to allow for early participation from the public and agencies. A scoping notice was distributed that gave a description of the project, location and overview, and purpose and need; identified preliminary scoping issues; and requested public participation. The scoping notice also identified the location of public meetings, contact information to submit written comments, and the scoping period closure date. One public scoping meeting was conducted on March 18, 2015. Written comments were submitted via mail, e-mail, facsimile, or comment card, and oral comments could have been submitted over the phone or in person. The scoping period was open for 31 days. Twelve comments were received during the scoping period.

7.3.5 Agency Plan-EA Reviews

Prior to the Draft Plan-EA issuance to the public, the BLM (cooperating agency) and National Water Management Center (NWMC) were provided copies of the preliminary report for review. Any report comments or concerns were addressed and/or corrected prior to issuance of the Draft Plan-EA to the public.

7.3.6 Draft Plan-EA Public Comment

A public notice of availability of the Draft Plan-EA was mailed to interested parties, published in the local newspaper (Rio Grande Sun), and posted to the NRCS project website (see Appendix E). The Draft Plan-EA was released for public review and comment with electronic copies available on the NRCS website and hard copies available at the local library and Chimayo City Hall. The public notice and Draft Plan-EA public release occurred on January 10, 2020, the same day the public comment period opened. A public meeting was held on January 25, 2020. The public comment period was open for a total of 30 days and closed on February 10, 2020.

7.3.7 Final Plan-EA

A Notice of Availability will be published locally to notify the public of the finding. The Final Plan-EA will be published locally, and copies made available on the project website.

SECTION 8

PREFERRED ALTERNATIVE

8.1 Purpose and Summary

The Preferred Alternative for the project is the Structural Rehabilitation Alternative. This is based on the alternative's ability to meet the purpose and need for the action, to signify the least impact to environmental and social resources, and to provide the greatest net economic benefits of all the alternatives. Several items need to be addressed in order for the Site 1 Dam to meet current NRCS and New Mexico engineering safety standards for a high hazard dam, and to extend the useful life of the structure.

8.2 Rationale for Preferred Alternative Selection

The existing structure does not meet current safety regulations and engineering safety standards. The intent is to provide continued flood protection (flood damage reduction) in the currently protected area downstream of the dam, and to meet current NM Dam Safety and NRCS engineering safety standards. There is a need to meet dam safety and performance standards, to provide continued flood protection to the downstream community, and to decrease the risk of dam failure for approximately 1,038 people, 326 residential/commercial structures, numerous agricultural properties, and multiple roads located within the breach inundation area.

The NED alternative for this project is the federally-assisted Structural Rehabilitation Alternative, as human life would be at risk in the event of a catastrophic failure of the existing dam, and the existing structure does not meet current engineering safety standards. The Preferred Alternative is designed to meet these standards and provides the greatest net benefit of the federally-assisted alternatives. See the Investigation and Analysis Report (Appendix D, Section D.15) for benefit comparisons between the alternatives considered for detailed study.

8.3 Measures to be Installed

The Structural Rehabilitation Alternative is the Preferred Alternative and would consist of measures to meet current NRCS and New Mexico engineering safety standards and extend the life of the structure 71 years. The Structural Rehabilitation Alternative is depicted in Appendix B-Map 5 and would include the following measures:

Dam Embankment

The dam crest would be raised approximately 10.6 feet to elevation 6,365.0 feet. The dam crest would be widened from 18 feet to 24 feet and graded with a cross slope of no more than 3% to direct water back into the basin. The entire dam embankment would be covered with a gravel blanket (1-foot-thick) for erosion protection. The upstream embankment slope would be maintained at 3H:1V and the downstream slope would be maintained at 2H:1V for the upper approximately 36 feet, and 2.5H:1V for the lower portion.

Auxiliary Spillway

The auxiliary spillway crest would be raised approximately 11.1 feet to elevation 6,360.7 feet. A new reinforced concrete auxiliary spillway would be constructed within the footprint of the existing earthen spillway. The new concrete spillway would have an approximate 40-foot level control section. Riprap would be installed at the downstream toe of the new concrete spillway to provide energy dissipation and erosion protection for flows entering the adjoining drainage.

Retaining Dike

The existing retaining dike would be reconstructed to meet the requirements for a water impounding structure up to a crest elevation matching the dam crest at 6,365.0 feet (10.6-foot raise). The crest would have a minimum width of 12.5 feet and would be graded with a cross slope of no more than 3% to direct water back into the basin. The entire retaining dike would be covered with a gravel blanket (1-foot-thick) for erosion protection. The upstream embankment would be sloped at 3H:1V and the downstream embankment would be sloped at 2H:1V.

