RECLAMATION
Managing Water in the West

Final Environmental Assessment

Asaayi Dam

Safety of Dams Rehabilitation Project

U.S. Department of the Interior
Bureau of Reclamation
Phoenix Area Office

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CHAPTER 1 - PURPOSE AND NEED

1.1 Introduction

The Bureau of Reclamation (Reclamation) has prepared this Environmental Assessment (EA) to analyze potential effects to physical, biological, and cultural resources that may result from Safety of Dams (SOD) modifications to Asaayi Dam on the Navajo Indian Reservation in McKinley County, New Mexico. The EA was prepared in accordance with the National Environmental Policy Act (NEPA), Council on Environmental Quality Regulations (40 CFR 1500-1508), and Reclamation NEPA Handbook. Reclamation is the lead Federal agency pursuant to NEPA. The Bureau of Indian Affairs (BIA) and Navajo Department of Water Resources (NDWR) SOD Program are cooperating agencies for the preparation of this document.

This document is organized into six chapters:

- *Chapter 1 - Purpose and Need:* Presents information on the history of the project proposal, the purpose of and need for the project, and the lead agency's proposal for achieving that purpose and need. This section also details how the lead agency informed the public of the proposal and how the public responded.
- *Chapter 2 - Comparison of Alternatives, including the Proposed Action:* Provides a detailed description of the lead agency's proposed action, alternative methods for satisfying the stated purpose and need, and key environmental issues regarding the proposed action and alternatives. Finally, this section provides a summary table of the environmental consequences associated with each alternative.
- *Chapter 3 - Environmental Consequences:* Describes the environmental effects of implementing the proposed action and other action alternatives. The analysis is organized by affected resource topic. Within each section, the affected environment is described first, followed by the effects of no action, the proposed action, and other action alternatives.
- *Chapter 4 - Agencies and Persons Consulted:* Lists preparers and agencies consulted during the development of the EA.
- *Chapter 5 – Environmental Laws and Directives:* Lists relevant Federal environmental laws and directives.
- *Chapter 6 - Literature Cited:* Lists documents used in the preparation of this EA.
- *Appendices:* The appendices provide more detailed information to support the analysis presented in the EA.

1.2 Background

BIA proposes to modify Asaayi Dam and spillway to correct verified dam safety deficiencies (Reclamation 2003). Asaayi Dam is situated on Bowl Creek along the western edge of the Chuska Mountains. Construction of the dam was completed in 1964 by the Navajo Nation to provide opportunities for recreation and irrigation. Similar in many respects to other major dams on the Navajo Indian Reservation, Asaayi Dam consists of a riprap-armored earthen embankment, gated outlet works, and uncontrolled spillway.

Asaayi Dam has a crest length of 610 feet and a maximum height of 66 feet. The outlet works consist of a 330-foot-long, 24-inch-diameter, asphalt-coated, corrugated metal pipe (CMP) with a trashrack, concrete intake box located approximately 3 feet above the bottom of the lake (sill elevation of 7,482.2 feet). A 24-inch-diameter slide gate is located in the intake structure and is operated by a hydraulic hand pump placed inside a concrete vault on the upstream face of the dam. Maximum computed discharge capacity of the outlet works is 43 cubic feet per second (cfs) when the lake pool is at the spillway crest elevation of 7,536.5 feet.

Irrigation releases are made through a secondary 8-inch-diameter CMP located near the right abutment of the dam at elevation 7,534.3 feet. These releases are conveyed through a buried PVC pipeline to unlined irrigation ditches approximately 2 miles southwest of the dam. The irrigation outlet works was modified in 2001 with a 6-inch-diameter siphon to supply flows to downstream irrigators when lake levels are below the invert of the irrigation pipe intake portal. No irrigation releases were made from Asaayi Dam in 2005.

The spillway is an uncontrolled, 120-foot-long concrete structure located approximately 750-feet south of the left abutment of the dam. An approach channel connects the main body of the lake to the spillway. Discharges from the spillway cascade through a narrow rock chasm before reentering Bowl Creek a short distance below the dam.

Dam operations are performed by the NDWR SOD Program. Because of safety concerns, the lake is currently restricted to a maximum operating elevation of 7,528 feet, or 8.5 feet below the spillway crest elevation.[1] Two temporary siphons have been installed at the spillway to regulate lake levels and maintain the existing drawdown. No releases are being made through the outlet works. Under normal operating conditions, runoff from snowmelt and rainfall is allowed to fill the lake to the spillway crest elevation.

1.3 Purpose and Need for the Action

The purpose of the proposed project is to correct deficiencies that could jeopardize future dam safety. Verified SOD deficiencies that require corrective action include: corroded outlet works pipe, failing toe drain system, inability to safely evacuate the lake, and inadequate spillway capacity (Reclamation 2005). Corrective action is needed to preserve the recreation and irrigation values for which the lake was originally authorized and to reduce the probability of dam failure and associated risk to the public. The following deficiencies are described in greater detail in the Stage 3 Deficiency Verification Analysis (DVA) prepared by Reclamation (2004).

Corroded Outlet Works Pipe and Failing Toe Drain System - Inspections conducted by the Navajo SOD Program and Reclamation identified potentially serious deterioration of the outlet works pipe and toe drain system (Reclamation 2003). The inspections revealed corrosion and leaking joints in the outlet works pipe, partially blocked and failing toe

[1] The lake has been restricted to elevation 7,528 since January 2004 as a result of seepage observed on the downstream embankment and inoperable toe drain system.

drain system, and seepage on the downstream face of the dam. If not corrected, these deficiencies could lead to internal piping of embankment material along the CMP and slope instability on the downstream embankment. As a precautionary measure, the lake has been partially drawn down and the outlet works placed out of service until corrective action can be implemented.

Inability to Safely Evacuate the Lake - The outlet works has not been operated for several years. In the absence of routine use, a substantial amount of sediment has accumulated over the inlet structure and blocked the inlet portal. Corrosion and leakage in the CMP have also resulted in the operating restrictions described above.

Inadequate Spillway Capacity - Concern has also been expressed that the spillway is not capable of passing the 10,000-year flood event, which is estimated to be 24,100 cfs.[2] The spillway was designed to pass 10,700 cfs, lacking the desired capacity by 13,400 cfs. Under existing conditions, flows associated with the 10,000-year flood (and likely smaller storm events) would overtop the embankment and possibly cause catastrophic failure of the dam.

Access to Dam - In addition to the verified SOD deficiencies, the DVA report recommended further evaluation and correction of issues concerning poor access to the dam for routine and emergency operations by NDWR SOD personnel. Existing vehicle access is restricted to an unimproved and narrow 2.5-mile-long ranch road that approaches Asaayi Dam from downstream and traverses Bowl Creek at two low-water crossings. This road is often impassible during storm events and times of heavy stream flow. A foot path that crosses the spillway and provides secondary access to the dam from a nearby public road also cannot be safely used when the spillway is active.

1.4 Project Location

Assayi Dam is located on Bowl Creek in northwestern McKinley County, New Mexico (Figures 1 and 2). One of four major dams on the western fringe of the Chuska Mountains and Defiance Plateau, Asaayi Dam is approximately 25 miles northeast of Window Rock, Arizona. The project area consists of the dam and spillway, the lake basin, the downstream toe area, three possible borrow areas, and a 1,500-foot reach of Bowl Creek immediately upstream from the lake.

1.5 Public Involvement

The Council on Environmental Quality defines scoping as "… an early and open process for determining the scope of issues to be addressed and for identifying significant issues related to a proposed action" (40 CFR 1501.7). Scoping is an important underpinning of the NEPA process that aids in the identification of the affected public and agency concerns and focuses the analysis on relevant environmental issues.

[2] Reclamation guidelines for BIA dams indicate that the recommended Inflow Design Flood for Asaayi Dam should be the 10,000-year event (Reclamation 2005).

In July 2005, scoping information was mailed to public agencies, tribal governments, and interested individuals. One letter of comment was received from the Natural Resources Conservation Service (NRCS) requesting to be included in the review process for design of the irrigation outlet works. No other written comments were received by Reclamation.

A public meeting was held on November 16, 2005, at the Red Lake Chapter in Navajo, New Mexico. Fourteen people from the local community, Mexican Springs Chapter, Navajo SOD Program, BIA, and Reclamation attended the meeting. Attendees voiced interest in construction timelines and phasing, discharge capacity of the proposed irrigation outlet works, and possible impacts to recreation and the sport fishery.

During scoping, several issues were identified from discussions among the NEPA interdisciplinary team[3] and resource specialists from the Navajo Nation. The following environmental issues were considered early in the planning process and contributed to the development of mitigation strategies.

- potential effects to biological resources, including threatened and endangered species
- potential effects to water resources and wetlands
- potential effects to cultural resources
- potential effects to recreation
- potential effects to downstream water users

The draft EA was mailed to 29 potentially affected or interested individuals and agencies for a 30-day public review period on November 22, 2005. In addition, a news release was issued to the Navajo Times and other news media serving the Four Corners area of New Mexico and Arizona regarding the availability of the draft EA. The draft EA was also available on Reclamation's Phoenix Area Office website. One respondent submitted written comments on the proposed SOD project. These comments and Reclamation's responses are included in Appendix F.

1.6 Decision to be Made

Reclamation is the principal designer of the project and lead Federal agency responsible for determining whether the proposed action will have a significant effect on the human environment. If the EA demonstrates that the environmental consequences are not significant, Reclamation will prepare a Finding of No Significant Impact (FONSI). The FONSI will allow the project to proceed without preparation of an Environmental Impact Statement (see Chapter 5 for additional environmental compliance requirements).

[3] The NEPA interdisciplinary team consisted of biologists, archaeologists, and engineers from Reclamation and SOD staff from the Navajo Nation and BIA.

Figure 1. Location Map - HERE

Figure 2. Asaayi Dam and Spillway - HERE

CHAPTER 2 - DESCRIPTION OF ALTERNATIVES

The EA analyzes several design alternatives for addressing the purpose and need for the project. No action is included as a baseline for comparing potential effects of the action alternatives. The alternatives are the result of a design process which identified SOD issues (Reclamation 2003) and formulated conceptual designs (Reclamation 2005) for correcting safety deficiencies. Documentation of the design process decisions is located in the project file at Reclamation's Denver Technical Service Center. Correction of verified SOD deficiencies would result in modification to the dam and spillway as described in the action alternatives below.

2.1 No Action

Under the No Action Alternative, no SOD modifications would be pursued. Deficiencies in the outlet works and toe drain system would persist or worsen with only minor repair actions possible. The existing lake operating restrictions would be maintained, and releases would be made through the siphons. Continued deterioration of the embankment could require further drawdown or permanent dewatering of the lake.

2.2 Preferred Action (Alternative A)

Reclamation proposes the following structural modifications to the dam and appurtenances to correct verified safety deficiencies and improve access for SOD personnel. Potential construction impact areas are also described. Implementation of the Preferred Action would take approximately 16 months to complete. Construction is scheduled to begin in May or June 2007.

Slipline Outlet Works and Install Pressurized Irrigation Discharge Works - The existing outlet works would be modified with a double-walled, high-density polyethylene (HDPE) pipe which would be sliplined into the existing 24-inch-diameter CMP to provide structural integrity and prevent seepage (see Figure 3 and Appendix A). The HDPE liner would be constructed on site from sections of pipe using thermal butt-welding of the joints. Once in place, the annular space between the CMP and HDPE liner would be filled with cement grout using low-pressure grouting techniques.

The existing trashrack intake and downstream headwall structures would be removed prior to sliplining. After the HDPE liner is installed, a new concrete inlet structure, slide gate, and trashracks would be installed in the upstream embankment slightly above the location of the former inlet portal.

The new outlet works would include a pressurized pipe for irrigation releases (see Appendix A). A 14-inch HDPE pipeline would be constructed from the pressurized irrigation outlet works discharge portal along the right downstream toe of the dam to the existing irrigation pipeline near the right abutment. Irrigation releases would be controlled by a 14-inch butterfly valve and control mechanism located in a secured gate

house. The existing irrigation outlet works pipe in the right abutment of the dam would be removed.

New Stilling Basin - The downstream headwall would be replaced with a gate house and Type-VI impact stilling basin to reduce flow velocities and erosion potential of discharges from the outlet works (see Appendix A). Approximately 25 feet of the outlet channel immediately downstream from the stilling basin would be lined with riprap to reduce the potential for erosion.

Raise the Crest Height of the Dam and Construct New Toe Drains - The crest height of the dam would be raised 4 feet. This would increase storage capacity and retention time and allow the 10,000-year flow event to safely pass when used in tandem with the spillway design proposed below. Approximately 59,500 cubic yards (yd^3) of fill would be used to raise the height of the embankment and construct the downstream face at a slope of 3H:1V. A buttress would be constructed on the downstream embankment which would incorporate a new filter and toe drain system to correct seepage and instability issues. The toe drain would require approximately 15,000 yd^3 of sand and 8,900 yd^3 of gravel for the filter blanket. Raising the crest height would extend the downstream embankment toe nearly 87 feet from its present location and permanently displace an equivalent length of the discharge channel.

