Chapter 3
Affected Environment and Environmental Consequences

3.1 INTRODUCTION

The purpose of Chapter 3 is to identify specific impacts that could occur as a result of development and operation of Refined Alternatives 4 and 6. Also presented are impacts anticipated in the Final Supplement to the Final Environmental Statement (1996 FSFES) that would occur under the No Action Alternative. The chapter is organized by resource topics. Each resource topic identifies the affected environment, potential environmental consequences (impacts), and proposed mitigation measures for Refined Alternatives 4 and 6. As discussed in the preceding chapters, both of these alternatives consist of a combination of structural components and non-structural components and non-binding end uses. Impacts were evaluated at varying levels of specificity using the assumptions and methodologies discussed below.

The structural component of Refined Alternative 4 includes the development of a Ridges Basin Dam and Reservoir, a Durango Pumping Plant and reservoir inlet conduit, and an approximately 29-mile water pipeline, referred to in this document as the Navajo Nation Municipal Pipeline (NNMP). The non-structural component would provide a water acquisition fund of approximately $40 million for the %
purposes of enabling the Ute Mountain Ute and Southern Ute Indian Tribes (Colorado Ute Tribes) to, at their discretion, acquire water rights through the purchase of currently irrigated agricultural lands.

The structural component of Refined Alternative 6 includes increasing the height of Lemon Dam and Reservoir approximately 11 feet and the 29-mile NNMP discussed above. The non-structural component of Refined Alternative 6 includes the reoperation of Navajo, Vallecito, Lemon, Red Mesa, and Jackson Gulch Reservoirs, and would provide funding to enable the Colorado Ute Tribes to acquire water rights through the purchase of currently irrigated agricultural land. This alternative also assumes that non-Colorado Ute Tribe recipients of water from Ridges Basin under Refined Alternative 4 would acquire water through reservoir reoperation and irrigated agricultural land purchases.

The non-binding water end use analysis for each of the alternatives addresses potential end uses of the Colorado Ute Tribes water that would be supplied through in-stream or pipeline conveyance from %
structural components of the two alternatives or from existing or new stream diversions.

3.1.1 Structural Components

This Final Supplemental Environmental Impact Statement (FSEIS) is a supplemental document intended to analyze the differences between the impacts that were identified for the Animas-La Plata (ALP) Project Proposed Plan in the 1996 FSFES and the two revised alternatives under consideration. Due to the differences between the current alternatives and the 1996 Proposed Plan, much of the resource analysis contained in the chapter does not rely extensively upon the 1996 FSFES analysis, although, to the extent possible, the 1996 FSFES was consulted and the analysis incorporated herein. Each resource section analyzes potential impacts that could occur as a result of the construction and operation of the structural components of the two alternatives.

3.1.2 Non-Structural Component

Chapter 2, Development of Alternatives, discusses the non-structural components associated with Refined Alternatives 4 and 6. A number of assumptions were necessary in order to conduct a reasonable analysis of the potential impacts associated with the non-structural components. Under Refined Alternative 4, it was assumed that the $40 million water acquisition fund allocated to the Colorado Ute Tribes would be used to acquire 13,000 acre-feet/year (afy) of water rights through the purchase of 10,300 acres of irrigated agricultural lands within the Pine, Animas, Florida, La Plata, and Mancos River Basins. It was also assumed under Refined Alternative 4 that all of the lands purchased would remain in irrigated production and none of the water would be transferred to alternative uses. **Table 3.1-1** shows the assumptions that were made with regard to the amount and potential locations of irrigated agricultural land purchases.

Table 3.1-1
Agricultural Land Assumptions Associated with Land Acquisition
Under the Non-Structural Components

Basin from Which Lands Would Be Purchased	Refined Alternative 4			Refined Alternative 6		
	Total Land Purchased (acres)	Purchased Lands Removed from Irrigation (acres)	Purchased Lands Remaining in Irrigation (acres)	Total Land Purchased (acres)	Purchased Lands Removed from Irrigation (acres)	Purchased Lands Remaining in Irrigation (acres)
Pine River	2,300	0	2,300	10,000	10,000	0
Animas/Florida Rivers	2,300	0	2,300	4,643	0	4,643
La Plata River	2,400	0	2,400	785	0	785
Mancos River	3,300	0	3,300	500	500	0
McElmo Creek	0	NA	NA	4,719	657	4,062
Total	**10,300**	**0**	**10,300**	**20,647**	**11,157**	**9,490**

It was also assumed that the non-structural component of Refined Alternative 6 could result in the acquisition of approximately 30,447 afy of water rights through the purchase of 20,647 acres of irrigated agricultural lands within the Pine, Animas, Florida, La Plata, and Mancos River and McElmo Creek Basins. It was assumed under Refined Alternative 6 that 13,000 afy of the water rights acquired would continue to be used for irrigated agricultural production on the lands purchased for the acquisition of their associated water rights. The remaining 17,447 afy of water rights acquired through irrigated land acquisition would be transferred for M&I uses. Under this assumption, lands from which water rights would be transferred would either be dry land farmed (i.e., farmed with no irrigation water) or would be taken out of production.

3.1.3 Non-Binding End Uses

In order to determine the impacts that could be associated with the potential end uses of project water, a study was conducted which involved discussions with Tribal leaders and decision-makers to determine potential end uses. This study (included in Technical Appendix 1 of the FSEIS) identified a range of end uses, water requirements and the possible locations of each (Dornbusch 1999). Following the identification of these end uses, a system of potential water conveyance pipelines and pumping plants was developed under each alternative that, along with in-stream transfers, could be used to transport water to these end uses. The potential end uses and conveyance methods were identified in the preceding chapters.

The analysis in this FSEIS considers the potential impact of the end uses and conveyance systems described in Chapter 2. While the impact analysis identifies, to the extent possible, specific impacts that would be associated with the end uses and conveyance systems, it is recognized that, if constructed, final design of these systems would vary. As such, for ultimate development of many of the end uses, additional National Environmental Policy Act (NEPA) compliance may be necessary as discussed in Chapter 1, Introduction, Purpose of, and Need for the Project. This FSFEIS may be used for tiering at a time when the development of specific end uses occurs.

3.1.4 Structure of Sections

Each resource section that follows is divided into three primary subsections. The first subsection, Evaluation Methodology, identifies the methodology and significance criteria used to determine potential impacts to a particular resource under Refined Alternatives 4 and 6. The current No Action Alternative is similar to the No Action Alternative in the 1996 FSFES. As discussed in Chapter 2, the No Action Alternative would result in conditions under which eventual outcomes of not resolving the Colorado Ute Tribal water rights claims are unknown. As such, determining impacts associated with this alternative would also be speculative. Each resource section does, however, restate the No Action Alternative impacts that were presented in the 1996 FSFES. The resource sections in this chapter do not directly correspond with the resource topics used during the alternatives evaluation process discussed in Chapter 2. Each of the resource topics evaluated in the alternatives evaluation process was considered in the analysis and are presented in this chapter; however, in some instances resource topics were combined with related topics.

The second subsection, Affected Environment, presents general as well as specific information concerning the resource being addressed. Because the general geographic boundaries in which Refined Alternatives 4 and 6 would be located are essentially the same, the Affected Environment discussions are generally applicable to both alternatives. Separate headings or additional clarification is provided within the text when specific information presented is pertinent to only one of the alternatives.

The third subsection, Environmental Consequences and Mitigation, presents numbered impact statements and associated mitigation measures for both Refined Alternatives 4 and 6. Adverse impacts are each identified as significant, potentially significant, or less than significant based upon significance criteria presented in the Evaluation Methodology sections. Beneficial impacts are also identified, but their significance is not addressed. It is important to note that due to uncertainties associated with the No Action Alternative, impacts identified for Refined Alternatives 4 and 6 were determined as compared to without-Project (i.e., current or baseline) conditions or, when applicable, future-without-project (i.e., baseline conditions projected into the future assuming the ALP Project is not developed) conditions. As discussed above, the No Action Alternative impact discussion is included as presented in the 1996 FSFES and, as such, does not follow the same presentation format as Refined Alternatives 4 and 6. Mitigation measures are presented for each adverse impact, when available, to reduce both significant and less than significant impacts. Section 3.21 at the end of this chapter presents a tabular summary of the impacts identified for both Refined Alternatives 4 and 6, as well as proposed mitigation measures. Section 5.4 of Chapter 5 discusses the commitments that the Bureau of Reclamation (Reclamation) %

would make to reduce or avoid impacts when possible. Mitigation measures and commitments discussed in this document supersede those made by Reclamation in previous ALP Project NEPA documents.

3.2 WATER RESOURCES/HYDROLOGY

3.2.1 Introduction

This section addresses potential impacts to hydrology that could result from actions associated with Refined Alternative 4, Refined Alternative 6, and the No Action Alternative. Only direct impacts to hydrology are considered in this section. The subsequent impacts to other resources as a result of the change in hydrology are reported in their respective sections. Section 3.2.2 defines the Evaluation Methodology and significance criteria used for determining impacts, Section 3.2.3 describes the affected environment, and Section 3.2.4 identifies potential impacts and mitigation measures that would serve to reduce or eliminate anticipated impacts. Plots of flow at key locations in the system appear in Attachment F (Hydrologic Data). Details of the modeling approach and flow impacts appear in Technical Appendix 2 (Hydrologic Modeling Analysis).

3.2.2 Evaluation Methodology

This section discusses the methodology used to determine potential impacts that could result from Refined Alternatives 4 and 6. Also discussed are specific criteria that were used to determine the significance of the impacts identified.

The non-structural components of Refined Alternative 4 involve the purchase of irrigated land in the Pine, Florida, Animas and La Plata River Basins, ultimately acquiring 13,000 afy of depletion associated with this irrigated land. Under this scenario, it was assumed that the water would remain on the land and continue to be used in the same manner that existed prior to acquisition. As such, there would be no impact. If the water were transferred off the land some time in the future, then the environmental impacts of such a transfer would be assessed at that time.

3.2.2.1 Methodology

Determining the impact of the project on the water resources of the San Juan River Basin required modeling the complex relationships associated with multiple diversion and return flow points associated with the project. A number of basin-scale models exist that take hydrologic input data and simulate the behavior of a river system. A requirement of the modeling of this project was the ability to assess water resources system responses over the long term.

RiverWare was the simulation model selected for use in project analysis. It has been implemented in the San Juan River Basin since 1998 in support of assessing the relationship between flow recommendations for endangered fish in the San Juan River and water development. Modification to simulate the effects of this project was a natural extension of this tool and allowed comparison of results with earlier analysis related to the flow recommendations.

The model is in an ongoing process of review and improvement. After the completion of the DSEIS, model refinements were made to more closely match gage flows in the model calibration. This model refinement reduced the available water for future development. At the same time, operating rules for Navajo Dam and Durango Pumping Plant were modified to meet flow recommendations with this reduced available water supply. These changes result in some changes of flow statistics and elimination of the runs to assess mitigation of impacts to Indian Trust Assets due to the reduction in available water.

The model in its present configuration represents the best science available to assess the impacts of this development on the ability to meet flow recommendations for endangered fish and to test operating rules designed for that purpose. The presently defined operating rules and model configuration do not indicate availability for substantial additional depletions in the basin with the present flow recommendations. Further modification of the operating rules and/or improvement in the simulation of system operation in the San Juan River would be required to demonstrate the possibility of further development within the limits of the present flow recommendations.

3.2.2.1.1 Configuration for Future Conditions Without the Project

RiverWare model representation of the future conditions expected in the San Juan River Basin without completion of the project is required to establish the “baseline” against which impacts are measured. The depletions associated with the baseline condition include all current depletions, all depletions that are reasonably likely to occur in the foreseeable future without further federal action and all depletions for which favorable biological opinions have been issued through the Endangered Species Act (ESA) Section 7 consultation process. The depletions that could occur without further federal action are primarily water rights that are not presently used but are likely to be put to use in the foreseeable future. The states of Colorado and New Mexico have identified these rights. Depletions falling into these categories for the San Juan River basin are listed in **Table 3.2-1**. The baseline depletion averages about 789,000 afy. Included in this total are about 601,000 afy of current net depletions and 188,000 afy of future depletions due to anticipated development in the basin without considering ALP Project depletion. About 145,000 afy of this total is associated with the completion of the Navajo Indian Irrigation Project (NIIP). The balance of 43,000 afy represents undeveloped water rights within the two states (Indian and non-Indian) that could be developed without further federal action and changes in Navajo Reservoir evaporation. The model was applied with these depletions in place, utilizing the basic recommended Navajo Reservoir operating rules from the San Juan River Basin Recovery Implementation Program (SJRBRIP) Flow Recommendations Report (Holden 1999) to determine the baseline flow conditions. Any ALP Project depletion must be added to this baseline depletion to determine impacts.

3.2.2.1.2 Configuration for the Refined Alternative 4

In order to conduct the impact analysis for Refined Alternative 4, the elements of that alternative as described in Chapter 2 were input into the model. For analysis of impacts to hydrology, depletion of the full 57,100 afy described for the ALP Project is required. Since the Ute Tribal Water Use Study (Dornbusch 1999) did not account for the entire depletion allocation for the Colorado Ute Tribes, any additional depletions not identified in the study was assumed to be used to meet future regional demands, distributed by the same proportion as specified in the non-binding use description for regional supply. Since the uses specified for the Colorado Ute Tribes are non-binding and the water could be used for other M&I purposes, it was assumed that standard M&I use with 50 percent efficiency (half the diverted water is consumed and not returned to the system) would occur at each of the demand locations specified. The diversions and depletions associated with the ALP Project under this scenario are shown in **Table 3.2-2**. The overall configuration of the model is shown in **Figure 3.2-1**. The model details for the Refined Alternative 4 are shown in **Figure 3.2-2**.

Table 3.2-1
Summary of Future Without Project (Baseline) Depletions in the San Juan River Basin
(average afy)

Depletion Category	Future Without Project	Depletion Range (1929-93)	
New Mexico Depletions			
Navajo Lands Irrigation Depletion			
Navajo Indian Irrigation Project	280,600 [a]	297,203	224,796
Hogback	12,100	14,216	9,592
Fruitland	7,899	9,279	6,432
Cudei	900	1,058	687
Subtotal	**301,499**		
Non-Navajo Lands Irrigation Depletion			
Above Navajo Dam - Private	738	1,040	504
Above Navajo Dam - Jicarilla	2,190	3,086	1,494
Animas River	36,711	42,671	29,418
La Plata River	9,739	11,272	7,516
Upper San Juan River	9,137	10,735	7,347
Hammond Area	10,268	12,063	8,256
Farmers Mutual Ditch	9,532	11,272	5,894
Jewett Valley	3,088	3,757	2,604
Westwater	110		
Subtotal	**81,513**		
Total New Mexico Irrigation Depletion	**383,012**		
Non-Irrigation Depletions			
Navajo Reservoir Evaporation	27,694	32,099	19,733
Utah International	39,000	39,000	39,000
San Juan Power Plant	16,200	16,200	16,200
Industrial Diversions near Bloomfield	2,500		
Municipal and Industrial Uses	8,454		
Scattered Rural Domestic Uses	1,400 [b]		
Scattered Stockponds & Livestock Uses	2,200 [b]		
Fish and Wildlife	1,400 [b]		20,957
Total New Mexico Non-Irrigation Depletion	**98.848**		
San Juan Project Exportation	107,514	201,047	23,457
Unspecified Minor Depletions	4,500 [d,e]		
Total New Mexico Depletions (excluding ALP Project)	**593,874**		

Table 3.2-1 (continued)
Summary of Future Without Project (Baseline) Depletions in the San Juan River Basin
(average afy)

Depletion Category	Future Without Project	Depletion Range (1929-93)		
Colorado Depletions				
Upstream of Navajo				
Upper San Juan River	10,858	13,905	7,341	
Navajo-Blanco	7,865	10,345	5,015	
Piedra	8,098	13,196	2,935	
Pine River	71,664	96,692	53,175	
Subtotal	**98,485**			
Downstream of Navajo				
Florida River	28,538	33,137	15,688	
Animas River	25,113	32,354	19,659	
La Plata River	13,048	23,647	1,747	
Mancos River	19,530	24,339	14,257	
Subtotal	**86,229**			
Total Colorado Depletions (excluding ALP Project)	**184,714**			
Colorado and New Mexico Combined Depletions	**778,588**			%
McElmo Creek Basin Imports	-11,990	-17,969	7,756	
Utah Depletions	**9,140** [c,b]	1,705	1,705	
Arizona Depletions	**10,010** [b]	0	0	
NET New Mexico, Colorado, Utah, Arizona Depletion	**785,748**			%
New Mexico Off-River Depletions				
Chaco River	2,832 [b]	0	0	
Whiskey Creek	523 [b]	0	0	
GRAND TOTAL	**779,103**			%

[a]Includes 10,600 af of annual groundwater storage. At equilibrium, this drops to 270,000 af.
[b]Indicates off-stream depletion accounted for in-calculated natural gains. Incorrectly reported in DSEIS as depletion demand. Now reported as actual depletions with the effect of supply shortage.
[c]1,705 San Juan River depletion, 7,435 off-stream depletion.
[d]1,500 af of depletion from minor depletions approved by SJRBRIP in 1992; 3,000 af from 1999.
[e]Inter-service consultation, a portion of which may be in Colorado.

Table 3.2-2
Modeled Diversion and Depletion Summary for Refined Alternative 4
With All M&I Use at 50 Percent Efficiency

Category	Diversion (afy)	Depletion (afy)	Diversion Location	Return Flow Location
Southern Ute				
Florida Mesa Housing	140	70	Ridges Basin	Animas River at Florida Confluence
Animas River Basin Housing	140	70	Ridges Basin	Animas River at Florida Confluence
La Plata River Basin Housing	140	70	Ridges Basin	La Plata River at Farmington
Animas Industrial Park M&I	40	20	Ridges Basin	Animas River at Florida Confluence
Ridges Basin Golf Course	796	398	Ridges Basin	Ridges Basin
Ridges Basin Resort	44	22	Ridges Basin	Ridges Basin
Coal Mine	830	415	Ridges Basin	La Plata River at Farmington[a]
Coal-Fired Power Plant	27,000	13,500	Ridges Basin	La Plata River at Farmington[a]
Livestock and Wildlife	30	15	Ridges Basin	La Plata River at Farmington[a]
Southern Ute Total	**29,160**	**14,580**		
Ute Mountain Ute				
La Plata Housing	280	140	Ridges Basin	La Plata River at Farmington[a]
Mancos Canyon Golf Course	978	489	Ridges Basin	Mancos River
Mancos Canyon Resort	33	17	Ridges Basin	Mancos River
Gas-Fired Power Plant	4,600	2,300	San Juan at Power Plant Diversion	San Juan Above Shiprock
Livestock and Wildlife	40	20	Ridges Basin	La Plata River at Farmington[a]
La Plata Basin Resort	30	15	Ridges Basin	La Plata River at Farmington[a]
La Plata Basin Golf Course	626	313	Ridges Basin	La Plata River at Farmington[a]
La Plata Basin Dude Ranch	10	5	Ridges Basin	La Plata River at Farmington[a]
Ute Mountain Ute Total	**6,597**	**3,299**		

Table 3.2-2 (continued)
Modeled Diversion and Depletion Summary for Refined Alternative 4
With All M&I Use at 50 Percent Efficiency

Category	Diversion (afy)	Depletion (afy)	Diversion Location	Return Flow Location
Regional Water Supply				
Durango	15,338	7,669	Ridges Basin	Animas River Below Pump
Bloomfield and Upstream Uses	4,533	2,267	San Juan-Citizen's Ditch	San Juan River at Farmington
Farmington	28,373	14,187	Farmington M&I Diversion	San Juan River Below Animas Confluence
Florida Mesa	7,016	3,508	Ridges Basin	Animas River at Florida Confluence
Red Mesa Plateau	2,105	1,052	Ridges Basin	La Plata River at Farmington[a]
Kirtland, New Mexico	7,016	3,508	Farmington M&I Diversion	San Juan River Above Hogback
Aztec, New Mexico	4,911	2,456	Aztec M&I Diversion	Animas River at Farmington
Less Animas La-Plata Water Conservancy District Allocation (ALPWCD)	(5,200)	(2,600)		
San Juan Water Commission Allocation (SJWC)	(20,800)	(10,400)		
Total Regional Water Supply	**43,292**	**21,646**		
Total Ute Settlement	**79,050**	**39,525.[b]**		
Other Uses				
Navajo Nation	4,680	2,340	Farmington M&I Diversion	Shiprock Below Gage
ALPWCD	5,200	2,600	See Regional Water Supply	
SJWC	20,800	10,400	See Regional Water Supply	
Ridges Basin Evaporation[c]	2,235	2,235	Ridges Basin	None
Total Other Uses	**32,915**	**17,575**		
			Range of Depletions at Four Corners, New Mexico	
TOTAL WATER USE	**111,965**	**57,100**	**8,200 - 100,500 afy**	

[a] This location for modeling convenience. For all other purposes, assume return flow at state line.
[b] Reduced from 39,960 afy due to increased evaporation for modeling balance with the larger reservoir. Actual allocation of increased evaporation may be put to other uses as well.
[c] Due to a larger reservoir size for Refined Alternative 4, evaporation was increased to 2,235 afy from 1,800 afy as presented in the Administration Proposal.

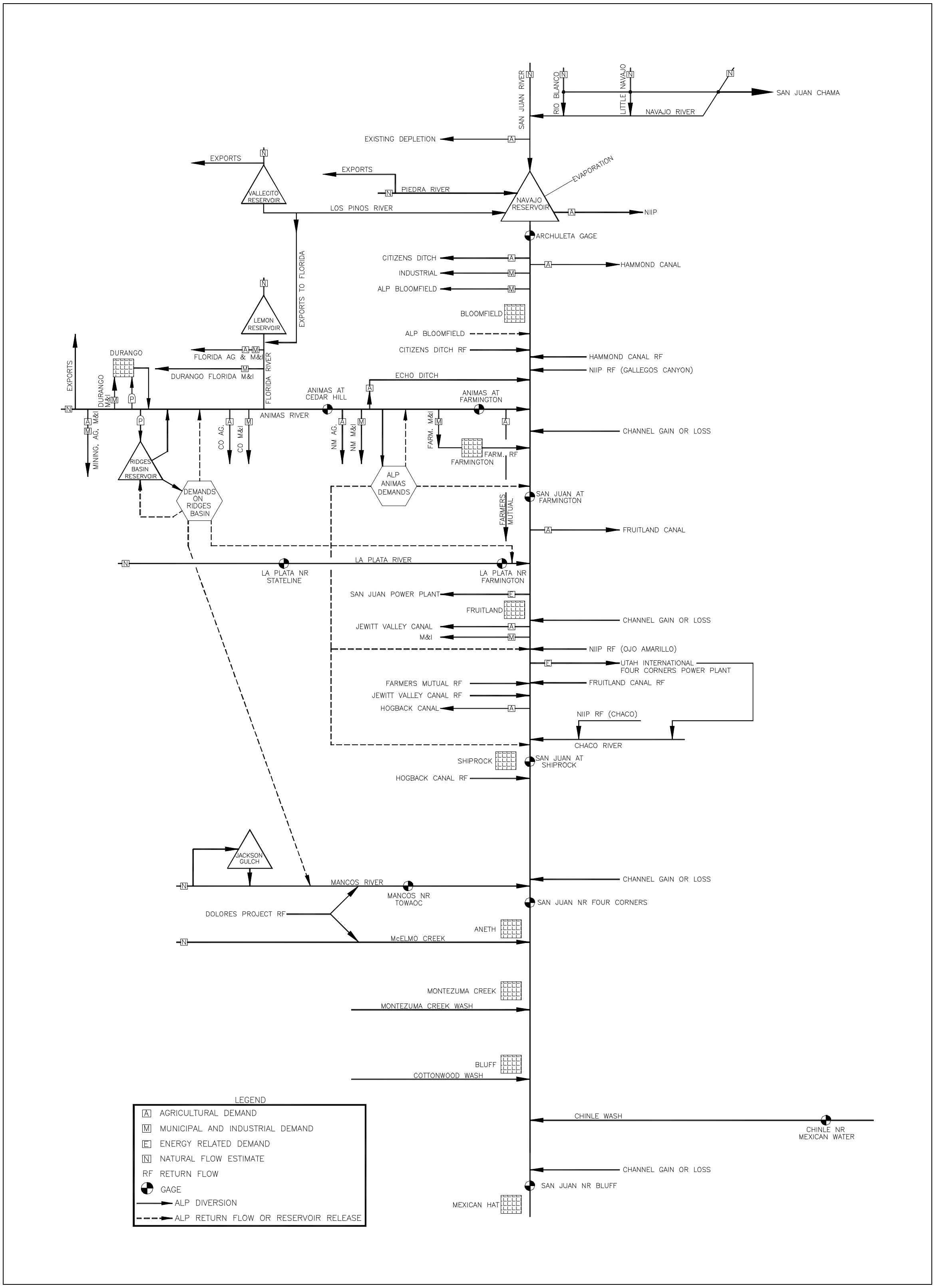


Figure 3.2-1 Components of the San Juan Basin Hydrology Model

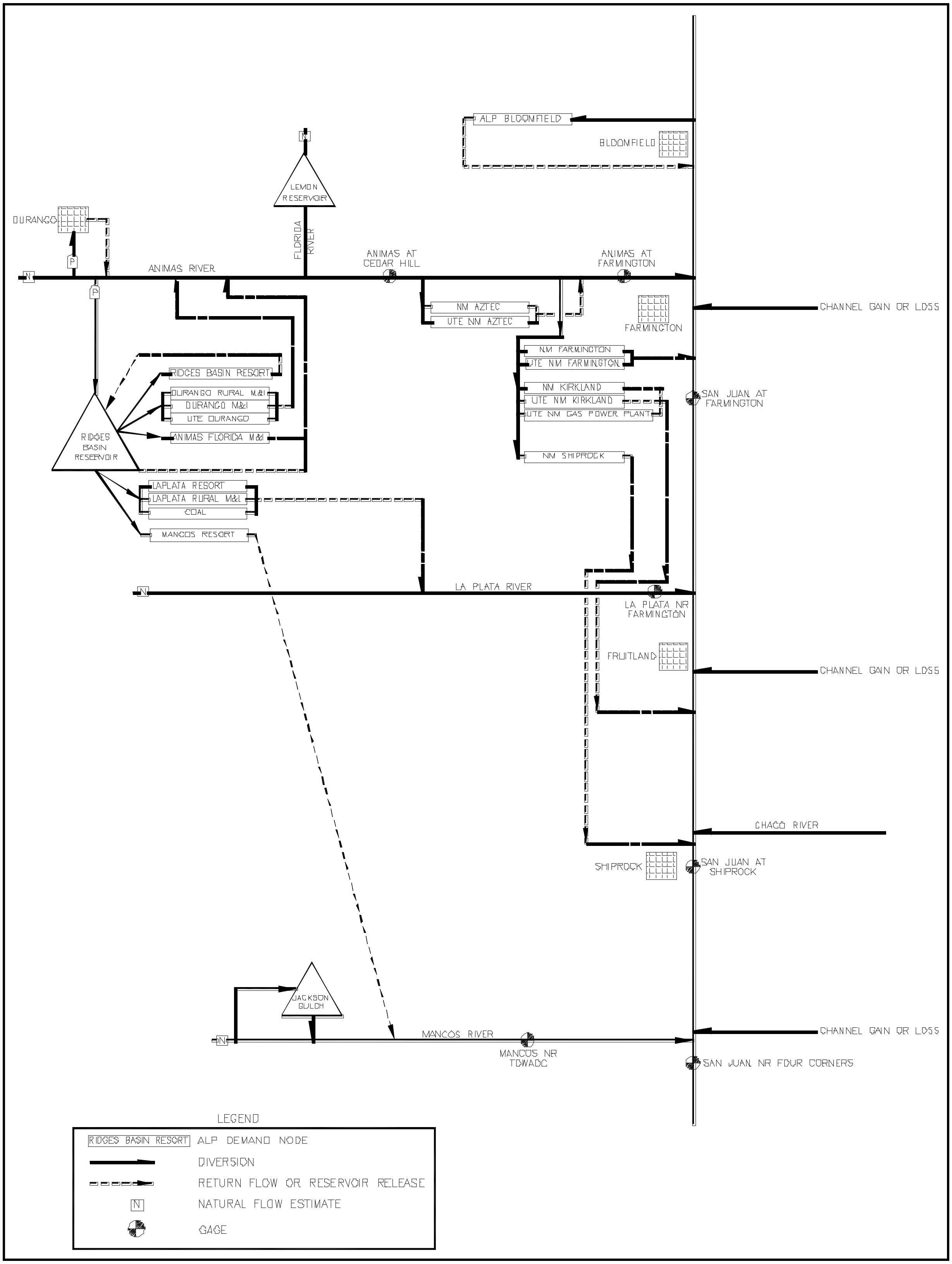


Figure 3.2-2 Detail of Components of Refined Alternative 4 in the San Juan Basin Model

The Durango Pumping Plant would be operated in a manner that insures that its operations do not violate the flow recommendations. Pumping would be decreased or stopped during certain periods in order to meet the recommendations. When there have been no endangered fish releases from Navajo Dam for two years and the planned release for the current year is the minimum release specified in the flow recommendation report, the Durango Pumping Plant would be turned off during June, increasing flow in the Animas River by an additional 280 cfs to meet flow recommendations for endangered fish below the Animas River confluence in the San Juan River[1]. After satisfying all downstream senior water rights demands and downstream ALP Project water demands, pumping would be further limited to allow the following bypass flows in the Animas River at the pumping plant intake: October through November - 160 cfs; December through March - 125 cfs; and April through September - 225 cfs.

Demands on Ridges Basin Reservoir are divided in the model between direct diversion (those delivered directly from the reservoir without release to the Animas River) and release to the Animas River via Basin Creek to meet uses downstream. Downstream demands in the Animas River are met first by streamflow available after meeting historic demand, including project return flow entering above the diversion point, and then by release from Ridges Basin Reservoir. The details of the model configuration describing use elements and flow paths are shown in Figures 3.2-1 and 3.2-2.