Principal Spillway

The existing principal spillway riser structures would be demolished and replaced with one new principal spillway riser. The crest elevation would be raised approximately 17.8 feet to accommodate capacity for 71 years of sediment accumulation. The new riser would be constructed of reinforced concrete with a steel trash rack, and designed to meet all current state and NRCS engineering safety standards. The riser would be connected to the existing 30-inch reinforced concrete principal spillway conduit. The conduit would be sliplined to repair any leaks and restore structural stability.

The plunge pool at the principal spillway conduit outlet would be reconstructed with riprap for erosion protection and dissipation before discharging into the downstream channel. To allow connectivity to the existing downstream channel, an approximately 25-foot length of the existing acequia would be piped. The design of the piped section of the acequia would include aesthetically appropriate design features. An armored channel would extend over the piped section of the acequia and discharge into the existing downstream natural drainage channel.

Access Road and Staging

An approximately 8.1-acre staging area would be located upstream of the dam embankment and an approximately 2.4-acre staging area would be located downstream of the dam embankment within the basin. The existing access road to the structure is in poor condition and has a grade that is not traversable by most vehicles. This access road would be decommissioned and restored to native vegetative conditions. To provide stabilized construction access to the basin, a new access road would be constructed at a grade not to exceed 10% along a new alignment to the top of the dam crest. The new access road would be approximately 14 feet wide and 1,200 feet long. After construction completion the new access road would remain in place and serve as the new permanent access road to the basin.

Rock/Sediment Disposal

Any rock or soil materials excavated during construction activities that are not suitable for reuse would be hauled to an approximately 7.4-acre upland disposal location upstream of the structure and at an elevation above the proposed dam crest elevation (6,365.0 feet). The sediment would be evenly distributed and contoured to mimic the existing landscape. The sediment disposal area would be stabilized and restored upon construction completion. The need for environmental testing of the excavated material is not anticipated because there are no known hazardous waste sites and no naturally occurring or background contaminants in or near the dam or in the upstream drainage area. Likewise, pesticide or herbicides have not been commonly utilized in or near the structure.

Table 6-1 compares the existing dam features with the Preferred Alternative features.

Table 6-1. Comparison of Existing Dam and Preferred Alternative

Description	Existing Conditions	Preferred Alternative
Elevation Auxiliary Spillway Crest (ft)	6,349.6	6,360.7
Spillway Dimensions (ft)	600 wide by 150+ long	600 wide by 150+ long
Spillway Type	Earthen	Concrete
Elevation Dam Crest (ft)	6,354.4	6,365.0
Top Width of Dam Embankment (ft)	18	24
Downstream Embankment Slope / Stability Berm	2H:1V / 2.5H:1V	2H:1V / 2.5H:1V
Upstream Embankment Slope / Stability Berm	3H:1V / 4H:1V	3H:1V
Elevation Top of Design Sediment Pool (ft)	6,336.6	6,354.4
Sediment Storage Capacity	0-13.2 ac-ft	535.1 ac-ft
Floodwater Retarding Capacity	325.8 ac-ft	341.8 ac-ft
Total Storage Capacity (at Auxiliary Spillway Crest)	339 ac-ft	876.9 ac-ft

8.4 Avoidance, Minimization, and Mitigation

Compensatory mitigation would not be required for the Structural Rehabilitation Alternative. The avoidance and minimization measures proposed for the Structural Rehabilitation Alternative are described in Sections 6.4.1 through 6.4.12 below.

8.4.1 Erosion

Erosion may occur on disturbed and cleared areas within the project boundary during precipitation events. Proper BMPs will be installed during and after construction to prevent and control soil erosion. Areas disturbed during construction activities will be restored and stabilized through establishment of ground cover.

8.4.2 Surface Water Quality

Construction activities may temporarily impact surface water quality, but project design elements, including BMPs, will be used and will be implemented to reduce the quantity of sediment (1) entering drainages, and (2) flowing downstream and violating any federal or state water quality rules and regulations. Construction BMPs will include, but are not limited to, the following:

- A Storm Water Pollution Prevention Plan (SWPPP) that contains erosion and sediment control and pollution prevention BMPs, such as, but not limited to, silt fences, fiber wattles, and/or earth berms, will be required and implemented.
- Construction and staging areas will be assessed for the feasibility of such measures as straw bales, silt fences, and other appropriate sediment control BMPs, which will be implemented to prevent the entry of sediment and other contaminants into downstream drainages.

- To ensure that accidental spills do not enter waters, the storage of petroleum-based fuels and other hazardous materials and the refueling of construction machinery will not occur outside of approved designated staging/batch plant areas. Furthermore, the project will comply with federal and state water quality standards and toxic effluent standards to minimize any potential adverse impacts from discharges to waters of the U.S.