New Spillway - In addition to raising the crest height of the dam, the existing spillway would be replaced with a larger structure to create sufficient discharge capacity. The new spillway would be a 10-foot-high, 150-foot-long concrete structure adjacent to the footprint of the existing spillway, with a crest elevation of 7,536.5 feet (Appendix B). This design would require demolition of the existing spillway, blasting and removal of bedrock from the lower end of the spillway approach channel to improve flow-through capacity, and blasting and removal of bedrock in the upper portion of the spillway discharge channel to create a 25-percent slope.

Access Bridge - A 300-foot vehicle bridge would be constructed across the mouth of the spillway approach channel to connect the left abutment of the dam to a public road that serves the recreation area along the southeast side of the lake (Figure 4 and Appendix C). The bridge would provide SOD personnel with vehicular access to the dam from the public road. A locked gate would restrict access to the bridge. Routine use of the primitive ranch road for dam access would be discontinued.

Construction Borrow Areas - Three construction borrow areas (Borrow Areas A, B, and C) have been delineated on upland sites downstream from Asaayi Dam (Figure 5). Based on preliminary field investigations, an estimated 18 acres would likely be impacted in Borrow Areas A and B to obtain adequate quantities of fill for the buttress and embankment raise. Borrow Area C would be used only if the quantities of fill in Borrow Areas A and B are not sufficient to meet project requirements. In addition, material extracted from bedrock outcroppings near the downstream toe area would be used to supplement existing riprap armoring on the upstream embankment of the dam (Figure 5). Two areas totaling 0.6 acre would be affected by extraction of riprap. Existing roads

would be used for construction haulage between the material extraction areas and the dam to the maximum extent practicable.

Reclamation anticipates the sand for bedding the irrigation pipe connecting the pressurized outlet works to the existing irrigation pipeline would be obtained from processing sand deposits located within the upper lake basin. Sand extraction and processing could affect 1 acre within the dewatered lake basin (Figure 7).

Temporary Cofferdam and Construction Dewatering - Modifications to the outlet works would require dewatering the lake and constructing a temporary cofferdam at the inlet structure to protect the work area from flooding. Dewatering would be accomplished through existing and supplemental spillway siphons.

During construction, a temporary diversion dam would be constructed in Bowl Creek approximately 1,500-feet upstream from the lake. Approximately 60 yd^3 of borrowed material would be added to the upstream side of an existing Navajo Nation-maintained road crossing of Bowl Creek. One of two 7-foot-diameter culverts under the road would be temporarily blocked. A 4-foot-diameter pipe then would be inserted into the second culvert and the annulus sealed. Stream flow would be intercepted at the diversion dam and bypassed around the lake through a 4-foot-diameter, aboveground pipeline (Figure 6). All diverted flow would be discharged to the rock chasm below the spillway. After construction, the diversion dam would be removed and the material spoiled in one of the borrow areas.

A temporary cofferdam would be needed to protect a 50-foot square work area around the inlet structure of the dam. The cofferdam would be built with approximately 17,600 yd^3 of rock excavated from the lower spillway approach channel during spillway construction. Construction access to the inlet structure would require a temporary haul road in the dewatered lake basin along the upstream toe of the dam (Figure 5). Once the cofferdam is in place, an estimated 8 to 10 feet of sediment covering the inlet structure would be excavated and removed. The cofferdam would remain in place after construction.

2.3 Alternative Actions

Reclamation considered a combination of design formulations to address the SOD deficiencies and other issues. All of the design concepts require draining the lake, diverting stream flow, constructing a temporary cofferdam, and extracting embankment fill from identified borrow sources. The following alternatives include design formulations analyzed during the planning phase.

Alternative B (Outlet Works Replacement and New Spillway)

An outlet works replacement alternative was evaluated by Reclamation, BIA, and the Navajo SOD Program. Under this alternative, the dam would be excavated along the alignment of the existing outlet works in order to remove the CMP, intake structure, and

discharge portal headwall. New facilities consisting of an intake structure; steel-lined, reinforced-concrete conduit; and concrete stilling basin would be constructed along the same alignment as the old outlet works. The existing toe drain system would also be replaced. Removal of the outlet works and toe drains would require the excavation and stockpiling of more than 116,000 yd^3 of material (or 92 percent of the embankment). Approximately 4 acres of land would be needed to stockpile the excavated embankment material. Like the Preferred Action, this alternative would require a 4-foot raise in the height of the dam and a new spillway. Spillway design options consist of a 150-foot structure (see Preferred Action) or a 220-foot structure.

A 220-foot-long spillway would require deepening both the inlet and outlet channels approximately 10 feet below the existing spillway crest elevation. Extensive blasting of bedrock in the channel would provide the necessary depth. This design option would result in substantially greater modification to the spillway approach channel than the preferred spillway design.

Other elements of this alternative would be similar to the Preferred Action including construction of an access bridge across the spillway approach channel. Construction would require approximately 24 to 36 months.

Alternative C (Crest Height Raise without New Spillway)

Under this alternative, the crest height of the dam would be raised 7 feet. Increasing the height by 7 feet would provide additional storage capacity and retention time for passing flows associated with the 10,000-year storm event. The embankment raise would include the installation of a buttress on the downstream embankment with a new toe drain system and reconfiguration of the entire downstream embankment from the existing 2H:1V to 3H:1V. Like the Preferred Action, an HDPE pipe liner with pressurized outlet works, a new stilling basin, and riprap armoring of the discharge channel would be incorporated into the project. This option includes the placement of 77,000 yd^3 of embankment fill to raise the crest height of the dam, with an additional 18,500 yd^3 of sand and 11,000 yd^3 of gravel for the new filter drain. Raising the crest height would extend the downstream embankment toe nearly 100 feet from its existing location and permanently displace an equivalent length of the discharge channel. The existing spillway could be used under this alternative. Other elements of this alternative would be similar to the Preferred Action, including construction of an access bridge across the spillway approach channel.

2.4 Alternatives Eliminated from Further Consideration

During the planning phase, several design alternatives for meeting the purpose and need were considered but eliminated from further consideration for reasons stated below.

Enlarge Existing Spillway - Under this alternative, the existing 120-foot spillway would be extended an additional 150 feet to provide the required discharge capacity. However, there is limited space available to construct the additional length of spillway without significant visual impacts. Impacts would include the removal of several large trees

along the periphery of a high-use recreation area and extensive blasting to construct a wider and deeper discharge channel below the spillway. Widening the discharge channel would substantially modify the slope and top of a prominent sandstone outcrop and adversely affect the scenic qualities of the Asaayi Lake viewshed. This alternative was dropped from further consideration due to potential visual impacts.

Supplement the Existing Spillway with Capacity at the Right Abutment - This alternative requires construction of a large auxiliary spillway at the right abutment of Asaayi Dam. Supplemental capacity could be achieved with 21 10-foot-diameter box culverts (which would occupy 225 feet of the right abutment) or an open channel spillway. An open spillway would require an access bridge at the right abutment to accommodate vehicle traffic on the dam. The right abutment does not have a well-defined route for spillway discharges, and substantial excavation and armoring (concrete or riprap) would be needed to construct a discharge channel. This alternative would be significantly more expensive than other spillway options considered and was rejected due to cost.

Improve Existing Access Road to Dam - The 2.5-mile access road is in poor condition and often cannot be traveled during inclement weather. Required improvements include substantial widening, straightening, realignment, several cuts and fills, and resurfacing with an aggregate material to improve all-weather operation. Implementation of this alternative would require multiple fills and culverted crossings of drainage channels and removal of considerable vegetation from road widening and realignment. This alternative was dropped from further consideration due to potential environmental impacts along the 2.5-mile road alignment.

Construct New Road Along Northwest Side of Lake to Dam - An existing public road provides access to a picnic area located on the northwest side of Asaayi Lake. Reclamation investigated the construction of a road from the picnic area along the northwest side of the lake to the existing service road on the crest of the dam. Construction would require approximately 1,900 linear feet of new road with a width of 20 feet, including placement of culverts and embankment fill across a relatively large wash at the northwestern corner of the lake. Extensive blasting and removal of bedrock would be required along a portion of the alignment that intersects a prominent sandstone ridge. This alternative would adversely affect a wetland and erosion stabilization work performed by the NRCS in the lower end of the wash. In addition, removal of trees and modification of the rock formation within the road alignment would adversely affect the Asaayi Lake viewshed. This alternative was dropped from further consideration to avoid adverse impacts to the wetland.

Construct 200-Foot Vehicle Bridge across Spillway Approach Channel - Reclamation's value engineering study examined placing a 200-foot prefabricated bridge over the narrowest portion of the approach channel near the spillway. Approximately 200 feet of new road construction would be required along a prominent sandstone outcrop to connect the bridge with the service road on the crest of the dam. Most of the road bed would be established by extensive blasting across the face of the rock outcrop.

Modifications to the rock feature would significantly affect the scenic qualities of the Asaayi Lake viewshed. This alternative was dropped from further consideration due to its visual impacts.

2.5 Comparison of Alternatives

The environmental consequences of the action alternatives and No Action are summarized in Table 1. Additional detail is provided in Chapter 3.

Table 1. Comparison of Alternatives and Impacts.

Attribute	No Action	Alternative A (Preferred Action)	Alternative B	Alternative C
Multipurpose Pool Elevation	7,528 feet[1] (7,536.5 feet) [2]	7,536.5 feet	7,536.5 feet	7,536.5 feet
Outlet Works Capacity	0 cfs[1] (43 cfs) [2]	25 cfs	120 cfs	25 cfs
Safety Considerations	Hazards from embankment instability and inadequate spillway capacity. Access to dam not improved.	Safety deficiencies corrected. Access to dam improved.	Safety deficiencies corrected. Access to dam improved.	Safety deficiencies corrected. Access to dam improved.
Water Resources	Long-term loss of lake storage due to embankment instability.	Short-term (16 months) loss of storage due to construction drawdown.	Short-term (24-36 months) loss of storage due to construction drawdown.	Short-term (16 months) loss of storage due to construction drawdown.
Land Use and Recreation	Long-term impacts due to permanent drawdown or dewatering.	Short-term (16 months) impacts due to temporary drawdown and construction activity.	Short-term (24-36 months) impacts due to temporary drawdown and construction activity.	Short-term (16 months) impacts due to temporary drawdown and construction activity.
Soils	No change.	Short-term disturbance of 30 acres due to construction. Impacts minimized using best management practices.	Short-term disturbance of 33 acres due to construction. Impacts minimized using best management practices.	Short-term disturbance of 42 acres due to construction. Impacts minimized using best management practices.
Air Quality	No change.	Minor short-term, intermittent impacts (16 months) from construction.	Minor short-term, intermittent impacts (24-36 months) from construction.	Minor short-term, intermittent impacts (16 months) from construction.
Biological Resources	No change.	Direct impact to 24 acres of terrestrial habitat from construction. Long-term impacts reduced to a negligible level by revegetation. Minor displacement of wildlife from construction area. No effect to special status species.	Direct impact to 28 acres of terrestrial habitat from construction. Long-term impacts reduced to a negligible level by revegetation. Minor displacement of wildlife from construction area. No effect to special status species.	Direct impact to 38 acres of terrestrial habitat from construction. Long-term impacts reduced to a negligible level by revegetation. Minor displacement of wildlife from construction area. No effect to special status species.

Table 1 – continued.

Aquatic Resources	Long-term loss of fishery due to low water levels. Decline of wetlands in upper lake basin.	Short-term (16 months) loss of fishery due to drawdown. Long-term impacts reduced to a negligible level by restocking. Loss of 0.1-acre wetland in outlet works channel offset by recovery of 1 acre of wetland habitat in upper lake basin.	Short-term (24-36 months) loss of fishery due to drawdown. Long-term impacts reduced to a negligible level by restocking. Loss of 0.1-acre wetland in outlet works channel offset by recovery of 1 acre of wetland habitat in upper lake basin.	Short-term (16 months) loss of fishery due to drawdown. Long-term impacts reduced to a negligible level by restocking. Loss of 0.1-acre wetland in outlet works channel offset by recovery of 1 acre of wetland habitat in upper lake basin.
Cultural Resources	No effect.	No effect.	No effect.	No effect.
Environmental Justice/Socioeconomic Considerations	Long-term reduction or loss of irrigation due to embankment instability and loss of lake storage.	Potential construction jobs and local project-related expenditures. Short-term (12-16 months) loss of irrigation.	Potential construction jobs and local project-related expenditures. Short-term (24-36 months) loss of irrigation.	Potential construction jobs and local project-related expenditures. Short-term (16 months) loss of irrigation.
Indian Trust Assets	Long-term reduction or loss of water and fishing rights due to permanent drawdown or dewatering.	Short-term (16 months) limitation on access to fishery and water resources due to drawdown of lake. Use of project area for recreation temporarily restricted at construction sites.	Short-term (24-36 months) limitation on access to fishery and water resources due to drawdown of lake. Use of project area for recreation temporarily restricted at construction sites.	Short-term (16 months) limitation on access to fishery and water resources due to drawdown of lake. Use of project area for recreation temporarily restricted at construction sites.