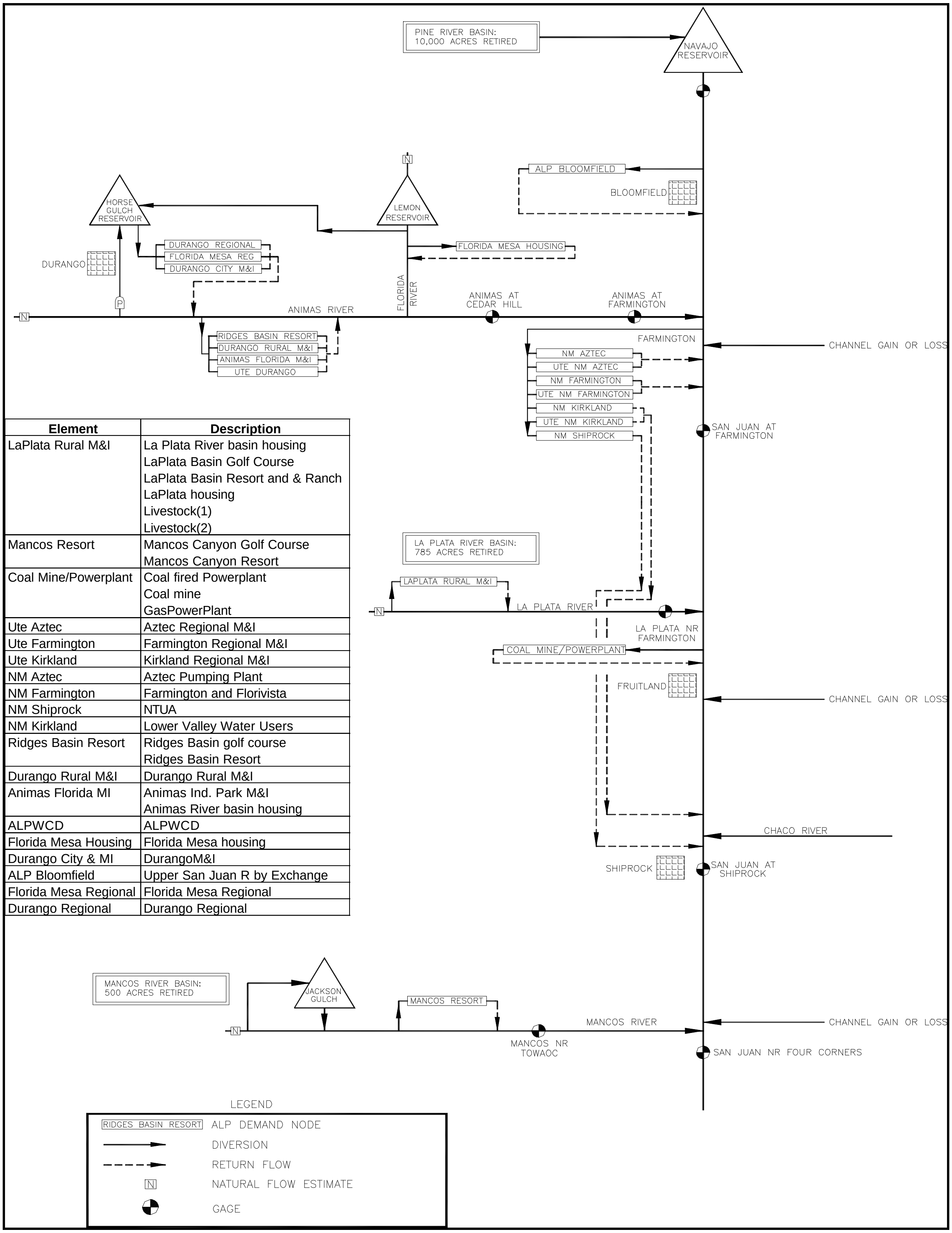
3.2.2.1.3 Configuration for Refined Alternative 6

The modeling process for Refined Alternative 6 was iterative, since the model was used to determine acreage purchases necessary to meet the M&I demands described for Refined Alternative 4. The model configuration was adjusted by removing Ridges Basin Reservoir and changing diversion locations for several of the non-binding uses to take advantage of available storage in existing reservoirs. The M&I demands were met first from available streamflow after meeting all pre-project demands. These available supplies were then augmented with operation of existing and modified storage facilities as described in Chapter 2. When demands could not be met by these two categories of water source, irrigated land was retired and the water transferred to M&I uses until sufficient water was available to meet the project demands without increasing shortages to existing uses. The retirement of irrigated lands required reoperation of federal reservoirs to account for the change in demand pattern. Since the model only simulates operation and does not solve for a specific solution, an iterative process of land acquisition adjustment and model operation was used to determine the required land acquisition in each sub-basin. The adjusted model configuration is shown in **Figure 3.2-3**.

The adjusted diversion points shown in Figure 3.2-3 were necessary to accommodate the new configuration and match demand to supply and availability of storage capacity. In addition to adjusting diversion points, the regional demand listed for Red Mesa in Refined Alternative 4 was moved to the Montezuma Valley Irrigation Company (MVIC) service area. This adjustment was made to better match demands to available supply. Since this demand is met by conversion of irrigation water to M&I use, the impact is in timing only and it was not included in the model, nor is it shown on Figure 3.2-3. The La Plata River is water short and transfer of water rights, without significant storage, supplies little M&I water in the low-flow months. Refined Alternative 4 did not propose to supply any Montezuma County M&I regional demand since it was not practical to pipe Animas River water that far. However, with Refined Alternative 6, the acquisition of water within Montezuma County and the projected regional

---

[1] Operation of the Durango Pumping Plant could change in the future if it is found through future refinements of the RiverWare Model and project operations that modifying the operations of the pumping plant would aid in meeting the flow recommendations for the San Juan River and in identifying additional water for future development. The impacts of changing pumping plant operations would be assessed before any changes would be implemented.



Element	Description
LaPlata Rural M&I	La Plata River basin housing LaPlata Basin Golf Course LaPlata Basin Resort and & Ranch LaPlata housing Livestock(1) Livestock(2)
Mancos Resort	Mancos Canyon Golf Course Mancos Canyon Resort
Coal Mine/Powerplant	Coal fired Powerplant Coal mine GasPowerPlant
Ute Aztec	Aztec Regional M&I
Ute Farmington	Farmington Regional M&I
Ute Kirkland	Kirkland Regional M&I
NM Aztec	Aztec Pumping Plant
NM Farmington	Farmington and Florivista
NM Shiprock	NTUA
NM Kirkland	Lower Valley Water Users
Ridges Basin Resort	Ridges Basin golf course Ridges Basin Resort
Durango Rural M&I	Durango Rural M&I
Animas Florida MI	Animas Ind. Park M&I Animas River basin housing
ALPWCD	ALPWCD
Florida Mesa Housing	Florida Mesa housing
Durango City & MI	DurangoM&I
ALP Bloomfield	Upper San Juan R by Exchange
Florida Mesa Regional	Florida Mesa Regional
Durango Regional	Durango Regional

Figure 3.2-3 Schematic of Modeled Components of Refined Alternative 6

demand in the area were matched to provide the regional M&I water supply. The depletions for this adjusted project are shown in **Table 3.2-3**.

This iterative process of determining the amount of irrigated land to retire in the Pine River basin was completed during modeling for the DSEIS. Impacts reported here are for that level of acreage retirement. The most recent hydrology modeling information has indicated that under Alternative 6 as presently configured, there would not be sufficient flows into Navajo Reservoir to meet the flow recommendation in the San Juan River. The most recent information indicates that acquisition of up to an additional 5,000 acres in the Pine River basin and allowing the water being used on 5,000 acres to flow downstream into Navajo Reservoir may be necessary. This additional water needs to be available in Navajo Reservoir in order to meet flow recommendations in the San Juan River. For purposes of this evaluation, however, Reclamation will use the more conservative approach with the analysis of 10,000 acres.

3.2.2.2 Significance Criteria

Significance of impacts on water resources was determined in four areas: (1) impact to existing water uses in the San Juan River Basin; (2) impacts to identified future uses for which valid water rights and environmental clearances are in place; (3) impact to flow recommendations formulated by the SJRBRIP for protection of endangered fish and designated critical habitat; and (4) impacts to Indian trust water rights that have not received environmental clearance.

An underlying assumption in analysis of the impact to water resources and in project formulation was that there could be no adverse impact to existing water use in the San Juan River Basin. All existing uses have been represented in the model. Comparing the modeled depletions with and without the project identifies impacts. If depletions decreased with the project, then an existing user had been impacted and the project was adjusted to eliminate the impact. If any impact remained, it was judged as significant.

Future uses with valid water rights and environmental clearance, where necessary, were handled in the same manner as existing rights with the same significance criteria.

The SJRBRIP flow recommendations (Holden 1999) were used as the basis for assessing the flow requirements for endangered fish in the San Juan River. Flow statistics based on the modeled period of 1929 - 1993 were compared to the flow requirements. Any violation of the recommended flows was considered significant. Operating criteria or project features were adjusted until the flow recommendations could be met.

There is presently one quantified non-Ute Indian trust water right that may be impacted by the development of the ALP Project, one planned project that includes delivery of water to Indian M&I uses, and one planned irrigation project completion. The Jicarilla Apache Tribe has a water right for an average annual depletion of 25,500 af from the San Juan River above or from Navajo Reservoir. This is an adjudicated right in settlement of their federally reserved rights. This adjudicated right has no identified use or associated project at this time, although negotiations are in progress that may result in third party contracts.

A municipal water supply project is proposed to supply domestic and M&I water to remote areas of the Navajo Reservation with limited or no water supply as well as to Gallup, New Mexico. The Navajo-Gallup Water Supply Project would divert 31,900 af and deplete 28,000 afy, including 7,500 af of diversion and depletion to the City of Gallup.

Table 3.2-3
Modeled Diversion and Depletion Summary for Refined Alternative 6
M&I Use at 50 Percent Efficiency

Category	Diversion (afy)	Depletion (afy)	Diversion Location	Return Flow Location
Southern Ute Indian Tribe - On-Reservation Non-Binding Uses				
Florida Mesa Housing	140	70	Florida River	Florida River at Confluence
Animas River Basin Housing	140	70	Animas River	Animas River at Florida Confluence
La Plata River Basin Housing	140	70	La Plata River at Cherry Creek	La Plata River Below Cherry Creek
Animas Industrial Park M&I	40	20	Animas River	Animas River at Florida Confluence
Ridges Basin Golf Course	796	398	Animas River	Animas River at Florida Confluence
Ridges Basin Resort	44	22	Animas River	Animas River at Florida Confluence
Coal Mine	830	415	San Juan River Below Animas River	San Juan River Above Shiprock
Coal-Fired Power Plant	27,000	13,500	San Juan River Below Animas River	San Juan River Above Shiprock
Livestock and Wildlife	30	15	La Plata River	La Plata River at State Line
Southern Ute Indian Tribe Total	**29,160**	**14,580**		
Ute Mountain Ute Tribe On-Reservation Non-Binding Uses				
La Plata Housing	280	140	La Plata River at Cherry Creek	La Plata Below Cherry Creek
Mancos Canyon Golf Course	978	489	Mancos River	Mancos River
Mancos Canyon Resort	33	17	Mancos River	Mancos River
Gas Power Plant	4,600	2,300	San Juan River at Power Plant	San Juan Above Shiprock
Livestock and Wildlife	40	20	La Plata River at Cherry Creek	La Plata Below Cherry Creek
La Plata Basin Golf Course and Resort	656	328	La Plata River at Cherry Creek	La Plata Below Cherry Creek
La Plata Basin Dude Ranch	10	5	La Plata River at Cherry Creek	La Plata Below Cherry Creek
Ute Mountain Ute Tribe Total	**6,597**	**3,299**		
Combined Colorado Ute Tribes' Non-Binding Regional Water Supply				
Durango	10,138	5,069	Animas River, Florida River	Animas River Below Pump
Farmington	17,608	8,804	Animas River or San Juan River	San Juan Below Animas Confluence

Table 3.2-3 (continued)
Modeled Diversion and Depletion Summary for Refined Alternative 6
M&I Use at 50 Percent Efficiency

Category	Diversion (afy)	Depletion (afy)	Diversion Location	Return Flow Location
Florida Mesa	7,016	3,508	Florida River	Animas at Florida Confluence
Montezuma County	2,102	1,051	Dolores Project	McElmo Creek
Kirtland, New Mexico	5,018	2,509	San Juan Below Animas River	San Juan River Above Shiprock
Aztec, New Mexico	1,410	705	Animas or San Juan River	Animas River at Farmington
Total Non-Binding Regional Water Supply	**43,292**	**21,646**		
Southern Ute Indian Tribe Non-Structural				
Florida River, Animas River - Agricultural, Future Conversion	13,000	6,500[a]	Florida River, Animas River, Left on Land	
Ute Mountain Ute Tribe Non-Structural				
Dolores River - Agricultural, Future Conversion	13,000	6,500[a]	Dolores - Montezuma Valley Left on Land	
Total Colorado Ute Tribal Settlement	**105,049**	**52,525**		
Other Uses				
San Juan Water Commission				
Bloomfield and Upstream Uses	4,533	2,267	San Juan-Citizen’s Ditch	San Juan River at Farmington
Farmington and Flora Vista	10,767	5,383	Animas River or San Juan River	San Juan Below Animas Confluence
Aztec	3,502	1,751	Animas River or San Juan River	Animas River at Farmington
Kirtland	1,998	999	San Juan River Below Animas	San Juan Above Shiprock
Total San Juan Water Commission	**20,800**	**10,400**		
Navajo Nation	**4,680**	**2,340**	Farmington M&I Diversion	Shiprock Below Gage
Animas-La Plata Water Conservancy District	**5,200**	**2,600**	Animas River, Florida River	Animas Below Durango Pump
Total Other Uses	**30,680**	**15,340**		
Total Water Use	**135,729**	**67,865**		

[a] This location for modeling convenience. For all other purposes, assume return flow at the Colorado/New Mexico state line.

In the 1991 Biological Opinion for blocks one through eight, 16,420 af of historic water depletion was transferred from the Hogback Project to NIIP. To eventually restore this project to it original acreage, this quantity of water would be required.

These Indian trust water supply totals 62,420 afy (depletions). Impact to these uses stems from reduction of available water to meet the flow requirements for the endangered fish and the limitations of existing operating rules for Navajo Dam. The flow recommendations would be reviewed in the future and may be modified and the operating rules may be optimized to provide additional water for development. Since the impact is not to any immediate need or identified use and there is reasonable probability that additional water would be made available in the future, this impact would carry less weight than those to existing or approved uses. However, when an impact is expected, the mitigation potential of the project is examined.

3.2.3 Affected Environment

The sections below discuss existing water resources/hydrology in the areas potentially affected by Refined Alternatives 4 and 6. The actions that may take place under the No Action Alternative are not fully known, and consequently, it is not possible to completely define the affected environment for that alternative. However, many of the eventual actions that may occur as a result of the No Action Alternative would likely take place within the same geographic setting as that of Refined Alternative 4.

The streamflow hydrology of five rivers—the Pine, Animas, La Plata, Mancos, and San Juan—would be affected by implementation and operation of Refined Alternatives 4 and 6. The operation of Refined Alternative 6 may affect the Dolores River and McElmo Creek as well. Project operation would cause either depletions or enhancements to the water resources of these rivers and flow regimes would be minimally to substantially modified. Although these depletions, enhancements, and streamflow modifications would affect the water resources of the region, they would be conducted within existing interstate water agreements and state water law regulations.

Surface water quantity for use in the area is similar to that described in the 1980 FES, as modified by the changes in the future conditions without project development. Groundwater is limited in the project area and is used primarily for domestic purposes. Supplies are not sufficient for development for large-scale uses.

Water supply in each of the streams for the pre-project condition is described in terms of the expected flows under baseline depletions as described in Table 3.2-1. The depletions that are included in the baseline are those that are presently occurring, those that could occur without further federal action, and those that have undergone ESA Section 7 consultation, with the exception of the 57,100 afy depletion assigned to the ALP Project in the 1996 and 2000 Biological Opinions. The hydrology records for the water years 1929 through 1993 were used for this analysis.

3.2.3.1 Refined Alternative 4 Structural Component

3.2.3.1.1 Animas River

Streamflow in the Animas River is characteristic of western United States rivers that have watersheds receiving runoff primarily from melting snowpack. Average annual runoff for the baseline condition at Durango is about 574,800 af. Streamflow is highly variable throughout the year. Flow typically peaks during the springtime melt of the snowpack in the higher mountain areas of the watershed, with peak monthly flows of about 2,800 cfs on average and over 5,000 cfs in wet years. Flows are generally low from mid-summer until the following year's spring runoff, usually averaging from 200 to 400 cfs, although mean monthly flows could be as low as 85 cfs in dry years.

Water is currently diverted from the Animas River for M&I use and for irrigation of lands in Colorado and New Mexico. However, streamflow also enters the river from downstream tributaries, the primary one being the Florida River. By the time it reaches the confluence with the San Juan River, the Animas River without the project has an average annual runoff of about 563,700 af. Minimum monthly flows average about 240 cfs, but can approach zero for the last few hundred feet between the last diversion and the confluence with the San Juan River in dry years due to irrigation depletions.

3.2.3.1.2 La Plata River

The La Plata River is a much smaller river than the Animas River, with a mean annual runoff of about 39,000 af at Hesperus, Colorado. Streamflow in the La Plata River in the study reach is characteristic of western United States rivers that have watersheds containing both a plains region and a higher mountainous area. Flow typically peaks during the springtime melt of the snowpack in the mountain areas of the watershed. Flows are generally low from mid-summer until the following year's spring runoff. However, short-lived, rainfall-induced flood flows may occur from July through October.

Streamflows in the La Plata River are substantially affected by irrigation. At several reaches along the river (e.g., above the confluence with Cherry Creek and in New Mexico), the river goes completely dry during certain times of the year. This is a result of both irrigation diversion and streamflow losses to groundwater. Flows are reduced from spring through fall for irrigation diversion. However, irrigation return flows likely increase the wintertime base flow of the river. At the confluence with the San Juan River, mean annual runoff is about 22,900 af. Diversions for irrigation and channel losses result in the lower average annual flow at the confluence, even though the drainage area has increased substantially from the Colorado/New Mexico state line.

3.2.3.1.3 Mancos River

The Mancos River has approximately the same annual flow conditions as the La Plata River, with a large portion of its flows diverted for irrigation and M&I uses in the Mancos Valley. Large reaches of the river from Mancos, Colorado to the confluence with the San Juan River are chronically dewatered by irrigation diversions.

3.2.3.1.4 San Juan River

The San Juan River is the largest of the project area rivers and collects inflow from all three rivers and other tributaries. Mean annual runoff in the river at Farmington, just downstream of the confluence with the Animas River, is about 1.13 million af. Near Bluff, Utah, mean annual discharge increases to about 1.25 million af. The increase is accounted for by tributary inflow below Farmington and irrigation return flow from the NIIP. As with the other rivers, flow peaks in the springtime and remains low from summer to fall, punctuated by short duration peaks resulting from storm events. The river is regulated by Navajo Reservoir and has substantial irrigation water use along both it and its tributaries. Navajo Reservoir has tended to reduce peak spring flows and to supplement flows in other seasons since its operation began in 1962. Proposed operation of Navajo Dam to mimic a natural hydrograph as specified in the SJRBRIP Flow Recommendation Report (Holden 1999) would result in flow patterns similar to those prior to 1962. Impacts to flows are considered against the projected modified flow regime recommended by the SJRBRIP.

3.2.3.1.5 Navajo Reservoir

Navajo Reservoir has a maximum content of 1.7 million af at the spillway crest (elevation 6,085 feet) with a surface area of 15,610 acres. The minimum content, controlled by the outlet works elevation to the NIIP is 625,675 af at elevation 5,985 feet in winter and 661,800 af at elevation 5,990 feet during the irrigation season. %

3.2.3.2 Refined Alternative 4 Non-Structural Component

3.2.3.2.1 Pine River

Streamflow in the Pine River is characteristic of western United States rivers that have watersheds receiving runoff primarily from melting snowpack. Mean runoff into Vallecito Reservoir is about 269,000 afy. Streamflow is highly variable throughout the year. Flow typically peaks during the springtime melt of the snowpack in the higher mountain areas of the watershed, with flows up to about 2,700 cfs. Flows are generally low from mid-summer until the following year's spring runoff, usually ranging from 100 to 200 cfs, with minimum monthly average flows as low as 40 cfs. Vallecito Reservoir markedly alters the hydrograph below the dam, with peak flows less than 1,800 cfs. Summer flows are increased to provide water for irrigation, but winter flows may be reduced to as low as 20 cfs.

Below irrigation diversions, flows on the Pine River can approach zero in summer months, with significant stretches of the stream de-watered. At the inflow to Navajo Reservoir, mean monthly flows can be as low as 6 cfs and as high as 2,000 cfs under baseline conditions. %

3.2.3.2.2 Florida River

Streamflow in the Florida River is similar in nature to the Pine River except the drainage area is smaller and the mean elevation somewhat lower, resulting in much less inflow. Inflow to Lemon Reservoir averages about 71,000 afy. Peak average monthly flows can be as high as 800 cfs and as low as 4 cfs. Lemon Reservoir regulates streamflows to provide enhanced summer flows for irrigation, storing runoff and winter flows for later release. Downstream diversions for irrigation and subsequent return flow further alter the flows in the Florida River. At certain times during the year, flows at the confluence with the Animas River are entirely irrigation return flow. Outflow at the confluence under baseline conditions is expected to average about 49,000 afy with average monthly flows ranging from 2 to 500 cfs.

3.2.3.3 Refined Alternative 6

In addition to affecting all the rivers listed above under Refined Alternative 4, Refined Alternative 6 would also affect Dolores River and McElmo Creek.

3.2.3.3.1 Dolores River

The Dolores River originates northeast of Cortez, Colorado in the La Plata and San Miguel Mountains. Flowing generally northwest, it reaches its confluence with the Colorado River near Cisco, Utah. The main tributaries of the river upstream of McPhee Dam are Beaver and Lost Canyon Creeks, and the West Dolores River.

The annual inflow to McPhee Reservoir averaged about 244,600 af between 1928 and 1973, while the discharge into the Colorado River averaged 507,000 af. Flows are highly variable with about 84 percent %

% of the runoff occurring as a result of snowmelt during the months of April through June. The completion of McPhee Dam allowed regulation below the dam so that some base flow can be maintained.

In addition to McPhee Reservoir (381,000 af) that stores water for the Dolores Project, there are two reservoirs that store water for the MVIC. They are Groundhog Reservoir (21,700 afy) and Narraguinnep Reservoir (19,000 afy).

3.2.3.3.2 McElmo Creek

McElmo Creek originates northeast of Cortez, Colorado and flows southwest past Cortez and then west to join the San Juan River near Aneth, Utah. The hydrology has been heavily modified by irrigation diversions and return flow. It presently discharges about 37,000 af at the Colorado/Utah state line, much of which is irrigation return flow from the MVIC and Dolores Project. Monthly variation in flow is much reduced compared to natural streams. The peak flow month is typically August, reflecting the influence of irrigation return flow. Average monthly flows vary less than 20 percent.

3.2.4 Environmental Consequences and Mitigation

The following sections discuss potential impacts to water resources of Refined Alternative 4, Refined Alternative 6, and the No Action Alternative. In addition, proposed mitigation measures to reduce or eliminate potential impacts to water resources, when feasible, are included.

3.2.4.1 Refined Alternative 4

Hydrology Impacts 1 through 6 (below) consider full development of the planned project depletion of 57,100 af associated with the components of Refined Alternative 4. Impact 7 results from the purchase of existing water rights associated with the non-structural component.

3.2.4.1.1 Operation of Structural Components and Delivery to Non-Binding Uses

Refined Alternative 4 Hydrology Impact 1 - Less than Significant: Depletions resulting from operation of Refined Alternative 4 would alter flows in the Animas River between the Durango Pumping Plant and the confluence of the San Juan River.

The effect of project operation on the Animas River varies depending on the stream reach and the amount of diversion and return flow that occurs in each reach. **Table 3.2-4** presents the mean, minimum, and maximum monthly average flow with and without implementation of Refined Alternative 4 at three locations on the Animas River. The first set of values is for impacts just below the Durango Pumping Plant. The average annual impact is a reduction in flow of about 78,100 af. The impact is greatest in wet years when the pumping plant can operate at its full 280 cfs capacity. In dry years, the pumping limits to provide bypass flows in the Animas River limit impact. Minimum flows are actually enhanced at this location with the ALP Project since the pumps would not be operating and there would be some return flow from the Durango municipal diversion associated with the project.

The second set of values in Table 3.2-4 compares flows just above the confluence of the Animas River with the Florida River. The releases from Ridges Basin Reservoir are included in the flow at this point, resulting in an average annual reduction in flow of about 46,300 af from the baseline condition. The minimum flows are enhanced at this location due to releases from Ridges Basin Reservoir to meet downstream demands.

Table 3.2-4
Mean, Minimum and Maximum Monthly Average Flow of the Animas River at Three Locations for Future Conditions with and without the Project

	Future without Project Average Monthly Flow (cfs)			Future with Project Average Monthly Flow (cfs)		
Month	**Mean**	**Maximum**	**Minimum**	**Mean**	**Maximum**	**Minimum**
	Animas River below Durango Pumping Plant					
October	376	1,810	160	262	1,701	157
November	259	751	147	191	665	154
December	188	369	101	148	345	104
January	161	271	84	137	243	87
February	165	271	91	132	216	96
March	249	563	118	173	495	122
April	829	1,787	238	670	1,691	207
May	2,308	4,586	501	2,117	4,413	312
June	2,827	5,385	398	2,611	5,397	421
July	1,149	3,092	197	987	2,821	216
August	554	1,544	196	436	1,365	214
September	439	1,715	143	341	1,563	158
Average	792	1,845	198	684	1,743	187
Minimum	161	271	84	132	216	87
Maximum	2,827	5,385	501	2,611	5,397	421
	Animas River above Florida Confluence					
October	417	2,072	173	350	2,010	182
November	308	904	172	279	856	208
December	230	480	153	200	466	139
January	202	322	103	188	301	116
February	214	423	116	205	396	144
March	368	972	121	319	925	150
April	1,016	2,065	279	896	1,886	287
May	2,353	4,874	417	2,208	4,748	275

Table 3.2-4 (continued)
Mean, Minimum and Maximum Monthly Average Flow of the Animas River at Three Locations for Future Conditions with and without the Project

	Future without Project Average Monthly Flow (cfs)			Future with Project Average Monthly Flow (cfs)		
Month	**Mean**	**Maximum**	**Minimum**	**Mean**	**Maximum**	**Minimum**
June	2,832	5,736	334	2,703	5,834	444
July	1,167	3,276	152	1,074	3,074	257
August	549	1,630	161	505	1,525	274
September	456	1,807	116	425	1,720	216
Average	843	2,047	191	779	1,978	224
Minimum	202	322	103	190	301	116
Maximum	2,832	5,736	417	2,703	5,834	444
	Animas River at Farmington (San Juan Confluence)					
October	397	2,675	90	269	2,550	59
November	348	1,163	189	269	1,065	172
December	273	565	177	230	537	150
January	238	382	114	211	350	113
February	249	450	127	208	392	125
March	431	1,010	127	347	929	121
April	951	2,496	31	781	2,237	39
May	2,189	4,960	218	1,983	4,771	14
June	2,740	5,903	42	2,497	5,887	38
July	953	3,398	-	770	3,105	14
August	343	1,573	-	203	1,371	15
September	315	1,746	-	197	1,573	13
Average	786	2,193	93	664	2,064	73
Minimum	238	382	-	197	350	13
Maximum	2740	5,903	218	2,497	5,887	172

The last set of values in Table 3.2-4 presents the comparison of flows at the confluence of the Animas River with the San Juan River. At this location, most of the diversions have been taken and few of the return flows are present. This is the location of maximum impact, with a mean annual reduction in flow of 88,200 af. These flows are below the Farmer's Mutual Ditch diversion just upstream of the confluence with the San Juan River. Under historic conditions, there are shortages in the driest years, resulting in a model computed zero flow. In reality, some flow passes this point due to inability to divert 100 percent of the water. With the ALP Project in place, there is a small enhancement in flows at this point.

The change in flow in the Animas River is greatest during wet periods when the Durango Pumping Plant is operating at its maximum capacity. The impact is not great during this time, however, because the pumping rate is a small percentage of the flow. Impacts are limited in the upper Animas River during low-flow times by the minimum bypass flows specified. In the lower river, the impact is greatest in moderately dry months when the project diversions reduce the flows past the last diversion. In the driest months, occurring during the irrigation season, there is no significant change in flows at the San Juan River confluence. During these times historically the flows were at or near zero below the Farmer’s Mutual Ditch, the lowest diversion on the Animas River. Releases from Ridges Basin Reservoir during these dry months supply the project demands with no significant change to the flows in the river below the last diversion point.

The impacts to water supply in the Animas River for Refined Alternative 4 are not significant under the standards of evaluation specified in Section 3.2.2.2. There are no Indian trust water rights other than those associated with the project and there is no designated critical habitat for endangered fish. Releases to meet downstream project demands are protected by both Colorado and New Mexico State Law as project water, allowing the water to be delivered past upstream irrigators that may be water short in dry years. Even though the flows in the Animas River are reduced due to project operation, none of the standards established in Section 3.2.2.2 are violated. Therefore, the impacts would not be significant.

Mitigation for Refined Alternative 4 Hydrology Impact 1: No mitigation is proposed.

Refined Alternative 4 Hydrology Impact 2 - Significant: Impacts to existing flow are anticipated in the San Juan River as a result of project operation that would reduce water supply for future Indian trust water uses. %

The project effect on the San Juan River varies somewhat between the confluence with the Animas River and Four Corners, New Mexico as return flow enters the system. The greatest impact, 80,700 afy, would occur between the confluence with the Animas and La Plata Rivers. This is a short reach of river, the minimum flow requirements for endangered fish are met, and the percent impact (about two percent of total flow) is small. The Four Corners gage has been the typical location for analyzing flows for endangered fish. Therefore, all impacts are analyzed at Four Corners, New Mexico.