8.4.3 Air Quality

Construction activities will temporarily emit air pollutants. Fugitive dust, MSAT, and GHG emission increases associated with construction will be minimized by implementation of the following applicable BMPs:

- Spraying the soil onsite with water, or other similar approved dust suppressant/soil binder.
- Wetting materials hauled in trucks, providing adequate freeboard (space from the top of the material to the top of the truck), or covering loads to reduce emissions during material transportation/handling.
- Providing a stabilized construction entrance (track-out pad), wheel washers, and/or other similar BMPs at construction site accesses to reduce track-out of site materials onto the adjacent roadway network.
- Removing tracked-out materials deposited onto adjacent roadways.
- Wetting material stockpiles to prevent wind-blown emissions.
- Establishing vegetative cover on bare ground as soon as possible after grading to reduce wind-blown dust.
- Requiring appropriate emission-control devices on all construction equipment.
- Requiring the use of cleaner burning fuels.
- Using only properly operating, well-maintained construction equipment.

8.4.4 Special Status Plant Species

Construction activities will be limited to the smallest extent practicable within the project area. A site survey will be conducted prior to construction on areas of the project footprint that have suitable habitat for special status plant species. If the special status plant species are identified, appropriate BLM personnel will be contacted and a mitigation plan initiated and implemented prior to the start of construction.

8.4.5 Noxious Weeds and Invasive Plants

Construction activities will put the project area at risk for future invasion of noxious weeds and invasive plant species. BMPs will be implemented during construction to prevent the spread of noxious weeds and invasive plant species. During construction and until restoration areas are fully established, BMPs will be maintained on a regular basis to prevent the establishment of noxious weeds and invasive plant species. Non-desirable plant species will be controlled by cleaning equipment prior to delivery to the project site, eradicating them before the start and during construction as discovered, and routinely monitoring after construction completion. A PCSRP will be developed and will include mechanisms for addressing weed establishment and treatment. Long-term negative impacts will be managed with re-planting and various methods of weed control.

8.4.6 Wildlife and Wildlife Habitat

Construction activities will be limited to the smallest extent practicable within the project area. Disturbed areas will be restored to preconstruction conditions after construction completion.

8.4.7 Fish and Fish Habitat

If construction activities occur when the acequia is flowing, fish salvage will be performed in any areas dewatered to facilitate construction. The acequia will be piped around the construction area to maintain flows downstream and avoid any temporary impacts to fish or fish habitat downstream.

8.4.8 Special Status Animal Species

Refer to Section 6.4.9 Migratory Birds/Bald Eagles for avoidance and minimization measures for BLM sensitive species pinyon jay and BLM sensitive species/state-listed bald eagle.

Construction activities will be limited to the smallest extent practicable within the project area. Disturbed areas will be restored to preconstruction conditions after construction completion. The project area would be surveyed by a qualified biologist within 30 days prior to construction for signs of Gunnison's prairie dog. If the species or their sign are encountered, appropriate BLM personnel would be contacted, and consultation initiated. Additionally, project employees would receive prairie dog awareness training prior to commencement of rehabilitation construction activities. If the species is found to be present, modifications could be made to avoid disturbance to occupied areas or relocations could be performed to avoid harm to the species.

8.4.9 Migratory Birds/Bald Eagles

Construction activities will be limited to the smallest extent practicable within the project area. Disturbed areas will be restored to preconstruction conditions after construction completion. If construction activities occur during migratory bird breeding/nesting periods, the project area (and surrounding habitats) will be surveyed by a qualified biologist for active nests no more than 5 days prior to the commencement of work. If active nests are found during surveys, spatial buffers will be established around such in coordination with USFWS and NRCS. Construction activities within the buffer areas will be prohibited until a qualified biologist confirms that all nests are no longer active.

8.4.10 Historic Properties/Cultural Resources

A minimum 20-foot buffer would be maintained during construction around archaeological sites determined to be eligible for listing in the NRHP. If determined in final design that that any of the archaeological sites cannot be avoided and a 20-foot buffer maintained, additional consultation would be conducted with the New Mexico HPD. Modifications to the historic landscape feature eligible for NRHP listing (Acequia de la Cañada Ancha) would incorporate a historic aesthetic design.

8.4.11 Hazardous Materials

NRCS requires that contractors comply with all federal, state, and local laws and regulations pertaining to pollution and contamination of the environment to prevent pollution of surface water, groundwater, soil, and air with any hazardous materials.