[1] SOD operating restriction.
[2] Normal operating levels.

Insert Figure 3 - HERE

Figure 4. Existing Roads and Proposed Bridge Location.

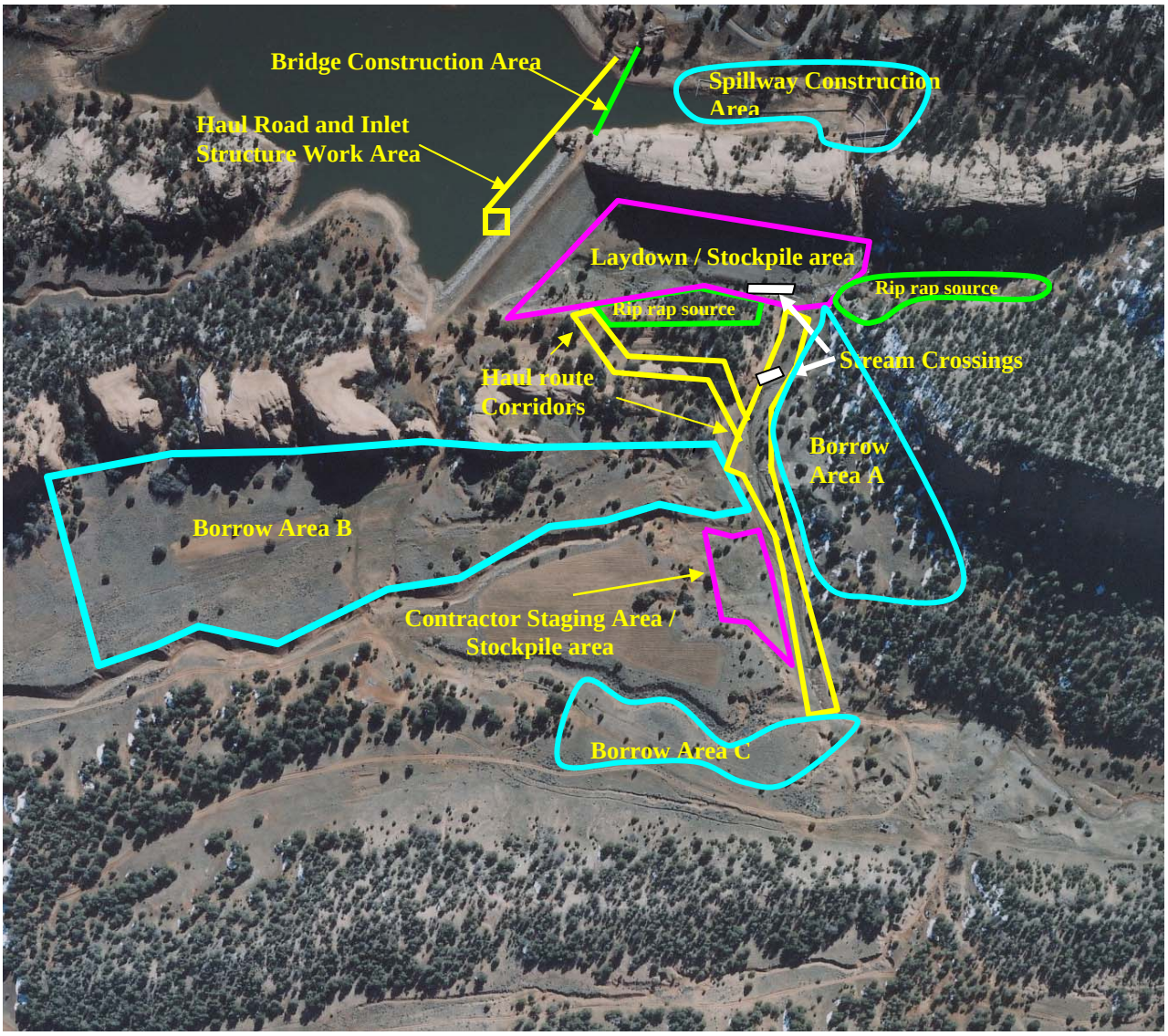

Figure 5. Potential Impact Areas at Dam and Spillway.

Figure 6. Proposed Stream Diversion Pipeline Route.

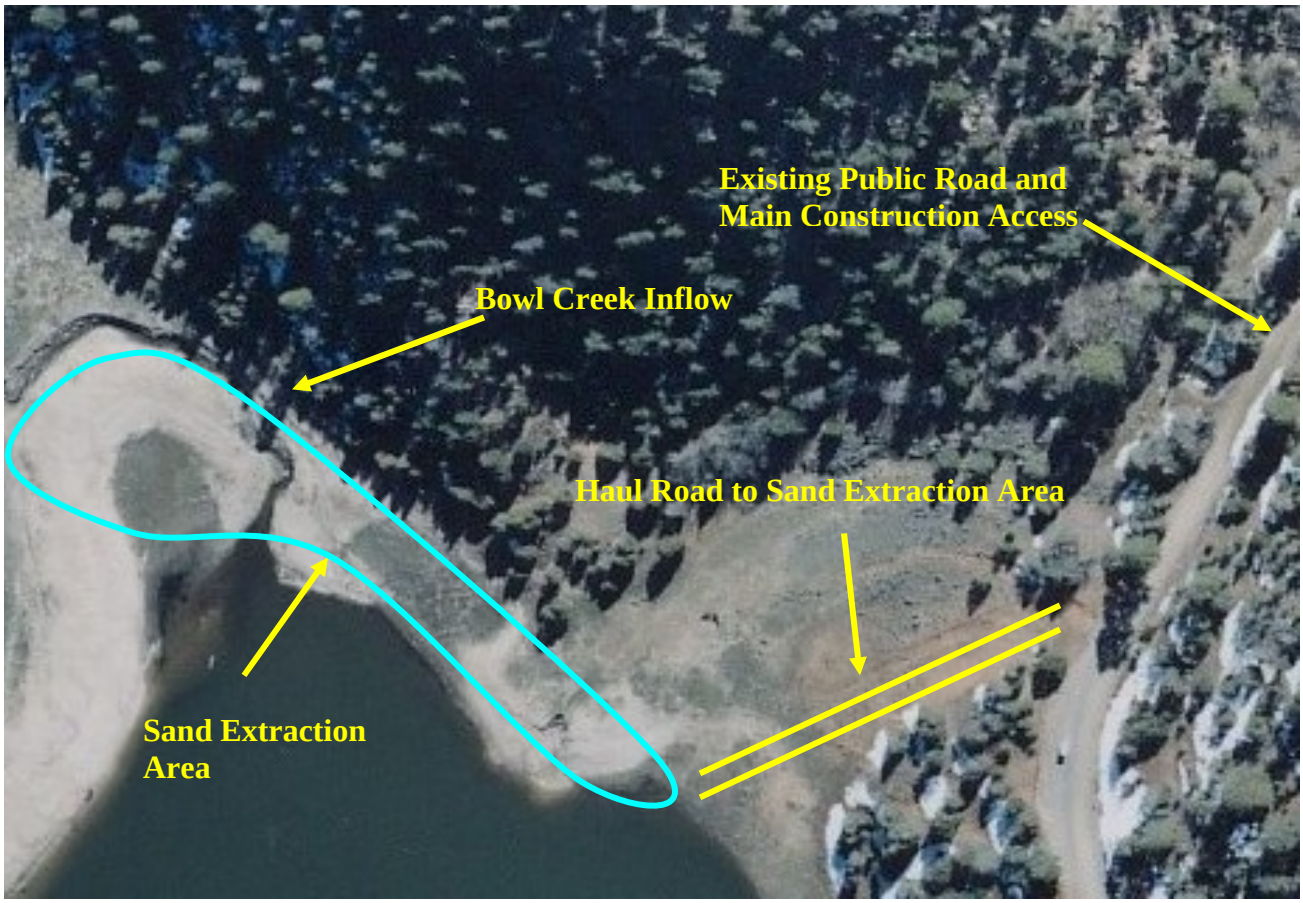

Figure 7. Sand Borrow Area and Access Road.

CHAPTER 3 - AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

Environmental attributes that are evaluated in this document fall within the general categories of water resources, land use, soils, air quality, biological resources, cultural resources, socioeconomics, environmental justice, Indian Trust Assets, and waste management.

3.1 Water Resources

3.1.1 Affected Environment

Asaayi Dam is an earth-fill embankment located on the lowermost perennial reach of Bowl Creek. Asaayi Lake (also known as Bowl Lake) has a storage capacity of 683 acre-feet and surface area of 39 acres at the spillway crest elevation of 7,536.5 feet. Maximum pool depth at the inlet structure was approximately 57 feet when the lake was filled in 1964; however, an estimated 8 to 10 feet of sediment has since covered the lakebed along the upstream toe of the dam. Until SOD concerns are corrected, existing safety restrictions will keep the maximum operating pool elevation at 7,528 feet.

Bowl Creek is a headwater tributary of the Little Colorado River, originating near the crest of the Chuska Mountains approximately 8 miles northeast of Asaayi Lake. Drainage area elevations vary from 8,900 feet in the Chuska Mountains to 7,210 feet at the Tohdildonih Wash confluence. Stream discharges are influenced by a snow-melt hydrograph that produces high flows in late winter and early spring and monsoon storms that generate flashy flows in late summer. Base flows of less than 1 cfs are prevalent in the stream reach immediately above Asaayi Lake in the weeks preceding the summer monsoon. Low seasonal flows are inadequate to maintain the lake at a steady level, and drawdown routinely occurs as upper storage volume is lost to evaporation, percolation through lake-bottom substrates, and irrigation releases. Stream flow below the dam is ephemeral, being wholly dependent on local storm runoff and seasonal high-flow spillage from Asaayi Lake.

During the growing season (May 1 to September 15), the upper storage volume of Asaayi Lake has historically been available to meet the irrigation needs of local farmers. Prior to 2000, irrigation water was discharged from the main outlet works and conveyed through the stream channel where it was diverted by Navajo farmers into a series of unlined farm ditches approximately 2 miles southwest of the lake. In recent years, approximately 34 acres were irrigated with water supplied from Asaayi Dam (NRCS 1995). An additional 46 acres have been used by farmers for irrigated and dryland crops (NRCS 1995). Crops traditionally grown include alfalfa, corn, and small grain, all for local consumption.

In 2002, the NRCS finished construction on a 15,000-foot buried PVC pipeline to convey irrigation water from a siphon and outlet pipe on the right abutment of the dam to approximately 40 acres of farmland within the lower Bowl Creek drainage. The pipeline is intended to reduce losses that typically result from spillage, seepage, and evaporation

during conveyance and improve reliability of water deliveries. However, low lake levels associated with the SOD drawdown have hindered the performance of the siphon, and very little water has been delivered to farmers through the pipeline.

3.1.2 Environmental Consequences

No Action Alternative

SOD operating restrictions would maintain the lake surface at or below elevation 7,528 feet, which would require supplementing the 6-inch-diameter siphon with a pump to provide irrigation releases into the pipeline. Instability of the embankment could require additional drawdown or permanent dewatering of the lake. Without adequate storage capacity, low crop yields or crop failures would likely result in years of water shortage and drought. In addition, the permanent loss of storage capacity would significantly degrade or eliminate wetlands that are dependent on the hydrology associated with the lake.

Alternative A (Preferred Action)

Under the Preferred Action, Asaayi Lake would be gradually dewatered through existing and supplemental spillway siphons beginning in May or June 2007. Dewatering would require approximately 30 to 40 days. Stream flow would be diverted from Bowl Creek and conveyed through a temporary aboveground pipeline to the spillway outlet. Asaayi Lake would remain dry during rehabilitation of the outlet works, precluding delivery of water through the irrigation pipeline. Partial refilling of the lake could begin once modification to the outlet works has been completed (possibly early 2008).

Construction would be completed in time to impound high flow pulses associated with snowmelt and rain in late 2008 or early 2009. The rate at which the lake returns to normal operating levels would depend on discharges from Bowl Creek. Irrigation releases to the pipeline would likely resume no later than 2009.

Upon project completion, the outlet works would be capable of handling a maximum release of 25 cfs. The spillway crest elevation of 7,536.5 feet would remain the designated top of active storage in the lake. Long-term and cumulative effects of the project would be to sustain the water resources associated with the lake and substantially improve reliability of irrigation releases into the foreseeable future.

Alternative B

The impacts of Alternative B would be similar to those described for the Preferred Action. Total replacement of the outlet works and toe drain system would require construction dewatering for 24 to 36 months. Normal irrigation releases to the pipeline would not resume until 2010 or 2011.

Alternative C

The impacts of Alternative C would be similar to those described for the Preferred Action. Modification to the outlet works and replacement of the toe drain system would require construction dewatering for approximately 16 months. Normal irrigation releases to the pipeline would not resume until 2009.