Table 3.2-5 summarizes the mean, maximum, and minimum monthly average flows of the San Juan River at Four Corners, New Mexico, with and without project. In the driest winter months, the flows would be the same for with and without project conditions since Navajo Dam is operated to maintain a minimum flow at this location. The impacts in the other months would be small.

Table 3.2-5
Mean Monthly Flows for the San Juan River at Four Corners, New Mexico (USGS Gage) with Refined Alternative 4 and without (Baseline Condition) Project for the Modeled Period 1929-1993

Month	Future without Project Average Monthly Flow (cfs)			Future with Refined Alternative 4 Average Monthly Flow (cfs)		
	Mean	**Maximum**	**Minimum**	**Mean**	**Maximum**	**Minimum**
October	954	6,423	537	907	6,137	537
November	764	3,148	542	729	3,078	542
December	723	2,346	542	710	2,329	542
January	654	1,085	542	648	1,041	542
February	782	2,001	542	773	2,013	542
March	1,219	6,054	542	1,166	5,919	541
April	2,319	7,401	564	2,148	7,330	592
May	4,409	12,261	755	4,214	12,119	738
June	5,079	9,762	946	4,823	9,416	815
July	1,496	4,833	637	1,397	4,635	631
August	1,026	4,230	540	995	4,081	540
September	903	3,559	538	880	3,425	538
Average	1,694	5,259	602	1,616	5,127	592
Minimum	654	1,085	537	648	1,041	537
Maximum	5,079	12,261	946	4,823	12,119	815

Table 3.2-6 presents the statistical criteria of the SJRBRIP flow recommendation (Holden 1999) and the resulting statistics for the with and without project conditions when Navajo Dam is operated to mimic a natural hydrograph. All flow recommendations are met.

Operating Navajo Reservoir to meet flow recommendations would reduce the available water to meet future Indian trust water development that depends on the water supply in Navajo Reservoir. For the baseline condition, only 20,000 of the 62,420 afy of depletion required can be delivered. With Refined Alternative 4, present model results indicate no further allowable development, resulting in an impact to Indian trust water development of 20,000 afy. The impact is based upon the use of modified recommended operating rules for Navajo Dam to mimic a natural hydrograph for the benefit of endangered fish in the San Juan River. With additional model refinement and improved operating rules, this impact may be less. The flow recommendations for endangered fish would be subject to adaptive management in the future and the operating conditions of Navajo Dam would be optimized as new information becomes available. However, until the flow recommendations are changed and Navajo Dam is operated in such a way as to make additional water available for development and/or progress is made in the endangered fish recovery program allowing additional water development to take place, the impact is considered significant.

Table 3.2-6
Summary of Flow Statistics for San Juan River at Four Corners, New Mexico
for Pre- and Post-Dam Historic Flows
Future Condition with and without Refined Alternative 4 for the Modeled Period 1929-1993

Parameter	Pre-dam 1929-61	Post-dam 1962-91	Future Without [a] Project 1929-93	Future with Refined[b] Alternative 4 1929-93	Flow Recommendation Limits
Average Peak Daily Runoff -cfs	12,409	6,749	8,822	8,375	
Average March-July Runoff - af	1,263,890	891,712	867,681	830,085	
>10,000 cfs for 5 days - frequency	39%	**13%**	29%	28%	≥20%
>8,000 cfs for 10 days - frequency	45%	**17%**	42%	38%	≥33%
>5,000 cfs for 21 days - frequency	64%	**37%**	58%	52%	≥50%
>2,500 cfs for 10 days - frequency	100%	83%	86%	80%	≥80%
Maximum Years Between Flow Events for Minimum Duration					
10,000 cfs - 5 days	4	**14**	9	9	≤10
8,000 cfs - 10 days	4	**7**	6	6	≤6
5,000 cfs - 21 days	4	**7**	4	4	≤4
2,500 cfs - 10 days	0	1	1	2	≤2
Average Date of Peak	May 31	June 1	June 3	June 4	
Days > 10,000 cfs	14	3	4	4	
Days > 8,000 cfs	23	8	13	12	
Days > 5,000 cfs	46	28	33	31	
Days > 2,500 cfs	82	67	57	53	
Meets Recommendation	Yes	No	Yes	Yes	

Note: Values in bold indicate non-compliance with standard.
[a] As simulated for baseline depletion conditions and Navajo Dam operated to meet flow recommendations.
[b] As simulated for Refined Alternative 4 in addition to baseline conditions and Navajo Dam operated to meet flow recommendations.

Mitigation for Refined Alternative 4 Hydrology Impact 2: Continue model and operating rule %
refinement to provide additional water for development while meeting the flow recommendations. %

Work is continuing to refine the San Juan River Basin hydrology model and improve operating rules to %
meet flow recommendations and provide for water development. Other elements of mitigation not %
dealing directly with hydrology or modeling are listed under Indian Trust Assets. Since the water %
required to meet this demand is inadequate even without the project, the impacts of this alternative are %
incremental to the total impact. Since water remains limiting, the impact remains potentially significant. %

Refined Alternative 4 Hydrology Impact 3 - Potentially Significant: Project return flow from non-binding uses would increase flows in the La Plata River in New Mexico in an area that is now water-short. Unless these return flows are protected or the depletion of them replaced,

downstream depletion would increase above 57,100 afy with subsequent impact to endangered fish flows.

The La Plata River would be impacted from the Colorado/New Mexico state line to the confluence with the San Juan River. No diversions for Refined Alternative 4 are taken from the La Plata River, but return flow from a number of the non-binding uses would be added to the flow. It has been assumed that these return flows would enter at the Colorado/New Mexico state line. The flows in this reach of the river would be enhanced by about 15,500 afy.

The average, maximum, and minimum monthly average flows with and without the project appear in **Table 3.2-7** for the La Plata River at the Colorado/New Mexico state line and at the confluence with the San Juan River. The percentage increase during low-flow periods would be substantial. If this flow is to stay in the stream, a mechanism for protecting these flows would be needed. Otherwise, the water-short irrigators in New Mexico would divert a portion of this extra available water to meet their irrigation demands, thus increasing the depletions lower in the system.

Under the assumptions of the model, the flows in the La Plata River would be enhanced with no adverse impact to any irrigator. If the water remains in the stream, then it would become available for aquatic resource enhancement, requiring a mechanism to protect the flow. If the enhancement does not remain in the stream, but is taken by the water-short irrigators, there would be a positive impact to their water supply and no impact to the supply for aquatic resources. In this latter case, the additional depletion from the system could have a downstream impact that has not been analyzed but would likely have a negative effect on flows for endangered fish.

In the case of the La Plata River, the assumption of 50 percent efficiency for all uses is not the extreme condition. Since flows are enhanced in the La Plata River from ALP Project operation, the enhancement is actually much less under the non-binding use scenario with the delivery to power plants and golf courses at the appropriate efficiency. In this case, the return flow would be reduced to about 1,400 af, a relatively insignificant enhancement.

Mitigation for Refined Alternative 4 Hydrology Impact 3: Pursue a method to protect the non-binding component return flow waters in the La Plata River drainage as a water supply for endangered fish.

Projected return flows to the La Plata River would enhance flows in the reaches of the river where shortages to irrigation users are common. Currently, water to enhance flows for endangered fish cannot be identified as a project purpose for ALP Project water. Measures would be taken to work with all appropriate State and Federal agencies to protect this water for the life of the project. Alternately, any depletion of these return flow water volumes would be included within the annual average depletion of 57,100 afy for the project. As a practical matter, it is unlikely that these return flows can be protected and passed downstream during water-short months. The use of these return flows by downstream irrigators during water-short periods becomes depletion incidental to the project. To prevent exceeding the total project depletion of 57,100 afy, project uses would be reduced by the amount of incidental depletion resulting from the return flow use.

Table 3.2-7
Mean, Minimum, and Maximum Monthly Average Flow of the La Plata River at Two Locations With and Without Refined Alternative 4

Month	Future without Project Average Monthly Flow (cfs)			Future with Refined Alternative 4 Average Monthly Flow (cfs)		
	Mean	Maximum	Minimum	Mean	Maximum	Minimum
	La Plata River at Colorado/New Mexico State Line					
October	11.7	113.0	2.7	34.2	135.5	25.2
November	9.0	79.1	0.9	27.0	97.1	18.9
December	9.4	52.0	0.8	14.8	57.3	6.1
January	9.3	28.3	1.1	14.6	33.7	6.4
February	14.3	46.9	0.7	25.5	58.1	12.0
March	33.6	127.8	1.9	46.2	140.4	14.5
April	107.7	360.5	9.2	125.9	378.7	27.4
May	129.1	456.5	14.3	152.0	479.3	37.2
June	103.1	590.4	23.9	145.0	632.3	65.7
July	44.9	277.9	8.8	78.1	311.0	42.0
August	16.5	55.3	1.5	51.6	90.5	36.7
September	11.8	92.4	0.8	42.9	123.5	31.9
Average	41.7	190.0	5.5	63.2	211.4	26.9
Minimum	9.0	28.3	0.7	14.6	33.7	6.1
Maximum	129.1	590.4	23.9	152.0	632.3	65.7
	La Plata River at San Juan River Confluence					
October	10.8	128.2	1.3	33.3	150.7	23.8
November	9.1	139.3	0.0	27.1	157.3	18.0
December	12.9	71.5	0.0	18.2	76.8	5.4
January	16.8	97.7	0.1	22.2	103.0	5.4
February	21.6	86.4	0.1	32.7	97.7	11.3
March	31.0	163.6	0.1	43.6	176.2	12.7
April	83.8	403.2	1.6	102.0	421.4	19.9
May	75.4	413.0	5.0	98.3	435.9	27.9
June	58.4	562.4	6.4	100.2	604.3	48.3
July	29.1	317.0	7.7	62.3	350.1	40.9
August	18.3	123.7	5.1	53.5	158.9	40.3
September	12.3	211.5	2.1	43.4	242.6	33.3
Average	31.6	226.5	2.5	53.1	247.9	23.9
Minimum	9.1	71.5	0.0	18.2	76.8	5.4
Maximum	83.8	562.4	7.7	102.0	604.3	48.3

Refined Alternative 4 Hydrology Impact 4 - Beneficial: Increased flow in the lower Mancos River due to return flow from non-binding uses in Mancos Canyon.

Return flows from the Ute Mountain Ute resort and golf course would enhance flows in the Mancos River from the Highway 666 bridge to the confluence with the San Juan River. The average annual enhancement would be about 500 af or approximately 1 percent of the average annual runoff of around 38,000 af. While the impact is positive, it is also negligible.

Refined Alternative 4 Hydrology Impact 5 - Beneficial: Ridges Basin Reservoir would add a permanent pool of water in the San Juan River Basin.

Ridges Basin Reservoir would create a new water resource in the San Juan River Basin. The minimum reservoir content during the 65 years of analysis would be about 26,400 af with a surface area of about 705 acres. The reservoir would remain 99 percent full or more about 39 percent of the time and have an average content of 104,500 af. The reservoir would remain below the target elevation of 30,000 af for 5 months in one year out of 65.

Refined Alternative 4 Hydrology Impact 6 - Less than Significant: The water level in Navajo Reservoir would be lowered slightly by operation of Refined Alternative 4.

The operation of Navajo Reservoir would be impacted by operation of Refined Alternative 4 in that additional water must be released from Navajo Dam to offset downstream impacts of the ALP Project in terms of meeting the flow requirements for endangered fish. With project operation, the average reservoir content would drop by 20,500 afy from 1,347,500 afy (79 percent full) to 1,327,000 afy (78 percent full). The minimum reservoir content would drop from 645,700 afy to 637,500 afy, or about 12,000 afy above the minimum allowable content.

Mitigation for Refined Alternative 4 Hydrology Impact 6: No mitigation is proposed.

3.2.4.1.2 Water Conveyance Impacts for Non-Binding Uses

The water conveyance components of the non-binding uses would have no other impact during operation than those described above related to the delivery of water to these uses and the associated return flow. During construction, there could be a less than significant impact to flow associated with dewatering for stream crossings. The impact would be short-term (usually less than two days) and small (less than one cfs).

3.2.4.2 Refined Alternative 6

Refined Alternative 6 Hydrology Impacts 1 through 7 below result from implementation of the components of Refined Alternative 6 that are equivalent to the structural and non-binding portions of Refined Alternative 4. For this alternative, structural and non-structural components are combined to deliver water to the non-binding uses. The purchase of irrigated lands equivalent to the non-structural portion of Refined Alternative 4, would have no impact on the water supply of any of the rivers in the ALP Project area since the water would remain on the land in the same use.

Refined Alternative 6 Hydrology Impact 1 - Less than Significant: Depletions resulting from operation of Refined Alternative 6 would alter flows in the Animas River between the Durango Pumping Plant and the confluence of the San Juan River.

Average minimum and maximum monthly flows resulting from operation of Refined Alternative 6 are shown in **Table 3.2-8**, compared to without project conditions for the Animas River below the Durango Pumping Plant and above the confluence with the Florida River. At Durango, the average monthly flows are reduced from the without-project condition by about 13 cfs, compared to 109 cfs for Refined Alternative 4. No diversion is taken when flows are below the target levels described earlier. Supplemental water would be delivered from Lemon or Horse Gulch reservoirs during these times.

At the confluence with the Florida River, this alternative would reduce the average monthly flow by 16 cfs compared to 63 cfs for Refined Alternative 4. The minimum flow is reduced by about 5 cfs.

The average flow at Farmington under Refined Alternative 6 has not been computed precisely since the project demands that would come from the Animas River to meet the lower Animas Basin M&I demands are actually modeled as taken from the San Juan River below Farmington to allow access to storage in Navajo Reservoir. The average monthly flow would be impacted more than 16 cfs but less than 128 cfs, the impact resulting from Refined Alternative 4. Minimum flows would remain about the same and there would be no impact to any existing water rights.

The impacts to water supply in the Animas River from Refined Alternative 6 would not be significant under the established standards of evaluation. There are no Indian trust water rights other than those associated with the project and there is no designated critical habitat for endangered fish.

Mitigation for Refined Alternative 6 Hydrology Impact 1: No mitigation is proposed.

Refined Alternative 6 Hydrology Impact 2 - Significant: Impacts to existing flow are anticipated in the San Juan River that would reduce water supply for future Indian trust water uses and would not meet flow recommendations.

Table 3.2-9 summarizes the mean, maximum, and minimum monthly average flows of the San Juan River at Four Corners, New Mexico for Refined Alternative 6. The average annual impact at this location is 34,455 af to deliver total project depletions of 54,865 af. The difference is made up from purchase of irrigated land and transfer of the depletion to M&I use. The impacts in all months are small, ranging from -7 percent to +4 percent. The recommended operating rules for Navajo Dam prevent minimum flows from dropping below the prescribed level in the SJRBRIP flow recommendations. With the retirement of 10,000 acres of irrigated land in the Pine River basin, not all of the required flow recommendation criteria for endangered fish specified in Table 3.2-6 would be met for this alternative. 2,500 cfs for 10 days is only met 78.5 percent of the time rather than the 80 percent required. In addition, the maximum duration without meeting the 10,000 cfs criteria is nine years, three years longer than recommended. The maximum duration for the 2,500 cfs criteria is three years rather than two as recommended.

This alternative would reduce the available water to meet future Indian trust water development that depends on the water supply in Navajo Reservoir. Since Navajo Dam would be operated to meet project demands in this case, no storage remains to deliver water to meet future Indian trust water development, resulting in a 20,000 afy impact. The combination of not meeting flow recommendations and reducing supply available for future Indian trust water development would be a significant impact.

Table 3.2-8
Mean, Minimum, and Maximum Monthly Average Flow of the Animas River at Two Locations for Future Conditions with and without Refined Alternative 6

Month	Future without Project Average Monthly Flow (cfs)			Future with Refined Alternative 6 Average Monthly Flow (cfs)		
	Mean	Maximum	Minimum	Mean	Maximum	Minimum
	Animas River Below Durango City Pumping Plant					
October	376	1,810	160	362	1,797	160
November	259	751	147	249	741	147
December	188	369	101	185	366	101
January	161	271	84	158	269	84
February	165	271	91	159	265	91
March	249	563	118	242	556	118
April	829	1,787	238	818	1,776	229
May	2,308	4,586	501	2,293	4,571	486
June	2,827	5,385	398	2,798	5,357	370
July	1,149	3,092	197	1,126	3,069	197
August	554	1,544	196	532	1,521	196
September	439	1,715	143	421	1,695	143
Average	792	1,845	198	779	1,832	193
Minimum	161	271	84	158	265	84
Maximum	2,827	5,385	501	2,798	5,357	486
	Animas River Above Florida River Confluence					
October	417	2,072	173	401	2,056	170
November	308	904	172	296	892	171
December	230	480	153	226	476	152
January	202	322	103	199	318	102
February	214	423	116	207	415	115
March	368	972	120	360	963	119
April	1,016	2,065	279	1,003	2,052	267
May	2,353	4,874	417	2,334	4,856	399
June	2,832	5,736	334	2,799	5,702	301
July	1,167	3,276	152	1,140	3,249	147
August	549	1,630	161	524	1,603	157
September	456	1,807	116	436	1,784	113
Average	843	2,047	191	827	2,031	184
Minimum	202	322	103	199	318	102
Maximum	2,832	5,736	417	2,799	5,702	399

Table 3.2-9
Mean, Minimum, and Maximum Monthly Average Flow of the San Juan River at Four Corners, New Mexico for Future Conditions with and without Refined Alternative 6

	Future without Project Average Monthly Flow (cfs)			Future with Refined Alternative 6 Average Monthly Flow (cfs)		
Month	**Mean**	**Maximum**	**Minimum**	**Mean**	**Maximum**	**Minimum**
October	954	6,423	537	921	6,365	533
November	764	3,148	542	735	3,084	550
December	723	2,346	542	729	2,357	562
January	654	1,085	542	675	1,067	562
February	782	2,001	542	777	1,989	556
March	1,219	6,054	542	1,224	6,011	553
April	2,319	7,401	564	2,268	7,371	551
May	4,409	12,261	755	4,303	12,318	751
June	5,079	9,762	946	4,883	9,621	757
July	1,496	4,833	637	1,393	4,629	631
August	1,026	4,230	540	979	3,996	540
September	903	3,559	538	870	3,443	538
Average	1,694	5,259	602	1,646	5,188	590
Minimum	653	1,085	537	675	1,067	533
Maximum	5,079	12,261	946	4,883	12,318	757

Mitigation for Refined Alternative 6 Hydrology Impact 2: Pursue the purchase of additional irrigated land upstream of Navajo Reservoir, convert the depletion to M&I use and deliver to Navajo Reservoir as required to fulfill future ITA uses and flow recommendations.

Operating the project as described for Refined Alternative 6 does not leave any water to meet future Indian trust water demands from Navajo Reservoir and does not provide sufficient water to meet the flow recommendations under present operating criteria. Mitigation could involve purchasing additional irrigated lands above Navajo Reservoir and delivering the water that would have been depleted by irrigation to Navajo Reservoir. An additional 5,000 acres of retired irrigation are required to meet flow recommendations. Additional land would be required to provide water to meet Indian trust water requirements. The feasibility of acquiring needed water is tied to the ability to convert to M&I use, the ratio of that conversion to the amount of land available, and ability to procure available lands. Costs associated with this mitigation are not defined at the current time. %

Refined Alternative 6 Hydrology Impact 3 - Less than Significant: Operation of Refined Alternative 6 would change the flows in the La Plata River drainage primarily by increasing flows from the Colorado/New Mexico state line to the confluence with the San Juan River as a result of the introduction of return flow from San Juan River diversions.

Retirement of 785 acres of agricultural land and conversion of the irrigation depletion to M&I would change the timing of flows slightly above the Colorado/New Mexico state line and decrease flows by an average of 60 afy, or 0.2 percent of the annual runoff. Most of the impact would be during winter months and during snowmelt runoff when water is available. During late summer, water would come from storage.

From the Colorado/New Mexico state line to the confluence with the San Juan River, return flows from non-binding uses served by diversions from the San Juan River would increase flow by about 13,500 af or 60 percent. Since this alternative has the diversion for these uses downstream of the return flow point, these flows could be designated as project waters and be used to meet the diversion demand.

The percentage increase during low flow periods due to return flows would be substantial and would have a beneficial impact on the La Plata River. However, this impact would be the result of return flows from a non-binding use and is therefore not guaranteed. Since the beneficial effect cannot be assured, the impact would be determined to be less than significant.

Mitigation for Refined Alternative 6 Hydrology Impact 3: No mitigation is proposed.

Refined Alternative 6 Hydrology Impact 4 - Less than Significant: Flows in the Mancos River would change primarily in timing as a result of operation of Refined Alternative 6.

Flow in the Mancos River would be about the same as historical flows in volume due to the retirement of 500 acres of agricultural lands and transfer of the water to the resort and golf course. Timing would be slightly altered, however. Flow would be increased between the town of Mancos and the diversion point for the golf course, but the change would be small. The impacts would be less than significant.

Mitigation for Refined Alternative 6 Hydrology Impact 4: No mitigation is proposed.

Refined Alternative 6 Hydrology Impact 5 - Less than Significant: The water level in Navajo Reservoir would be lowered slightly by operation of Refined Alternative 6.

The operation of Navajo Reservoir would be impacted by the operation of Refined Alternative 6 in that additional water must be released from Navajo Dam to meet downstream demands and to offset downstream impacts of the project in terms of meeting the flow requirements of the endangered fish. With this alternative, the average reservoir content would drop by 8,270 afy from 1,347,500 afy (79 percent full) to 1,339,230 million afy (78 percent full). The minimum reservoir content would be slightly greater, going from 645,700 afy to 667,100 afy. The change in reservoir content and elevation would be less than significant.

Mitigation for Refined Alternative 6 Hydrology Impact 5: No mitigation is proposed.

Refined Alternative 6 Hydrology Impact 6 – Beneficial: Transfer of water rights from irrigation to instream flow enhancement and downstream M&I use on the Pine River under Refined Alternative 6 could have enhancing hydrology effects on the Pine River.

The conversion of irrigation water to M&I uses with releases downstream to Navajo Dam would increase the flow in the Pine River during the irrigation months of April through October. The annual increase in flows would be about 15,100 af. The approximate average monthly increase in cfs is shown in **Table 3.2-10**. Winter flows would be slightly reduced due to loss of agricultural return flow that would return after irrigation ceases in the fall, but these losses are not represented in the model. The actual result would be a slightly higher increase in flow during the irrigation months with a slight decrease in flow in the winter. The net annual gain would remain the same. This gain would be accomplished by transferring the depletion associated with 10,000 acres of irrigated land to M&I use.

Table 3.2-10
Increase in Average Monthly Flows in the Lower Pine River Resulting From Transferring 10,000 Acres of Irrigation Depletion to Downstream M&I Use

Month	Average Flow (cfs)
April	7
May	32
June	55
July	54
August	47
September	28
October	9

This element of Refined Alternative 6 is potentially beneficial to the flows in the lower Pine River. Only depletions associated with crop production would be transferred. The incidental depletions associated with getting the water to the crop land would remain in the stream system.

Refined Alternative 6 Hydrology Impact 7 – Less than Significant: Irrigated land purchased in the Montezuma Valley Irrigation Company service area for which the depletion is transferred to M&I use would slightly modify the timing of flows in McElmo Creek and upper Dolores River.

The purchase of 657 acres in the MVIC service area with transfer of 1,051 afy of depletion to meet regional M&I demand in the Cortez, Colorado area would modify the timing of demands and return flows. There would be no change in net depletion due to this element of Refined Alternative 6. The change in timing represents less than 0.3 percent of the MVIC diversion and less than 1 percent of the McElmo Creek flow at the Colorado-Utah state line. No existing rights would be impacted by this small change in timing. The impact would be less than significant.

Mitigation for Refined Alternative 6 Hydrology Impact 7: No mitigation is proposed.

3.2.4.3 No Action Alternative

Under the No Action Alternative, streamflows would generally occur as they have in the past, with baseline water uses continuing. Streamflow could be developed for future uses, within the limitations of state water laws and interstate agreements. A mean annual runoff of the Animas River at Durango and Farmington was calculated, assuming all baseline water uses are in place. These runoff volumes are 574,800 afy and 563,700 afy at Durango and Farmington, respectively. No exercise of Colorado Ute Tribal water rights beyond their historic right is included since it is not quantified without the project. On the San Juan River, future operations are expected to mimic the natural hydrograph as described in the SJRBRIP flow recommendations, and the Section 7 baseline is used as the future without project condition.

Under the No Action Alternative, modeling has shown that the flow recommendations for endangered fish could be met and that at least 20,000 af of annual depletion would be available to meet Indian Trust water rights out of Navajo Reservoir.

3.3 WATER QUALITY

3.3.1 Introduction

This section addresses potential impacts to water quality that would result from actions associated with Refined Alternative 4, Refined Alternative 6, and the No Action Alternative. Section 3.3.2 defines the Evaluation Methodology and significance criteria used for determining impacts, Section 3.3.3 describes the affected environment, and Section 3.3.4 identifies potential impacts and mitigation measures that would serve to reduce or eliminate anticipated impacts to water quality.

3.3.2 Evaluation Methodology

This section discusses the methodology used to determine potential impacts that could result from Refined Alternatives 4 and 6. Also discussed are specific criteria that were used to determine the significance of the impacts identified. It was assumed that all lands purchased under the non-structural component of Refined Alternative 4 and some of the land purchased under the non-structural component of Refined Alternative 6 would remain in irrigation. As such, no water quality impacts were evaluated for this aspect of these two alternatives.

3.3.2.1 Methodology

3.3.2.1.1 Approach

Relevant federal and state regulations and standards were reviewed to identify appropriate significance criteria. Specifically, the Colorado, New Mexico, and Utah state surface water quality standards were obtained for the various river segments. The water classifications change along each river and the water standards change depending on the location. The methodology adopted in this study was to look at each segment individually and calculate the average concentration for the period of reliable record, and the number of exceedences of the relevant standard.

Surface water quality data for the San Juan River Basin and the upper Dolores River were compiled from the EPA Storage and Retrieval System (STORET) database (EPA 1999), and data collected by Reclamation (Reclamation 1999a) and the Bureau of Indian Affairs (BIA) (BIA 1999) (combined STORET-Reclamation-BIA water quality database). Reclamation data for selenium collected from 1992 through 1995 was excluded from the data set due to quality control problems with the laboratory (see detailed discussion in Technical Appendix 3, Water Quality Analysis). The compiled data set contains approximately 275,000 observations collected mainly during the period of 1950-1998. A subset, consisting of 74,000 measurements of the parameters regulated by the states, was selected and formed the database for the water quality analysis. Other parameters were selected for biological studies as needed. In computing average concentrations, values that were below the detection point were assumed to have a concentration equal to one half the detection limit. Non-detection values cannot be used in calculating exceedences, since the initial concentration to which an increase is applied is not known. When the standard is lower than the detection limit, as for mercury, it is not possible to discern if a measurement exceeded the standard. For reporting purposes in these cases, the standard used by regulating agencies was employed, whereby concentrations that are below detection are considered to be below the standard.

When the standard is above the detection limit, only measurements that are above detection can be used to compute the impact to exceedences.

In addition to surface water quality data, streamflow data were compiled from the U.S. Geological Survey (USGS) hydrologic records (Hydrosphere 1999 and USGS 1999) matching the gage location and the period of the water quality collection. These data were used to compute loading under historic conditions. Similarly, streamflows predicted by RiverWare model simulations were used to compute water quality parameter loading for project impacts.

The quantification of potential changes in water quality was based on: (1) regional water quality data collected since the early 1950s, (2) regional streamflow data at the same locations and periods, and (3) projected streamflow and mass loading changes occurring under project operation. These potential changes were computed by comparing the historical conditions to the conditions expected with full build-out of the structural components and non-binding uses with a 50 percent efficiency (50 percent of diverted water is depleted from the stream system) for all uses as described in Section 3.2 (Water Resources/Hydrology).

The regional water quality data used in the analysis consisted of 74,000 observations reported in the combined STORET-Reclamation- BIA water quality databases (EPA 1999; Reclamation 1999a; BIA 1999). This water quality subset contained only observations of the chemical parameters regulated by the three states of Colorado (Colorado Public Health 1998), New Mexico (New Mexico Water Quality Control Commission 1995), and Utah. **Table 3.3-1** lists these chemical parameters. Presently, selenium and mercury are not included in the state 303(d) lists for any rivers in the San Juan River Basin.

3.3.2.1.2 Standards by State

State agencies have designated the surface water in the river segments into various use classes. Each classification carries with it a set of water quality standards. The segment description, classification and numeric water quality standards in Colorado, New Mexico, and Utah are listed in Technical Appendix 3. The actual number of segments along each river used in this study were:

- ❑ Five segments on the Animas River - three in Colorado and two in New Mexico;
- ❑ Three segments on the La Plata River - two in Colorado and one in New Mexico;
- ❑ One segment on the Mancos River in Colorado; and
- ❑ Three segments on the San Juan River - one each in New Mexico, Colorado, and Utah.