8.4.12 Visual Resources

Areas disturbed during construction activities will be restored to preconstruction conditions. This will be accomplished by grading to match natural contours and stabilizing through establishment of ground cover. These areas will be reestablished by seeding with an herbaceous plant seed mixture and revegetation with NRCS and BLM-approved plant species to match the surrounding plant community. The visual

management objectives and associated reclamation standards outlined in the BLM Resource Management Plan (BLM 2012) will be adhered to.

8.5 Permits and Compliance

The federal, state, and local permits and compliance actions described in this section would be required for construction of the Structural Rehabilitation Alternative. A Watershed Agreement and a Memorandum of Understanding shall be completed and signed by the NRCS and the SFPSWCD prior to the obligation of construction funds for the Structural Rehabilitation Alternative.

8.5.1 Federal

USACE: Under Section 404 of the Clean Water Act, a USACE permit may be required for discharge of dredged or fill materials in waters of the U.S. including wetlands. This is based on correspondence with the USACE noting that if a 404 permit is required for project activities, there is a possibility that work may qualify for a Nationwide Permit 43, as long as loss of waters do not exceed 0.5 acres (Appendix A).

BLM: A BLM right-of-way application would be submitted and a permit obtained for work on BLM lands.

USFWS: A BE was submitted to the USFWS on September 21, 2018 and determined that the project would have no effect to federally-listed ESA species, except for Mexican spotted owl and southwest willow flycatcher which had a may affect, but not likely to adversely affect determination (Appendix A). On November 9, 2018, the USFWS concurred with the determination for the project (Appendix A).

U.S. EPA: Under Section 402 of the Clean Water Act, a stormwater Construction General Permit is required for construction activities that disturb more than 1 acre and discharge pollutants to surface waters. An SWPPP would be developed, including submitting a Notice of Intent (NOI), to the U.S. EPA Region 6 office.

8.5.2 State

New Mexico Office of the State Engineer Dam Safety Bureau: For a dam construction permit to be issued by NM Dam Safety, approval would be required for the final design report, construction drawings, and specifications.

New Mexico HPD: A Class III Cultural Resources Inventory Report was submitted to the New Mexico HPD to comply with Section 106 of the National Historic Preservation Act. The Report determined that no adverse effect and HPD concurrence with the determination was received April 29, 2019 and has been included in Appendix A. In the event that cultural/archaeological resources are found during construction activities, construction would stop and the appropriate agencies would be notified according to NRCS protocol.

New Mexico Division of Oil, Gas and Mining: If materials are obtained from a source that does not have an existing mining permit, a mining operations permit would be required to mine the materials.

New Mexico State Lands Office: A right-of-way application would be submitted and a permit obtained for work on state lands.

8.5.3 Local

Rio Arriba County Floodplain Development Permit: A floodplain development permit would be submitted and a permit obtained for working in a FEMA and NFIP designated floodplains.

Rio Arriba County Floodplain Coordination: Coordination with the downstream community floodplain administrators and emergency preparedness managers (Rio Arriba County and City of Chimayo) should be performed regarding changes to FEMA and NFIP floodplain designations.

Rio Arriba County Development Permit: A development permit would be submitted and a permit obtained for rehabilitation of the dam.

8.6 Installation and Financing

8.6.1 Planned Sequence of Installation

SFPSWCD would complete all approvals and permits for the project prior to the start of construction; these may take up to 1 year to obtain. The major construction elements for the Structural Rehabilitation Alternative would be sequenced to complete the critical path items first.

8.6.2 Responsibilities

The original Watershed Work Plan set forth the responsibilities of the NRCS (formerly Soil Conservation Service [SCS]) and Sponsor SFPSWCD (formerly Pojoaque Soil Conservation District). The roles and responsibilities for the NRCS and the SFPSWCD would continue in accordance with this Plan-EA, the Watershed Agreement, and the Memorandum of Understanding. The NRCS is responsible for leading the planning efforts and providing engineering support, the SFPSWCD is responsible for environmental permits and construction implementation, and NRCS or SFPSWCD is responsible for the project design. NRCS would assist the SFPSWCD during construction by providing oversight and certifying completion of the project.

8.6.3 Contracting

Rehabilitation improvements installed from NRCS funding mechanisms would be procured using contracts awarded. The NRCS would oversee and administer the construction of the project in coordination with the SFPSWCD.

8.6.4 Real Property and Relocations

The land upstream of the dam and below the elevation of the top of the dam is on private land and land managed by the BLM. SFPSWCD has obtained easements that include the basin footprint within the existing elevation of the dam crest (Appendix C-Map 12). The Structural Rehabilitation Alternative proposes to raise the dam crest elevation, increasing the footprint of the basin beyond the existing easement boundary. In addition, a new access road would be constructed that is not within the existing easement for the structure (Appendix C – Map 13). There are no structures within the lands proposed for works of improvement that are outside of the existing easement boundaries, and relocations would not be required for the project. The SFPSWCD would be responsible for obtaining real property rights on BLM and private lands for construction of the new access road and new basin footprint for the proposed dam raise.