Mitigation Requirements

- Work would not begin until a Clean Water Act (CWA) Section 404 permit has been issued by the U.S. Army Corps of Engineers. Terms and conditions of the permit would be integrated into the project.

- Work would not begin until a CWA Section 401 Water Quality Certification has been issued by the U.S. Environmental Protection Agency (EPA). Terms and conditions of the certification would be integrated into the project.

- A CWA Section 402 storm water pollution prevention plan with appropriate pollution control best management practices (BMPs) would be prepared prior to construction. Coverage under the National Pollutant Discharge Elimination System general permit for storm water discharges associated with construction would be obtained.

- Fuels and other hazardous construction chemicals would be stored outside the 100-year floodplain of Bowl Creek more than 50 feet from Asaayi Lake.

3.2 Land Use and Recreation

3.2.1 Affected Environment

The area encompassing Asaayi Lake consists of a patchwork of rangeland, scrubland, and pine forest. Land uses within the project area include livestock grazing, hunting, and water-based recreation. Timber management areas are limited to the upper watershed in the Chuska Mountains. Approximately 80 acres are farmed by local Navajo residents for irrigated and dryland crop production 2 to 3 miles southwest of Asaayi Dam. Irrigation on approximately 40 acres is dependent on water supplied from Asaayi Lake.

Asaayi Lake is a popular camping and fishing spot accessible from unpaved public roads that intersect Highway 134 and Navajo Route 12. Recreation functions at the lake are administered by the Navajo Parks and Recreation Department and Navajo Fish and Wildlife Department (NFWD). Current recreational facilities include campgrounds and picnic areas equipped with picnic tables and modern privy-style toilets, a boat-launching area, and graded park roads. The lake is managed as a put-and-take trout fishery. Public use of the lake area occurs mostly during the summer and early fall. Vehicular access to the lake is closed during the winter.

3.2.2 Environmental Consequences

No Action Alternative

Permanent drawdown of Asaayi Lake would reduce storage volume that was previously allocated for irrigation and recreation. A substantial reduction in storage volume would force area farmers to rely more heavily on dryland crop production.

Low lake levels would affect the type and intensity of recreational use, particularly if additional drawdown is required in the future. Any additional drawdown would reduce the surface area for boating and fishing and increase the probability of user conflicts by concentrating these activities into a smaller area. Substantial loss of deep-water lentic habitat could adversely affect the quality of the coldwater sport fishery.

Alternative A (Preferred Action)

The project would introduce temporary adverse effects on recreation during the 16-month construction period. Portions of the recreation area on the southeast side of Asaayi Lake would be reserved for contractor use and unavailable to the public. Draining the lake for construction purposes would eliminate the sport fishery, necessitating a full restocking program by NFWD once normal lake operations resume. Construction would disrupt passive and active use of the lake area for other recreational pursuits such as picnicking, camping, and sightseeing for approximately 16 months. The borrow areas and potential riprap extraction sites are visually isolated from the lake by intervening terrain; therefore, changes in landform resulting from borrow activity would not affect the scenic quality of the Asaayi Lake viewshed.

At the present time, no water is being delivered to farmers through the pipeline due to low lake levels. The existing suspension of irrigation releases would persist during construction, sustaining current levels of agricultural activity through 2007 and part or all of 2008. Irrigation releases would resume once the outlet structure is operational and sufficient quantities of water have been impounded in the lake.

The long-term cumulative effect of the project would be to restore the maximum pool elevation of 7,536.5 feet and improve the reliability of irrigation discharges and recreational opportunities at Asaayi Lake.

Alternative B

The impacts to land uses from construction dewatering would be similar to those described for the Preferred Action, except the duration for total replacement of the outlet works and toe drain system would require a longer dry-up period. Replacement of the outlet works could curtail water-based recreation and irrigation releases for up to 36 months due to dewatering. Continued suspension of irrigation releases during construction would sustain existing levels of agricultural activity until the new outlet works become operational.

Alternative C

The impacts to land uses from construction dewatering would be similar to those described for the Preferred Action. Construction would curtail water-based recreation for approximately 16 months due to construction dewatering. Continued suspension of irrigation releases during construction would sustain existing levels of agricultural activity until the new outlet works become operational.

Mitigation Requirements

- NFWD would restock sport fishes into Asaayi Lake following project completion (personal communication, Jeff Cole, NFWD, June 2005).

3.3 Geology and Soils

3.3.1 Affected Environment

Asaayi Dam is located within the southern boundary of the Colorado Plateau. Locally exposed rock units are Jurassic-age sedimentary rocks of the San Raphael Group. Exposed rock units include the Summerville and Todilto Formations and sandstone of the Entrada Formation. Sandstone and siltstone of the Summerville Formation form the bedrock at the right abutment of Asaayi Dam. Entrada sandstone underlies alluvial and embankment material at the dam. Todilto limestone is exposed northwest of the right abutment of the dam outside the project area (Reclamation 2003).

Upland soils within the project area are classified as Entroboralfs and Ustorthents (NRCS 1995). These soils are shallow to deep, well-drained, and formed in residuum from sedimentary parent material. Soils within the floodplain, terraces, and fans of Bowl Creek and the bottom of Asaayi Lake are alluvial in nature.

Soil conditions vary throughout the project area as a result of long-term grazing pressure and recreation. Livestock grazing on upland slopes has reduced ground cover and accelerated storm runoff and erosion. Concentrated recreational use and grazing along the southeastern portion of the lake have destabilized soils and resulted in sediment production from sheet, rill, and roadside erosion (NRCS 1995).

3.3.2 Environmental Consequences

No Action Alternative

Existing soil erosion and sedimentation trends would likely persist into the foreseeable future.

Alternative A (Preferred Action)

The three borrow areas constitute the largest collective area potentially affected by project activities. Borrow activities at these sites would be required to obtain appropriate material for raising the crest height of the dam, constructing the buttress on the downstream embankment, supplementing existing riprap armoring on the upstream embankment, and constructing the diversion dam. In addition, sand from the dewatered basin near the upper end of Asaayi Lake would be extracted for bedding the irrigation pipeline at the outlet works. Excavation of soils, sand, and rock within the various material extraction sites would affect a minimum of 20 acres. Existing roads would be used for haulage between the borrow areas and Asaayi Dam to the maximum extent practicable.

Modification of the crest height and downstream embankment configuration would affect approximately 2 acres on Asaayi Dam. Staging and stockpiling areas associated with modification of the downstream embankment, outlet works, and toe drains would affect approximately 4 acres below the dam. The downstream toe area was previously impacted during construction of Asaayi Dam in 1964.

Construction at the spillway and bridge site would impact an estimated 3 acres consisting of lake-bottom alluvium, upland soils, and sandstone bedrock in and adjacent to the spillway approach channel. Staging of materials and construction traffic would require closure of the recreation area along the southeast side of the lake.

A temporary cofferdam would be constructed to protect a 50-foot square work area at the inlet structure. The cofferdam would be constructed of rock removed from excavation within the spillway channel. Access to this work area would be by means of a temporary haul road constructed in the dewatered lake basin along the upstream toe of the dam from the spillway approach channel. Once the cofferdam is in place, sediments around the inlet structure would be excavated and removed. Approximately 1.3 acres in the dewatered lake bottom would be affected by the cofferdam and haul road.

Construction of a temporary diversion dam to direct stream flow into the bypass pipeline would affect less than 0.1 acre in Bowl Creek. The pipeline would be placed above-ground along the high watermark of the lake to minimize impacts to soils and vegetation.

Alternative B

Ground disturbances associated with material extraction from borrow sources, material staging, toe drain rehabilitation, and embankment modifications would be similar to those described in the Preferred Action. The material stockpiling requirements of Alternative B would impact approximately 4 acres more than the Preferred Action. Approximately 34 acres of terrestrial and aquatic substrates would be impacted under Alternative B.

Alternative C

Ground disturbances from material staging and stockpiling, toe drain rehabilitation, and embankment modifications would be similar to those described in the Preferred Action. The material extraction requirements associated with the 7-foot embankment raise under Alternative C would impact approximately 14 acres more than the Preferred Action. In total, approximately 42 acres of terrestrial and aquatic substrates would be impacted under Alternative C.

Mitigation Requirements

- Existing roads would be used for construction haulage to the fullest extent practicable.
- No stockpiles of material would remain following project completion.
- Construction equipment would be routinely inspected for leaks and other deficiencies that could cause spillage of petroleum products onto the ground. Substantial leaks would be promptly corrected.
- Petroleum products would be stored in a designated portion of the contractor yard. Lined secondary containment would be required for petroleum storage.
- Spills and disposal of contaminated media would be managed in accordance with Federal and tribal guidelines.
- BMPs outlined in a storm water pollution plan would be implemented to minimize soil erosion. These BMPs may include installation of silt fencing, anchored straw bales, mats, mulch, or sediment basins.
- Ground disturbances on upland sites would be restored and seeded with a mixture of native vegetation. Borrow areas would be graded to conform to surrounding landscapes, stabilized, and seeded.

3.4 Air Quality

3.4.1 Affected Environment

Air quality is determined by the ambient concentrations of pollutants that are known to have detrimental effects. The EPA has promulgated National Ambient Air Quality Standards (NAAQS) for six criteria pollutants: carbon monoxide, nitrogen dioxide, particulate matter (PM_{10} and $PM_{2.5}$), ozone, sulfur dioxide, and lead. McKinley County is in attainment of standards for all criteria pollutants. Air quality in the project area is considered very good.

The EPA has also established classes of air quality. Class I status under Section 162(a) of the Clean Air Act is designated for specified geographic areas where the cleanest and most stringent protection from air quality degradation is considered important. Class I areas include national parks over 6,000 acres and national wilderness areas over 5,000 acres. There are no Class I areas near Asaayi Lake.

The project area lies at an approximate elevation of 7,500 feet and is representative of climates typically associated with montane zones in New Mexico. Rainfall along the western slope of the Chuska Mountains averages 15 to 20 inches annually. On a regional scale, periodic high winds can contribute to temporary increases in the levels of atmospheric dust.

3.4.2 Environmental Consequences

No Action Alternative

No major changes in human activities are expected in the project area that would contribute to long-term changes in air quality. Agricultural activity southwest of the project area would be a minor source of localized wind-blown dust. Permanent drawdown or dewatering would expose silty material in the lake basin to wind erosion and contribute minor amounts of atmospheric dust.

Alternative A (Preferred Action)

During construction, sources of air pollution include particulate emissions from construction operations and tailpipe emissions from construction equipment and vehicles. Tailpipe emissions would persist only during active construction. Primary sources of fugitive dust would include earth moving associated with material borrowing and stockpiling, embankment modification, and excavation in the spillway approach channel. Construction-related road dust could also be generated by traffic using haul roads in the work area. Soils that are destabilized by ground-disturbing activities would likely become a passive source of wind-blown dust until stabilization efforts can be implemented.

Dust picked up and dispersed by construction traffic and wind at disturbed sites could increase the concentration of total suspended particulates. These effects would be temporary and highly localized. After disturbed sites are stabilized, atmospheric dust is expected to return to background levels.

Alternative B

The air quality effects would be similar to those described for the Preferred Action, except emissions would persist approximately 8 to 20 months longer. Additional fugitive dust emissions could result from substantial embankment excavation and stockpiling of earthen material. Intermittent construction emissions would persist during active construction and until disturbed sites are stabilized.

Alternative C

The air quality effects would be similar to those described for the Preferred Action. Intermittent construction emissions would persist during active construction and until disturbed sites are stabilized.

Mitigation Requirements

- Implement standard airborne dust abatement practices during construction.
- Maintain adequate soil moisture on unpaved haul roads to minimize visible dust emissions.
- Halt earth-moving activities during periods of high winds (greater than 25 miles per hour).
- Disturbed sites would be stabilized and reseeded as appropriate.

3.5 Cultural Resources

3.5.1 Affected Environment

The region of the Navajo Nation encompassing Asaayi Lake contains a large number of diverse cultural resources that date from the late Paleo-Indian period (ca. 8,500 B.C.) to the mid-20th century. Typical cultural resources found on the mountains, mesas, adjacent flats, and river valleys include a wide range of prehistoric and historic site types including petroglyph and pictograph sites, agricultural sites, resource procurement and processing sites, and a variety of habitation sites from Basketmaker and Anasazi rock shelters to one- and two-room masonry surface structures and historic Navajo and Anglo-European structures and features.

Reclamation completed a Class III intensive cultural resources survey of 35 acres denoting the area of potential effect of the action alternatives. Previous Class III surveys were conducted for erosion control management, road improvements, and recreational development around the lake and for construction of the irrigation pipeline (DeFrancia and Harden 1994).

A potentially eligible site (NM-Q-1-17) containing an abandoned log cabin and historic debris pile was recorded near the southeast corner of Borrow Area C. This site is adjacent to an existing dirt road that has potential utility for construction haulage if Borrow Area C is activated. An isolated scatter of pottery sherds near the southwest corner of Borrow Area A is outside the project area. Asaayi Dam is less than 50 years old and is not considered historic.