These regulatory stream segments are shown on **Figure 3.3-1.** The Navajo Nation adopted water quality %
standards which are applicable to portions of the San Juan River within the boundaries of the Navajo %
Nation. The Southern Ute Indian Tribe has also adopted water quality standards that are applicable, at %
this time, to waters that flow through land owned by the Southern Ute Indian Tribe. %

Table 3.3-1
The Chemical Parameters Regulated along River Reaches
Potentially Affected by the Project

Aluminum Dissolved (μg/l as Al) [NM, UT]	Lead Total (μg/l as Pb)
Ammonia Unionized (Calc Fr Temp-pH-NH4) (mg/l) [CO, NM, UT]	Lead Total Recoverable in Water as Pb (μg/l)
Ammonia Unionized (mg/l as N) [CO, NM, UT]	Magnesium Dissolved (mg/l as Mg)
Arsenic Dissolved (μg/l as As) [CO, UT]	Manganese Dissolved (μg/l as Mn) [CO]
Arsenic Total (μg/l as As)	Manganese Total (μg/l as Mn)
Arsenic Total Recoverable in Water as As (μg/l) [CO]	Manganese Total Recoverable in Water as Mn (μg/l) [CO]
Beryllium Dissolved (μg/l as Be)[NM]	Mercury Dissolved (μg/l as Hg) [CO, UT]
Beta Total (piC/l) [UT]	Mercury Total (μg/l as Hg) [CO, NM]
BOD 5 Day 20° C (mg/l) [UT]	Mercury Total Recoverable in Water as Hg (μg/l)
Boron Dissolved (μg/l as B) [CO]	Nickel Dissolved (μg/l as Ni) [CO, NM, UT]
Cadmium Dissolved (μg/l as Cd) [CO, NM, UT]	Nickel Total (μg/l as Ni)
Cadmium Total (μg/l as Cd)	Nickel Total Recoverable in Water as Ni (μg/l)
Cadmium Total Recoverable in Water as Cd (μg/l)	Nitrate Nitrogen Dissolved (mg/l as N) [CO, UT]
Calcium Dissolved (mg/l as Ca)	Nitrate Nitrogen Total (mg/l as NO3) [CO, UT]
Chlordane(tech mix & metabolites) Whole Water (μg/l)[NM]	Nitrite Nitrogen Dissolved (mg/l as N) [CO]
Chloride Dissolved in Water (mg/l) [CO]	Nitrite Nitrogen Dissolved (mg/l as NO2) [CO]
Chlorine Total Residual (mg/l) [CO, NM]	Oxygen Dissolved (mg/l) [CO, NM, UT]
Chromium Dissolved (μg/l as Cr) [CO, NM, UT]	pH (Standard Units) [CO, NM, UT]
Chromium Hexavalent (μg/l as Cr) [CO, NM, UT]	pH Field (Standard Units) [CO, NM, UT]
Chromium Total (μg/l as Cr)	Phosphorus Total (mg/l as P) [UT]
Chromium Total Recoverable in Water as Cr (μg/l) [CO]	Selenium Dissolved (μg/l as Se) [CO, UT]
Copper Dissolved (μg/l as Cu) [CO, NM, UT]	Selenium Total (μg/l as Se)
Copper Total (μg/l as Cu)	Selenium Total Recoverable in Water as Se (μg/l)[CO, NM]
Copper Total Recoverable in Water as Cu (μg/l)	Silver Dissolved (μg/l as Ag) [CO, NM, UT]
Cyanide Total (mg/l as CN) [CO, NM, UT]	Silver Total (μg/l as Ag)
Fecal Coliforms Membr Filter M-fc Broth 44.5º C [CO, NM]	Silver Total Recoverable in Water as Ag (μg/l) [CO]
Fecal Coliforms Membr Filter M-fc 0.7 μm [CO, NM]	Solids Susp.-residue on Evap. At 180ºC (mg/l) [UT]

Table 3.3-1 (continued)
The Chemical Parameters Regulated along River Reaches
Potentially Affected by the Project

Hardness Ca Mg Calculated (mg/l as CaCO3) [CO, NM, UT]	Sulfate Dissolved (mg/l as SO4) [CO]
Hardness Total (mg/l as CaCO3) [CO, NM, UT]	Sulfide Dissolved (mg/l as S) [CO, UT]
Iron Dissolved (μg/l as Fe) [CO, UT]	Temperature Water (ºC) [CO, NM, UT]
Iron Total (μg/l as Fe)	Zinc Dissolved (μg/l as Zn) [CO, NM, UT]
Iron Total Recoverable in Water as Fe (μg/l) [CO]	Zinc Total (μg/l as Zn)
Lead Dissolved (μg/l as Pb) [CO, NM, UT]	Zinc Total Recoverable in Water as Zn (μg/l)
States for which parameter is regulated are shown in brackets	

3.3.2.1.3 Sites with Water Quality Measurements

The water quality sites were selected based on those segments of the river network affected by the alternatives analyzed. Details on the location of these sampling sites are included in Technical Appendix 3.

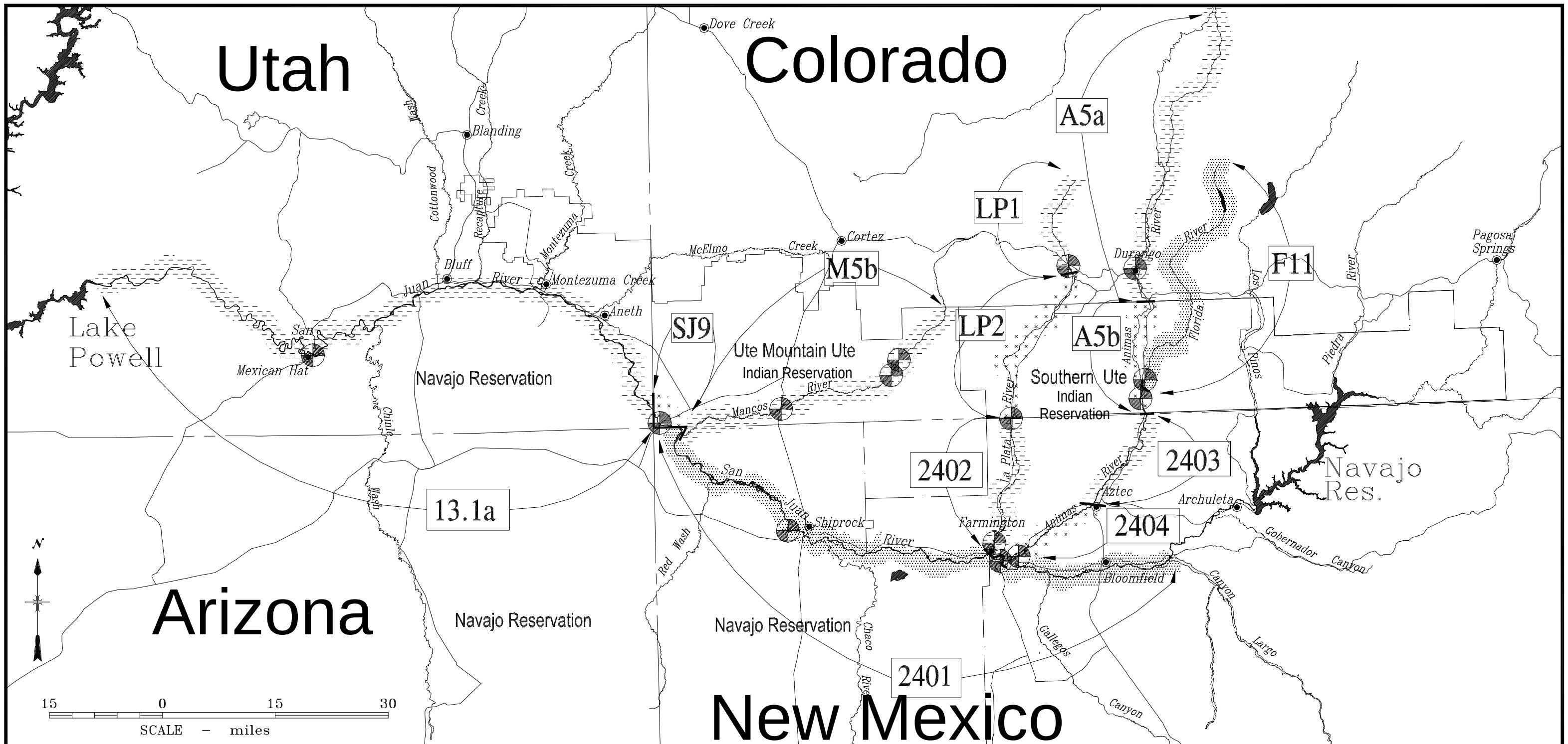
About 99 percent of the water quality data reported in STORET were collected by the USGS during the period 1960-1990. Reclamation started collecting water quality data in 1989 and continues to do so. A full summary of data collected through 1995 appears in Appendix B of the 1996 FSFES. The BIA started collecting water quality data in 1994 and that work is continuing. The available compliance monitoring data for the City of Farmington under its National Pollution Discharge Elimination System (NPDES) Permit was also included in the compilation (EPA 1999). These sites were used to extract a subset from the combined STORET-Reclamation-BIA water quality database consisting of the parameters listed in the Table 3.3-1.

3.3.2.1.4 Historic Streamflow Data

The historic streamflow data in the San Juan River Basin were extracted from the USGS hydrologic record for gages (Hydrosphere 1999 and USGS 1999) to match both the location and time period of water quality sampling. The USGS stations included in this extracted streamflow database are shown on Figure 3.3-1.

3.3.2.1.5 Streamflow Data from the San Juan River Hydrology Model

After the project configuration and the reservoir size were established in the San Juan River Hydrology Model, the calculated flows were selected at suitable nodes. Only the nodes where project-related water would be diverted or returned to the river system were included in the selection process. The nodes or objects extracted from the model output for use in the water quality calculations are listed in Technical Appendix 3.



State Defined River Reaches

5a - River Reach

River	Reach	Description	River	Reach	Description	River	Reach	Description
Colorado			**New Mexico**			**Utah**		
Animas	A5a	Source to S.Ute boundary	San Juan	2401	Blanco,NM to Stateline	San Juan	13.1a	Stateline to Lake Powell
Animas	A5b	S.Ute boundary to St-line	La Plata	2402	Stateline to San Juan Conf			
Florida	F11	Source to Animas Confl.	Animas	2403	Stateline to Aztec,NM			
La Plata	LP1	Source to Hay Gulch Div.	Animas	2404	Aztec,NM to San Juan Conf			
La Plata	LP2	Hay Gulch Div. to Stateline						
San Juan	SJ9	Main stem in Montezuma County						
Mancos	M5b	Ute Mtn Ute bound to San Juan Conf						

USGS Gaging Stations

Figure 3.3-1 State Water Quality Regulatory Stream Reaches

3.3.2.2 Significance Criteria

According to each state's regulations, the significance of impacts on surface water quality must be based on the number of exceedences for that parameter. In this FSEIS, the criteria were used in each river segment to recalculate exceedences under Refined Alternative 4 and to show the changes relative to the concentrations measured in the past. The same criteria are used for assessing impacts of Revised Alternative 6, but the impacts were not modeled at the same level of detail.

The exceedence criteria for each state are divided into chronic and acute standards based on the exposure time that aquatic wildlife experience. The chronic standard is often expressed as a four-day average and the acute standard as a one-hour average. Few of the observed water measurements in the STORET-Reclamation-BIA database were averaged over time, nor were they collected on four consecutive days to separate the measurements into chronic or acute exposures. Hence, the measurements were taken individually and each tested on the chronic and the acute basis. Standards for each state contain wording that the acute standards should not be exceeded more often than once in every three years. The Colorado and Utah standards specifically state that the occurrence frequency is to be the average occurrence. For a long period of record, there could be several occurrences in any one three-year period if there were other periods with no occurrences, such that the average was less than one occurrence in three years. The New Mexico standard would require a strict interpretation whereby two exceedences in any consecutive three-year period would violate the standard. This strict interpretation applies if four-day average data are available. Historical data are typically reported only as a single event and rarely, if ever, are there four consecutive daily values. In this circumstance, applying the frequency criteria as an average over the period of record is allowable. Therefore, the implication would be that an occasional exceedence would not be deemed significant if the average frequency was less than one occurrence in three years.

3.3.3 Affected Environment

The environment affected by the alternatives analyzed consists of the Animas, La Plata, Florida, Mancos, and San Juan Rivers. Changes in water quality would be downstream of any components located on these rivers. Nonstructural components could also affect water quality in the Pine River in addition to these rivers. Water quality changes in area groundwater could occur from reservoir seepage, irrigation return flows, and M&I return flow.

Due to the surface water interconnections, the area potentially affected by the project consists of a broad region within the San Juan River Basin system. Diversion and return flow points are the locations where water quality changes could occur on any river or stream. Diversions do not change the concentration of any chemical constituent, but the mass loading or amount of the constituent is changed. From each location, changes in water quality could spread downstream. Changes in the Animas, La Plata, Pine, Florida and Mancos Rivers would ultimately accumulate within the San Juan River. The project's net effect on the water quality would be the effect of removing 57,100 afy of the approximately 1.25 million afy recorded at the Bluff gage, plus the effect of additional leaching into the area's groundwater and return flow concentrations based on the proposed uses.

3.3.3.1 Animas River

Water quality in the Animas River is generally affected by trace metals from historical mining activities in the headwaters, by naturally occurring minerals in various reaches, and by depletions for M&I uses and irrigation in the lower sections. For the Animas River, the trace metal content tends to diminish as the water flows downstream and the metals partition to bed sediments (Church et al. 1997). %

Based on the water quality measurements found in the combined STORET-Reclamation-BIA water quality database, there are eight constituents in Colorado and six in New Mexico that periodically exceed the standards. For mercury, there are 100 historic exceedences in Colorado and 31 in New Mexico. For selenium there are 43 exceedences in New Mexico. The trace metals arsenic, cadmium, copper, iron, manganese, silver and zinc show exceedences in Colorado. Cadmium, copper, lead, and aluminum showed historic exceedences in New Mexico.

There is currently underway an extensive cleanup of mine wastes and discharges in the upper Animas River Basin. This cleanup would improve the water quality of the Animas River over the historic values reported and decrease the base against which impact is assessed. The future water quality would likely be better than projected.

3.3.3.2 San Juan River

The water quality of the San Juan River steadily decreases moving downstream. For example, the salt content continually increases going downstream from Navajo Reservoir to Mexican Hat. This happens as the San Juan River collects water from the Animas, La Plata, and Mancos Rivers and from numerous smaller intermittent streams and washes. Irrigation and M&I depletions along the river also impact the water quality. The water quality can also fluctuate quickly due to storm runoff from these small streams and washes.

Based on the water quality measurements found in the combined STORET-Reclamation-BIA water quality database, there are a number of constituents in New Mexico and Utah that periodically exceed the standards. Above Farmington, New Mexico, there are a few historic exceedences in the San Juan River for aluminum, mercury, selenium, cadmium and lead. The number of exceedences increases between Farmington and Shiprock, New Mexico, including several for copper and zinc. At Four Corners, New Mexico, the number of exceedences decreases and then increases again at Mexican Hat (near Bluff), Utah. According to Utah regulations, there are exceedences in nutrients and total suspended solids.

These historic values could be slightly affected by the operation of Navajo Dam for endangered fish. The timing of releases to produce reduced base flow and increased spring runoff would result in the winter flows containing a higher percentage of return flows in the lower reaches. Higher summer base flows reduce the portion of return flows for a potential improvement in water quality in these post-runoff months. However, measurements over the last seven years of modified flows have not detected a measurable change in water quality due to this change in flow regime.

3.3.3.3 Pine River

The water quality of the Pine River is not affected by mining activities as are most of the other rivers. There are some irrigation and M&I return flows in the lower river system which account for an increase in constituent concentration of about 28 percent, but the source water quality is so high that the resulting outflow quality is still very good. Since none of the structural or non-structural elements of either Refined Alternative 4 or 6 negatively impact this system, the water quality has not been analyzed against state standards.

3.3.3.4 Mancos River

Water quality in the Mancos River is poor, with elevated levels of trace metals from mining in the headwaters, leaching from the Mancos shale that underlies the river basin, and irrigation return flows.

Salinity and selenium concentrations are high in the lower portion of the basin. Colorado regulations are not as strict for this portion of the Mancos River as for other rivers, so there are only a few exceedences in dissolved oxygen, pH, and selenium. Mercury concentrations are often exceeded.

3.3.3.5 La Plata River

The La Plata River has been heavily impacted by historical mining activities and agricultural development. During the summer season, flows in the lower river are principally irrigation return flows. In the Colorado portion of the river, there are historic exceedences for copper, mercury, manganese, silver, and zinc. In the New Mexico segment of the river, the number of exceedences for mercury increases. For the remaining metals, the number of exceedences drops to just several or none. Selenium standards are exceeded about 25 percent of the time per New Mexico standards which are stricter than Colorado's regulations.

3.3.3.6 Florida River

The origin of the Florida River is from snow melt in the San Juan Mountains, similar to that of the Pine River. However, the drainage area is smaller and the mean elevation is somewhat lower than the Pine River Drainage Basin. Water is stored in the Lemon Reservoir high in the system. No water quality measurements could be located for the reservoir water, but the water quality is assumed to be excellent above Lemon Reservoir. Few water quality measurements were found in the combined STORET-Reclamation-BIA water quality database for the Florida River. Although there are irrigated lands in the lower Florida River, the water quality appears to be good.

3.3.4 Environmental Consequences and Mitigation

The following sections discuss potential impacts to water quality of Refined Alternative 4 and Refined Alternative 6. No Action Alternative impacts are also included as presented in the 1996 FSFES. In addition, mitigation measures are proposed to reduce or eliminate potential impacts to water quality.

3.3.4.1 Refined Alternative 4

Water quality under Refined Alternative 4 would be changed in the lower San Juan River Basin including: (1) the Animas River below the proposed Durango Pumping Plant to its mouth, (2) the San Juan River from Bloomfield to Lake Powell, (3) the La Plata River within New Mexico, and (4) the lower Mancos River.

The water quality of the Animas River would be impacted beginning at the Durango Pumping Plant downstream of the City of Durango. Any releases from the reservoir, M&I return flows from Durango, and M&I returns via the Florida River would affect downstream water quality in the Animas River. Further diversions and return flow between Aztec and Farmington, New Mexico would propagate changes downstream in the Animas River and into the San Juan River below its confluence with the Animas River.

Refined Alternative 4 would import Ridges Basin water into the La Plata River Basin for the various non-binding uses. The return flow from the uses would impact the water quality in downstream segments of the La Plata River. Ultimately the impacts would pass into the San Juan River.

Animas River water delivered to the Mancos River to meet the non-binding uses in that drainage would affect water quality in the lower reaches of the Mancos River. These impacts would also be carried downstream to the San Juan River.

Impacts include temporary impacts during construction and sustained impacts due to operation.

The non-structural components would have no impact on water quality, since there is no change in use.

3.3.4.1.1 Structural Component with Delivery to Non-Binding Uses

Refined Alternative 4 Water Quality Impact 1 – Potentially Significant: Construction of the proposed Durango Pumping Plant and new gas pipelines, associated with the relocation and realignment of gas pipelines in Ridges Basin, could result in temporary increases in suspended sediment loads in the Animas River.

Construction of the proposed Durango Pumping Plant and its intake bays would temporarily disturb the bank material, which could increase the suspended load in the Animas River. In addition, groundwater removed during construction dewatering would need disposal. Based on existing data and anticipated dewatering rates, discharge is not expected to cause exceedence of any regulated parameter (1996 FSFES). However, if the dewatering rates are higher or the water quality lower, treatment of the groundwater may be needed prior to discharge.

In anticipation of the need to relocate existing gas pipelines aligned around the Ridges Basin area, Reclamation performed an "Alternative Route Analysis for Gas Pipeline Relocations in Ridges Basin" (see Volume 2, Attachment K). Alternative pipeline alignments have been considered by Reclamation. Some of these, if selected, would involve crossing the Animas River south of Durango (Attachment K, Figure 1). Pipeline construction at these crossings could temporarily disturb the banks and bottom sediments, contributing to the suspended sediment loads to the Animas River.

Mitigation measures for Refined Alternative 4 Water Quality Impact 1 are discussed following Water Quality Impact 3 below.

Refined Alternative 4 Water Quality Impact 2 – Potentially Significant: Construction of the NNMP could temporarily increase suspended sediment loads in the San Juan River.

Installation of siphons across the San Juan River at Farmington and near Shiprock for the NNMP could temporarily increase the suspended sediment loads contributed by soil disturbing activities and bank erosion.

Mitigation measures for Refined Alternative 4 Water Quality Impact 2 are discussed following Water Quality Impact 3 below.

Refined Alternative 4 Water Quality Impact 3 – Potentially Significant: Construction of the Ridges Basin Dam and outlet structure could temporarily increase sediment loads in Basin Creek.

Construction of Ridges Basin Dam, reservoir and outlet structures and stabilization of the stream channel could temporarily increase the suspended sediment loads in Basin Creek and subsequently in the Animas River during construction. The channel regrading and stabilization should prevent an increased sediment load to the Animas River after initial stabilization with no significant impact during operation.

Mitigation for Refined Alternative 4 Water Quality Impacts 1, 2, and 3: Implement a program to reduce, minimize or eliminate temporary, short-term increases in suspended sediment loading or other water quality constituents, potentially caused by project construction, through the incorporation of permits, Best Management Practices (BMPs), and sediment control structures.

The significance of these impacts would be reduced to less than significant through the following measures:

- ❏ Reclamation or the contractor would be required to obtain discharge permits from the appropriate regulatory agency. If more than five acres of land were disturbed, a storm water permit would be obtained.
- ❏ BMPs and construction schedule techniques would be implemented to minimize adverse water quality impacts.
- ❏ Measures would be implemented to time construction activities to coincide with periods of low flow, and measures to capture sediment would be employed.
- ❏ The duration of placement of fill materials would be minimized to as short a period of time as practicable to reduce the duration of turbidity.
- ❏ Gas pipelines crossing the Animas River would be directionally drilled. %
- ❏ Temporary cofferdams/berms would be used to contain fine materials and placement of fill material during periods of low water flows in Basin Creek and the Animas River.
- ❏ Stockpiles of fill materials would be placed above ordinary high water marks and protected by measures to prevent erosion of those materials into the waters of the United States.
- ❏ Silt screens or other appropriate methods would be used in Basin Creek, the Animas River, and the pipeline crossing at the San Juan River to confine suspended particulates and turbidity to small areas where settling or removal can occur.
- ❏ The Durango Pumping Plant would be designed to allow for the continued unrestricted movement of groundwater on the site. Groundwater levels and quality are also being monitored at a series of wells on the site as agreed with the Department of Energy (DOE) and the State of Colorado in conjunction with Reclamation's restricted use plan for the site.
- ❏ Reclamation or the contractor for Durango Pumping Plant would be required to secure a discharge permit from the appropriate regulatory entity in the Colorado Department of Health for construction activities at the site. In addition, because the site is a former Uranium Mill Tailings Remedial Action Site, regular monitoring of the water removed during dewatering operations would be required. Also, Reclamation would require the contractor to prepare and implement, if necessary, a contingency plan for treating the water removed during excavation in the event that groundwater contamination levels exceed anticipated limits.
- ❏ Reclamation would comply with applicable state water quality standards under Section 313 of the Clean Water Act. Overall, the project is designed to comply with Sections 401, 402, and 404 of the Clean Water Act.

These measures would reduce the sediment entering the streams and minimize the amount of groundwater from dewatering entering the Animas River during construction activities.

Refined Alternative 4 Water Quality Impact 4 – Less than Significant: Filling Ridges Basin Reservoir, and operational releases from the reservoir would alter the concentration of water quality parameters in both the reservoir and the receiving streams (i.e., the Animas, La Plata and Mancos Rivers).

The proposed Ridges Basin Reservoir was modeled using the Tennessee Valley Authority's (TVA) Box Exchange Transport Temperature and Ecology of a Reservoir (BETTER) water quality simulation model. For periods of stratification, temperature, dissolved oxygen, nutrients (nitrogen and phosphorous), and algae biomass were estimated for three representative hydrologic conditions (dry, average, and wet years) that would be experienced by the reservoir. The chemistry of the reservoir was modeled using the Environmental Protection Agency's (EPA), Metal Specification Equilibrium Model for Surface and Ground Water (MINTEQA2), Version 3.11. The parameter concentration in the pumped inflow to the reservoir was based on the water quality data at four stations just upstream of the pumping plant location on the Animas River. The water quality of the reservoir would be influenced by the chemical conditions of the Animas River when filling and the development of chemical equilibrium during reservoir operation. Results of these modeling efforts appear in Technical Appendix 3.

During the first few years, Ridges Basin Reservoir would be filled without large withdrawals until the structural components are built. The BETTER model showed that after the first year, nutrient recycling was minimal under all precipitation and evaporation scenarios tested for a static reservoir without withdrawals. Similarly, no phase or chemical changes, other than iron and manganese precipitation, were found using MINTEQA2 with up to 20 percent evaporation losses from the static reservoir. The change in the concentration of selenium from the soils during reservoir filling would be undetectable.

For the fully operational reservoir with full project demands, BETTER was used to model the nutrient recycling, temperature structure and, oxygen concentrations. Chemical equilibrium modeling of the reservoir under all temperature and oxygen conditions showed that the trace elements, except for iron and manganese, would remain in solution. Among the parameters of most concern are selenium and mercury. Chemical equilibrium modeling of the selenium in the pumped inflow showed that selenium would neither change chemical forms nor be removed from solution during reservoir operation. At equilibrium, the selenium concentration in the reservoir would approach the average value, 1.2 μg/l, of measurements taken in the Animas River at Durango. Similarly at equilibrium, the total mercury concentration would be about 0.16 μg/l.

The implication of mercury concentration in Ridges Basin Reservoir was discussed in Appendix B of the 1996 FSFES. The conclusion at the time was that resultant mercury concentrations in fish in the reservoir would be similar to that in Ridgway Reservoir on the Uncompaghre River with a maximum concentration in fish of 0.2 mg/kg. The Uncompaghre River was described as having similar water quality to that of the Animas River.

Inflow mercury concentrations are lower for Ridges Basin Reservoir than for McPhee Reservoir. In addition, removal of vegetation from the basin and the low nutrient loading would reduce the potential for methylation of mercury relative to McPhee Reservoir by reducing the carbon source for methylating bacteria. Therefore, the mercury concentration in fish taken from Ridges Basin Reservoir would likely be lower than in those from McPhee Reservoir.

Recent data on mercury levels in fish taken from Farmington Reservoir indicated levels similar to those in McPhee Reservoir. Although Farmington Reservoir receives its water supply from the Animas River, the inflow point is much lower in the system than that proposed for Ridges Basin Reservoir. There is substantial irrigation return flow above this point, increasing the nutrient load. Farmington Reservoir is algae rich, unlike projections for Ridges Basin Reservoir, providing ample carbon source for methylating bacteria. Mercury levels in fish in Ridges Basin Reservoir are, therefore, not expected to be as high as those in fish from Farmington Reservoir. None of the recent data contradict the conclusions in the 1996 FSFES.

There is also some potential for bio-accumulation of selenium in Ridges Basin Reservoir. Given the inflow water quality and the conditions in the reservoir, selenium levels in fish would be expected to be similar to the levels in fish in the San Juan River below Farmington, which average about 4.0 mg/kg dry weight.

Other impacts to the reservoir would come from return flows from the resort located in the reservoir drainage area. These could include fertilizer nutrients and herbicides from the golf course. Given the small area of the golf course and typical quantities of fertilizer used, it would not be possible for this impact to be measurable. Pesticide impact is also expected to be negligible based on the results of testing completed in the San Juan River where historic pesticide use has been much greater than the use would be for the golf course, with no associated concerns in the reservoir.

The temperature of the water leaving the reservoir could affect the temperature of the Animas River below Basin Creek. During the summer the water temperature in the Animas River below Basin Creek could be cooled by as much as 2.2º C during the lowest flow periods.

The main impact of the Ridges Basin Reservoir and operation to deliver water to the non-binding uses would be on the water quality of the receiving streams. Depending on (1) the flow regime and current water quality of the stream and (2) the amount and timing of the water conveyed, the impact could degrade or improve water quality of the receiving stream. The water quality calculations were carried out as if all trace metals pumped into the reservoir from the Animas River remained in the reservoir water and would be discharged at the average concentration of the inflow water over the period of record. The water was then distributed to the various parts of the project and the impact was calculated to each stream.

Under Refined Alternative 4, permanent impacts to water quality in the river reaches would occur within the following development regions: pumping into and releases from Ridges Basin Reservoir, M&I return flows from the City of Durango, the Florida Mesa and the Animas River housing unit. The M&I return flows are assumed to be treated with the usual wastewater processes and would re-enter the river system as surface return flows. Data from Farmington treatment plant discharge does not indicate elevated levels of the regulated elements beyond that expected by depletion. Therefore, these return flows were assumed to enter the river system at a concentration increased solely by depletion. Further, typical sewage treatment plant discharge does not customarily have large increases in water quality parameter concentrations since the depletion of the portion of the water returning through the treatment plant is low. While the concentrating effect of depletion is less than projected for treatment plant discharge, it is likely greater than that computed for return flow from M&I outdoor use that returns through the groundwater system. To be consistent with the assumption that 50 percent of the diversion is depleted, the average concentration of return flow from all M&I uses must be about twice that of the supply water.

The regional water supplies would be conveyed throughout diffuse areas and some of the return flow would enter the shallow groundwater. Since there is a lack of information about the locations of use and the composition of the shallow groundwater in both the Durango and Florida regions, the changes in the water quality of the return flow in those areas are unknown. In the La Plata region there are shallow groundwater quality data (1996 FSFES, Appendix B) which show that concentrations of most parameters are near the detection limits. Hence, the composition of groundwater return flow was assumed unchanged from the water conveyed from Ridges Basin Reservoir, except for the concentrating effect of water depletion.

Table 3.3-2 presents the observed and expected concentrations of key water quality parameters in the Colorado portion of the Animas River. The average values have been flow-weighted. Only the parameters which show exceedence of state standards are presented. These calculations showed that the exceedences for cadmium, copper and iron would increase by one or two occurrences in a 40-year sampling period. Under state stream standards, levels would not be exceeded more than once every three years on the average. Exceedences for manganese and silver would drop. Exceedences for selenium would not change. Any change in mercury exceedences was indeterminate due to the standard being below the detection limit. Average concentrations of regulated parameters would increase less than 10 percent; most by no more than 5 percent, which would likely not be measurable.