8.6.5 Emergency Action Plan

A new EAP must be completed by the SFPSWCD to address the rehabilitation changes to the dam and must be prepared as a standalone document. The NRCS would need to approve the EAP prior to the execution of fund obligating documents for construction of the dam rehabilitation. EAPs shall be reviewed and updated by the SFPSWCD annually for consistency with the project and to include all local points of contact necessary for an emergency response. The EAP assists the dam Sponsor/owner in recognizing and responding to emergency and non-emergency events and should include the items outlined in the Emergency Action Plans for Dams guide (New Mexico Office of the State Engineer 2011).

8.6.6 Financing

The NRCS would provide 65% of the total construction rehabilitation cost for the Preferred Alternative with funding from the Watershed Protection and Flood Prevention Act (PL 83-566, as amended by PL 106-472), not to exceed 100% of the total construction cost. The SFPSWCD is responsible for providing the remaining non-federally funded 35% of the rehabilitation cost of the project. NRCS would provide 100% of design engineering, and both NRCS and SFPSWCD would bear project administration costs that each incurs for the project. The SFPSWCD is responsible for 100% of the costs associated with obtaining real property rights.

The Sponsor is responsible for correcting O&M deficiencies (see Section 2.7.1) prior to work commencing on the rehabilitation project. Funding for O&M of the dam after construction would be derived from normal revenues of the SFPSWCD. This O&M cost would be budgeted annually so that the dam is kept in good condition and meeting current NRCS and NM Dam Safety regulations.

8.7 Operation and Maintenance

Operation of the dam includes the administration, management, and performance of non-maintenance actions needed to keep the dam structure safe and functioning as designed. Maintenance includes performance of work, measuring the recording instrumentation data, preventing deterioration of structures, and repairing damage or replacing the structure as needed to prevent failure. Damages to completed structures caused by normal deterioration, droughts, flooding, or vandalism are considered maintenance. Maintenance includes both routine and as-needed measures.

Inspection of the dam is necessary to verify that the structures are safe and functioning properly. The SFPSWCD and NM Dam Safety are responsible for inspecting the dam on an annual basis as well as after major events such as floods and earthquakes. Inspection reports would be supplied to the NRCS following each inspection. Inspections and the associated reports would assess the following items:

- Identify the adequacy of O&M activities.
- Identify needed O&M work.
- Identify unsafe conditions, including changes in the use of the floodplain below the dam.
- Specify ways of relieving unsafe work or performing other needed work.
- Set action dates for performing corrective actions.

As indicated in Table 6-5, SFPSWCD would continue to be responsible for the operation, maintenance, rehabilitation, and future modifications to the dam, and the estimated annual O&M cost is \$4,000. A specific O&M Plan would be prepared by the NRCS and the SFPSWCD in accordance with the NRCS National Operation and Maintenance Manual (NRCS 2003). This plan and agreement would be entered into prior to the start of construction activities and would be in place for the extended life of the project. The agreement would provide for inspections, reports, and procedures for performing the maintenance items. The

agreement would include specific provisions for retention, use, and property improved with PL 83-566, as amended by PL 106-472, assistance.

8.8 Costs

The installation cost estimate for the Structural Rehabilitation Alternative (Preferred and NED Alternative) is \$19,022,900, as identified in Table 6-2. Economic tables have been included to present information relevant to the costs and benefits of the Preferred Alternative and NED Alternative. Structural tables have been included to present the relevant structural information pertinent to the design of the Preferred Alternative. The costs for the Preferred Alternative are conceptual level cost estimates only with an estimated range of accuracy at ±30%, and are intended to reflect the maximum level of cost that could be associated with the rehabilitation. Detailed structural designs and construction cost estimates would be prepared for the project during the final design phase and prior to the start of the competitive bidding process. The final cost of the project would be the price received from the winning construction bid plus or minus the amount of contract modifications. Assessments, considerations, and calculations are based on a 71-year evaluation period and a discount rate of 2.75%.

The Estimated Installation Cost table (Table 6-2) documents land status upon which the project structures reside, as well as federal and non-federal funding sources, respectively.

Table 6-2. Estimated Installation Cost
 Santa Cruz River Watershed - Site 1 Dam
 Santa Cruz River Watershed, New Mexico
 (Dollars)¹

Works of Improvement	PL83-566 Funds ²			Other Funds			Total
	Federal Land	Non-Federal Land	Total	Federal Land	Non-Federal Land	Total	
Floodwater-Retarding Structure (Rehabilitation)	\$11,177,400	\$2,402,600	\$13,580,000	\$ 4,479,900	\$963,000	\$5,442,900	\$19,022,900

¹Price base: 2018

Prepared May 2018

²Works of improvement will be on 82 % federal land (BLM), and 18% private land.