A Navajo gravesite was identified on the hillside downstream from the right abutment of the dam. This site is within the project area but outside designated work zones required for construction.

3.5.2 Environmental Consequences

No Action Alternative

Permanent drawdown or dewatering due to embankment instability would not impact cultural resources.

Alternative A (Preferred Action)

The gravesite, site NM-Q-1-17, and the isolated pottery sherd scatter would be avoided. No cultural resources would be affected by the project. The Navajo Nation Historic Preservation Department (NHPD) concurred with the no effect determination (Appendix E).

Alternative B

Alternative B would not affect cultural resources.

Alternative C

Alternative C would not affect cultural resources.

Mitigation Requirements

- Reclamation consulted with the NHPD in accordance with section 106 of the National Historic Preservation Act. Site NM-Q-1-17 and the pottery sherd scatter would be flagged by a qualified archaeologist and avoided during construction. NM-Q-1-17 would be avoided by a minimum of 50 feet by all project activities.

- Reclamation consulted with the NHPD in accordance with the Native American Graves Protection and Repatriation Act. The Navajo burial site would be fenced and avoided during construction.

- Construction access to sites outside the project area would require additional cultural resource clearances before work could begin.

- In the event of a discovery of previously undocumented cultural resources, all operations in the immediate vicinity of the discovery would be suspended pending notification to NHPD.

3.6 Biological Resources

The results of inventories conducted in the spring and summer of 2005 are summarized below. These inventories were completed from available data and field surveys of the project area.

3.6.1 Affected Environment

Vegetation - Asaayi Lake is located within a transition zone between Great Basin conifer woodland and Petran (Rocky Mountain) montane conifer forest as described by Brown (1994). Overstory vegetation surrounding the lake consists primarily of open stands of ponderosa pine (*Pinus ponderosa*). Riparian habitat is limited to a narrow stringer of thinleaf alder (*Alnus tenuifolia*) along the lower perennial reach of Bowl Creek upstream from the lake. Below Assayi Dam, mixed pinyon (*Pinus edulis*) and juniper (*Juniperus* spp.) woodlands are sparsely interspersed with ponderosa pine on hilltops and slopes. Scattered sagebrush (*Artemisia tridentata*), snakeweed (*Gutierrezia sarothrae*), and mixed grasses dominate rangeland on the valley floor between the dam and farmland to the southwest. Gambel oak (*Quercus gambelii*) is locally common on dry, rocky sites.

Recreation areas near the spillway approach channel and dam have been heavily impacted by visitor use and are devoid of any significant ground vegetation. Near the spillway and along most of the southeast side of the lake, the continuity and distribution of overstory vegetation are disrupted by recreation-use facilities, such as shelters, roads, parking pads, and trails. Vegetation throughout the project area shows considerable evidence of trampling and grazing by livestock.

Wildlife - The ponderosa pine habitat supports a varied mammal community consisting of several notable species such as Abert's squirrel (*Sciurus aberti*), porcupine (*Erethizon dorsatum*), black bear (*Ursus americanus*), coyote (*Canis latrans*), bobcat (*Felis rufus*), mountain lion (*Puma concolor*), mule deer (*Odocoileus hemionus*), and elk (*Cervus elaphus*).

Numerous avian species occur in or near the project area as year-round or seasonal residents and migrants. Waterfowl and wading birds are common summer residents of Asaayi Lake and other lakes and ponds of the Chuska Mountains and foothills. Suitable habitat for a number of raptor species exists within the project area. The red-tailed hawk (*Buteo jamaicensis*) is a common year-round resident and nests in tall trees and cliffs near the lake. Other birds of prey that likely frequent the area include Cooper's hawk (*Accipiter cooperii*), American kestrel (*Falco sparverius*), osprey (*Pandion haliaetus*), turkey vulture (*Cathartes aura*), great horned owl (*Bubo virginianus*), and northern saw-whet owl (*Aegolius acadicus*). Avian species (including definitive signs of occurrence) observed during site visits by Reclamation biologists on May 18, June 15 and 16, and July 19, 2005, included wild turkey (*Meleagrus gallopavo*), belted kingfisher (*Ceryle alcyon*), red-tailed hawk, Steller's jay (*Cyanocitta stelleri*), mountain bluebird (*Sialia currucoides*), hairy woodpecker (*Picoides villosus*), northern flicker (*Colaptes auratus*),

rufous hummingbird (*Selasphorus rufus*), white-breasted nuthatch (*Sitta carolinensis*), common raven (*Corvus corax*), and peregrine falcon (*Falco peregrinus*).

Special Status Species - Table 2 and the following discussion present the federally and Navajo-listed special status species that could occur in the area delineated by the Todilito Park, New Mexico, 7.5-minute series U.S. Geological Survey quadrangle map. The potential for species occurrence was determined on quadrangle-wide coarse habitat characteristics and species range information provided by NFWD. The U.S. Fish and Wildlife Service (FWS) lists three additional species that potentially occur in McKinley County but are not included in Table 2. Ecological conditions in the project area are not suitable for Zuni bluehead sucker (*Catostomus discobolus yarrowi*) and western yellow-billed cuckoo (*Coccyzus americanus*). The occurrence of bald eagle (*Haliaeetus leucocephalus*) has not been recorded at Asaayi Lake by NFWD.

Table 2. Navajo- and federally listed special status species.[1]

Species		Habitat Type	Status		Potential Occurrence
Common Name	**Scientific Name**		**Federal**[2]	**Navajo**[3]	
Black-footed ferret	*Mustela nigripes*	Associated with prairie dog towns in desert grasslands	E/Exp	Group 2	Prairie dog towns absent - no occurrence
Mountain plover	*Charadrius montanus*	Dry upland grasslands, plowed fields, and sandy desert		Group 4	Suitable habitat absent - no occurrence
Golden eagle	*Aquila chrysaetos*	Nest on cliff ledges in Chuska Mountains and foothills; nearest recorded nest > 1 mile southwest of Asaayi Lake		Group 3	Potential nesting habitat present; dispersed foraging in impact area possible - no occurrence of species during site visits
Mexican spotted owl	*Strix occidentalis lucida*	Nests and roosts in mixed conifer forests and steep-walled, narrow canyons with riparian vegetation and cool microclimates; nearest Protected Activity Center approximately 2 miles northeast of Asaayi Lake in Chuska Mountains	T	Group 3	Nesting habitat absent; winter foraging possible along foothills in mixed stands of pinyon, juniper, and ponderosa pine

Table 2 - continued.

Southwestern willow flycatcher	*Empidonax traillii extimus*	Riparian obligate nesting along rivers, streams, and wetlands where dense growths of willow, seepwillow, boxelder, tamarisk, or other plants are present	E	Group 2	Suitable riparian habitat absent - no occurrence
American dipper	*Cinclus mexicanus*	Forested areas (spruce-fir, pine, and aspen) along fast-flowing mountain streams at elevations above 4,000 feet in Chuska Mountains		Group 3	Suitable habitat absent - no occurrence
Peregrine falcon	*Falco peregrinus*	Cliffs and steep terrain often near forests or permanent water		Group 4	Active nest on cliff approx. 3,300-feet north of dam
Blue grouse	*Dendragapus obscurus*	Mixed conifer forests (spruce, fir, and Douglas fir) and aspen in Chuska Mountains		Group 4	Suitable habitat absent - no occurrence
Northern leopard frog	Rana pipiens	Permanent lakes, streams, and wetlands that support aquatic vegetation; also in wet meadows		Group 2	Suitable habitat absent - no occurrence
Western seep fritillary	*Speyeria nokomis*	Moist meadows, seeps, marshes, and streamside habitat with flowering plants		Group 3	Suitable habitat absent - no occurrence
Arizona leather flower	*Clematis hirautissina var. arizonica*	Grows in moist meadows, stands of ponderosa pine, and mixed conifer forests on soils derived from limestone and rarely sandstone		Group 4	Potentially suitable edaphic conditions present in Borrow Area A; area surveyed - no occurrence
Rhizome fleabane	*Erigeron rhizomatus*	Grows in pinyon-juniper woodland at an elevational range of 7,300 to 8,000 feet; restricted to red detrital clay derived from the Chinle shale or Baca formations on erodible slopes	T	Group 2	Suitable edaphic conditions absent[4] - no occurrence

Table 2 – continued.

Goodding's onion	Allium gooddingii	Forested drainage bottoms and on moist, north-facing slopes of mixed conifer and spruce-fir woodlands, at elevations above 7,500; species has been documented within 3 miles of Asaayi Dam in the Chuska Mountains		Group 3	Ecological and edaphic conditions absent - no occurrence

[1] Source: NFWD 2005 (Appendix D) and FWS (2005).
[2] Federal = Endangered Species Act, species listed by FWS: E = endangered; T = threatened; Exp = experimental.
[3] Navajo = Navajo Nation Endangered Species List (refers to status on Navajo Indian Reservation): Group 1 = extirpated; Group 2 = likely to become extirpated on all or part of range; Group 3 = likely to become endangered; Group 4 = insufficient information on status (no legal protection is afforded species with Group 4 status).
[4] Exposed rock units within the project area consist primarily of sandstone and siltstone of the Summerville Formation and sandstone of the Entrada Formation; limestone of the Todilto Formation is exposed northwest of the top of the right abutment of Asaayi Dam outside the project area (Reclamation 2003).

Black-footed ferret. The black-footed ferret was listed as endangered on March 11, 1967 (32 FR:4001). This species is associated with medium to large prairie dog towns (usually >200 acres) on grasslands and open desertscrub. Once relatively abundant in prairie dog towns from the Great Plains to the inter-mountain region and the Southwest, the last known wild population of ferrets in the United States disappeared from Wyoming in the mid-1980s. Reintroduction of experimental populations is underway in Wyoming, Montana, South Dakota, and Arizona. The Arizona Game and Fish Department introduced an experimental population of black-footed ferrets on the Navajo Nation in the Aubrey Valley of north-central Arizona in 1996. The black-footed ferret has not been recorded near Asaayi Lake.

Mountain plover. Not listed under Endangered Species Act (ESA); Federal protection afforded by the Migratory Bird Treaty Act. The mountain plover is a Great Plains native bird that breeds in the arid shortgrass prairie from northern Montana to southern New Mexico and winters in California, Texas, and Mexico. Short vegetation, bare ground, and a flat topography constitute recognized habitat characteristics at both breeding and wintering locales. Mountain plovers historically nested in prairie dog towns or other areas heavily grazed by prairie herbivores (64 FR:7587). This plover is also attracted to manmade landscapes (e.g., fallow and cultivated agricultural fields) that mimic natural habitat associations. In northwestern New Mexico, this species occurs in basin sagebrush with large bare areas created by livestock grazing, prairie dog colonies, and other disturbances. On the Navajo Nation, the only known breeding occurs on grasslands in New Mexico. Grasslands between the Chuska Mountains and Black Mesa and southwest of Black Mesa to the Little Colorado River are potential habitat (Mikesic et al. 2005).

Golden eagle. Not listed under ESA; Federal protection afforded by the Bald Eagle Protection Act and the Migratory Bird Treaty Act. Golden eagles occur throughout New Mexico and Arizona in a variety of habitats including deserts and grasslands that afford

open areas for hunting. On the Navajo Nation, cliffs are important nest sites for this species. Nest sites consist of steep, high cliffs (typically > 90-feet tall) in sheltered ledges, potholes, or small caves which provide protection from the elements. Nesting cliffs are normally directly adjacent to foraging habitat of desert grasslands or desertscrub, with only sparse trees present, which provide primary prey of cottontail and jackrabbits. The nearest golden eagle nest recorded by NFWD is more than 1 mile southwest of Asaayi Dam. Surveys of potential nest sites within 1 mile of Asaayi Dam were negative.

Mexican spotted owl. The Mexican spotted owl was listed as threatened on March 16, 1993 (58 FR:14248), with critical habitat designated on August 31, 2004 (69 FR:53181). No critical habitat has been designated for this species on the Navajo Nation. Suitable habitat for the Mexican spotted owl generally consists of mixed overstory vegetative communities that support the combined activities of nesting, roosting, and foraging. Mixed conifer forest (spruce-fir communities) is most often used by this species for nesting and roosting. Typical mixed stands that support roosting and nesting contain three distinct types: (1) mid-aged to mature mixed conifer stands dominated by white fir (*Abies concolor*) or Douglas fir (*Pseudotsuga meziesii*), typically on mountain slopes, with moderate to dense canopies and multiple canopy layers; (2) steep-walled narrow canyons often with riparian vegetation and cool microclimates; and (3) moderately sloped drainages with Douglas fir and pinyon-juniper (e.g., Black Mesa). The FWS does not consider relatively pure stands of ponderosa pine as suitable habitat; however, pure ponderosa pine associations could be used for foraging where they are found in close proximity to other forest communities that do support nesting and roosting activity (95 FR:13606). On the Navajo Nation, suitable habitat (and documented occurrence) is located in the Chuska Mountain Range, Defiance Plateau, Canyon de Chelly, and Black Mesa (Mikesic et al. 2005). The nearest Protected Activity Center is approximately 2 miles northeast of Asaayi Lake in mixed conifer forest along the western slope of the Chuska Mountains (personal communication, David Mikesic, Navajo Natural Heritage Program, May 18, 2005). The open ponderosa pine community at the lake does not afford suitable nesting habitat.