In the New Mexico portion of the Animas River (see **Table 3.3-3**), one more exceedence of phosphorus, five more exceedences of selenium, four more exceedences of cadmium, and two more exceedences of lead were identified over a 45-year sampling period. Under New Mexico stream standards, concentrations would not to be exceeded more than once every three years. Therefore, the increase in these exceedences would not be significant. Average concentrations of regulated parameters would increase less than 10 percent; and most by no more than 5 percent, which would likely not be measurable.

Table 3.3-4 presents the observed and expected concentrations of key water quality parameters in the La Plata River in New Mexico (the potentially affected portion of the river). The return flow from the non-binding uses in the La Plata drainage would enter the La Plata River at or near the Colorado/New Mexico state line. Changes in the mean concentrations for all regulated parameters would be less than 10 percent. Some increased average concentrations would probably be measurable for mercury, selenium, silver, copper and zinc. The average concentrations for cadmium and chromium would decrease. The number of exceedences for selenium, copper, and zinc would decrease. There would be no increases in exceedences for any other parameters. Any changes in exceedences for mercury would be indeterminate due to the standard concentrations being less than the detection limit.

An increase in average concentration and a decrease in exceedences may seem counter-intuitive, but it is actually the case for selenium, copper and zinc. The average goes up because the average concentration in the return flow from Ridges Basin Reservoir water is higher than the average in the stream and the return flow volumes are relatively large (over a 50 percent increase in flow at Farmington). The number of exceedences goes down because Ridges Basin Reservoir averages inflow water quality and removes the high concentration events, providing a diluting effect during high concentration events in the La Plata River.

Table 3.3-2
Water Quality Parameters Affected by Refined Alternative 4 for Colorado Portion of the Animas River

Parameter	Number of Observations	Average for 9 Sites		Total Exceedence for 9 Sites	
		Observed	Calculated for Refined Alternative 4	Observed	Calculated for Refined Alternative 4
Arsenic (chronic) dissolved - μg/l	495	28.8	29.9	2	2
Cadmium (chronic) dissolved - μg/l	255	0.31	0.33	3	5
Copper (chronic) dissolved - μg/l	492	6.8	7.0	5	7
Fecal Coliform - number/100 ml	11	91	91	2	2
Iron (acute) total - μg/l	257	1,482	1,511	1	1
Iron (chronic) total - μg/l	344	1,482	1,511	28	29
Lead (chronic) dissolved - μg/l	243	6.0	6.2	4	4
Manganese (chronic) dissolved - μg/l	756(263)[a]	117.1	118.5	493	427
Mercury (chronic) total - μg/l	582(482)[a]	0.23	0.24	100	100
Oxygen dissolved - mg/l[b]	31	9.02	9.02	6	6
pH - standard units[b]	908	7.78	7.78	21	21
Silver (chronic) dissolved - μg/l	487	0.16	0.17	3	2
Specific Conductance - μmhos/cm	1,498	445	457	-	-
Sulfate - mg/l	1,094	66.8	67.7	1	1
Temperature - °C[b]	557	10.3	10.3	-	-
Zinc (chronic) dissolved - μg/l	489	32.1	33.2	2	2
Zinc (acute) dissolved - μg/l	489	32.1	33.2	2	2

[a]Value in parentheses is the number of observations below detection limit.
[b]Changes in these parameter values were not modeled so the observed and calculated values are the same.

Table 3.3-3
Water Quality Parameters Affected by Refined Alternative 4 for New Mexico Portion of the Animas River

Parameter	Number of Observations	Average for 4 Sites		Total Exceedence for 4 Sites	
		Observed	Calculated for Refined Alternative 4	Observed	Calculated for Refined Alternative 4
Aluminum (acute) dissolved - µg/l	113	48.4	48.4	2	2
Aluminum (chronic) dissolved - µg/l	113	48.4	48.4	9	9
Cadmium (chronic) dissolved - µg/l	74(66)[a]	1.6	1.7	5	9
Copper (chronic) dissolved - µg/l	252(243)[b]	4.3	4.4	4	4
Fecal Coliform - number/100 ml[c]	124	443	443	19	19
Lead (chronic) dissolved - µg/l	231(174)[a]	1.6	1.7	6	8
Mercury (acute) total - µg/l	314(283)[b]	0.16	0.17	1	1
Mercury (chronic) total - µg/l	314(283)[b]	0.16	0.17	31	31
pH - standard units[c]	1,053	7.76	7.76	20	20
Phosphorus - mg/l	35	0.09	0.09	4	5
Selenium (chronic) total recoverable - µg/l	351	1.0	1.0	43	48
Specific Conductance - µmhos/cm	952	549	563	-	-
Temperature - °C[c]	189	11.9	11.9	9	9

[a]Value in parenthesis is the number of observations used in exceedence calculation. Insufficient information was available for the other data points to complete the exceedence calculations.
[b]Value in parentheses is the number of observations below detection limit.
[c]Changes in these parameter values were not modeled so the observed and calculated values are the same.

Table 3.3-4 Water Quality Parameters Affected by Refined Alternative 4 for New Mexico Portion of the La Plata River					
		Average for 6 Sites		Total Exceedence for 6 Sites	
Parameter	Number of Observations	Observed	Calculated for Refined Alternative 4	Observed	Calculated for Refined Alternative 4
Beryllium (chronic) dissolved - µg/l	15	3.0	3.0	1	1
Cadmium (chronic) dissolved - µg/l	14(14)	1.4	1.3	1	1
Copper (acute) dissolved - µg/l	237(236)[a]	3.4	4.3	1	0
Copper (chronic) dissolved - µg/l	237(236)[a]	3.4	4.3	2	0
Fecal Coliform - number/100 ml[b]	56	528	528	7	7
Lead (chronic) dissolved - µg/l	162(80)[a]	2.4	3.1	1	1
Mercury (chronic) total - µg/l	325(294)[c]	0.14	0.18	31	31
Mercury (acute) total - µg/l	325(294)[c]	0.14	0.18	2	0
pH - standard units[b]	395	7.87	7.87	3	3
Selenium (chronic) total recoverable - µg/l	225	0.9	1.1	54	41
Specific Conductance - µmhos/cm	328	1,674	1,611	-	-
Temperature - °C[b]	152	9.3	9.3	1	1
Zinc (chronic) dissolved - µg/l	324(240)[a]	6.2	16.7	1	0

[a]Value in parenthesis is the number of observations used in exceedence calculation. Insufficient information was available for the other data points to complete the exceedence calculations.
[b]Changes in these parameter values were not modeled so the observed and calculated values are the same.
[c]Value in parentheses is the number of observations below detection limit.

Permanent impacts to water quality in the lower portion of the Mancos River would arise from the return flow from the Mancos Canyon golf course and resort. The return flow from the resort was assumed to undergo the usual water treatment processes for M&I waste water and would re-enter the river system as surface return flow. Deep percolation from irrigation of the golf course would enter the shallow groundwater system and leach some constituents from the underlying soils. Since this deep percolation would be a major part of the return flow, the concentration increases were taken into account in the water quality calculation. **Table 3.3-5** presents the observed and expected concentrations and exceedence values for key water quality parameters in the Mancos River below the resort. There were no increases, but some decreases in the mean concentrations of the regulated parameters in the Mancos River downstream of the resort. Nutrient and herbicide concentrations might increase downstream of the golf course, but there were no data on these constituents nor are they part of the regulated parameters. In a situation similar to that of the Ridges Basin golf course, these impacts are likely too small to be detectable.

Table 3.3-5
Water Quality Parameters Affected by Refined Alternative 4 for Mancos River

Parameter	Number of Observations	Average for 8 Sites		Total Exceedence 8 Sites	
		Observed	Calculated for Refined Alternative 4	Observed	Calculated for Refined Alternative 4
Fecal Coliform - number/100 ml[a]	4	215	215	-	-
Mercury (chronic) total - μg/l	158(118)[b]	0.20	0.20	40	40
Oxygen dissolved - mg/l	131	8.86	8.86	2	2
pH - standard units[a]	263	7.9	7.9	6	6
Selenium (chronic) dissolved - μg/l	92	2.8	2.9	2	2
Specific Conductance - μmhos/cm	417	1,406	1,399	-	-
Temperature - °C[a]	61	12.1	12.1	-	-

[a]Changes in these parameter values were not modeled so the observed and calculated values are the same.
[b]Value in parentheses is the number of observations below detection limit.

None of the predicted increases in contaminant levels exceed state standards. The impact is less than significant.

% **Mitigation for Refined Alternative 4 Water Quality Impact 4: Potential impacts to water quality**
% **associated with the filling of Ridges Basin could be mitigated through development and**
% **implementation of a water quality monitoring program in the Animas River from the Durango**
% **Pumping Plant to the confluence with the San Juan River. Such a program would be developed to**
% **monitor compliance with the water quality standards and criteria of the Southern Ute Indian**
% **Tribe and states of Colorado and New Mexico. Also see mitigation for Refined Alternative 4**
% **Aquatic Resources Impact 3, in Section 3.6.4.1 of the Aquatic Resources section.**

Refined Alternative 4 Water Quality Impact 5 - Less than Significant: Refined Alternative 4 would contribute to the present increase in concentration of trace metals in the San Juan River between Farmington, New Mexico and Mexican Hat (near Bluff), Utah.

Under Refined Alternative 4, permanent impacts to water quality in this reach of the San Juan River would arise from the Animas River and its regional return flows (including the Florida River), from the La Plata River and its regional return flows, and from the Mancos River. Hence, any changes in concentrations of the various trace elements present in each return flow would propagate into the San Juan River. Although on the average the changes would be small, there could be selective increases in the late summer, in early fall months, or during low-flow years which might increase the number of exceedences. These conditions are all represented in this impact analysis.

At Farmington, New Mexico, there would be some measurable increases in average concentrations (see **Table 3.3-6**). There would be no increase in exceedences from the impact of the Bloomfield and the Animas River regional return flows.

Between Farmington and Shiprock, New Mexico, there would be some measurable increases in average concentrations (see **Table 3.3-7**). There would be no increase in exceedences from the impact of the La Plata River regional return flows.

Between Shiprock and Four Corners, New Mexico, there would be some measurable increases in average concentrations (see **Table 3.3-8**). There would be an increase of one exceedence for cadmium from the impact of the Mancos River regional return flows, but the state criteria would not be violated. No additional exceedences are predicted for other regulated parameters.

Between Four Corners, New Mexico and Mexican Hat, Utah, there would be a small increase in the average concentration of some parameters (see **Table 3.3-9**). There would be an increase of one exceedence for cadmium from the upstream impacts, but the state criteria would not be violated. No additional exceedences would be predicted for other regulated parameters.

Under Refined Alternative 4, permanent impacts to water quality in the San Juan River would be small. The change in the mean concentration of all regulated parameters would be less than five percent, except for cadmium or iron in specific river reaches. Along the entire river reach, there would be only one increase in any exceedence (cadmium) in the Four Corners segment during a 50-year sampling period. These impacts would be less than significant.

Mitigation for Refined Alternative 4 Water Quality Impact 5: No mitigation is proposed.

3.3.4.1.2 Non-Binding End Uses and Water Conveyance Systems

Refined Alternative 4 Water Quality Impact 6 – Potentially Significant: Erosion and sediment discharge during construction of end use water conveyance pipelines could increase suspended sediment loads in the Animas, La Plata, and Mancos Rivers.

Installation of siphons across the Animas, La Plata and Mancos Rivers and minor tributaries could temporarily increase the suspended sediment loads. These impacts would be expected only at the stream crossings and not along the entire pipeline routes.

Table 3.3-6
Water Quality Parameters Affected by Refined Alternative 4 for San Juan River at Farmington, New Mexico

Parameter	Number of Observations	Average for 1 Site: Observed	Average for 1 Site: Calculated for Refined Alternative 4	Total Exceedence for 1 Site: Observed	Total Exceedence for 1 Site: Calculated for Refined Alternative 4
Aluminum (chronic) dissolved - µg/l	34	33.2	33.2	5	5
Cadmium (chronic) dissolved - µg/l	11(11)[a]	0.76	0.84	1	1
Fecal Coliform - number/100 ml[b]	94	10,466	10,466	58	58
Lead (chronic) dissolved - µg/l	67(37)[a]	0.8	0.8	1	1
Mercury (chronic) total - µg/l	78(70)[c]	0.12	0.12	8	8
pH - standard units[b]	939	7.95	7.95	4	4
Selenium (chronic) total recoverable - µg/l	76	0.5	0.6	3	3
Specific Conductance - µmhos/cm	905	550	555	-	-
Temperature - °C[b]	60	11.5	11.5	0	0

[a]Value in parenthesis is the number of observations used in exceedence calculation. Insufficient information was available for the other data points to complete the exceedence calculations.
[b]Changes in these parameter values were not modeled so the observed and calculated values are the same.
[c]Value in parentheses is the number of observations below detection limit.

Table 3.3-7
Water Quality Parameters Affected by Refined Alternative 4 for San Juan River at Shiprock, New Mexico

Parameter	Number of Observations	Average for 3 Sites: Observed	Average for 3 Sites: Calculated for Refined Alternative 4	Total Exceedence for 3 Sites: Observed	Total Exceedence for 3 Sites: Calculated for Refined Alternative 4
Aluminum (acute) dissolved - µg/l	138	51.6	51.6	2	2
Aluminum (chronic) dissolved - µg/l	138	51.6	51.6	15	15
Cadmium (chronic) dissolved - µg/l	71(68)[a]	1.2	1.3	11	11
Chlordane (chronic) total - µg/l	13	0.10	0.10	13	13
Copper (chronic) dissolved - µg/l	165(162)[a]	4.4	4.5	1	1
Fecal Coliform - number/100 ml[b]	173	1,884	1,884	73	73
Lead (chronic) dissolved - µg/l	135(162)[a]	1.8	1.9	13	13
Mercury (chronic) total - µg/l	225(193)[c]	0.21	0.22	32	32
pH - standard units[b]	1,287	7.9	7.9	33	33
Selenium (chronic) total recoverable - µg/l	83	1.1	1.2	28	28
Specific Conductance - µmhos/cm	1,136	716	727	-	-
Temperature - °C[b]	227	12.7	12.7	0	0
Zinc (chronic) dissolved - µg/l	268(163)[a]	11.6	12.0	1	1

[a]Value in parenthesis is the number of observations used in exceedence calculation. Insufficient information was available for the other data points to complete the exceedence calculations.
[b]Changes in these parameter values were not modeled so the observed and calculated values are the same.
[c]Value in parentheses is the number of observations below detection limit.

Table 3.3-8
Water Quality Parameters Affected by Refined Alternative 4
for San Juan River at Four Corners, New Mexico

Parameter	Number of Observations	Average for 1 Site		Total Exceedence for 1 Site	
		Observed	Calculated for Refined Alternative 4	Observed	Calculated for Refined Alternative 4
Aluminum (acute) dissolved - µg/l	40	40.8	40.8	1	1
Aluminum (chronic) dissolved - µg/l	40	40.8	40.8	1	1
Cadmium (chronic) dissolved - µg/l	15(15)[a]	1.2	1.3	2	3
Fecal Coliform - number/100 ml[b]	23	193	193	4	4
Iron (chronic) dissolved - µg/l	13	13,404	14,340	7	7
Mercury (chronic) total - µg/l	71(64)[c]	0.14	0.15	7	7
pH - standard units[b]	167	8.15	8.15	1	1
Selenium (chronic) total recoverable - µg/l	71	1.1	1.2	10	10
Specific Conductance - µmhos/cm	112	644	651	-	-
Temperature - °C[b]	79	13.8	13.8	0	0

[a]Value in parenthesis is the number of observations used in exceedence calculation. Insufficient information was available for the other data points to complete the exceedence calculations.
[b]Changes in these parameter values were not modeled so the observed and calculated values are the same.
[c]Value in parentheses is the number of observations below detection limit.

Table 3.3-9
Water Quality Parameters Affected by Refined Alternative 4
for San Juan River between Four Corners, New Mexico and Mexican Hat, Utah

Parameter	Number of Observations	Average for 5 Sites: Observed	Average for 5 Sites: Calculated for Refined Alternative 4	Total Exceedence for 5 Sites: Observed	Total Exceedence for 5 Sites: Calculated for Refined Alternative 4
Aluminum (chronic) dissolved - µg/l	174	54.9	54.9	22	22
Aluminum (acute) dissolved - µg/l	174	54.9	54.9	3	3
Cadmium (acute) dissolved - µg/l	56(53)[a]	1.6	1.7	1	1
Cadmium (chronic) dissolved - µg/l	56(53)[a]	1.6	1.7	5	6
Fecal Coliform - number/100 ml[b]	9	625	625	-	-
Iron total - µg/l	201	4,218	4,466	18	18
Lead (chronic) dissolved - µg/l	343(198)[a]	1.6	1.6	4	4
Mercury (chronic) dissolved - µg/l	338(305)[b]	0.21	0.22	33	33
Mercury (acute) dissolved - µg/l	338(305)[b]	0.21	0.22	1	1
Nitrate nitrogen dissolved - mg/l	1,891	0.49	0.51	15	15
Oxygen dissolved - mg/l	478	8.74	8.74	9	9
pH - standard units[b]	1,607	7.82	7.82	3	3
Phosphorus total - mg/l	95	0.51	0.51	80	80
Selenium (chronic) dissolved - µg/l	349	1.2	1.2	6	6
Specific Conductance - µmhos/cm	2,020	931	947	-	-
Suspended Solids total - mg/l	283	745	771	194	197
Temperature - °C[b]	343	12.6	12.6	-	-

[a]Value in parenthesis is the number of observations used in exceedence calculation. Insufficient information was available for the other data points to complete the exceedence calculations.
[b]Changes in these parameter values were not modeled so the observed and calculated values are the same.

Mitigation for Refined Alternative 4 Water Quality Impact 6: Develop and implement a program to reduce, minimize or eliminate the temporary, short-term increases in suspended sediment loading that potentially may occur during project construction through the incorporation of BMPs and sediment control devices.

The significance of Refined Alternative 4 Water Quality Impact 6 would be reduced to less than significant through the following measures:

- ❑ BMPs and construction schedule techniques would be implemented to minimize adverse water quality impacts.

- ❑ Measures would be implemented to time construction activities to coincide with periods of low flow, and measures to capture sediment would be employed.

- ❑ The duration of placement of fill materials would be minimized to as short a period of time as practicable to reduce the duration of turbidity.

- ❑ Temporary cofferdams/berms would be used to contain fine materials and placement of fill material during periods of low water flows in the vicinity of intermittent drainages, creeks and rivers.

- ❑ Stockpiles of backfill materials would be placed above ordinary high water marks and protected by measures to prevent erosion of those materials into the waters of the United States.

- ❑ Silt screens or other appropriate methods would be used in and near intermittent drainage channels, creek beds, and river banks to confine suspended particulates and turbidity to small areas where settling or removal can occur.

- ❑ Reclamation would comply with applicable state water quality standards under Section 313 of the Clean Water Act. Overall, the project is designed to comply with Sections 401, 402, and 404 of the Clean Water Act.

3.3.4.2 Refined Alternative 6

3.3.4.2.1 Structural Component

Refined Alternative 6 Water Quality Impact 1 – Less than Significant: Enlargement of Lemon Reservoir and use of stored Florida River water would contribute to changes in concentrations of water quality parameters in the Florida and Animas River Basins.

Under this alternative, the enlargement of Lemon Reservoir would contribute only temporary changes to water quality in the reservoir. Some of the additional water would be used in the Florida River Basin and the remainder would be exported to Durango. The net effect of the M&I depletions in the Florida River Basin would be similar to the water quality effects of Refined Alternative 4. The effect of Durango using Florida River water would be a slight improvement of the water quality in the Animas River relative to Refined Alternative 4. The impacts would be less than significant.

Mitigation for Refined Alternative 6 Water Quality Impact 1: No mitigation is proposed.

3.3.4.2.2 Non-Structural Component

Under Refined Alternative 6, the M&I uses would be located in the same places and the depletions would be the same amount as under Refined Alternative 4, with the exception of 1,051 af of regional M&I use transferred from the La Plata River drainage to the McElmo Creek drainage. Hence, the salt loading in each river basin would be very similar under both alternatives. Any differences will be discussed in the following impacts. There are no impacts to water quality from purchase of irrigated land in the Florida, Animas, and Montezuma valleys with the water left on the land, so they are not listed here.

Refined Alternative 6 Water Quality Impact 2 – Beneficial: Retirement of land in the Pine River Basin and downstream use of water would improve water quality parameters in Pine River.

This transfer of water rights from the Pine River to downstream users would improve water quality in the Pine River due to reduced depletions and increased flows. There could be as much as a seven percent reduction in concentration of parameters due to this transfer. The improvement would propagate downstream through the Navajo Reservoir and as far as the confluence of the San Juan and Animas Rivers.

Mitigation for Refined Alternative 6 Water Quality Impact 2: No mitigation is proposed.

Refined Alternative 6 Water Quality Impact 3 – Less than significant: Retirement of land in the La Plata and Mancos River Basins and use of water would contribute to changes in water quality parameters.

The retirement of irrigated lands and transfer of the water for M&I uses would mean that there would be no net change in water quality parameters relative to historic conditions if efficiencies were the same and the end use did not add contaminants. The only caveat would be that the monthly flows are distributed differently. The impact would be less in these basins than with Refined Alternative 4 and, therefore, would be less than significant.

Mitigation for Refined Alternative 6 Water Quality Impact 3: No mitigation is proposed.

Refined Alternative 6 Water Quality Impact 4 – Less than significant: Operation of Navajo Dam to deliver project water would contribute to changes in water quality parameters.

The operation of Navajo Dam would be tailored to supplement available Animas River flows. Navajo Reservoir water, especially with the additional Pine River water, would tend to improve San Juan River water quality during release periods. During low releases, the water quality in the San Juan River would be no worse than under Refined Alternative 4. In downstream reaches, the reduced depletion for this alternative relative to Refined Alternative 4 would result in less water quality impacts. The impacts would be less than significant.

Mitigation for Refined Alternative 6 Water Quality Impact 4: No mitigation is proposed.

3.3.4.2.3 Non-Binding End Uses

Refined Alternative 6 Water Quality Impact 5 – Less than Significant: M&I return flows from new housing, industrial, and recreation developments in the Florida Mesa, Animas River Basin, Red Mesa, La Plata River Basin and the Mancos River Basin would contribute to changes in concentrations of water quality parameters.

Under Refined Alternative 6, permanent impacts to water quality would occur in the river reaches with these development regions. Below the return flow points in the Florida River Basin, the net effect of the M&I depletions would be similar to the water quality effects of Refined Alternative 4. On the Animas River, the water quality would improve relative to Refined Alternative 4 because the flow in the Animas River would be larger (no reservoir pumping) and the concentration of water quality parameters would be smaller. The timing of the Animas River flows would be slightly different, but water quality during low-flow periods, which are the times of likely exceedences, would be similar to historic conditions.

In the La Plata River, there would be no measurable net change in water quality parameters relative to historic conditions above the Colorado/New Mexico state line, except that the monthly flows and water quality would be distributed differently than under historic conditions. Below the state line, return flows from the off-reservation non-binding uses greatly increase flows. Flows would be substantially greater than historic flows, and similar to, but slightly less than, flows under Refined Alternative 4. These return flows are from water delivered from the San Juan River, with improved water quality over that of Ridges Basin water. Therefore, the expected water quality would likely be better than historic conditions and possibly better than for Refined Alternative 4.

Since there is no import of water into the Mancos River Basin and no net change in depletion, the water quality would be similar to historic conditions. The change in depletion pattern could have a small effect on water quality during some months, but it would be small. The water quality should be no worse than historic or Refined Alternative 4 conditions, and, therefore, less than significant.

Each alternative has a different effect on water quality within the Animas, La Plata and Mancos River Basins. However, below the Mancos confluence, the net effect of Refined Alternative 6 on San Juan River water quality is less than for Refined Alternative 4 due to the reduced net depletions. The impact is less than significant.

Mitigation for Refined Alternative 6 Water Quality Impact 5: No mitigation is proposed.

3.3.4.3 No Action Alternative

It is anticipated that if the project is not constructed, water development in the Animas, La Plata, and Mancos Rivers would eventually take place, subject to settlement of Indian water rights. It is not currently possible to identify how this water development would affect water quality in the Animas, La Plata, Mancos, and San Juan Rivers.

The La Plata and Mancos Rivers downstream from Hesperus and Mancos, Colorado, respectively, have been subjected to extreme water depletions for decades due to seasonal irrigation demands. This has resulted in extensive dewatering in much of the irrigation season. The water quality in lower portions of these rivers is now very degraded and is expected to remain that way. In addition, historical mining activities in the headwaters of the Animas, La Plata, and Mancos Rivers have been and continue to be a source of toxic metals. Water quality has been and is likely to remain relatively poor in many of the seasonally dewatered stream sections dominated by irrigation return flows or from mining activity impacts.

In the immediate future, pesticide use patterns in the project area would not be expected to change significantly (1996 FSFES, Page III-24).

3.4 VEGETATION RESOURCES

3.4.1 Introduction

This section addresses potential impacts to upland, wetland, and riparian vegetation that could result from actions associated with Refined Alternatives 4 and 6, and the No Action Alternative. Section 3.4.2 defines the Evaluation Methodology and significance criteria used for determining impacts, Section 3.4.3 describes the affected environment, Section 3.4.4 identifies potential impacts and discusses mitigation measures that would serve to reduce or eliminate anticipated impacts to vegetation resources.

3.4.2 Evaluation Methodology

This section discusses the methodology used to determine potential impacts that could result from Refined Alternatives 4 and 6. Also discussed are specific criteria that were used to determine the significance of the impacts identified. Impacts of the No Action Alternative are included as presented in the 1996 FSFES.

3.4.2.1 Methodology

This analysis was conducted using literature and database reviews and expert consultation. A number of publications on vegetative resources within the ALP Project area exist. The Colorado Division of Wildlife (CDOW) has produced a general vegetation map using 30-meter resolution satellite imagery of Colorado. Analysis of the map units provided estimates of the amounts of vegetation cover that would be lost by the inundation of Ridges Basin under Refined Alternative 4.

Because it was assumed that irrigated agricultural lands acquired under the non-structural component of Refined Alternative 4 would remain in irrigated production, it was also assumed that no impacts to vegetation would occur.

3.4.2.1.1 Structural Components

Sources of information and data on wetlands and riparian vegetation in the ALP Project study area include environmental assessment documents and background technical reports. The latter include vegetation maps of the Animas River, La Plata River, and Mancos River corridors (Reclamation 1995b). In addition, information on the vegetation cover within Ridges Basin and wetlands associated with the basin drainage systems was reviewed. The basis for concluding impacts to wetland and riparian resources is contained in these reports as well as in collateral technical reports available in referenced scientific journals.

Site visits were conducted to establish the presence or absence of wetland/riparian covers types at Ridges Basin, Basin Creek, and the proposed routing of the NNMP. The locations of existing areas of wetlands or riparian vegetation were compared to the potential footprint outline of proposed structural features to determine the potential impacts on wetlands/riparian vegetation.

3.4.2.1.2 Non-Structural Components

Site visits were conducted to establish the presence or absence of wetland/riparian cover types within the Pine and Mancos River Basins. These surveys were limited to areas that could be viewed from existing public roads, bridges, and scenic overlooks. The CDOW digital aerial photographs supplemented the information. Additional surveys were conducted along two irrigation ditches within the Pine and Mancos River Basins.

3.4.2.1.3 Non-Binding M&I Water End Uses and Distribution Systems

Reconnaissance-level site visits were conducted to establish the presence or absence of wetland/riparian covers types within the areas of the potential corridors of the non-binding water conveyance systems and the sites of potential end-uses. These surveys were limited to areas that could be viewed from existing public roads, bridges, and scenic overlooks.

3.4.2.2 Significance Criteria

Defined standards or criteria determined by United States regulatory agencies and accepted professional opinion guide the assessment of impact significance of potential effects of the ALP Project on vegetation resources. The standards applied to the assessment of impacts in this analysis are listed below. Impacts were deemed significant if they resulted in the following:

- ❑ The project would have a significant adverse effect if it would substantially diminish the cover of vegetation or the loss of individual native plant species.

- ❑ The project would have a significant adverse effect if it would result in a change in diversity of plant species, introduce new species of plants into the area, or deteriorate existing vegetation cover.

For the specific purposes of determining the effect of the ALP Project on wetlands and riparian vegetation, impacts were considered significant if the project would result in:

- ❑ Conversion of wetland/riparian vegetation to upland vegetation, or

- ❑ Loss of wetland or riparian vegetation.

3.4.3 Affected Environment

This section discusses existing vegetation resources in the areas potentially affected by Refined Alternatives 4 and 6. The actions that may take place under the No Action Alternative are not fully known at this time, and consequently, it is not possible to completely define the affected environment for that alternative. However, many of the eventual actions that may occur as a result of the No Action Alternative would likely take place within the same geographic setting as that of Refined Alternative 4.

The ALP Project area includes upland vegetation cover consisting of pinyon-juniper woodlands, with a sagebrush understory, and irrigated agricultural lands. Further south, sagebrush and high-desert grasses with sparse and scattered pinyon-juniper overstory become the dominant vegetation structure. The area also includes five major rivers (i.e., Animas, La Plata, San Juan, Pine, and Mancos), a number of important tributaries, drainage areas, open-irrigation canals, and naturally-occurring low spots containing wetlands or riparian vegetation. Such resources are protected by federal and state laws under Section 404 of the Clean Water Act, and federal guidance documents. These include Executive Orders 11988, Floodplain Management, and 11990, Protection of Wetlands. These Executive Orders require federal agencies to assess alternatives to actions that would impact floodplain and wetland functions.

3.4.3.1 Structural Components

Ridges Basin is located in the eastern Colorado Plateau semidesert province with a northern boundary in the foothills of the La Plata Mountains and a southern boundary just south of the San Juan River. The predominant upland vegetation cover type in the foothills (6,000-8,000 feet elevation) is pinyon-juniper woodland with a sagebrush understory. Elevation decreases to the south, and sagebrush and semidesert grass/shrublands become the predominant upland cover types. More detailed descriptions of the upland vegetation types occurring within the Ridges Basin area appear in the 1980 FES. A list of plants within the ALP Project area that includes both upland and riparian/wetland species appears in the ALP Definite Plan Report (Reclamation 1979). The vegetation cover along the route of the proposed NNMP in New Mexico is predominantly the native grass, sagebrush, and rabbitbrush-dominated type.