The Estimated Cost Distribution table (Table 6-3) shows the estimated costs to be charged to PL 83-566, as amended by PL 106-472, funds and the costs borne by SFPSWCD. Note that relocation payments and water rights costs have not been included in the table because there are no anticipated costs associated with these components based on the project alternative.

Table 6-3. Estimated Cost Distribution - Water Resource Project Measures
 Santa Cruz River Watershed - Site 1 Dam
 Santa Cruz River Watershed, New Mexico
 (Dollars)¹

Works of Improvement	Installation Cost - Public Law 83-566 ²				Installation Cost - Other Funds ³					Total Installation Costs
	Construction	Engineering	Project Admin	Total Public Law 83-566	Construction	Real Property Rights	Permits	Project Admin	Total Other	
Floodwater Retarding	\$10,071,100	\$3,481,400	\$27,500	\$13,580,000	\$5,401,900	\$4,500	\$20,000	\$16,500	\$5,422,900	\$19,022,900

Structure (Rehabilitation)										
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¹ Price base: 2018

Prepared May 2018

² PL 83-566 cost does not include permits since permits are 100% the responsibility of the Sponsor and cannot be cost shared.³ Sponsor cost does not include engineering since 100% of the engineering cost is covered by NRCS.

The Structural Data table below (Table 6-4) shows important physical characteristics for Santa Cruz River Watershed - Site 1 Dam and compares existing conditions with the proposed conditions after construction of the Preferred Alternative.

Table 6-4. Structural Data - Dam with Planned Storage Capacity

Santa Cruz River Watershed - Site 1 Dam
Santa Cruz River Watershed, New Mexico

Item	Unit	Existing Conditions	Structural Rehabilitation Alternative
Dam Number	#	924043	924043
Hazard Class of Structure	Design	High	High
Seismic Zone	-	1	1
Total Drainage Area (Uncontrolled)	sq mi	8.34	8.34
Runoff curve N. (1-day) (AMC II)	-	76.1	76.1
Time of concentration (Tc)	hrs	1.34	1.34
Elevation top dam	ft	6,354.4	6,365.0
Elevation crest auxiliary spillway	ft	6,349.6	6,360.7
Elevation crest high stage inlet	ft	6,336.6	6,354.4
Elevation crest low stage inlet	ft	6,333.6	6,336.6
Auxiliary spillway type	-	Earthen open channel	Concrete channel
Auxiliary spillway bottom width	ft	600	600
Auxiliary spillway exit slope	%	32.7	25.8
Maximum Height of Dam	ft	67	78
Volume of Fill in Dam Embankment	cy	375,000	445,000
Total Capacity ¹	ac-ft	339	876.9
Sediment Submerged ²	ac-ft	0	0
Sediment Aerated (2017)	ac-ft	13.2	535.1
Beneficial Use (irrigation, recreation)	ac-ft	0	0
Floodwater Retarding Capacity (2017)	ac-ft	325.8	341.8
Between high and low stage inlet	ac-ft	485 (54.5 remaining that is not filled in with sediment)	535.1
Surface Area			
Sediment Pool	ac	10.5	47.6
Beneficial Use Pool	ac	0	0
Floodwater Retarding Pool ¹	ac	38.7	57.4
Principal Spillway Design (low-level outlet)			
Rainfall Volume (1-day, 100 yr)	in	0.76	0.76
Rainfall Volume (10 day, 100 yr)	in	1.82	1.82

Item	Unit	Existing Conditions	Structural Rehabilitation Alternative
Runoff Volume (10 day, 100 yr)	in	1.72	1.72
Capacity of Low Stage Outlet (max)	cfs	20.0	0.0
Capacity of High Stage Outlet (max)	cfs	125.0	125.0
Dimension of Conduit (low-level outlet)	in	24 (upper), 30 (lower)	30
Type of Conduit (low-level outlet)	N/A	CMP (upper), RCP (lower)	RCP
Frequency of Operation Auxiliary Spillway (assumes a full sediment pool)	% chance	>0.1	<0.1
Auxiliary Spillway Hydrograph			
Rainfall Volume	in	4.89	4.89
Runoff Volume	in	2.45	2.45
Storm Duration	hrs	24	24
Velocity of Flow (Ve)	ft/s	7.3	3.6
Maximum Aux. Spillway Discharge ³	cfs	2,157.2	2,278.6
Max. Reservoir Water Surface Elevation ⁴	ft	6,351.3	6,361.6
Freeboard Hydrograph			
Rainfall Volume	in	13.25	13.25
Runoff Volume	in	10.11	10.11
Storm Duration ³	hrs	6	6
Max. Reservoir Water Surface Elevation ⁴	ft	6,359.2	6,364.9
Capacity Equivalents			
Sediment Volume	in	0.03	1.20
Floodwater Retarding Volume	in	0.76	0.77
Beneficial Volume (irrigation/recreation)	in	0	0

Note: All elevations are in NAVD88

Prepared May 2018

¹ Crest of auxiliary spillway

² This is a dry basin so no sediment is submerged.