Bald eagle. The bald eagle was downlisted from endangered to threatened on July 12, 1995 (60 FR[133]:36000). No critical habitat has been designated. Habitat requirements include large trees, snags, or cliffs near water for nesting. Bald eagles feed primarily on fish, but waterfowl, small mammals, and carrion are also eaten. Recent nesting in the Southwest is limited to the Verde, Salt, Animas, and Gila Rivers. There are no nesting records on the Navajo Nation, but fall migrants use several lakes including Tsaile, Wheatfields, Many Farms, Morgan, Little White Cone, Red, and Black Lakes and various lakes at higher elevations in the Chuska Mountains (Mikesic et al. 2005). Bald eagles have not been recorded at Asaayi Lake, although they may appear infrequently as fall migrants. Freezing of high elevation lakes and streams precludes wintering in the Chuska Mountains. Winter foraging on the Navajo Nation is documented only along the San Juan and Colorado Rivers.

Southwestern willow flycatcher. The southwestern willow flycatcher was listed as endangered on February 27, 1995 (60 FR:10694), with critical habitat proposed on November 12, 2004 (69 FR:60705). This neotropical migratory species breeds in the southwestern United States from approximately early May to late August and migrates to Mexico, Central America, and possibly northern South America during the nonbreeding season (Sogge et al. 1997). The historical range of the southwestern willow flycatcher included southern California, Arizona, New Mexico, western Texas, southwestern Colorado, southern Utah, extreme southern Nevada, and extreme northwestern Mexico (Unitt 1987). This species is a riparian obligate that nests near surface water or saturated soils in monotypic or mixed stands of native (e.g., willow, cottonwood, boxelder) or exotic (e.g., tamarisk or Russian olive) species, with or without an overstory. Vegetation is typically >10-feet tall, dense with a closed canopy, although the understory may be dispersed or clumped (Sogge et al. 1997). Nesting habitat varies in size and shape but usually does not include linear riparian zones <30-feet wide. Although nesting has been recorded only along the Colorado and San Juan Rivers, breeding may occur at any elevation on the Navajo Nation where appropriate habitat exists (Mikesic et al. 2005). No nesting activity had been recorded in the Chuska Mountains in New Mexico (personal communication, Sartor O. William, III, New Mexico Department of Game and Fish (NMDGF), August 26, 2005).

American dipper. Not listed under ESA; Federal protection afforded by the Migratory Bird Treaty Act. American dippers inhabit forested areas (primarily spruce-fir, yellow pine, and aspen habitat) along fast-flowing clear mountain streams at elevations usually ranging from 5,000 feet to timberline. Nests are near streams with a variety of riffles, pools, and waterfalls with substrate of rock, sand, and rubble; instream and streamside boulders are necessary for perches. Dippers forage on macroinvertebrates in streams. Territories are linear and reflect the nature of streamside habitat. This species resides on the Navajo Nation in the Chuska Mountains, upper Canyon de Chelly, Little Colorado River, and upper Piute Canyon near Navajo Mountain (Mikesic et al. 2005).

Peregrine Falcon. Not listed under ESA; Federal protection afforded by the Migratory Bird Treaty Act. Peregrine falcons breed in habitat consisting of steep, high cliffs (typically > 90-feet tall) in scrapes or on sheltered ledges. Foraging habitat quality is an important factor; often, but not always, water (lakes, rivers, or extensive wetlands) or forests are within the falcon's hunting range. Although peregrines are capable of killing birds the size of mallards and coots, resident birds probably rely mainly on smaller, more abundant passerine species. Jays, woodpeckers, swifts, and doves are among the commonly-taken prey species in Arizona and New Mexico. Breeding occurs across the Navajo Nation where appropriate habitat exists, including the Chuska Mountains, Canyon de Chelly, Black Mesa and north to Glen Canyon, the Dilkon-buttes region, and the canyon reaches of the San Juan, Colorado and Little Colorado Rivers (Mikesic et al. 2005). A peregrine falcon aerie was recorded by Reclamation approximately 3,300-feet north of Asaayi Dam during surveys conducted in 2005.

Yellow-billed cuckoo. The yellow-billed cuckoo's western U.S. "distinct population segment" was listed as a candidate species on July 25, 2001 (66 FR:38611). Western

yellow-billed cuckoos breed in dense willow and cottonwood stands in river floodplains. On the Navajo Nation, this species is only known from several sections of the San Juan River. Potential for breeding may also occur along the Little Colorado and Colorado Rivers, within Canyon de Chelly, Chinle Valley, and other canyons or streams with appropriate habitat (Mikesic et al. 2005). Asaayi Lake lacks suitable cuckoo habitat.

Blue grouse. Not listed under ESA; Federal protection afforded by the Migratory Bird Treaty Act. Blue grouse inhabit all major mountain ranges of the western United States and Canada, including New Mexico and Arizona. On the Navajo Nation, blue grouse has been recorded only in the Chuska Mountains. Structural diversity is a major determinant of habitat suitability for blue grouse. The species nests primarily in mixed conifer forests, especially those dominated by Douglas fir with varying amounts of aspen and possibly ponderosa pine. Winter habitat is almost exclusively montane conifer forests composed of fir or spruce and occasionally pinyon pine (Mikesic et al. 2005).

Northern leopard frog. Not listed under ESA. The northern leopard frog was listed as threatened on the Navajo Endangered Species List in 1997 as a result of negative surveys at historic sites in the Chuska Mountains. Geographically widespread declines or local extirpation of leopard frog populations have been noted in New Mexico and Arizona over the last several decades. Predation and competition by nonnative species (primarily crayfish, bullfrogs, and fishes), pollution, and random fluctuations in small populations are a few of numerous potential causes of these declines. Throughout its range, the northern leopard frog is found in permanent water bodies that support aquatic vegetation, including irrigation ditches, streams, rivers, ponds, lakes, wetlands, and wet meadows. On the Navajo Nation, the historic range included the Chuska Mountains; Little Colorado, Colorado, and San Juan Rivers; Navajo and Chinle Creeks; Canyon de Chelly; and areas near Tuba City, Cameron, Thoreau, and Newcomb. Most of these populations are now extirpated (Mikesic et al. 2005).

Zuni bluehead sucker. The Zuni bluehead sucker was listed as a candidate species on October 30, 2001 (66 FR:54808). This species occupies lotic habitats featuring moderate to fast-flowing water above a rubble-rock substrate. The historic range of the Zuni bluehead sucker was the Little Colorado River and tributaries, particularly the Zuni River system. Zuni bluehead suckers are currently limited to headwaters of the Zuni drainage in New Mexico and possible one creek in Apache County, Arizona (NMDGF 1994 and Probst 1999). The Kinlichee Creek population of the bluehead sucker on the Navajo Nation (Chuska Mountains) has been compared to the Zuni bluehead sucker subspecies, but preliminary genetic analysis indicates it is not *Catostomus discobolus yarrowi*. Bluehead sucker have not been recorded in Bowl Creek. Ecological conditions are not suitable for this species in Asaayi Lake.

Western seep fritillary. Not listed under ESA. The range of the western seep fritillary extends across eastern Utah, western Colorado, and northern Arizona and New Mexico. This species is dependent on moist meadows, seeps, marshes, and streamside habitat dominated by grasses and forbs with few shrubs. The caterpillar host plant is the northern bog violet (*Viola nephrophylla*). Flower nectar is the food source for the

butterfly. Throughout its North American range, several populations have been lost due to draining of habitat, herbicide application, and heavy grazing. On the Navajo Nation, fewer than ten populations have been recorded along Tsaile, Wheatfields, and Whiskey Creeks, and two springs near Washington Pass, although additional populations are possible where suitable habitat is present in the Chuska Mountains and Defiance Plateau (Mikesic et al. 2005). Ecological conditions are not suitable for this species at Asaayi Lake and along Bowl Creek below Asaayi Dam.

Arizona leatherflower. Not listed under ESA. In Arizona and New Mexico, this Clematis occurs as isolated populations in moist mountain meadows, prairies, mixed conifer forests, and ponderosa pine at an elevation of 6,000 to 9,000 feet, usually on limestone soils and rarely on sandstone soils. A recent floristic review of the genus Clematis in North America (Pringle 1997) showed no clear differences between *C. hirsutissima* var. *arizonica* and *C.h.* var. *hirsutissima*. Many authorities now believe *C. h.* var. *arizonica* should be placed in synomy under *C.h.* var. *hirsutissima*. *C.h.* var. *hirsutissima* is a wide-spread taxon, known from nine western states, and is not presently imperiled within its range. On the Navajo Nation, either variety is known from two locations in the Chuska Mountains (near Sonsela Buttes, Arizona, and Crystal, New Mexico) (Mikesic et al. 2005). Potentially suitable edaphic and ecological conditions exist in Borrow Area A below Asaayi Dam.

Rhizome fleabane. The rhizome fleabane (also known as Zuni fleabane) was listed as threatened on April 26, 1985 (50 FR:16682). The species is found in pinyon-juniper woodland in an elevation range of 7,300 to 8,000 feet. It is often directly associated with Pinyon pine, oneseed juniper (*Juniperus monosperma*), Gambel oak, mountain mahogany (*Cercocarpus montanus*), and fourwing saltbush (*Atriplex canescens*). The species tends to be restricted to red or gray detrital clay soils derived from the Chinle Formation in the Zuni and Chuska Mountains and the Baca Formation in the Datil and Sawtooth Mountains, typically on erodible slopes with gradients up to 40 percent. The rhizome fleabane grows only on north-, west-, or east-facing exposures in areas that receive 14 to 16 inches of precipitation a year. On the Navajo Nation, the species has been recorded in the Chuska Mountains near Lukachukai, Arizona, and west of Red Valley south to Navajo, New Mexico. Potential distribution occurs in pinyon-juniper associations between Lupton, Arizona, and Prewitt, New Mexico (Mikesic et al. 2005). Soils in pinyon-juniper stands near Asaayi Dam are derived from sandstone and siltstone of the Summerville and Entrada Formations (Reclamation 2003) and lack the fine-textured clays required by the species.

Goodding's onion. Not listed under ESA. This species occurs within mixed conifer and spruce-fir forests in moist, shady canyon bottoms and north-facing slopes at elevations ranging from 6,400 to 11,250 feet; often found along streams. Soils which support Goodding's onion are basaltic or rhyolithic with the upper horizon composed of loamy alluvium with a high organic content. In the Chuska Mountains, this species is also found in oak thickets interspersed with aspen, dogwood, and Douglas fir. Distribution on the Navajo Nation consists of the Chuska Mountains and Canyon de Chelly. Potential distribution is throughout the Chuska Mountains and Defiance Plateau on sites with

suitable ecological and edaphic conditions (Mikesic et al. 2005). The project area does not afford suitable conditions for this species.

3.6.2 Environmental Consequences

No Action Alternative

Vegetation - No significant change in the plant community is anticipated in the foreseeable future. Vegetation would continue to be affected by grazing and recreational activities. Substantial drawdown or permanent dewatering due to embankment instability would create an opportunity for invasive plants to become established in the dry margins of the lake.

Wildlife - Substantial loss of the lake resource would have a minor effect on aviafauna. Numerous other foothill and mountain lakes and ponds of the Chuska Mountains are available to water-dependent birds, such as summer resident or migrating waterfowl, wading birds, and shore birds.

Special Status Species - Permanent drawdown or dewatering would not affect special status species.

Alternative A (Preferred Action)

Vegetation - Approximately 24 acres of vegetated habitat are located within areas likely to be affected by construction. Of the total disturbed area, the greatest impact would occur at the spillway, dam, downstream toe area, and borrow areas. Increasing the crest height of the dam would affect about 1.5 acres of nonnative herbaceous vegetation on the downstream embankment. An additional 4 acres of native and nonnative herbaceous plants, shrubs, and scattered juniper would be impacted by contractor staging and riprap extraction in the downstream toe area. Spillway and bridge construction would require the removal of three to five tall ponderosa pine trees on a 0.5-acre site in the recreation area adjacent to the spillway approach channel. Nearly 6 acres of woodland habitat consisting primarily of pinyon-juniper, with scattered ponderosa pine and Gambel oak, would be affected by borrow activities in Borrow Area A. Additional material extraction would affect approximately 12 acres of rangeland in Borrow Area B. Borrow Area C would be used only if there are insufficient quantities of borrow material in the other extraction sites. Less than 0.1 acre of riparian habitat above Asaayi Lake would be affected by diversion of Bowl Creek.