The Animas River, San Juan River, and Basin Creek would be affected by implementation of the ALP Project. Other rivers and creeks would only be affected if water from Ridges Basin Reservoir were subsequently delivered within their watersheds. The Animas River, San Juan River, and Basin Creek support riparian/wetland vegetation typical of the semiarid southwestern United States. Generally, six riparian/wetland cover types occur within a one-mile wide corridor along these drainages:

- Russian Olive and/or Tamarisk
- Cottonwood
- Willow
- Riparian Shrub
- Grass/Forb Riparian
- Emergent Wetlands

The plant species composition of these cover types varies along and among the rivers and creeks. Brief summaries of the existing riparian/wetland vegetation associated with the Animas River and Basin Creek appear in the 1996 FSFES (Pages II-54 to II-55). More detailed descriptions of the riparian/wetland plant communities associated with the Animas River and the methods used to inventory and classify these communities are in the *Animas-La Plata Project Wetland/Riparian Vegetation Communities: Classification and Inventory* (Reclamation 1995b).

A separate analysis was conducted for riparian/wetland vegetation cover types located within the construction limits of Ridges Basin Dam and Reservoir. In 1992, Reclamation identified and mapped four wetland types within the basin: open water, emergent channel, sedge/rush meadow, and cattail marsh. Although not quantified, the majority of these wetlands are created or supplemented by irrigation water. An analysis describing these wetland types in terms of vegetative composition soils, hydrology, and geology was later completed (Reclamation 1995c).

3.4.3.1.1 Ridges Basin

Grassland, sagebrush, pinyon-juniper, mountain shrub, coniferous forest, and wetlands define the major vegetation cover types on the uplands and bottomlands within Ridges Basin. Pinyon-juniper, mountain shrub, and coniferous forest cover the surrounding hillsides and ridges. Sagebrush and grasslands predominantly cover the slopes of the surrounding hills. Wetlands, grasslands, and formerly irrigated hayfields primarily cover the bottomlands.

Grassland Community

Typical vegetation of the lower zones within Ridges Basin consists of mixed grasses interspersed with various species of saltbushes. Principal plants include Indian ricegrass, alkali sacaton, fourwing saltbush, and shadscale. Various low-growth habitat shrubs such as greasewood, rabbitbrush and winterfat are common.

Sagebrush Community

Sparsely distributed clumps of big sagebrush, usually with an understory of grasses, define this vegetation type within Ridges Basin. Isolated individual stunted pinyon pine and juniper may occur on
% shallow or stony soil within this community. Major grasses include Indian rice-grass, western wheatgrass, squirreltail, and galleta.

Pinyon-Juniper Woodland Community

Pinyon pine and juniper are the codominant plant species in this community. An understory of mountain shrubs (bitterbrush, Gambel oak, serviceberry, mountain mahogany, etc.) and grasses (Indian ricegrass, wheatgrass, squirretail, etc.) is usually associated with the larger pine and juniper species.

Mountain Shrub Community

This community is characterized by an abundance of mountain browse shrubs such as Gambel oak, serviceberry, mountain mahogany, and fendlerbush. Ponderosa pine and juniper often occur on wind-protected sites within the surrounding shrub cover. Grasses, such as needle-and-thread, western wheatgrass, slender wheatgrass, and squirreltail may also occur.

Coniferous Forest Community

Ponderosa pine dominates this vegetation community type on the ridges surrounding the basin. Stands of ponderosa pine often grade into pinyon-juniper or sagebrush-dominated communities. Mountain shrubs and grassland species are also associated as understory vegetation cover in some areas of ponderosa pine.

Wetland Community

% A total of 121 acres of wetland was identified within Ridges Basin (**Table 3.4-1**) as part of the analysis
% conducted for the 1996 FSFES. As discussed previously, these wetlands are largely man-induced, chiefly
% by irrigation. Irrigation ceased for 3 to 4 years between the late 1980s and the early 1990s and was
% reinitiated in the mid-1990s but, since 1999, it no longer occurs. The irregular irrigation schedule
% appears to have resulted in a significant reduction of wetland cover within the Basin.

Table 3.4-1
Wetland Vegetation Cover Types within Ridges Basin Reservoir Site

Riparian/Wetland Type	Acres
Open Water	3
Emergent Channel	25
Sedge/Rush Meadow	72
Cattail Marsh	21
Total	**121**

Open water wetland (three acres) consists of manmade ponds less than 0.5 acre in size. All ponds are less than five feet deep and usually support an emergent littoral zone dominated by cattails, sedges, and rushes.

In general, the emergent channel wetland type (30 acres) consists of watercourses within the basin, including Basin Creek (see discussion of Basin Creek below) and its tributaries and other surface drainages that have a defined channel. This wetland type includes both the channels of the watercourse and the wetland vegetation associated with its riparian zone. The presence of wetland vegetation associated with these watercourses is highly variable. Common wetland plants include cattails, Baltic rush, sedges, coyote willow, and reed canary grass.

The sedge/rush meadow (72 acres) is the most common wetland type within the basin. In general, these wetlands are located in gently sloping and/or low-lying areas that receive surface runoff. The presence of underlying soils high in clay content impedes surface water infiltration. As a result, these areas remain saturated throughout most of the growing season when irrigated, and are dominated by wetland plants such as Baltic rush, sedges, and reed canary grass.

The cattail marsh wetland type (21 acres) is another common wetland type within the basin. As with the sedge/rush meadows, these wetlands are located in gently sloping and/or low-lying areas, and are underlain by soils with high clay content and poor permeability. These areas receive more water, however, than the sedge/rush meadows and remain either partially inundated or saturated for longer periods. As a result, cattails and other flood-tolerant plants dominate these wetlands.

The wetland functions at Ridges Basin were evaluated by a group of biologists from the U.S. Fish and Wildlife Service (Service), CDOW, Natural Resources Conservation Service (NRCS), Reclamation, and private consultants. For the most part, the defined functional variables identified in the evaluation can be grouped into four major categories: hydrology/water quality; landscape integrity; fish and wildlife habitat; and recreation/aesthetics. The functional wetland values at Ridges Basin were rated low in the ability to meet water quality and hydrology functions; moderate in landscape integrity; and low to moderate for recreation, aesthetics, and wildlife. The Ridges Basin wetlands did rate high in the areas of permanence and public access. Additional information on the evaluation is included in Attachment B-2.

3.4.3.1.2 Basin Creek

Basin Creek immediately downstream of the proposed dam site at the mouth of Ridges Basin currently supports a variety of upland plant communities over most of the valley bottom and the adjoining hillsides. Sagebrush, rabbitbrush, oak brush, and pinyon-juniper are the dominant upland vegetation cover types.

Approximately five acres of emergent channel wetlands are associated with the upper portions of the creek below the site of the proposed Ridges Basin Dam. Hydrophytic vegetation occurs elsewhere along the length of the creek only within the discontinuous riparian zone adjacent to the stream channel. In many places, tall, vertical gully walls (3 to 30 feet high) confine this area. Because of the height and slope of the gully banks, all of the emergent channel and riparian vegetation is confined to the floodplain zone between the banks. Within this area, the cover of riparian vegetation is estimated at eight acres based on the CDOW digital aerial photography. The cover is composed primarily of coyote willow, smooth brome, and reed canarygrass. Fremont or plains cottonwoods (*Populus fremontii, P. deltoides*) and narrow-leaf cottonwood (*Populus angustifolia*) occur sporadically, either in small clumps within the floodplain at stream bends or as individuals.

The lower portion of the creek includes a large meadow area above the valley bottom. This area has apparently been converted from a pinyon-juniper plant community to its current cover of pasture or hayfield (Reclamation 1995b).

3.4.3.1.3 Animas River

In 1996, 3,790 acres of riparian/wetland vegetation cover were identified and mapped within a 1-mile-wide corridor along the Animas River from Durango to its confluence with the San Juan River. Of this total, approximately 2,350 acres of wetland/riparian vegetation were identified within the river's zone of influence.

The Animas River is at least 100 feet wide for most of its distance between Durango and the San Juan River confluence. Upstream from Flora Vista, New Mexico, the river generally flows upon alluvium and is confined within a bedrock valley. The riparian zone along this reach of the river tends to be narrow, frequently abutting steep bedrock walls.

Linear stands of mature cottonwoods occur on terraces located above the active river channel, but young cottonwood stands are infrequent. Seedling recruitment is comparatively rare because scouring floods tend to remove new growth before it becomes well-established and capable of withstanding flood flows.

Emergent and shrub riparian/wetland communities are usually located along riverbanks, on islands, and in old channel or meander scars where depth to the water table is shallow. Riparian/wetland communities also occur on the river's floodplain or on higher terraces where irrigation return flows from adjacent terraces or mesas provide a water supply.

Downstream from Flora Vista, the river emerges from a bedrock canyon and becomes more sinuous, meandering through a valley floor 3,000 to 5,000 feet wide. Between Flora Vista and the San Juan River confluence, meandering of the river has created a wider floodplain with larger sand and gravel point bars. These conditions support greater potential for riparian/wetlands compared to upstream reaches. However, because the broad valley floor is suitable for human occupation and agricultural uses, riparian/wetlands have been extensively altered and/or fragmented. For example, at many locations, channel stabilization measures, including bank shaping and riprap emplacement, have been undertaken to prevent river migration. As a result, the extent of riparian/wetlands at these locations has been greatly reduced.

3.4.3.1.4 San Juan River

The San Juan River originates in the San Juan Mountains, 11 miles northeast of Pagosa Springs, Colorado. Flowing in a southwesterly direction, it travels a distance of 330 miles by way of Navajo Reservoir before emptying into Lake Powell in southern Utah. Vegetation cover types along the San Juan River include: cattail, cottonwood, Russian olive, tamarisk, tamarisk/Russian olive/willow, sedge/rush, and upland plant cover dominated by rabbit brush and sagebrush.

Along the 29-mile stretch of the San Juan River between Farmington and Shiprock, the river channel averages 75 to 150 feet wide. There is a well-developed floodplain along this portion of the river. Numerous canals divert water for irrigation and stock watering.

The majority of the wetland present is riparian/wetland that includes linear stands of mature cottonwoods on terraces located above the active river channel. Small clumps of young cottonwoods and cottonwood seedlings also occur within limited reaches along the lower terraces. The associated small-tree and shrub riparian community consists of dense stands of willow, tamarisk, and Russian olive. Wetlands along the floodplain include such species as horsetail, spike rush, red top grass, and hair grass.

Return flows and canal leakage either support or augment the hydrology of widely distributed areas of wetlands outside the floodplain. Along the proposed NNMP alignment, there are limited areas where leakage from either the Fruitland Irrigation Canal or Hogback Canal systems supports both emergent and riparian wetlands. Along the Hogback Canal leakage from the canal supports a substantial amount of emergent wetlands.

At the two proposed NNMP crossings of the San Juan River, riparian wetlands were disturbed when the existing water pipeline was installed; however, due to the length of time the pipeline has been in service, the riparian vegetation cover has nearly completely re-established.

3.4.3.1.5 Lemon Reservoir

The vegetation cover on the steep slope around Lemon Reservoir consists of a ponderosa pine-dominated community along the lower slopes grading into a spruce-fir forest at the ridgelines. Mountain shrubs and grassland species are associated as understory cover on the lower slopes.

3.4.3.2 Non-Structural Component

In the Pine, Florida, Animas, La Plata, and Mancos River Basins and in McElmo Creek, upland vegetation cover consists of agricultural lands, some of which are irrigated, and areas covered with vegetation typical of the range of cover types within Ridges Basin. Higher elevation areas are dominated by ponderosa pine or pinyon-juniper cover types. Sagebrush dominates broad, relatively flat areas adjacent to these forests and woodlands, as well as on lands formerly under agricultural land use. Wetlands are distributed along channels, within floodplain depressions, or within the hydrological influence of drainage ditches, irrigation canals and irrigation water return flows, and include the following:

- Wet Meadow Grass or grass-like cover type (wetland grasses, sedges, spike rush, rush, etc.);
- Emergent Wetland cover types (cattails, rush, bulrush, spike rush within saturated soils or shallow water); and
- Riparian cover type (willow, cottonwood, riparian shrubs).

A system of earthen canals and ditches diverts and delivers irrigation water to agricultural lands throughout the Pine, Florida, Animas, La Plata, Mancos River valleys, and the McElmo Creek area. Many of these earthen canals are porous and subject to substantial loss of water through leakage. In some places, leakage is sufficient to accumulate water. Under optimal soil and topographic conditions, wetland vegetation develops in response to this water-enhancement.

The extent and type of wetland communities depends on the magnitude of the leakage and the degree to which water accumulates down-gradient from the irrigation canals. Large areas of emergent wetland vegetation can develop in depressions down-slope of canals, in places where leakage water seeps into natural drainage ways, or along roadsides. Return flows and tailwater along with deep percolation can also create wetlands or augment natural wetlands.

3.4.3.2.1 Mancos River

Virtually all of the ALP Project area within the Mancos River drainage is located within the boundaries of the Ute Mountain Ute Tribe Reservation. The Mancos River is approximately the same size as the La Plata River. Throughout much of its length, the river is entrenched and has a very narrow floodplain. A total of approximately 2,910 acres of riparian/wetland communities has been identified along the Mancos River corridor (1996 FSFES). In general, riparian/wetland vegetation associated with the river is confined within the narrow, entrenched floodplain and is dominated by willows and tamarisk. Cottonwoods are generally scarce along the Mancos River, although the presence of same-age classes of young cottonwoods indicates that recruitment is occurring.

3.4.3.2.2 Pine River

The Pine River extends 70 miles from the headwaters in the San Juan Mountains to the point where it enters Navajo Reservoir in New Mexico at an elevation of 6,100 feet. Vallecito Reservoir, constructed in 1941 as a component of the Pine River Project, regulates the river's flow. Distribution of Pine River Project water is through a series of privately owned ditches and canals, all of which were constructed prior to the construction of Vallecito Dam. Most of the ditches and canals divert water directly from the Pine River. A few divert water from tributaries. About 200 miles of ditches and canals and 150 miles of laterals throughout the region are served by Pine River Project water. The capacity of the ditches and canals ranges from 260 cfs to 1 cfs. In addition to the canals, there are five diversion dams along the Pine River downstream from Vallecito Dam.

Irrigation return flows and canal leakage also augment the hydrology to support riparian and wetland vegetation throughout the Pine River Basin and within the river's zone of influence. Over approximately the past 40 years, linear bands of riparian/wetland vegetation of varying widths (**Table 3.4-2**) have developed along the banks of most of the canals managed by the Pine River Irrigation District and along the laterals managed by private landowners.

Assuming an average wetland/riparian corridor width of 8 feet and a total length of canals and laterals of 350 miles, approximately 340 acres of canal-associated wetlands have developed in the Pine River irrigation area. (This estimate does not include wetlands supported by on-farm ditches nor does it include wetlands associated with irrigation return flows.) Based on the 30-meter resolution CDOW GIS map data, approximately 4,617 acres of riparian vegetation are contained within an area influenced by Pine River irrigation. Because of the topographic position of these wetlands, they appear to be hydrologically influenced by the canals and laterals, or the Pine River and its tributaries.

The CDOW riparian map category includes woody species such as narrowleaf and broadleaf cottonwood, Russian olive, tamarisk, and various species of willow. This same category also includes sedges, scouring rush, and cattails. Based on this mapped information, approximately 1,079 acres of riparian vegetation occur within a 500-foot buffer on each side of the Pine River. Therefore, of the 4,617 acres of riparian/wetland habitat mapped within the Pine River irrigation area, about 1,079 acres are associated with the river, while the remaining 3,538 acres are either naturally occurring wetlands, or wetlands maintained and enhanced by canal leakage or by irrigation return flows.

The wetland functions in the Pine River area were evaluated by the same team that rated Ridges Basin wetlands (see Section 3.4.3.1.1). The functional wetland values at the Pine River were rated moderate to high for water quality, hydrology, landscape integrity, recreation/aesthetics, and wildlife. The exception was that Pine River wetlands rated low for public access.

Table 3.4-2
Examples of Representative Widths of Canal Wetland Vegetation

Representative Site	Width of Wetland Vegetation (feet)	Dominant Species in the Wetland Corridor
A - Morrison Consolidated Ditch	15	Willow (adjacent to wet meadow dominated by spike rush, Baltic rush, foxtail, etc.)
B - Morrison Consolidated Ditch	6	Rush, redtop grass, willow, rose, Siskiyou aster
C - Along Route 521, North of Bayfield	6 - 10	Willow, Siskiyou aster (wet meadow downslope of canal dominated by spike rush, redtop grass, sedge, rush, cattail)
D - Canal along Route 520, South of Bayfield	6 - 15	Willow
E - Morrison Ditch, under Route 516, South of Bayfield	3 - 10	Willow, cattails, redtop grass, grasses
F - Canal along Route 518, South of Bayfield, near Dry Creek	10	Willow
G - Canal along Route 518	3	Spike rush, Siskiyou aster, rush, foxtail barley, field horsetail, redtop grass (canal enhances adjacent wet meadow dominated by spike rush and FACW grasses)
H - Pine River Canal near Route 524	10 - 15	Willow

3.4.3.2.3 McElmo Creek

McElmo Creek is located in the western portion of the ALP Project area, near Cortez. Within the broader region that includes the irrigated lands along McElmo Creek, vegetation cover reflects the changes in elevation and precipitation. The vegetation communities are therefore varied and include sagebrush, grasslands, irrigated and dry cropland, pinion-juniper woodlands, mountain shrubs, and coniferous forest. The extent of riparian vegetation varies locally but, for the most part, is confined to narrow bands along McElmo Creek and other streams.

3.4.3.3 Non-Binding Water End Uses and Conveyance Systems

In addition to the areas discussed for the structural and non-structural components, areas that could be impacted by future water uses include the La Plata River Basin.

3.4.3.3.1 La Plata River

The La Plata River is much smaller than the Animas River. Throughout the reach from Hesperus, Colorado, to Farmington, New Mexico, the river channel is between 25 and 40 feet wide. In general, the river's zone of influence corresponds with the width of its valley floor, which is about 500 feet wide on average. Approximately 3,580 acres of riparian/wetland vegetation have been identified within a 1-mile-wide corridor along the La Plata River (1996 FSFES). Of this total, approximately 2,350 acres are identified within the river's zone of influence.

Upstream from near the confluence with Cherry Creek, the La Plata River is relatively steep and fairly straight. The channel bed and banks are composed mostly of cobble and gravel. Cottonwood forest is the predominant riparian/wetland vegetation cover type in this river reach, with emergent and shrub wetlands also occurring rather frequently.

From near the confluence with Cherry Creek to the confluence with McDermott Arroyo, the La Plata River is generally more sinuous than upstream, becoming highly meandering in some areas. The river is entrenched, on average, about 4 feet into a low valley terrace. Typically, the entrenched river has a narrow floodplain and small, sandy point bars. Certain reaches have been channeled and straightened, with agricultural fields planted to near the river edge. The six general riparian/wetland communities described in Section 3.4.3.1.1 are present, but are usually confined to a linear band along the river corridor.

Below McDermott Arroyo, the character of the river changes dramatically due to a large volume of sand-size material that is introduced into the river by McDermott and several other tributary arroyos. The river is actively meandering and has a wide floodplain, with sandbars and large point bars common. Streamflow depletions from irrigation diversions and channel straightening are prevalent. Despite these perturbations, riparian/wetland vegetation is usually well established, with Russian olive and tamarisk being the most common community type.

Numerous canals divert water from the La Plata River for irrigation and stock watering. Return flows and canal leakage either support or augment the hydrology of numerous riparian/wetlands throughout the river's zone of influence. In addition, very narrow, linear bands of riparian/wetland vegetation have become established along the banks of most canals. Reclamation estimates that within the project area of the La Plata River Basin, approximately 292 acres of riparian/wetland vegetation are associated with 128 miles of canals (1996 FSFES).

3.4.4 Environmental Consequences and Mitigation

The following sections discuss potential impacts to vegetation of Refined Alternative 4, Refined Alternative 6, and the No Action Alternative. Also included is a discussion of proposed mitigation measures that could reduce or eliminate potential impacts to vegetation resources.

3.4.4.1 Refined Alternative 4

3.4.4.1.1 Structural Component

Refined Alternative 4 Vegetation Impact 1 - Significant: Approximately 1,500 acres of upland vegetation would be permanently lost by the construction of Ridges Basin Reservoir and Dam.

The construction of Ridges Basin Reservoir and Dam, and the resulting filling of the reservoir would either directly remove existing upland vegetation or result in the inundation-induced conversion of 1,487 acres of upland vegetation to either open water or shoreline (**Table 3.4-3**).

Mitigation for Refined Alternative 4 Vegetation Impact 1 is discussed below under Mitigation for Refined Alternative 4 Vegetation Impact 2 below.

Table 3.4-3
Loss of Upland Vegetation at Ridges Basin

Cover Type	Acres
Grass/Forb Rangeland	379
Sagebrush	514
Mountain Shrub	298
Pinon/Juniper	221
Ponderosa Pine	21
Barren/Rock	54
Total	**1,487**

Refined Alternative 4 Vegetation Impact 2 - Significant: Construction of Durango Pumping Plant, the relocation of County Road 211, and construction of new access and maintenance roads would impact approximately 158 acres of upland vegetation and could result in minor impacts to riparian vegetation near Wildcat Creek.

Construction of Durango Pumping Plant would permanently impact 10 acres of disturbed upland vegetation. Relocation of CR 211 and the construction of access and maintenance roads would impact approximately 16 to 20 acres of upland vegetation. At this time, a definite route for the relocation of CR 211 has not been identified. The construction of the new road, however, may result in minimal impacts to riparian wetlands associated with small, drainage tributaries to Basin Creek or the crossing of Wildcat Creek, as the new road would join State Highway 141.

A recreational fishery would be maintained at Ridges Basin Reservoir. No other federal recreational facilities would be constructed under Refined Alternative 4. It is likely, however, that other facilities could be constructed by some non-federal entity. If such is the case, construction of future recreation facilities, such as hiking trails, campsites, picnic sites, parking areas, and administrative buildings or other similar structures would result in the permanent loss of an additional 128 acres of upland vegetation.

Mitigation for Refined Alternative 4 Vegetation Impacts 1 and 2: Replacement and protection of approximately 1,645 acres of upland vegetation lost from the construction of Ridges Basin Dam and Reservoir, the Durango Pumping Plant, the relocation of CR211, recreation and associated facilities, and new O&M access roads by acquiring compensatory lands and on-site creation, restoration, or enhancement of riparian/wetlands impacted by the relocation of CR211.

The acquisition of compensatory upland vegetation should be completed prior to the initiation of ground-breaking construction activities at the reservoir and pumping plant. Land acquired to compensate for the permanent loss of 1,645 acres of upland vegetation would be in a large, contiguous block that would also meet the mitigation requirements for wildlife habitat associated with the loss of vegetation. An attempt would be made to acquire these lands first in the river basins affected by the project, and then outside of those basins. Final decision on the lands to be acquired for compensatory mitigation would be made in consultation with state and federal wildlife agencies. This mitigation is discussed further in the wildlife section of this report.

The relocation of CR 211 is expected to result in minimal impacts to riparian-wetlands. As such, on-site mitigation in areas close to the site of impact should be possible. The potential impacts to riparian/wetland vegetation along Wildcat Creek could be further reduced if the bridge crossing the creek spans the entire stream channel and associated riparian vegetation.

Refined Alternative 4 Vegetation Impact 3 - Significant: Construction of Ridges Basin Reservoir and Dam would permanently inundate or fill 121 acres of wetlands/riparian vegetation cover.

Construction of Ridges Basin Reservoir and Dam would result in a permanent loss of 121 acres of riparian/wetlands. No riparian/wetlands would be lost by the construction of the Durango Pumping Plant.

Mitigation for Refined Alternative 4 Vegetation Impact 3: Mitigation for Refined Alternative 4 Vegetation Impacts 3 and 4 are discussed under Mitigation for Refined Alternative 4 Vegetation Impact 4 below.

Refined Alternative 4 Vegetation Impact 4 - Significant: Construction and initial operation of Ridges Basin Reservoir would destroy approximately 13 acres of wetland/riparian vegetation within Basin Creek downstream of the proposed dam.

Approximately five acres of riparian/wetlands would be lost at the proposed dam site and immediately downstream of the dam. Another estimated eight acres of riparian vegetation would be lost along Basin Creek below the proposed dam site to the confluence with the Animas River as a result of channel stabilization. Erosion and scouring resulting from the initial release of stored water during ALP Project operations would contribute to the impacts of wetlands/riparian vegetation within Basin Creek. Reclamation estimates that water from Ridges Basin Reservoir could be periodically released down Basin Creek to the Animas River at a rate ranging between 25 to 130 cfs. Future releases for non-binding Colorado Ute Tribes' water use development could amount to an additional 120 cfs. After time, depending on the release schedule and volume of discharge, the creek geomorphology may reach some level of equilibrium, allowing for some wetland riparian plants to reestablish portions of the creek channel between discharge events.

Mitigation for Refined Alternative 4 Vegetation Impacts 3 and 4: The loss of 134 acres of wetland/riparian habitat would be compensated at a mitigation ratio to replace or exceed the habitat value of wetland/riparian habitat lost.

Wetland types impacted have been previously described and are dominated by irrigation-induced sedge/rush meadows. Reclamation would replace these at a planned ratio of 1.5:1, thus providing a mitigation of approximately 200 acres of replacement wetlands. The mitigation would involve a program of land acquisition, wetland development, long-term management, and monitoring and evaluation. To the extent possible, this program would be integrated into the wildlife habitat mitigation program to expand benefits and provide larger blocks of contiguous wildlife habitat. The actual amount of land needed to create this amount of wetlands depends on topography, soils, and water availability on lands acquired. For purposes of this report, it is assumed 600 acres would be necessary. Because of the limited water supplies for new wetland creation in the region, restoration of degraded wetlands, along with creation and enhancement of wetlands, would be an important component of any wetland plan.

Because the location of lands to be developed for wetlands cannot be confirmed prior to land acquisition contracts being signed, specific wetland plans and their mitigation credit cannot be determined at this time. The location, topography, presence of waterways, and hydrology conditions on the land acquired would dictate the feasibility and type of wetland development undertaken. Since the wetlands need to be replaced prior to or concurrently with losses due to reservoir construction, Reclamation would acquire the properties for wetland mitigation prior to awarding the Ridges Basin Dam construction contract. Prior to reservoir filling, the physical features of wetland developments would be completed to at least a 95 percent level under plans designed in cooperation with the Service. This commitment would assure that wetland values and functions would be replaced concurrently with impacts.

The wetlands mitigation program would follow a general process outlined below and would involve coordination with the Service and other interested agencies:

- identification of potential land areas
- appraisal of lands' potential for wetland mitigation (soils, hydrology, adjacent land use, etc.)
- selection and acquisition of land area
- on-site assessment of topography, soils, vegetation, hydrology, fish and wildlife resources, etc.
- establishment of baseline for monitoring purposes
- setting of goals for wetland restoration, creation, enhancement
- design of wetland plan, including management plan
- development of monitoring plan and success criteria
- construction of physical features, vegetation planting
- refinement of management plan
- management of the area
- refinement of monitoring plan; monitoring, including photography, vegetation transects, and fish and wildlife resources to determine effectiveness of development and management

The monitoring plan prepared would include purposes and goals; monitoring techniques; frequency and duration of monitoring; data analysis and interpretation plans; and decision threshold levels, i.e. measurable conditions that indicate if goals are being met.

As with wildlife habitat mitigation, the La Plata River Basin would be given first priority for wetland development. All reasonable attempts would be made to acquire interests in lands on a willing seller basis through acquisition mechanisms that could include fee simple purchases, conservation easements, or purchase options. However, this does not preclude the use of other authorities available to acquire such land interests. Because of the preference to acquire interests in lands on a willing seller basis, the exact location cannot be determined at this time. Acquiring contiguous tracts would also be a high priority.

In 1997, Reclamation investigated the potential of creating and enhancing wetlands along a sample of the La Plata River encompassing about 460 acres of river corridor and falling under several ownerships (see Map 3-1 in Section 3.5). Potential lands that could be considered were evaluated in the "Mitigation Opportunities Report for the La Plata River Corridor" included in Technical Appendix 4 of this FSEIS (Bio/West 1997). This report was supplemented in 2000 (Wenger 2000). The supplement is found in Attachment B-2. Three subzones influenced by the river were identified: (1) the channel-bar subzone, (2) the floodplain subzone, and (3) the low terrace subzone. All three have potential to support wetlands, but the potential is not reached due to the influence of grazing, reduced spring and base flows, and channel manipulation. The flood frequency of the low terrace subzone has apparently been greatly reduced and vegetation is limited to old, deep-rooted cottonwoods and invading upland species. Overall, the river corridor has been altered by removal of vegetation, conversion to pasture, intensive grazing, channel modification, and river flow changes that have resulted in a loss of riparian/wetland communities.

Potential measures to restore the wetland and riparian areas and their value include grazing control, instream structures, individual plantings, reestablishment of meandering channels, and providing water to upper terraces. On the sample reach of river investigated, it was estimated that around 240 acres of lost or damaged wetlands could be restored to a naturally functioning ecosystem. With import of additional water, another 150 acres of wetlands could be created in this area.

Creation of new wetlands on higher river terraces would require importing water or using existing water rights on the property acquired. Importing water from Ridges Basin, while expensive, is a future possibility if multiple needs could be met.

Overall, the investigations along the La Plata point out that it is feasible to restore lost and damaged wetland/riparian communities on lands acquired that include natural waterways. The great advantage of this approach is that permanent, naturally functioning wetlands are developed. The amount developed would depend on the location of the property acquired.