³ The 6-hour storm event was determined to be the critical storm event for auxiliary spillway integrity.

⁴ Assumes aerated sediment capacity at the end of the evaluated life.

The Average Annual Cost table (Table 6-5) shows the anticipated installation costs of the Preferred Alternative. It also summarizes the total annual cost based on the annualized cost of installation, amortized over 71 years, and the average annual cost for operations and maintenance.

Table 6-5. Estimated Average Annual NED Costs
Santa Cruz River Watershed - Site 1 Dam
Santa Cruz River Watershed, New Mexico
(Dollars)¹

Improvements	Project Outlays Amortization of Installation Cost ²	Project Outlays, O&M and Replacement Cost	Total
Rehabilitation	\$612,400	\$4,000	\$616,400

¹Price base: 2018.

Prepared May 2018

² Amortized at 2.75% annually for 71 years.

The Estimated Average Flood Damage Reduction Benefits table below (Table 6-6) summarizes the results of the flood damage reduction analysis conducted for this project.

Table 6-6. Estimated Average Annual Damage Reduction Benefits

Santa Cruz River Watershed - Site 1 Dam
 Santa Cruz River Watershed, New Mexico
 (Dollars)¹

Item	Estimated Average Annual Damage ²		Damage Reduction Benefit
	Without Project (No [Federal] Action Alternative)	With Project (Preferred Alternative)	
Floodwater			
Crop and Pasture	\$185	\$156	\$29
Other Agricultural	\$0	\$0	\$0
Residential	\$4,098	\$3,626	\$473
Commercial	\$0	\$0	\$0
Other	\$420	\$398	\$23
Subtotal	\$4,703	\$4,179	\$524
Sediment			
Overbank Deposition	\$0	\$0	\$0
Erosion			
Channel Scour	\$0	\$0	\$0
Total	\$4,703	\$4,179	\$524

¹ Price base: 2018

Prepared May 2018

² All flood damage is agriculture related per Section 506.19 (8) of the NWPM.

The Comparison of NED Benefits and Costs table below (Table 6-7) summarizes the benefits and costs of each analysis unit within the project and documents the overall benefit to cost ratio of the proposed rehabilitation improvements.

Table 6-7. Comparison of Annual NED Benefits and Costs

Santa Cruz River Watershed - Site 1 Dam
 Santa Cruz River Watershed, New Mexico
 (Dollars)¹

Item	Damage Reduction Benefits			
	Average Annual Benefits ²	Average Annual Costs	Benefit Cost Ratio	Net Economic Benefits
Rehabilitation	\$673,824	\$616,400	1.1	\$57,424

¹ Price base: 2018

Prepared May 2018

² \$673,300 was added to the average annual flood damage reduction benefits (\$524) because the Sponsor would avoid the cost of implementing the No [Federal] Action Alternative.

SECTION 9

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SECTION 10 LIST OF PREPARERS

10.1 Plan-EA Preparers

Table 8-1 lists the people who participated in the preparation of this document.

Table 8-1. List of Preparers

Name	Title (Years of Experience)	Education	Other
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Sponsoring Local Agency			
SFPSWCD	Board Members	Education Varies - B.S., M.S., PhDs (Elected Officials from the Watershed Area)	
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John Long	Economist (20+)	B.S. – Agricultural Economics	

SECTION 11 DISTRIBUTION LIST

A notice of availability for the Draft Plan-EA will be distributed to the following government agencies/staff and organizations.