Project effects on native vegetation would be reduced to the maximum extent practicable by using existing roads for haulage and previously disturbed sites (recreation sites and the toe area below the dam) for construction staging and material stockpiling. Following construction, affected areas would be rehabilitated as appropriate. Direct and residual effects of construction on vegetation would be low.

Wildlife - Construction dewatering would displace water-dependent, summer resident and migrating avifauna to other ponds and lakes along the Chuska Mountains. The short-term loss of scattered ponderosa pine, pinyon-juniper woodland, and rangeland within the construction impact area would have a minor effect on wildlife by reducing potential reproductive, thermal, and foraging cover. Loss of this habitat represents a minor impact due to the abundance of similar habitat in surrounding areas. Human activity and noise from construction may disturb foraging and breeding for some avian and mammalian species.

Special Status Species - No special status species would be affected by construction. Most of the project area has been heavily impacted by recreation use or livestock. The most biologically diverse and pristine area potentially affected by ground-disturbing activity is the pinyon-juniper community in Borrow Area A.

Black-footed ferret. The absence of prairie dog towns in the project area precludes the possible occurrence of black-footed ferrets. No effect to the black-footed ferret is anticipated.

Mountain plover. Rangeland associated with Borrow Areas B and C does not afford suitable habitat for this species. The habitat is elongate, relatively small, and bordered by dense juniper-pinyon woodlands. Surveys of these areas in 2005 were negative for mountain plover. No effect to this species is anticipated.

Bald eagle. There are no records of bald eagles utilizing habitat at Asaayi Lake. Migrating bald eagles are highly mobile, and the proximity of other lakes to the project area would negate any potential impact of temporary dewatering. No effect to the bald eagle is anticipated.

Golden eagle. No nests occur within 1 mile of Asaayi Dam. The abundance of foraging habitat along the western edge of the Chuska Mountains would preclude any impact from the minor loss of ponderosa pine, pinyon-juniper, and range habitat. Surveys of potential cliff nest sites would be repeated in 2007 prior to construction. No adverse effect to the golden eagle is anticipated.

Mexican spotted owl. The project area does not contain suitable roosting or nesting habitat for the Mexican spotted owl. This species has not been recorded in the project area, although stands of ponderosa pine at the lake and pinyon-juniper habitat in Borrow Area A could be used by winter transients for foraging. Loss of approximately 6 acres of pinyon-juniper and scatter ponderosa pine habitat at the spillway and Borrow Area A would not be expected to affect winter foraging due to the abundance of similar habitat in surrounding areas. No effect to the Mexican spotted owl is anticipated.

Southwestern willow flycatcher. Overstory trees along the lake's perimeter and areas downstream of the Asaayi Dam consist of ponderosa pine and pinyon-juniper thickets. A narrow stringer (< 25 feet) of alder along a 300-foot segment of Bowl Creek above the lake would be affected by stream diversion during construction. This area does not

afford suitable nesting habitat due to the lack of width, density, and structure (open canopy with tree heights < 15 feet). No effect to the southwestern willow flycatcher is anticipated.

American dipper. Asaayi Lake and downstream reaches of Bowl Creek do not contain suitable American dipper habitat. No effect to the American dipper is anticipated.

Peregrine falcon. Mitigation measures identified below would be implemented to minimize or avoid potential impacts to peregrine falcon. Surveys of potential nest sites would be repeated in 2007 prior to construction. No adverse effect is anticipated.

Blue grouse. Habitat characteristics of the project area are not suitable for this species. No effect to the blue grouse is anticipated.

Northern leopard frog. Asaayi Lake lacks the habitat heterogeneity that is necessary to sustain viable Ranid populations. Fluctuating water levels have created expansive banks that are devoid of cover. Drawdown during late fall and winter also exposes shallow bottom substrates to desiccation and freezing, precluding use of these areas by hibernating frogs. The absence of shallow water with emergent vegetation – a key element for Ranid breeding – combined with abundant predatory trout precludes the possible occurrence of this species in the lake. Bowl Creek is ephemeral below Asaayi Dam and is not suitable for leopard frogs.

Zuni bluehead sucker. The lentic environment combined with the presence of trout precludes the suitability of Asaayi Lake for this species. The reach of Bowl Creek below Asaayi Dam is ephemeral and does not contain fish. No effect to the Zuni bluehead sucker is anticipated.

Western seep fritillary. Existing lakeside and streamside habitats in the project area do not afford the moist conditions and vegetation required by western seep fritillary. Cropland irrigated by releases from Asaayi Lake is grazed by livestock following each season's harvest and does not support suitable habitat for the species.

Arizona leatherflower. With the exception of Borrow Area A, potential construction impact sites within the project area do not afford suitable edaphic conditions to support this species. Surveys conducted in Borrow Area A were negative for this species. No effect to the Arizona leatherflower is anticipated.

Rhizome fleabane. The project area does not have suitable ecological conditions to support this species. No effect to the rhizome fleabane is anticipated.

Goodding's onion. The project area does not have suitable ecological conditions to support this species. No effect to the Goodding's onion is anticipated.

Alternative B

Vegetation - Impacts to vegetation would be similar to those described for the Preferred Action. Additional impacts to vegetation would result from the greater material stockpiling requirements of Alternative B. Approximately 28 acres of habitat would be impacted under this alternative.

Wildlife - Impacts to wildlife would be similar to those described under the Preferred Action; however, the duration of construction dewatering and other project effects would be longer.

Special Status Species - No impact is anticipated.

Alternative C

Vegetation - Impacts to vegetation would be similar to those described under the Preferred Action. Additional impacts to vegetation in Borrow Areas B and C would result from the greater embankment fill requirements of Alternative C. Approximately 38 acres of habitat would be impacted under this alternative.

Wildlife - Impacts to wildlife would be similar to those described for the Preferred Action.

Special Status Species - No impact is anticipated.

Mitigation Requirements

- Site restoration consisting of recontouring and seeding would be performed on disturbed upland sites. A native seed mix approved by the Navajo Nation would be used for reseeding purposes. Seeding of disturbed sites and post-project monitoring of revegetation success would be performed by the NDWR to ensure conformance with tribal requirements.

- Surveys for golden eagle and peregrine falcon would be conducted prior to construction in 2007.

- No project activities would be conducted within ½ mile of an active peregrine falcon aerie during the breeding season (March 1 to July 31). No use of explosives would be permitted within 1 mile of an aerie during the breeding season.

3.7 Aquatic Resources (including fisheries and wetlands)

3.7.1 Affected Environment

The aquatic margins of Asaayi Lake are ephemeral due to fluctuations in water levels and winter freezing. Emergent aquatic vegetation is absent, and there are no rooted plants along the wetted perimeter of the lake. One acre of wetland habitat in the upper lake basin is declining as a result of the SOD drawdown and corresponding changes in hydrology. Seepage from the outlet works is sustaining 0.1 acre of herbaceous wetland vegetation in the outlet works discharge channel.

Asaayi Lake is stocked annually by NFWD with rainbow trout (*Oncorhynchus mykiss*) and cutthroat trout (*Oncorhynchus clarki*). No native species of fish have been recorded in the lake. Bowl Creek is within the geographic and elevation range of speckled dace (*Rhinichthys osculus*) and bluehead sucker, however NFWD has no record of either species occurring in the drainage. Native lotic fishes that stray into the lake would not be expected to persist because of predation by trout.

3.7.2 Environmental Consequences

No Action Alternative

Substantial and sustained drawdown would lower the overall number of fish in the lake by reducing available habitat. The reduction in storage volume also increases the chance for winterkills. Drawdown would result in the general decline of the coldwater aquatic habitat and adversely affect management of the lake as a trophy-level trout fishery. Wetland habitat in the upper lake basin would likely become reduced in areal coverage or disappear altogether.

Alternative A (Preferred Action)

There would be no effect on aquatic biota upstream from the bypass pipeline diversion dam and downstream from the outlet works discharge channel. Construction dewatering would result in temporary loss of the trout fishery, the macroinvertebrate community, and other aquatic biota associated with the lake. Stocking by NFWD would restore the fishery once normal lake operations resume. Recolonization of macroinvertebrate populations from Bowl Creek would quickly restore the food base for the fishery. The cumulative, long-term impact of the project would be to sustain the cold-water lentic habitat into the foreseeable future.

Modification to the outlet works would eliminate seepage from the CMP and remove the source of water sustaining the wetland in the outlet works channel. Without this water supply, the wetland would not be expected to persist. Resumption of normal lake operations would promote recovery of wetland habitat in the upper lake basin. There would be a net benefit to wetland resources from implementation of the project.

Alternative B

The effects on aquatic resources would be similar to those described under the Preferred Action, with the exception that Asaayi Lake would remain dry an additional 8 to 20 months.

Alternative C

The effects on aquatic resources would be similar to those described under the Preferred Action.

Mitigation Requirements

- Drawdown would be coordinated with the NFWD.
- Sport fishery would be restocked following construction.

3.8 Indian Trust Assets

3.8.1 Affected Environment

Indian Trust Assets are legal interests in assets held in trust by the United States through the Department of Interior, Bureau of Indian Affairs, for Indian tribes or individual Indians. This trust responsibility requires that all Federal agencies, including Reclamation, ensure their actions protect Indian Trust Assets.

"Assets" are anything owned that has monetary value. The asset need not be owned outright but could be some other type of property interest, such as a lease or a right of way. They can be real property, physical assets, or intangible property rights. Common examples of trust assets may include lands, minerals, hunting and fishing rights, water rights, other natural resources, and money. "Legal interest" means there is a primary interest for which a legal remedy, such as compensation or injunction, may be obtained if there is improper interference. Trust assets do not include things in which a tribe or individual have no legal interest, such as off-reservation sacred lands in which a tribe has no legal property interest. It should be noted that other Federal laws pertaining to religious or cultural laws should be addressed if impacts to such lands were to occur from Reclamation actions.

The United States has an Indian trust responsibility to protect and maintain rights reserved by or granted to Indian tribes or individual Indians by treaties, statutes, and Executive Orders. This trust responsibility requires that all Federal agencies, including Reclamation, take actions reasonably necessary to protect trust assets.

Trust assets of the Navajo Nation and individual Navajo Indians that might be affected by this project include land, fishing rights, and water resources.

3.8.2 Environmental Consequences

No Action Alternative

Current SOD operating restrictions would remain in effect into the foreseeable future. Permanent drawdown would reduce the amount of water available to downstream irrigators. Low water levels would force the coldwater sport fishery into decline and affect the aesthetic value of Asaayi Lake. Substantial additional drawdown or dewatering of the lake due to embankment instability would result in a loss of fishing rights and water rights associated with the lake.

Alternative A (Preferred Action)

The project area encompasses Asaayi Lake and surrounding tribally owned land. Ground disturbances resulting from construction and contractor use would directly affect 9 acres of land at the dam, downstream toe area, and spillway, including a portion of the recreation area along the spillway approach channel. Extraction of fill material, rock, and sand would potentially affect more than 20 acres below the dam and within the dewatered lake basin. Temporary nuisance effects such as dust and noise would discourage potential recreation use of tribal land near sites where active construction is underway. Access to tribal land within the project area would be temporarily restricted during construction.

The sport fishery would be lost during construction dewatering. This would constitute a short-term, minor loss of fishing rights. After construction, stocking by the NFWD would restore the fishery and access to fishing rights.

Construction dewatering would also create temporary loss of access to water rights for irrigation and other purposes. After project completion, Asaayi Lake would be refilled to normal operating levels, with no permanent loss of water rights. The long-term, cumulative effect of the project would be to sustain tribal member rights to the fishery and water resources of Asaayi Lake.

Alternative B

The effects to Indian Trust Assets would be similar to those described under the Preferred Action, except Alternative B would require an additional 8 to 20 months to complete and affect 4 more acres of land resources.

Alternative C

The effects to Indian Trust Assets would be similar to those described under the Preferred Action, except Alternative C would affect 12 additional acres of land resources.

Mitigation Requirements

- The project would have the long-term benefit of securing access to water and fishing rights. No mitigation is recommended.

3.9 Environmental Justice and Socioeconomic Considerations

3.9.1 Affected Environment

Executive Order (EO) 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," was issued by the President of the United States on February 11, 1994. This order established requirements to address Environmental Justice concerns within the context of agency operations. As part of the NEPA process, agencies are required to identify and address disproportionately high and adverse human health or environmental effect on minority or low-income communities. Federal agencies are directed to ensure that Federal programs or activities do not result, either directly or indirectly, in discrimination on the basis of race, color, or national origin. The order also requires that "the responsibilities set forth shall apply equally to Native American programs." There are no residential properties within the project area. Navajo farmers downstream of Asaayi Lake represent the only EO 12898 population that would be affected by implementation activities.

The Navajo Nation faces serious economic and social challenges. Data obtained from the 2000 census indicate median household income and average per capita incomes for the Navajo Nation were substantially below respective levels in New Mexico and the United States (Table 3).[4] The Navajo unemployment rate on the reservation was approximately three times the rate of the general population in New Mexico or the United States. Approximately 40 percent of the Navajo families on the reservation lived below the Federal poverty levels. This poverty rate is one of the worst in the United States.