In addition to the La Plata River wetland report in Technical Appendix 4, the 404(b)(1) Evaluation (see Volume 2, Attachment B-2) provides an overview of some of the other wetland mitigation opportunities that exist in the project area. These opportunities include lands around Ridges Basin, along the Animas River, and along other tributary streams.

In addition to wetland mitigation discussed above, and to reduce the significance of the impact to Basin Creek channel wetlands and riparian vegetation, Reclamation has selected a means of erosion and siltation controls that use a series of check and drop, or vortex weirs for 2.5 miles of creek bed. The lower 0.7 miles of creek would use natural rock controls and would not required the construction of the check and drop step structures. The implementation of these controls would produce an increase in silt transport initially but would stabilize with use. Some wetlands could be created over time. The creek bed would be realigned into gentle curves and graded to create relatively flat slopes. The checks across the creek bed would be about 60 feet wide, with a depressed 10-foot wide weir in the center. A damp area approximately 50 feet wide by 2.5 miles long could provide 10-15 acres of wetland development. Releases from Ridges Basin down Basin Creek should be adequate to maintain wetland vegetation.

Refined Alternative 4 Vegetation Impact 5 - Less than Significant: Approximately 30 acres of upland vegetation and approximately 1 acre of riparian/wetlands would be temporarily impacted by the construction of the Ridges Basin inlet conduit. Additional, unquantifiable temporary impacts to upland vegetation and riparian/wetlands could result from the relocation of a transmission line and natural gas/petroleum pipelines.

Assuming a conduit length of 12,000 feet and a 100-foot wide construction zone about 30 acres of vegetation would be temporarily impacted by construction. The short-term, temporary loss of vegetation would result from construction activities (trenching, back filling, soil storage, equipment staging, pipe lay down areas, etc.). Impacts to upland and wetland vegetation (crossing of intermittent drainages) would last through the length of the construction period.

Four buried natural gas/petroleum byproduct pipelines currently run east and west across Ridges Basin, a portion of which is within the footprint of the proposed reservoir. These pipelines would be relocated along a new alignment that has not been identified. Alternative routes are analyzed in the report entitled "Alternate Route Analysis for Gas Pipeline Relocations in Ridges Basin (Reclamation 1999b). This report is included in Volume 2, Attachment K. In addition, an electrical transmission line that falls within the footprint of the proposed reservoir would be relocated. It is likely that the pipelines and transmission line would be relocated to areas where the vegetation cover type would be similar to that found in Ridges Basin.

Because the relocated pipelines would be buried, it is assumed that any crossing of upland vegetation or riparian/wetlands would result in temporary, short-term loss of vegetation. Relocation of the new transmission line and associated power pole placement would result in additional temporary, short-term and highly localized impacts to vegetation.

Mitigation for Refined Alternative 4 Vegetation Impact 5: Reclamation would limit the ground disturbance to the smallest feasible areas, and would implement Best Management Practices (BMPs), along with planting or re-seeding using native plant species to assist in the reestablishment of native vegetation.

Efforts would be made to avoid impacts by minimizing areas used for construction, particularly lands above the high water line at the reservoir site. Gas pipeline crossings of the Animas River would be directionally drilled where feasible. Mitigation for vegetative losses and temporary impacts would include revegetation of lands disturbed by construction. It is anticipated that these impacts would be reclaimed with vegetation within three to five growing seasons, thereby avoiding any permanent loss of vegetative acreage.

Refined Alternative 4 Vegetation Impact 6 - Less than Significant: Reduced flow conditions in the Animas River may result in minor impacts to cottonwood recruitment near the confluence with the San Juan River.

The reductions are expected to have minimal effects to the river's flood regime and the depth to groundwater associated with its alluvial aquifer. Diversion of water from the Animas River to Ridges Basin for storage is not anticipated to significantly alter the hydrology supporting vegetative resources or the flood events necessary to maintain riparian/wetland recruitment within the river's zone of influence. Therefore, impacts to vegetative resources caused by reduced flows are expected to be minimal, especially between Durango and Flora Vista, New Mexico. However, there could be minor impacts to cottonwood recruitment between Flora Vista and the San Juan River confluence (Reclamation 1995b). In the 1996 FSFES, Reclamation concluded that ALP Project operations, which at that time included greater diversions than under the present plan, would not result in significant changes in water surface elevations in the Animas and San Juan Rivers. Therefore, impacts to vegetation were not expected and no further analysis was conducted.

Mitigation for Refined Alternative 4 Vegetation Impact 6: Reclamation would monitor Animas River riparian corridors to help determine any effects of the pumping regime.

Refined Alternative 4 Vegetation Impact 7 - Less than Significant: Construction of the NNMP could result in short-term disturbance to native upland vegetation and riparian wetlands.

Approximately 29 miles of pipeline would be constructed for the most part within the alignment of the existing pipeline. Impacts to grassland and sagebrush vegetation due to cut and fill activities would be temporary. The pipeline construction would involve two crossings of the San Juan River that could require trenching. Some riparian trees may need to be removed to accommodate the access of equipment. The proposed crossing rights-of-way would be as narrow as possible to further minimize any impacts. It is not expected that any long-term impacts to the riparian wetlands would occur as a result of construction of the NNMP.

The pipeline alignment has been routed to avoid impacts to the emergent wetlands along the Hogback Canal east of Shiprock. To avoid impacts to these wetlands, the alignment was moved to within the right-of-way shoulder of U.S. Highway 550.

Mitigation for Refined Alternative 4 Vegetation Impact 7: Limit ground disturbance and reestablish vegetation.

Reclamation would limit ground disturbing activities to upland and wetlands, and would replace in a 2:1 ratio riparian trees (cottonwoods) cut in specific areas for access of equipment. Reclamation would work toward reestablishing vegetation in those access corridors.

3.4.4.1.2 Non-Binding Water End Uses and Conveyance Systems

Refined Alternative 4 Vegetation Impact 8 - Significant: Construction of water conveyance pipelines could result in the loss of between 20 and 300 acres of wetland and riparian vegetation.

The potential alignment of non-binding water delivery pipelines crosses in part wetland/riparian vegetation (**Table 3.4-4**) that includes:

- ❑ Wet Meadow Grass or Grass-like cover type (wetland grasses, sedges, spike rush, rush, etc.)
- ❑ Emergent Wetland cover type (cattail, rush, bulrush, spike rush within saturated soils or shallow water).
- ❑ Riparian cover type (willow, cottonwood, riparian shrubs)

Depending on the width of the construction corridor (**Table 3.4-5**), wetland/riparian losses would result from trenching, earth stockpiling, equipment staging, and pipe storage and pipe laydown, all activities that are typical of pipeline construction.

Mitigation for Refined Alternative 4 Vegetation Impact 8: To avoid or minimize construction impacts to wetland and riparian vegetation located within the potential corridor alignments of the non-binding water conveyance pipelines, the construction zone would be the minimal needed to meet project objectives. If avoidance is not possible, a riparian/wetland mitigation and monitoring plan would be developed to compensate for the loss of vegetation cover.

Pipeline siting would be planned to avoid or minimize the crossing of significant wetlands or riparian vegetation cover. Whenever possible, directional boring would be employed to minimize the impact to wetlands/riparian vegetation along the La Plata River and other major watercourses. BMPs and a restoration plan for impacts to vegetation would be developed and monitored. All sensitive areas (extensive areas of trees, emergent wetlands, and open water) would be flagged during construction to prevent the accidental encroachment of construction equipment.

If impacts to wetlands/riparian vegetation cannot be avoided, a vegetation mitigation plan would be developed to compensate for the loss of vegetation cover. This plan would be developed in consultation with the Service, CDOW, and other agencies. The mitigation plan would contain a long-term monitoring program to ensure the success of the mitigation plan to fully compensate for the loss of vegetation cover .

Table 3.4-4
Wetland/Riparian Vegetation Crossed by Water Conveyance Laterals

Distribution Pipeline	Approximate Length (miles)	Proportion of Wetlands/Riparian Cover (miles)	Wetland/Riparian Vegetation Type
East of Ridges Basin Reservoir			
Florida Mesa Lateral	8.2	3.2	Riparian (cottonwood), emergent cattail, willows, and wet meadow associated with Animas River, Wilson Gulch, and irrigation return flows.
Sunnyside Lateral	6.5	1.5	Riparian and emergent cattail wetlands associated with Animas River, Spring Gulch, and Sunnyside Mesa drainage.
West of Ridges Basin Reservoir			
Coal Mine/Power Plant Lateral	16.7	0.75	Wet meadow associated with Long Hollow drainage
Breen/La Plata Lateral	18.2 (Colorado) 5.3 (New Mexico)	1.7 (Colorado) 1.3 (New Mexico)	Wet meadow, willow riparian, and emergent cattail associated with drainage to La Plata River, Church Hollow, Mooney Draw, Thomas Canyon drainage.
Alkali Gulch Lateral	6	1.7	Cottonwood, emergent, wet meadow associated with La Plata River, Hay Gulch, and Alkali Gulch
Grass Canyon Lateral	33	1.5	Emergent/Riparian wetlands associated with Johnny Pond Arroyo, Wheeler Draw, Red Horse Gulch, and La Plata River
North of San Juan River			
Gas-Fired Power Plant Lateral	7.4	0	No wetland crossing

Table 3.4-5
Riparian/Wetland Loss within 100, 500, and 1,000-feet Corridors
Along Water Conveyance Laterals

Corridor Width	Pine River to Ridges Basin (acres)	Florida Mesa Lateral (acres)	Sunnyside Lateral (acres	Laterals West of Ridges Basin (acres)	Total Area (acres)
100 feet	1.7	1.0	2.3	15.5	20.5
500 feet	11.1	15.8	13.1	96.5	136.5
1,000 feet	26.3	37.2	24.0	217.3	304.8

3.4.4.2 Refined Alternative 6

3.4.4.2.1 Structural Component

Refined Alternative 6 Vegetation Impact 1 - Significant: Raising Lemon Reservoir and Dam would inundate between 30 and 50 acres of wet meadow wetlands and approximately 60 acres of upland vegetation.

Raising the elevation of Lemon Dam by 11.5 feet and enlarging the reservoir pool could inundate between an estimated 30 to 50 acres of wet meadow wetlands at the upper end of the reservoir. These wet meadow areas are located on terraces bordering the Florida River as it enters the reservoir. Riverbed and wetland substrates within the inundation area would be permanently altered.

Vegetation around the reservoir is primarily ponderosa pine forest on steep slopes. Raising Lemon Reservoir would result in the inundation of a thin, 12-foot wide strip of forest vegetation around the perimeter of the water surface.

Mitigation for Refined Alternative 6 Vegetation Impact 1: The loss of 30 to 50 acres of wet meadow wetland would be compensated at a mitigation ratio to replace or exceed the functional value of wetland habitat lost.

Reclamation would replace the wet meadow wetlands at a ratio to be determined by the type of mitigation required to compensate for the loss. The mitigation ratios approved by the EPA, Service, and other agencies typically are: 3:1 for enhancement, 2:1 for creation, 1.5:1 for hydrologic restoration, and 1:1 for physical restoration. The ratios are negotiated on a case-by-case basis. Based on the range of ratios, it is expected that a low range of 30 to 90 acres and a high range of 50 to 150 acres of wetlands compensation would be required.

Because of the steepness of the surrounding hillside, the loss of 60 acres of upland vegetation would not substantially reduce the cover value of the ponderosa pine vegetation type. No mitigation is proposed for this loss of upland vegetation.

Refined Alternative 6 Vegetation Impact 2 Less than Significant: Construction of the NNMP could result in short-term disturbance to native upland vegetation and riparian wetlands.

This impact is the same as the Refined Alternative 4 Vegetation Impact 7.

Mitigation for Refined Alternative 6 Vegetation Impact 2: No mitigation is proposed.

3.4.4.2.2 Non-Structural Component

Refined Alternative 6 Vegetation Impact 3 - Significant: Acquisition of water rights and cessation of water conveyance and irrigation in the Pine, La Plata, and Mancos River Basins, and McElmo Creek Basin could result in the conversion of over 1,200 acres of wetland and riparian vegetation to upland vegetation cover.

In the Pine River Basin, converting 10,000 acres of irrigated land to non-irrigated land, removing water from the land and allowing it to flow into Navajo Reservoir would impact approximately 1,000 acres of wetlands. (Assuming 10 percent wetland cover based on surveys of the entire Pine River Basin. This number does not include the wetland vegetation associated directly with irrigation canals, nor the prospect of increasing flows in the Pine River by acquiring 5,000 additional acres as described in Section 3.2.4.2.)

If 785 acres of irrigated land would be purchased in the La Plata River Basin and water rights converted to M&I uses—assuming 10 percent of the total land cover is wetland, based on vegetation communities within a one-mile-wide corridor along the La Plata River—approximately 78.5 acres of wetlands would be impacted (Reclamation 1995b).

In the Mancos River Basin, if 500 acres of irrigated lands would be purchased and associated depletions transferred to M&I uses, wetland/riparian vegetation associated with irrigation canals and irrigation would be lost. Most wetland vegetation along the lower Mancos River is immediately adjacent to the stream, within the confining earthen walls. Riparian woody vegetation is found along the stream and in a narrow band on the valley floor. Assuming 6 percent of the total land cover along the Mancos River is wetland/riparian vegetation, approximately 30 acres of wetland/riparian vegetation would be impacted (Reclamation 1995b).

Removing irrigation water from 657 acres of land in the McElmo Creek Basin could result in the loss of 66 acres of riparian/wetland vegetation within the basin (assuming that 10 percent of the total land cover is riparian/wetland).

An estimated potential impact to 1,200 acres of wetland/riparian vegetation (1,000 acres from the Pine River, 79 acres from the La Plata River, 30 acres from the Mancos River, and 66 acres from the McElmo Creek Basins), could occur by removing water from the land. Conversion of irrigated lands to non-irrigated lands would alter the existing hydrology and, therefore, the existing vegetation cover on the lands affected. The changes in soil moisture and other ecological parameters would provide soil conditions that contribute to the natural progression of vegetation cover type to what is commonly referred to as a weed cover. Unless conservation measures are taken, noxious weed invasion could occur.

Mitigation for Refined Alternative 6 Vegetation Impact 3: Pursue a program of maintaining existing wetlands and wetland values by avoiding impacts and by replacing wetland losses that cannot be avoided.

Avoidance would be attempted by allowing a percentage of the consumptive use water acquired to remain on the land and thereby applied towards supporting the existing wetlands. This portion of consumptive use water must be protected as "project water" with the express purpose of supporting wetlands. In addition to water/land acquisition, agreements and perhaps easements/acquisitions would be needed to protect the avoided wetlands.

When water is transferred off irrigated land, the wetlands associated with the water losses from those irrigated lands would lose their water supply and cease to be wetlands. A portion of those wetlands impacted could be avoided if a water source remains available for the affected wetlands. This could be accomplished by leaving a portion of the water supply at the turnout for the parcel and routing the volume of water that would normally supply wetlands through the parcel and to the associated wetlands. It was assumed that the average acquired parcel is 40 acres and that 2,000 lineal feet of earth ditch would be required to accomplish the delivery for each parcel. With design, permitting, structures, earthwork and contingency, it is estimated that the cost of installing these impact avoidance features would average $350 per acquired acre. The capital cost for each basin is shown in **Table 3.4-6**.

Table 3.4-6
Refined Alternative 6
Summary of Wetland Impact Avoidance Assumptions and Costs

Category	Pine River Basin	La Plata River Basin	Mancos River Basin	Total
Acquired Acres	10,000	785	500	11,285
Capital Cost for Wetlands Avoidance	$3,500,000	$274,750	$175,000	$3,949,750
Annual Cost for Operation and Maintenance	$ 600,000	$ 47,100	$ 30,000	$ 677,100

To assure that water continues to flow to the affected wetlands, annual operation and maintenance would be required. It was assumed that the original cost of water delivery to the parcels would be maintained to avoid negative economic impacts to other water right owners in the basin. For estimating purposes it was assumed that this would average $15 per acre. In addition, annual maintenance of facilities was assumed to average 10 percent of the capital cost and sufficient labor to assure that the water is delivered regularly would be required. The unit cost of operation and maintenance was estimated at $60 per acre. The operational cost for each basin is shown in Table 2-68 for the acreage acquired.

Not all of the wetlands affected can be avoided in this manner. When water is transferred from irrigated land, a change in the regional water table occurs. Some of the lands may be adjacent to the parcel, especially those associated with surface runoff, but other wetlands may be somewhat remotely located and the replaced water supply would not be accessible. Although a detailed study has not been completed to understand the hydrology in each of these basins, it is estimated that about 50 percent of the wetland impacts could be avoided in this manner.

From a water balance standpoint, the water requirements associated with the wetlands would cause no new depletion in the basin, would require no additional water supply, and could allow all the depletions associated with the irrigated acreage to be transferred to M&I use as proposed. While transfers of small amounts of water from agriculture to wetlands have occurred within the State of Colorado, no large transfers are known, especially in Water Division 7. The process of quantifying the water available for transfer, that required by the wetlands, and that consumed by associated wetlands prior to transfer, would be rigorous and time-consuming. Proving that such transfers would not injure other water right holders would add to the difficulty of the analysis. In the end, the amount of wetlands impact avoidance and mitigation allowed by the state for any given water basin could be limited. This could be particularly critical in the Pine River Basin, where such a large transfer would be necessary and could infringe upon the practicability of the avoidance and mitigation measures.

It is assumed that up to 50 percent of the estimated 1,200 acres (or 600 acres) of the wetland impact could be avoided by allowing water to continue flowing to the wetlands. The viability/feasibility of this wetland avoidance method, however, declines as the amount of wetlands to be replaced/compensated for increases. Reclamation must show that no harm is caused to other water right holders during this process while still acquiring sufficient land with water to meet the M&I requirements.

The remaining 600 acres of wetland impacts would not be avoided. When water is transferred from irrigated land, alterations in local water tables occur. Some of the existing wetlands, particularly those associated with surface runoff, may be adjacent to a parcel of land where the water transfer occurs. Other wetlands may be somewhat remotely located, and the replacement water supply may not be accessible. Regardless, wetland losses that could not be avoided would need to be mitigated through a program of acquisition, development, and protection of compensatory wetlands.

Implementation of the mitigation for wetland/riparian vegetation (avoidance or compensation) could reduce the impact of the loss of wildlife habitat and other wetland functions. The feasibility of avoidance, however, would depend on many factors (e.g., location of lands, state water right decisions, agreements with landowners) that are difficult to predict. In addition, the mitigation for losses that could not be avoided would involve a large program of water and land acquisition from willing sellers to provide the elements needed to create replacement wetlands. Assuming one-half of the wetland impacts could be avoided and a planned mitigation ratio of 1.5:1 for the remainder lost, approximately 900 acres of wetlands (assume 2,700 acres of total land) would need to be developed. This mitigation would follow a similar process as outlined for mitigation of Refined Alternative 4, Vegetation Impacts 3 and 4.

The ratio of 1.5:1 assumes restoration of the hydrology that supports wetlands. The mitigation ratio and the lands required for compensation, however, would vary depending on the type of requirement negotiated with federal agencies. Based on the range of ratios, to mitigate for the loss of 600 acres of wetlands, it is expected that a range of 600 acres to 1,800 acres of wetlands compensation would be required.

3.4.4.2.3 Non-Binding Water End Uses and Conveyance Systems

Refined Alternative 6 Vegetation Impact 4 - Significant: Construction of water conveyance pipelines could result in the loss of between 20 and 300 acres of wetland and riparian vegetation at the crossing of creeks, drainage channels, canals, and floodplains.

This impact is similar to that for Refined Alternative 4 Vegetation Impact 9, although the total area impacted may be less due to decreased overall length of conveyance pipeline necessary.

Mitigation for Refined Alternative 6 Vegetation Impact 4: To avoid or minimize construction impacts to wetland and riparian vegetation located within the potential corridor alignments of the non-binding water conveyance pipelines, the construction zone would be the minimal needed to meet project objectives. If avoidance is not possible, a riparian/wetland mitigation and monitoring plan would be developed to compensate for the loss of habitat value.

Same as mitigation for Refined Alternative 4 Vegetation Impact 8.

3.4.4.3 No Action Alternative

Ridges Basin would continue to be managed for its wildlife value.

The following impacts of the No Action Alternative were taken from the 1996 FSFES.

Under the No Action Alternative, there would be no impacts to vegetative resources as a result of Project-related actions. However, it is likely that human modifications would continue to occur along the Animas and La Plata Rivers as a result of future growth and development, and that both upland and riparian/wetland vegetation would be affected by these modifications. Presently, there are mechanisms in place that, theoretically, would regulate certain activities affecting vegetative resources. For example, activities entailing river channelization, riverbank armoring, or the placement of dredged and/or fill material into wetlands would be regulated under Section 404 of the Clean Water Act.

Activities affecting vegetation communities important to federally listed species could be regulated under the ESA. Under the No Action Alternative, the project would not settle Indian water rights issues. This could lead to significant changes in existing water uses and could affect riparian/wetland vegetation with these uses.

Future development along the Mancos River corridor is less likely because it is located within Ute Mountain Ute Tribal lands; thus, future impacts to vegetative resources are likely to be minor. (1996 FSFES; Page III-57.)

3.5 WILDLIFE RESOURCES

3.5.1 Introduction

This section addresses potential impacts to terrestrial wildlife that could result from actions associated with Refined Alternative 4, Refined Alternative 6, and the No Action Alternative. Section 3.5.2 defines the Evaluation Methodology and significance criteria used for determining impacts, Section 3.5.3 describes the affected environment, and Section 3.5.4 identifies potential impacts and discusses mitigation measures that would serve to reduce or eliminate anticipated impacts. Vegetation cover type, the basis of wildlife habitat structure and value, is presented in Section 3.4, Vegetation.

A variety of wildlife occurs within the region-wide project area that encompasses Ridges Basin and the wildlife habitat within the Pine, Animas, La Plata, Mancos, and Dolores River Basins, as well as the San Juan River Basin. Because of the wide-ranging distribution and movement of wildlife, by necessity the ALP Project area has been circumscribed in terms of a regional context. Descriptions of some of the
% wildlife species occurring there can be found in Reclamation's Definite Plan Report (Reclamation 1979) and the 1996 FSFES, as can lists of wildlife species surveyed in the project area. Implementation of the project would result in modification of wildlife habitats, and species composition, distribution, and
% abundance may change. Reclamation, therefore, has limited the discussion herein to those species which have been identified as being more important or potentially unavoidably impacted by the construction or operation of the ALP Project.

Both the 1980 FES and the 1996 FSFES concluded that other than threatened and endangered species, elk (*Cervus elaphus*) and golden eagles (*Aquila chrysaetos*) and their associated habitats are two of the more important wildlife resources which would be affected by the construction and operation of Ridges Basin Dam and Reservoir. Reclamation, the Service, and CDOW have since shifted emphasis toward a more multi-species approach to wildlife mitigation, with mule deer, elk, and golden eagles of particular concern. Since 1996, Reclamation has decided to relocate natural gas pipelines currently located within the Ridges Basin Reservoir site to avoid impacting existing golden eagle nests; however, the inundation of Ridges Basin foraging habitat and the addition of recreation activity could have long-term effects on golden eagles.

The effects of the construction and operation of the NNMP are considered to be temporary resulting in less than significant effects to existing wildlife and their habitat. Reclamation has included in this analysis an assessment of general wildlife impacts associated with implementing non-binding water-use scenarios. A more specific assessment of impacts would be made once a more detailed use of project water is identified**.** Those impacts, once known, would be disclosed within a future NEPA document.

Because of a national emphasis on wetland loss, wetland and riparian habitats (see Section 3.4, Vegetation Resources) have become a much more important resource issue since the completion of the

1980 FES. Diverse and abundant wildlife species are associated with wetland and riparian zones, and both the 1996 FSFES and this FSEIS, in Section 3.4, include mitigation measures for affected wetland and riparian habitats.

3.5.2 Evaluation Methodology

This section discusses the methodology used to determine potential impacts that could result from Refined Alternative 4 and Refined Alternative 6. A discussion of the No Action Alternative is included as presented in the 1996 FSFES. Also discussed are specific criteria that were used to determine the significance of the impacts identified.

3.5.2.1 Methodology

3.5.2.1.1 Structural Components

This analysis was largely conducted using literature reviews and expert consultation. Several site surveys were also conducted. A fairly extensive library concerning wildlife resources within the ALP Project area exists. Most of Refined Alternative 4's major structural components (Ridges Basin Dam, Ridges Basin Reservoir, and Ridges Basin Inlet Conduit) are scaled-down versions of those described in the 1996 FSFES, so nearly all this portion of the ALP Project has been surveyed in the past. Reports of these previous investigations, Reclamation documents describing past versions of the ALP Project, and reports of recent surveys and inventories provided most of the data used in this analysis. Expert consultation with the Service, CDOW, and Reclamation furnished additional information concerning data of more recent origin and the opinions and desires of the agencies.

Site surveys were conducted to determine if the newly proposed NNMP would impact wildlife habitat areas along the proposed pipeline route in San Juan County, New Mexico. Particular attention was given to the proposed pipeline at Hogback, near Shiprock, New Mexico, and the two locations where the pipeline would cross the San Juan River.

Expert consultation with the Service, CDOW and Reclamation, and documents prepared by Reclamation addressing wildlife issues on existing projects, were used to collect information concerning wildlife use within the Lemon Reservoir area.

The Service has also prepared a Final Fish and Wildlife Coordination Act Report for the project (Service %
2000b) that has been used to help develop the impact analysis and mitigation plans. The %
recommendations in the Service's report are addressed in Chapter 6 of this EIS, and a copy of the report %
is included in Technical Appendix 7. %

3.5.2.1.2 Non-Structural Components

The CDOW general vegetation map, which is based on 30-meter resolution satellite imagery, was the primary method used to estimate the existing wildlife habitat within the Pine River system. The 1996 FSFES, Appendix H-Volume 1, *Wetland, Riparian and Vegetative Resources*, provided wildlife habitat cover data for the Animus, La Plata, and Mancos River Basins. Documents prepared by Reclamation addressing wildlife issues on existing projects were used to collect information on wildlife use within Montezuma and Dolores Counties.

Implementation of the non-structural component of Refined Alternative 4 would not impact wildlife or wildlife habitat. There are no anticipated changes in land uses, as it was assumed that lands acquired under this alternative would remain in irrigated production.

3.5.2.2 Significance Criteria

Defined standards or criteria determined by federal regulatory agencies and accepted professional opinion guide the assessment of impact significance of potential environmental effects of the ALP Project on wildlife. The standards applied to the assessment of impacts in this analysis include the following considerations and would have a significant effect on biological resources if it would:

- ❑ Substantially diminish habitat for wildlife; or
- ❑ Result in a deterioration of existing wildlife habitat.

In addition to these considerations, impacts resulting in permanent loss of critical wildlife habitat (wintering ground, wetlands) or in disturbances to wildlife during critical life stages (nesting, breeding) were also considered significant.

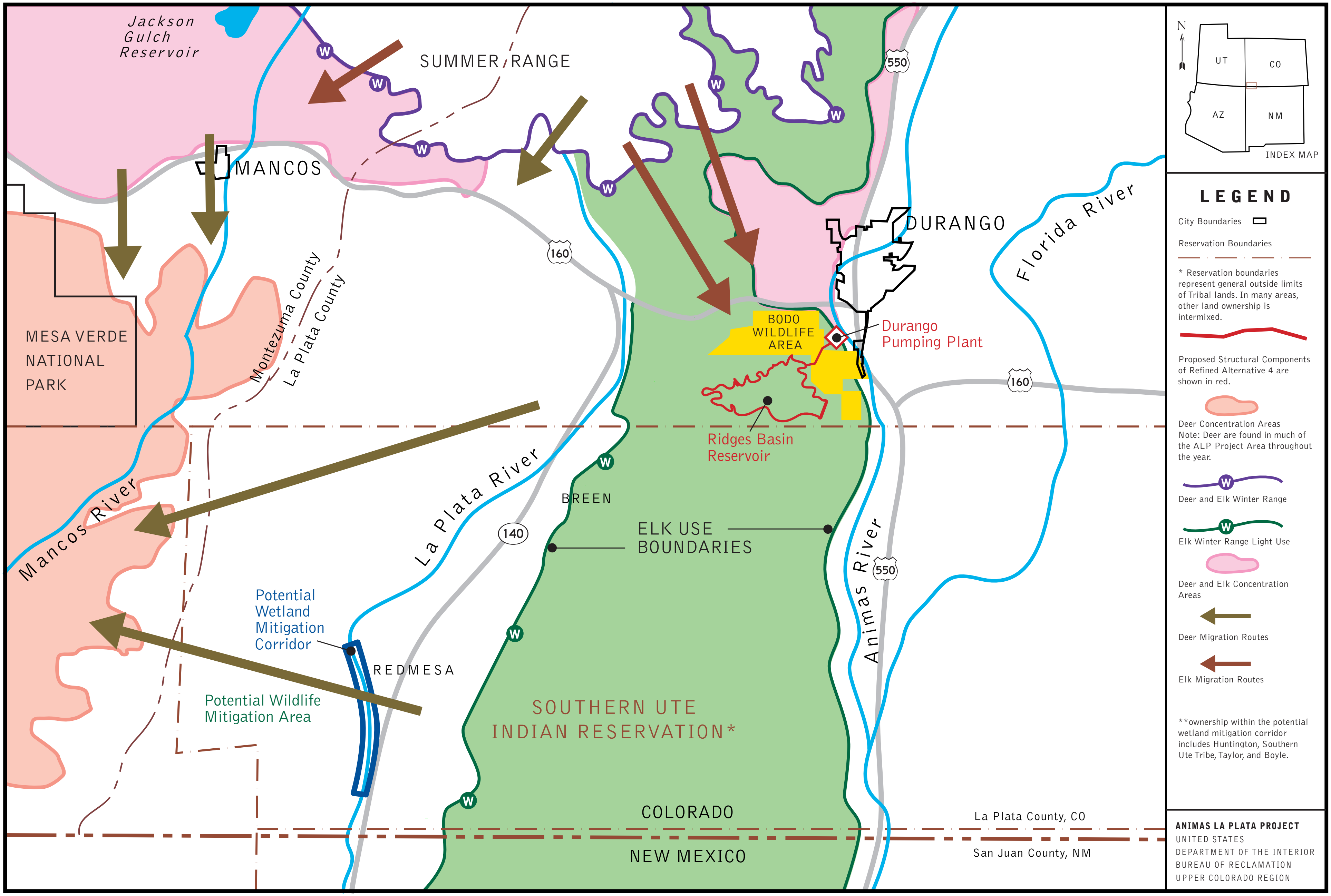
3.5.3 Affected Environment

This section discusses existing wildlife resources in the areas potentially affected by Refined Alternatives 4 and 6. The actions that may take place under the No Action Alternative are not fully known at this time, and consequently, it is not possible to completely define the affected environment for that alternative. However, many of the eventual actions that may occur as a result of the No Action Alternative would likely take place within the same geographic setting as that of Refined Alternative 4. The methodology used to determine potential impacts from the non-structural component assumed that there would be no changes to agricultural lands within the Florida and Animas River Basins, and the major portions of the Dolores River and McElmo Creek Basins. Accordingly, those basins are not specifically identified in this section.