11.1 Federal Government

BLM	Bureau of Indian Affairs
NRCS	National Parks Service
USACE	EPA
USFWS	Bureau of Reclamation
U.S. Forest Service	

11.2 State Government

New Mexico State Land Office	New Mexico Department of Game and Fish
New Mexico Department of Agriculture	New Mexico Office of the State Engineer
New Mexico Department of Public Safety	New Mexico Indian Affairs Department
New Mexico Department of Transportation	New Mexico HPD
New Mexico Department of Cultural Affairs	New Mexico Office of the Governor
New Mexico Environment Department	Senator Tom Udall
Senator Martin Heinrich	Representative Ben Luján
Representative Nick Salazar	NM Dam Safety
New Mexico Energy, Minerals and Natural Resources Department	

11.3 Local Government

Village of Chimayó
 Rio Arriba County
 Rio Arriba County Commissioners
 Santa Fe County
 Santa Fe County Commissioners
 City of Española
 Pueblo of Pojoaque
 Pueblo of Santa Clara

11.4 Businesses and Organizations

Greater Chimayó Mutual Domestic Water Consumers Association	
Santa Fe New Mexican	
Santa Cruz Irrigation District	Martinez Medio Ditch
New Mexico Acequia Association	Del Pueblo Lateral
New Mexico Wildlife Federation	Los Ranchos Ditch
Sierra Club Rio Grande Chapter	Espinosa Ditch
Wild Earth Guardians	Los Quarteles Ditch
Acequia de la Cañada Ancha Acequia Association	Acequia de los Ortigas
Reservoir and Reservoir / Canada Ancha	

11.5 Private Parties

The names and addresses of private parties who will receive notice of the Draft Plan-EA are not listed in this section for privacy.

SECTION 12

ACRONYMS, ABBREVIATIONS, AND SHORT FORMS

ACEC	Area of Critical Environmental Concern
ac-ft	acre-feet
ATV	All-Terrain Vehicle
BLM	United States Bureau of Land Management
BMPs	Best Management Practices
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
cfs	cubic feet per second
CH ₄	methane
CMP	corrugated metal pipe
CO	carbon monoxide
CO ₂	carbon dioxide
CWA	Clean Water Act
Draft Plan-EA	Draft Supplemental Watershed Plan and Environmental Assessment
EA	Environmental Assessment
EAP	Emergency Action Plan
EDR	Environmental Data Resources, Inc
EIS	Environmental Impact Statement
EMNRD	New Mexico Energy, Minerals and Natural Resources
EO	Executive Order
EPA	United States Environmental Protection Agency
ESA	Endangered Species Act
FBH	Freeboard Hydrograph
FEMA	Federal Emergency Management Agency
FONSI	Finding of No Significant Impact
FR	Federal Register
ft	feet
GHG	greenhouse gas
HEC-HMS	Hydrologic Engineering Center Hydrologic Modeling System
HPD	Historic Preservation Division
HTRW	hazardous, toxic, and radioactive waste
LiDAR	Light Detection and Ranging
MBCC	Migratory Birds of Conservation Concern

MBTA	Migratory Bird Treaty Act
MOU	Memorandum of Understanding
MSAT	Mobile Air Source Toxics
N ₂ O	nitrous oxide
NAAQS	National Ambient Air Quality Standards
NED	National Economic Development
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NHNM	National Heritage New Mexico
NMDGF	New Mexico Department of Game and Fish
NMED	New Mexico Environmental Department
NO ₂	nitrogen dioxide
NOI	Notice of Intent
NO _x	nitrous oxides
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRCS	United States Department of Agriculture Natural Resources Conservation Service
NRHP	National Register of Historic Places
NWI	National Wetland Inventory
NWPM	National Watershed Program Manual
NWSRS	National Wild and Scenic River System
O ₃	ozone
O&M	Operations and Maintenance
OHV	Off Highway Vehicles
OHWM	ordinary high water mark
PCSRP	Post-Construction Rehabilitation Plan
PGA	peak ground acceleration
PL	Public law
Plan-EA	Supplemental Watershed Plan and Environmental Assessment
PM	particle matter
PMF	Probable Maximum Flood
PMP	Probable Maximum Precipitation
RMP	Taos Resource Management Plan
ROD	Record of Decision
ROW	Right-of-Way
SDH	Spillway Design Hydrograph

SFPSWCD	Santa Fe-Pojoaque Soil and Water Conservation District
SITES	Water Resources Site Analysis Program
SLO	Sponsoring Local Organization
SO ₂	sulfur dioxide
SRMA	Special Recreation Management Area
SWPPP	Storm Water Pollution Prevention Plan
T&E	threatened and endangered
TR-60	Technical Release 60
USACE	United States Army Corps of Engineers
USCB	United States Census Bureau
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
USFS	United States Forest Service
USGS	United States Geological Survey
USWRC	United States Water Resources Council

SECTION 13

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APPENDIX A

CONSULTATION AND COORDINATION

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USACE Consultation
USFWS Consultation
New Mexico HPD Consultation
Tribal Consultation
State of New Mexico Consultation

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PROJECT MAPS

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SUPPORTING MAPS

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APPENDIX D

INVESTIGATION AND ANALYSIS REPORT

APPENDIX E
SUPPORTING INFORMATION

Scoping Report
Wetland Delineation Memo