The Navajo Nation continues to lose population to off-reservation communities due to slow rates of economic development and lack of employment opportunities. According to the Navajo Nation Vital Records Office and the 2000 census, approximately 34 percent of the Navajo population resides outside the reservation.

The absence of local businesses and services also diverts potential income away from Navajo communities. Approximately 68 percent of Navajo community member expenditures are spent in off-reservation towns and cities, further depressing economic development on the Navajo Nation (Navajo Division of Economic Development 2001).

[4] The 2001/2002 Comprehensive Economic Development Strategy report from the Navajo Nation Division of Economic Development cites an unemployment rate of 43.65 percent, per capita income of $6,217, and persons living below poverty at 56.1 percent.

Table 3. Income and Poverty Statistics for Navajo Nation.

Attribute	Navajo Nation	New Mexico	United States
Median Household Income	$20,005	$34,133	$41,994
Per Capita Income	$7,269	$17,261	$21,587
Unemployment Rate	11.2%	4.4%	3.7%
Individuals Below Poverty	42.9%	18.4%	12.4%
Families Below Poverty	40.1%	14.5%	9.2%

Source: U.S. Census Bureau, 2000 Census, http://factfinder.census.gov/home.

3.9.2 Environmental Consequences

No Action Alternative

Asaayi Lake would continue to support recreation and irrigation opportunities. However, safety deficiencies would persist without SOD modifications. Significant long-term loss of lake storage due to embankment instability could have an adverse impact on downstream Navajo farmers who use irrigation water supplied from Asaayi Dam.

Permanent drawdown or dewatering would destroy the sport fishery and produce localized, long-term adverse impacts to recreation. A reduction in recreational use could have a minor adverse effect on expenditures in the local economy for sporting supplies.

Alternative A (Preferred Action)

There would be a minor, short-term economic benefit for local businesses due to construction workers' expenditures on lodging and food. Most of the work force would likely commute from lodging venues in Fort Defiance and Window Rock, Arizona.

Potential project effects include soil disturbances, dust emissions, and noise. Project construction would not introduce chemical, biological, physical agents, or situations that have the potential to disproportionately and adversely affect the health or environment of low-income or minority populations as defined in EO 12898. Construction dewatering would have a temporary impact on recreation and irrigation. The project would create long-term, cumulative benefits by correcting SOD deficiencies and improving conditions that support expenditures for recreation-related goods and services.

Alternative B

The effects to EO 12898 populations and socioeconomic factors would be similar to those described under the Preferred Action, except Alternative B would require an additional 8 to 20 months to complete. Effects to the local economy from loss of the recreation resource would persist during construction.

Alternative C

The effects to EO 12898 populations and socioeconomic factors would be similar to those described under the Preferred Action.

Proposed Mitigation

- The project would protect the recreation resources and associated economic attributes of Asaayi Lake in the long term. No mitigation is recommended.

3.10 Hazardous Material and Solid Waste

3.10.1 Affected Environment

No hazardous material or solid waste-contaminated sites are known to occur within the project area. Use, storage, and disposal of hazardous materials and solid waste associated with construction have the potential to adversely affect the environment if these materials are improperly managed. In general, most potential impacts are associated with the release of these materials to the environment. Direct impacts of such releases would include contamination of soil, water, and vegetation, which could result in indirect impacts to wildlife, aquatic life, and humans.

3.10.2 Environmental Consequences

No Action Alternative

Existing conditions would prevail under this alternative.

Alternative A (Preferred Action)

Construction would require the short-term use of fuels, lubricants, and other fluids that create a potential contamination hazard. These and other hazardous substances would be stored and handled in accordance with Federal and tribal regulations. Any spills or leaks of hazardous material would require immediate corrective action and cleanup to minimize the impact on sensitive resources.

If on-site storage occurs, lubricants and fuels would be placed in temporary, clearly marked, aboveground containers which would be provided with secondary containment. Construction equipment would be maintained and inspected regularly. Any soil contaminated by fuel or oil would be removed and disposed of by a contractor to an approved disposal site.

Minor amounts of nonhazardous solid wastes would be generated by construction. These wastes would be disposed of in an approved solid waste landfill. Excess or unused quantities of hazardous materials would be removed upon project completion. Although

hazardous waste generation is not anticipated, any such wastes produced by the project would be properly containerized, labeled, and transported to an approved hazardous waste disposal facility.

Alternative B

The effects to solid waste would be similar to those described under the Preferred Action.

Alternative C

The effects to solid waste would be similar to those described under the Preferred Action.

Mitigation Requirements

- All construction equipment would be periodically inspected for leaks. Any significant leaks would be promptly corrected. No vehicle maintenance or fuel storage would be performed within the 100-year floodplain of Bowl Creek or within 50 feet of Asaayi Lake.

- Reclamation would incorporate spill containment measures in the storm water pollution prevention plan to ensure that pollutants are contained, removed, and disposed of, and notification is made, in accordance with Federal and tribal requirements.

CHAPTER 4 - AGENCIES AND PERSONS CONSULTED

List of Preparers

John McGlothlen, Reclamation, Environmental Biologist
Jon Czaplicki, Reclamation, Archaeologist
Henry Messing, Reclamation, Biologist

Other Contributors

Frank Blackett, Reclamation, Engineer
Chuck Nixon, BIA, Engineer

List of Agencies and Persons Contacted

Hopi Cultural Preservation Office
Hopi Tribal Council (Wayne Taylor, Jr., Chairman)
Natural Resources Conservation Service
Navajo Environmental Protection Agency
Navajo Department of Forestry
Navajo Division of Natural Resources
Navajo Fish and Wildlife Department
Navajo Historic Preservation Department
Navajo Land Department
Navajo Mexican Springs Chapter
Navajo Parks and Recreation Department
Navajo Red Lake Chapter
New Mexico Department of Game and Fish
Pueblo of Zuni (Arian Quetawki, Governor)
Pueblo of Zuni Cultural Resources Enterprise
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CHAPTER 5 - RELATED ENVIRONMENTAL LAWS/DIRECTIVES

The following is a list of selected statutes, regulations, and EOs that apply to actions discussed in this EA:

National Environmental Policy Act (NEPA) of 1969, as amended - NEPA requires Federal agencies to evaluate the potential environmental consequences of major Federal actions. An action becomes "Federalized" when it is implemented, wholly or partially funded, or requires authorization by a Federal agency. The intent of NEPA is to promote consideration of environmental impacts in the planning and decision-making process prior to project implementation. NEPA also encourages full public disclosure of the proposed action, accompanying alternatives, potential environmental effects, and mitigation.

This EA complies with NEPA statues and regulations. Scoping information and the draft EA were made available for public review (see section 1.5).

Fish and Wildlife Coordination Act (FWCA) of 1934, as amended - The FWCA provides a procedural framework for the consideration of fish and wildlife conservation measures in Federal water resource development projects. Coordination with the FWS and State wildlife management agencies (or appropriate Tribal agency if implemented in Indian Country) is required on all Federal water development projects.

Scoping information and the draft EA were provided to the FWS and NFWD for comment on mitigating losses to wildlife resources caused by the project. This review process satisfies the requirements of the FWCA.

Endangered Species Act (ESA) of 1973, as amended - The ESA provides protection for plants and animals that are currently in danger of extinction (endangered) and those that may become so in the foreseeable future (threatened). Section 7 of this law requires Federal agencies to ensure that their activities do not jeopardize the continued existence of threatened or endangered species or adversely modify designated critical habitat.

Reclamation has determined that the project would not affect species listed under ESA (see section 3.5).

Migratory Bird Treaty Act (MBTA) of 1918, as amended - The MBTA is the domestic law that implements the United States' commitment to the protection of shared migratory bird resources. The MBTA prohibits the take, possession, import, export, transport, selling, or purchase of any migratory bird, their eggs, parts, or nests.

The project would not violate provisions of the MBTA.

Clear Air Act (CAA) of 1963, as amended - The CAA requires that any Federal entity engaged in an activity that may result in the discharge of air pollutants must comply with all applicable air pollution control laws and regulations (Federal, State, or local). It also

directs the attainment and maintenance of NAAQS for six different criteria pollutants including carbon monoxide, ozone, particulate matter, sulfur oxides, oxides of nitrogen, and lead.

Air quality in the project area is in attainment of NAAQS. Short-term construction emissions associated with the proposed action would have localized and minor effects on air quality. Long-term air quality impacts would not result from implementation of the project.

Clean Water Act (CWA) of 1977, as amended - The CWA strives to restore and maintain the chemical, physical, and biological integrity of the nation's waters by controlling discharge of pollutants. The basic means to achieve the goals of the CWA is through a system of water quality standards, discharge limitations, and permits. Section 404 of the CWA identifies conditions under which a permit is required for actions that result in placement of fill or dredged material into waters of the United States. In addition, a 401 water quality certification and 402 National Pollutant Discharge Elimination System (NDPES) permit are required for activities that discharge pollutants to waters of the U.S. On District land, the EPA has primacy for issuing Water Quality Certifications (or waivers) and NPDES permits.

Reclamation would obtain water quality certification under Section 401 and permit coverage under Sections 402 (NPDES) and 404 of the CWA prior to construction.

National Historic Preservation Act (NHPA) of 1966, as amended - Federally funded undertakings that have the potential to affect historic properties are subject to Section 106 of the NHPA. Under this act, Federal agencies are responsible for the identification, management, and nomination to the National Register of Historic Places of cultural resources that would be affected by Federal actions. Consultation with the Advisory Council on Historic Preservation and the State Historic Preservation Office (or Tribal Historic Preservation Office) is required when a Federal action may affect cultural resources on, or eligible for inclusion on, the National Register.

Consultation with the NHPD (the recognized Tribal Historic Preservation Office for the Navajo Nation) regarding effects to historic properties within the project area was completed by Reclamation in 2005. No areas of traditional cultural importance are known in the area of potential effect. Mitigation is listed in section 3.5.

Native American Graves Protection and Repatriation Act (NAGPRA) - NAGPRA is intended to ensure that Native American human burials, associated and unassociated funerary objects, sacred objects, and items of cultural patrimony currently curated by Federal agencies, or by museums or institutions receiving Federal funding, are identified and inventoried for possible return to an appropriate tribe. NAGPRA provides regulations covering how the intentional excavation or accidental discovery of Native American human remains and associated cultural items on Federal or tribal lands must be handled.

Consultation with the NHPD regarding effects to a Navajo burial site located within the area of potential effect was completed by Reclamation in 2006. The burial site and appropriate buffer area determined by NHPD would be avoided during construction.

Resource Conservation and Recovery Act (RCRA), as amended - RCRA establishes thresholds and protocols for managing and disposing of solid waste. Solid wastes that exhibit the characteristic of hazardous waste, or are listed by regulation as hazardous waste, are subject to strict accumulation, treatment, storage, and disposal controls.

The project is not expected to generate hazardous waste as defined and regulated under RCRA. To minimize the possible impact of hazardous materials (petroleum, oil, and lubricants) used during construction, all equipment would be periodically inspected for leaks. Any significant leaks would be promptly corrected. Nonhazardous solid waste would be disposed of in accordance with State and Federal regulations at an EPA-approved landfill. Spills and disposal of contaminated media would be managed in accordance with tribal and Federal requirements.

EO 11988 (Floodplain Management) - This Presidential directive encourages Federal agencies to avoid, where practicable alternatives exist, the short- and long-term adverse impacts associated with floodplain development. Federal agencies are required to reduce the risk of flood loss; minimize the impacts of floods on human safety, health, and welfare; and restore and preserve the natural and beneficial values served by floodplains in carrying out agency responsibility.

Long-term flood impacts are not expected to result from implementation of the project.

EO 11990 (Wetlands) - This Order directs Federal agencies, in carrying out their land management responsibilities, to take action that will minimize the destruction, loss, or degradation of wetlands and take action to preserve and enhance the natural and beneficial values of wetlands.

Approximately 0.1 acre of wetland vegetation in the outlet works channel would be lost as a result of project. Resumption of normal lake operations would promote recovery of declining wetland habitat in the upper lake basin. There would be a net benefit to wetland resources from implementation of the project.

Secretarial Order 3175 (Indian Trust Assets) - Indian Trust Assets are legal interests in assets held in trust by the U.S. Government for Indian tribes or individual Indians. Assets are anything owned that has monetary values. They can be real property, physical assets, or intangible property rights. Common examples of trust assets include lands, minerals, water rights, hunting rights, other natural resources, money, or claims.

The project would have the long-term benefit of preserving Navajo Nation access to water and fishing rights at Asaayi Lake (see section 3.8).

EO 12898 (Environmental Justice) - This Order directs Federal agencies to identify and address, as appropriate, disproportionately high and adverse human health and environmental effects of their programs, policies, and activities on minority and low-income populations.

No high and disproportional adverse impacts on low-income or minority populations as defined by EO 12898 would result (see section 3.9).

CHAPTER 6 – LITERATURE CITED

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