3.5.3.1 Mule Deer

Mule deer, the most common large game animal, range throughout the ALP Project area. A resident herd of about 1,000 animals utilizes the area south of Highway 160 year-round. **Map 3-1** shows the general locations of deer winter and summer range, and migration corridors. This area is identified by CDOW as Wildlife Unit 741. A migratory herd of about 4,000 animals seasonally moves into Unit 741 from areas north of Highway 160 identified by CDOW as Wildlife Unit 74. The resident herd is fairly evenly distributed throughout the Bodo Wildlife Area. The Bodo Wildlife Area (also shown on Map 3-1) includes lands acquired by Reclamation for project purposes. Greater concentrations of deer, however, are found in the western portions of the project area in the vicinity of the Mancos River. These animals show little movement except during periods of heavy snow. The migratory herd uses the Bodo Wildlife Area primarily in the winter and spring.

The proposed Ridges Basin Reservoir site is located in an area where deer concentrate during the winter. CDOW records indicate approximately 300 mule deer commonly use the Bodo Wildlife Area, including those lands acquired by Reclamation. An additional 1,000 deer migrate through the area in the Fall and Spring, mostly overwintering on Southern Ute Indian Tribe lands to the south (Scott Waite, CDOW).



MAP 3-1
Location of Bodo Wildlife Area, Big Game Range and Migration Routes, and Potential Mitigation Acquisition Locations

[back page of map 3-1]

3.5.3.2 Elk

Two elk herds frequent the Bodo Wildlife Area. A small resident herd occurs on private lands throughout the area south of U.S. Highway 160 and within the boundaries of the Southern Ute Indian Tribe Reservation. A migratory herd of 1,700 to 2,000 elk moves from summer range (Wildlife Unit 74) in the San Juan Mountains to lower elevations, including the project area (Scott Waite, CDOW). Elk and their habitat constitute a significant wildlife resource in the project area, and the 1996 FSFES included mitigation for the loss of 10,538 elk habitat units. At the time of the 1996 FSFES, an estimated 100 elk resided in the Bodo State Wildlife Area and the Ridges Basin Reservoir area year-round, and 400 migratory elk used the area in the winter and spring. Elk calving takes place in May and June. Calving areas exist on northern portions of Ridges Basin within areas dominated by pinyon pine and juniper.

Currently, CDOW estimates that there is a resident elk herd of 75 animals around Ridges Basin with %
approximately 400 animals using the basin and surrounding area as winter range. A movement corridor %
has been identified by CDOW at the west end of Ridges Basin for animals moving onto the Southern Ute %
Indian Reservation (Service 2000b). %

3.5.3.3 Golden Eagles and Other Raptors

There are three known golden eagle nests on the face of Carbon Mountain in Ridges Basin, most probably associated with the same nesting pair of eagles. One or all of the nests have been active since 1993; the nests may be used alternately by the same mating pair of eagles. Golden eagles initiate mating and nesting activities in the winter and end in the spring or early summer after the eaglets have fledged. Golden eagles are protected under both the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act. A bald eagle is reported to nest near Lemon Dam in the project area (Stransky 2000). %

In 1995, CDOW discovered goshawks, a federal species of concern, successfully nesting in the northeastern region of Ridges Basin. Some raptors are very sensitive to disturbance, especially during the mating and nesting season. Other raptors that occur within the project area, including the areas along the Navajo National Municipal Pipeline, include prairie falcons *(Falco mexicanus*), kestrels (*Falco sparverius*), harriers (*Circus cyaneus*), Coopers hawks *(Accipiter cooperii*), sharp-shinned hawk (*Accipiter striatus*), and red-tailed hawks *(Buteo jamaicensis*). None of these species are presently considered to have their habitats significantly limited; however, they all are protected under the Migratory Bird Treaty Act.

3.5.3.4 Species Associated with Wetland and Riparian Habitats

A variety of wildlife species depend on or use wetland and riparian areas during some portion of their life. Mammals, neotropical migratory songbirds, waterfowl, raptors, vultures, amphibians, and reptiles obtain food, cover, and nesting and resting sites in wetland and riparian habitats. Wetland habitats within Ridges Basin are primarily wet meadows and small irrigation ponds. Examples of fauna using them include migratory waterfowl, yellow-headed and red-winged blackbirds, long-billed marsh wren, amphibians (such as leopard frogs and tiger salamanders), and small mammals such as voles, deer mice, muskrats, and occasionally raccoons and striped skunks. Wetland habitat along the San Juan River includes riparian and emergent wetlands. Wetlands associated with the Pine, La Plata, Mancos, and Dolores River Basins include those that are naturally occurring, as well as those that are associated with irrigation ditches and agricultural return flows. A more detailed description of wetland/riparian habitats potentially impacted by the project can be found in Section 3.4, Vegetation Resources.

3.5.4 Environmental Consequences and Mitigation

The following sections discuss potential impacts to wildlife resources of Refined Alternative 4, Refined Alternative 6, and the No Action Alternative. In addition, mitigation measures are proposed to reduce or eliminate potential impacts to wildlife resources. The purpose of these mitigation measures is to substantially reduce significant and potentially significant impacts to wildlife resources. The wildlife program would include several measures to avoid, minimize, or compensate for significant disturbance to wildlife and wildlife habitat. Reclamation, in coordination with other responsible agencies, would consider the need for seasonal road closures, buffer zones, and construction activity windows during all phases of project construction, operation, and management.

3.5.4.1 Refined Alternative 4

3.5.4.1.1 Structural Component

Refined Alternative 4 Wildlife Impact 1 - Significant: Inundation of Ridges Basin and other direct and indirect habitat losses would result in the loss of approximately 2,700-2,900 acres of wildlife habitat used by a variety of wildlife species, most notably big-game animals, principally mule deer and elk.

An estimated 1,487 acres of elk and deer winter range loss would be a direct result of the inundation of habitat in Ridges Basin. Up to 500 elk would be displaced by construction of the dam and other facilities, directly through loss of habitat and indirectly by interruption of migration routes. The reservoir, dam, and associated facilities would displace several hundred mule deer which winter in Ridges Basin and may interrupt migration routes to other wintering grounds. In addition, recreational development and the relocation of existing roads would directly and indirectly impact additional acreage of wildlife habitat. The combined adverse impact would be approximately 2,700-2,900 acres of wildlife habitat according to the Service (Service 2000a).

Mitigation for Refined Alternative 4 Wildlife Impact 1: The direct and indirect loss of approximately 2,700-2,900 acres of wildlife habitat would be mitigated by the purchase, development, and management of approximately 2,700-2,900 acres of suitable land.

The amount of land that would be acquired to obtain this level of mitigation would depend on the potential wildlife value of the lands acquired. All reasonable attempts would be made to acquire interests in lands on a willing-seller basis, using mechanisms that could include fee simple purchases, conservation easements, purchase options, and/or life estates. However, this does not preclude the use of other authorities available to acquire such land interests. Priority would be given to lands in the La Plata River drainage as well as in the vicinity of Ridges Basin to provide replacement habitat for displaced deer, elk, and other wildlife that utilize Ridges Basin and adjacent areas that would be affected. Large, contiguous parcels would be given priority to create unfragmented habitat and to facilitate management. Lands would be managed for wildlife, and other uses would not be allowed if they interfered with the wildlife habitat benefits. Acquisition, development, and management plans would be coordinated with the Service, CDOW, and possibly the Southern Ute Indian Tribe.

Because of the preference to acquire interests in lands on a willing-seller basis, it is recognized that the specific parcel locations would be difficult to establish at this time. If lands within the La Plata River Basin or Ridges Basin areas are unavailable, other lands within the San Juan River Basin would be sought. Based on similar past programs, it would be feasible to acquire the lands; however, it should be noted that they may not be in the immediate ALP Project impact area.

Lands would be acquired prior to award of the contract for construction of Ridges Basin Dam and development would occur concurrently with construction of the dam. Development of specifics would depend on site capabilities, but in general would include the following:

❑ Reclamation would be responsible for arranging long-term management of the area; %

❑ Soil/water/vegetation inventory, development and management plan preparation;

❑ Boundary survey and fencing;

❑ Rehabilitation of unneeded roads, removal of unneeded fences, creation of controlled access, parking, and signing; and %

❑ Weed control, erosion control, and vegetation and habitat enhancement.

Habitat development would emphasize providing winter feeding and cover areas for big game and undisturbed nesting areas for birds. Dependent on the parcel acquired, this could involve opening up pinon-juniper areas to promote shrub growth; protection and expansion of riparian areas; seeding of desirable grasses, forbs, and shrubs; and other methods. %

At the request of CDOW, Reclamation has acquired approximately 582 acres of Colorado State Land %
Board Trust lands within the contiguous boundaries of the Bodo Wildlife Area. Although only 244 acres of these 582 acres are directly needed for ALP Project purposes, the remaining 339 acres could be traded to CDOW for a 618-acre block of land to provide access for Ridges Basin Dam. The acquisition and long-term protection of the 582-acre and 618-acre parcels would also benefit elk herds by maintaining big game migration corridors from summer to winter range (1996 FSFES).

Refined Alternative 4 Wildlife Impact 2 - Significant: Construction of the gas pipeline relocation corridor, road relocation, and recreation area development associated with Refined Alternative 4 would have a temporary adverse effect on mule deer, elk and possibly elk calving areas.

Construction noise and human activities could disrupt wildlife habitat utilization and behavior patterns of wildlife during sensitive periods in the life histories of each species. Elk and deer security could be adversely affected, particularly for elk during the May through July calving period. Noise impacts to wildlife would last through the construction phases of the project and could result in short-term displacement of wildlife to other locations removed from the construction zones or the range of audible noise. As construction activities and noise levels and construction intrusion subside, displaced wildlife would be expected to potentially return to the area. The ambient noise levels and human access during project operation, however, would determine the rate and magnitude of return.

Mitigation for Refined Alternative 4 Wildlife Impact 2: Construction specifications would include noise, traffic, and human use restrictions to minimize disturbance to wildlife near the construction zone of Ridges Basin. The Carbon Mountain gas pipeline route, which could significantly impact golden eagle nesting, would not be considered.

Noise and human intrusion are unavoidable consequences of construction. Construction impacts on wildlife can be mitigated to a large extent by timing construction activities to avoid sensitive periods in the life histories of targeted species. Avoidance of construction during the May-July period in the vicinity of elk calving areas would minimize impacts to elk. Feasible noise controls on standard construction equipment would also reduce impacts to elk. Signage and restricted access to construction crews would contribute to the reduction of human intrusions into wildlife habitat areas that would be seasonally critical to wildlife.

Refined Alternative 4 Wildlife Impact 3 - Significant: Once constructed, the long-term effects of the use of the relocated road and recreation areas would reduce use of the area by elk and deer during the summer period and although the areas would continue to be used as winter range, increased use of the area by humans would disrupt deer and elk habitat utilization and behavior.

Project access roads would create corridors for human access into portions of Ridges Basin that are currently relatively remote from existing roads. Increased public access could adversely affect wildlife species, including deer and elk, which are sensitive to noise or human activity. Access on roads during the spring through fall seasons would be increased for motor vehicle traffic and during the winter season if over-snow vehicles, such as snowmobiles, were allowed.

Mitigation for Refined Alternative 4 Wildlife Impact 3: Recreational facilities and the new alignment for CR 211 would be sited or restricted in a way to minimize the disruption of deer and elk habitat utilization and behavior. In addition, the operation of those facilities would be managed through a plan that would support the minimization or elimination of those conflicts/impacts.

Siting of recreation facilities on the northern side of the reservoir would guide the majority of human activity to this area. Recreation facilities would not be permitted on the west and south sides of the reservoir to reduce impacts to big game migration corridors. Sufficient land would be acquired at the time reservoir right-of-way was acquired at the upper (western) end of the reservoir and along the southern shore to provide a wildlife migration corridor.

Seasonal closures between November 30 and March 30 would be included in all reservoir and recreation plans to protect wintering wildlife. In some critical areas, closures would extend from November 15 to May 1 in accordance with Service recommendations. Snowmobile and off-highway vehicle use in the area would be prohibited to protect wildlife, and mountain bike access would be limited to areas that do not impact wildlife. If lands were transferred to another entity, deed restrictions would be included in the transfer to protect wildlife values.

The Rafter J route, connecting CR 211 from the east to State Highway 141 in Wildcat Canyon, is recommended for CR 211. The final location of the route would have to be coordinated with La Plata County. This route would allow for discontinuation of CR 211 for about 2.5 miles to the northwest of the reservoir. The routing provides an undisturbed buffer zone for migrating deer and elk moving along the northwest and west shore of the proposed reservoir. Secondary roads leading from the recommended new alignment of CR 211, from the north shore of Ridges Basin Reservoir to Highway 141 in Wildcat Canyon, would be blocked to motorized vehicles to minimize disturbance to wildlife, particularly overwintering and migrating deer and elk. Secondary road access would be limited to public access to recreational areas, and service access to Bodo State Wildlife Area, Ridges Basin Dam, transmission lines, and other features. All unnecessary roads within Reclamation's right-of-way would be obliterated, recontoured, and planted with native vegetation during the construction phase of the project.

Refined Alternative 4 Wildlife Impact 4 - Significant: Construction of the Ridges Basin Dam, pumping plant, inlet conduit line, new road alignment for CR 211, reservoir access roads, relocation of transmission lines, and recreation facilities could impact nesting golden eagles.

Construction of Ridges Basin Dam would likely affect nesting golden eagles on Carbon Mountain due to an increase in noise levels and line-of-site visual disturbances. The existing nesting areas would not be directly impacted, and Reclamation believes these impacts would not lead to nest abandonment. These impacts are unavoidable and if requested by the Service, a permit acquired under provisions of the Bald and Golden Eagle Protection Act would be required. Also, construction of the reservoir and associated recreation facilities would lead to an increase in human use of the general area, including Carbon Mountain.

Mitigation for Refined Alternative 4 Wildlife Impact 4: Reclamation and raptor specialists from the Service and CDOW would collaborate on road realignment and construction activity at Ridges Basin Dam to identify and implement measures minimizing effects on existing golden eagles and their nests on Carbon Mountain. All reasonable means to preclude human activity on Carbon Mountain should be pursued. All powerlines would be designed raptor-proof.

Noise controls such as those identified in Mitigation for Wildlife Impact 2 would help to minimize impacts to golden eagle nest sites near the Ridges Basin Reservoir construction zone. Construction of Refined Alternative 4 would be planned to minimize noise levels and visual disturbance between December and June when the eagles are involved in nesting activities. If there is no practicable way to avoid affecting known nest sites, Reclamation would apply for federal permits under the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act to allow for the adverse impact on nesting to occur and would follow recommended mitigation measures.

Refined Alternative 4 Wildlife Impact 5 – Significant: Development of Ridges Basin Reservoir and associated recreation area would increase use in the general area, which could disturb nesting golden eagles on Carbon Mountain.

It is known that disturbance to nesting golden eagles can lead to nest abandonment. Unrestricted access to Carbon Mountain during nesting periods would effect golden eagle nesting activities.

Mitigation for Refined Alternative 4 Wildlife Impact 5: A 0.25 mile buffer around the existing golden eagle nests would be identified and all reasonable measures should be pursued to preclude human activity on Carbon Mountain between December 1 through July 15, the nesting period of golden eagles.

The elimination of human activity in the vicinity of Carbon Mountain during the golden eagle nesting period would likely prevent abandonment of nests.

Refined Alternative 4 Wildlife Impact 6 - Less than Significant: Construction of the NNMP could result in the displacement of wildlife along the alignment.

During construction of the NNMP, wildlife would temporarily be displaced as a result of ground-disturbing activity and equipment movement. Most of the alignment is through rangeland and agricultural areas, and is within existing rights-of-way for roads and the existing pipeline. No significant impacts to wildlife movement are expected to occur and wildlife use of the right-of-way would resume following construction. No clearing of large trees potentially used by nesting raptors would be necessary to install the pipeline.

Mitigation for Refined Alternative 4 Wildlife Impact 6: No mitigation is proposed.

3.5.4.1.2 Non-Binding End Uses and Water Conveyance

Refined Alternative 4 Wildlife Impact 7- Significant: Construction of water conveyance pipelines would result in the loss of 20 to 300 acres of wetland and riparian wildlife habitat. Construction activities, noise, and human intrusion could result in short-term disturbance to wildlife security.

The analysis of the estimated habitat loss (see Refined Alternative 4 Vegetation Impact 8) is only a representative magnitude of the wildlife habitat impacted by pipeline construction activities. The level of impact would be dependent on the sensitivity of the area crossed by the pipelines, the extent of wetlands or riparian habitat intersected by the pipelines, and the presence or absence of sensitive wildlife species.

Construction of pipelines could result in disturbance (particularly during nesting activities) due to noise effects, disrupting wildlife habitat utilization and behavior patterns. Increased access and activities of construction crews are known to adversely affect wildlife species that are sensitive to noise or human activity. If nighttime construction were planned, supplemental lighting would be particularly disturbing to nocturnal wildlife inhabiting riparian areas, resulting in abandonment of feeding and foraging areas.

Mitigation for Refined Alternative 4 Wildlife Impact 7: Construction zones would be the minimal needed to meet project objectives. If avoidance is not possible, riparian/wetland habitat mitigation and a monitoring plan would be developed to compensate for the loss of habitat value.

The implementation of the mitigation for wetlands/riparian vegetation (Mitigation for Vegetation Impact 8) would minimize or compensate the loss of habitat associated with Wildlife Impact 7**.** Feasible noise controls on standard construction equipment would assist in minimizing noise impacts. Similarly, the shielding or shrouding of impact tools when practicable, and exhaust mufflers on other equipment would also help. Signage and restricted access to construction crews would contribute to the reduction of human intrusions into wildlife habitat areas that would be seasonally critical to wildlife. Restrictions on nighttime construction and lighting would reduce the potential impact to nocturnal animals.

3.5.4.2 Refined Alternative 6

3.5.4.2.1 Structural Component

Refined Alternative 6 Wildlife Impact 1 - Potentially Significant: Raising Lemon Reservoir Dam, which would inundate 60 acres of ponderosa pine and other wildlife habitat, including 30 to 50 acres of wetlands, could result in short-term construction disturbance to sensitive wildlife and longer-term wildlife conflicts due to access road relocation around the reservoir.

Sensitive wildlife species such as osprey and other raptors are known to nest in the general vicinity of Lemon Reservoir. The reservoir may provide a food base for these and other species. The surrounding trees in the ponderosa forest may provide perch and roosting habitat. Construction-related activities, noise, and line-of-site visual disturbances could affect eagles, including nesting bald eagles, and other raptors. The realignment of a replacement road for the exiting road inundated by the enlarged capacity reservoir could have similar impacts.

Mitigation for Refined Alternative 6 Wildlife Impact 1: Prior to construction, field surveys would be conducted to identify sensitive wildlife receptors within the construction influence zone. A wildlife protection plan would be developed for construction and relocation of existing Lemon Reservoir facilities, structures, and access roads.

The wildlife management plan would identify the locations of sensitive wildlife, methods and procedures for impact avoidance, and procedures for construction monitoring. The Service would be consulted on impacts to bald eagles.

The mitigation applies to the potential impact of construction noise and human activity on wildlife. The impact would be short-term and temporary, lasting through the construction period. The impact of the loss of approximately 60 acres of pondersosa pine vegetation would be confined to a narrow, 13-foot wide strip of forest around the perimeter of the water surface of Lemon Reservoir. The impact of the 60-acre vegetation loss is not considered to be significant (see Section 3.4.4.2.1).

Refined Alternative 6 Wildlife Impact 2 - Less than Significant: Construction of the NNMP could result in the displacement of wildlife along the alignment.

This impact is the same as that for Refined Alternative 4 Wildlife Impact 6.

Mitigation for Refined Alternative 6 Wildlife Impact 2: No mitigation is proposed.

3.5.4.2.2 Non-Structural Component

Refined Alternative 6 Wildlife Impact 3 - Significant: Acquisition of water rights, converting irrigation water to M&I uses, and cessation of irrigation in the Pine River, La Plata River, Mancos River, Dolores River, and McElmo River basins could result in the conversion of over 1,200 acres of wetland and riparian wildlife habitat to upland habitat.

The impact to wetland/riparian vegetation cover, the basis of wildlife habitat, is addressed in Refined Alternative 6 Vegetation Impact 3. The estimated loss of wildlife habitat represents only a relative magnitude of the wildlife habitat impacted by allowing the abandonment of irrigation ditches, and elimination of irrigation and irrigation return flows. Wildlife associated with wetlands/riparian habitat would be displaced or lost. Wildlife movement and migration corridors, breeding and feeding habitats and animal security would all be adversely impacted by the altered hydrology that currently enhances and augments wetland and riparian habitat in the Pine, La Plata, Mancos, Dolores, and McElmo River Basins. A general reduction in wildlife habitat values for wetlands-associated species would potentially result from the conversion to dry upland or weedy vegetation cover.

Mitigation for Refined Alternative 6 Wildlife Impact 3: Attempts to avoid impacts up to 600 of the 1,200 acres of wetlands would be made by maintaining portions of the wetlands' water supply. The remaining 600 or more acres would be mitigated through a program of land acquisition and wetland development.

Avoidance would be attempted by allowing a percentage of the consumptive use water acquired to remain on the land and thereby being applied towards supporting the existing wetlands. This percentage of consumptive use water must be protected as project water/project purpose for support of wetlands. In addition to the water/land acquisition, agreements and perhaps easements/acquisitions would be needed to protect the avoided wetlands. The viability/feasibility of this wetland avoidance method declines as the amount of wetlands to be replaced/compensated for increases. Reclamation must also show that no harm is caused to other water right holders during this process while still acquiring sufficient land with water to meet the M&I requirements. Wetland losses that could not be avoided would have to be mitigated through a program of acquisition, development, and protection of wetlands.

Implementation of the mitigation for wetland/riparian vegetation (Mitigation for Refined Alternative 6 Vegetation Impact 3) could compensate for the loss of wildlife habitat and other wetland functions. The feasibility of avoidance would depend on many factors—location of lands, state water right decisions, agreements with landowners—that are difficult to predict. The mitigation for losses that could not be avoided would involve a large program of water and land acquisition from willing sellers to provide the elements needed to create replacement wetlands. Assuming one-half of the wetland impacts could be avoided and a mitigation ratio of 1.5:1 for the remainder lost, approximately 900 acres of wetlands (assume 2,700 acres of land total) would need to be developed. This large acquisition, occurring in an area where major water acquisitions were being conducted concurrently, may not be feasible.

3.5.4.2.3 Non-Binding Water End Use and Conveyance System

Refined Alternative 6 Wildlife Impact 4 - Significant: Construction of water conveyance pipelines would result in the loss of 20 to 300 acres of wetland and riparian wildlife habitat. Construction activities, noise, and human intrusion could result in short-term disturbance to wildlife security.

This impact is similar to Refined Alternative 4 Wildlife Impact 7.

Mitigation for Refined Alternative 6 Wildlife Impact 4: Construction zones would be the minimal needed to meet project objectives. If avoidance is not possible, riparian/wetland habitat mitigation and a monitoring plan would be developed to compensate for the loss of habitat value.

This mitigation is the same as that for Refined Alternative 4 Wildlife Impact 7.

3.5.4.3 No Action Alternative

The following impacts of the No Action Alternative were taken from the 1996 FSFES.

Elk

In 1991, Reclamation acquired 3,995 acres of the Bodo Wildlife Area from the State of Colorado for project purposes. Acquired in 1975 by CDOW, principally as elk winter range, the purchase left CDOW approximately 2,900 acres to manage. Under the No Action Alternative, Reclamation would evaluate several options relative to ownership and future management of this property. Reclamation would retain ownership of or transfer the property to the State of Colorado, one of the Ute Tribes, or another land management agency. Reclamation would select an option that would limit or exclude development and ensure management for the benefit of elk similar to the management between 1975 and 1991 by CDOW. (Page III-65.)

% **Note:** Anticipated residential development immediately north and west of Ridges Basin would continue
% to reduce the habitat suitability of the Basin for wintering elk, deer, and other wildlife.

Golden Eagles and Other Raptors

Golden eagles and goshawks probably would continue to nest within Ridges Basin barring other nearby development that might affect these species. Similarly, any alterations to wetland/riparian-associated wildlife population would be a result of changes in riparian hydrology and burgeoning development along the Animas and La Plata Rivers. These alterations may affect nesting and roosting sites for a variety of raptor species. (Page III-68.)

Wetland/Riparian Wildlife

Wildlife species dependent upon wetland/riparian habitat would probably continue to exist at approximately the same populations in the future. Localized impacts to riparian habitat would continue to occur which, in turn, would affect many of the small bird and mammal populations. (Page III-71.)

3.6 AQUATIC RESOURCES

3.6.1 Introduction

This section addresses potential impacts to aquatic resources that could result from actions associated with Refined Alternative 4, Refined Alternative 6, and the No Action Alternative. Section 3.6.2 defines the Evaluation Methodology and significance criteria used for determining impacts, Section 3.6.3 describes the affected environment, and Section 3.6.4 identifies potential impacts and discusses mitigation measures that would serve to reduce or eliminate anticipated impacts on aquatic resources.

The 1996 FSFES summarized the results of aquatic resource studies conducted on the Animas, La Plata, Mancos and San Juan Rivers as well as other smaller tributaries within the San Juan Basin from 1975 to 1995. Several of these studies were conducted specifically to gather baseline information on aquatic resources potentially impacted by the project from which mitigation options were formulated. Of particular concern was the project's effects on the non-native trout fishery and the native fishes. More detailed accounts of these studies can be found in several reports (Smith 1976, Miller et al. 1995; Whiteman 1997; Holden 1999; Whiteman 2000).

3.6.2 Evaluation Methodology

This section discusses the methodology used to determine potential impacts that could result from Refined Alternative 4 and Refined Alternative 6. Also discussed are specific criteria used to determine the significance of the impacts identified.

3.6.2.1 Methodology

Potential impacts were assessed on best professional judgement using both hydrologic modeling outputs and known life history requirements of affected fish species. Effects to physical habitat, from depletion in flow, were modeled based on full project effects to flow, both known and estimated using non-binding scenarios of water use. Also considered was the high density of native fishes in the Animas River. These data relating the relative importance of native fishes in both this river and the likelihood of maintaining this population as a source of recruitment to the San Juan River, indicated that any effect to this resource was potentially significant. River cross-sectional and water surface elevation data were collected from the Animas River in 1994 (Lyons 1994). Lyons partitioned the Animas River from Durango, Colorado to the confluence of the San Juan River into three reaches based on hydrologic, geomorphic and channel characteristics criteria **(Map 3-2).** Within these reaches, data were collected at nine separate sites. Reach 1 extended from the proposed Durango Pumping Plant location downstream to the confluence of the Florida River. Reach 2 extends approximately 19 miles downstream to Aztec, New Mexico and Reach 3 extends from Aztec, New Mexico to the confluence of the San Juan River (15 miles).

For all nine sites, the hydraulic modeling software *RHABSIM* (Thomas R. Payne and Associates 1998) was used to develop relationships between discharge and various hydraulic components. For each site, two transects, one characteristic of riffle habitat and one characteristic of run habitat, were selected. Also, for each transect, time series analysis was performed using wetted perimeter versus discharge and average depth versus discharge curves. Hydrology was compiled using water years 1929 to 1993. The hydrology was updated to reflect current water uses as was projected uses from which effects to the hydrology were assessed. The water years used for the 1996 FSFES (1951, 1949, and 1945) were selected to represent dry, wet, and average years, respectively.

Information presented in the 1996 FSFES and other available information were used to describe the aquatic resources in the Pine, La Plata, Mancos, Florida and Dolores River Basins. The effect to aquatic resources based on implementation of Refined Alternative 6 was difficult to assess because of the lack of information on specific project impacts. The CDOW provided some information from which to assess project impacts although some general assumptions and best professional judgement were largely used.

3.6.2.2 Significance Criteria

Impacts to aquatic resources were determined to be significant if either modeled hydraulic characteristics showed a greater than 15 percent decrease due to the operation of the project or if a potentially affected resource was thought to be significantly impacted due to habitat loss. Change in average depth and wetted perimeter were analyzed as the physical components most likely impacted by the project operation. The average depth change was also evaluated against absolute depth. For example, if the average depth changed more than 15 percent, but the depth was still greater than that needed for fish to migrate through riffles (e.g., 1.0 foot deep) the change was not considered significant. In terms of loss of wetted area, riffles would be the most impacted by flow reductions. A loss of wetted area within riffles would result in the greatest impact to the river’s productivity. This could have a negative impact on the river’s fishery component by limiting fish production (growth) and possibly eventually reducing the carrying capacity for fish in the river. Also affecting carrying capacity for native fishes is the chronic reduction in flow (fish habitat) caused by project pumping. This effect, although not expected to lead to serious declines in native fish population, would reduce the river’s ability to support native fish populations.

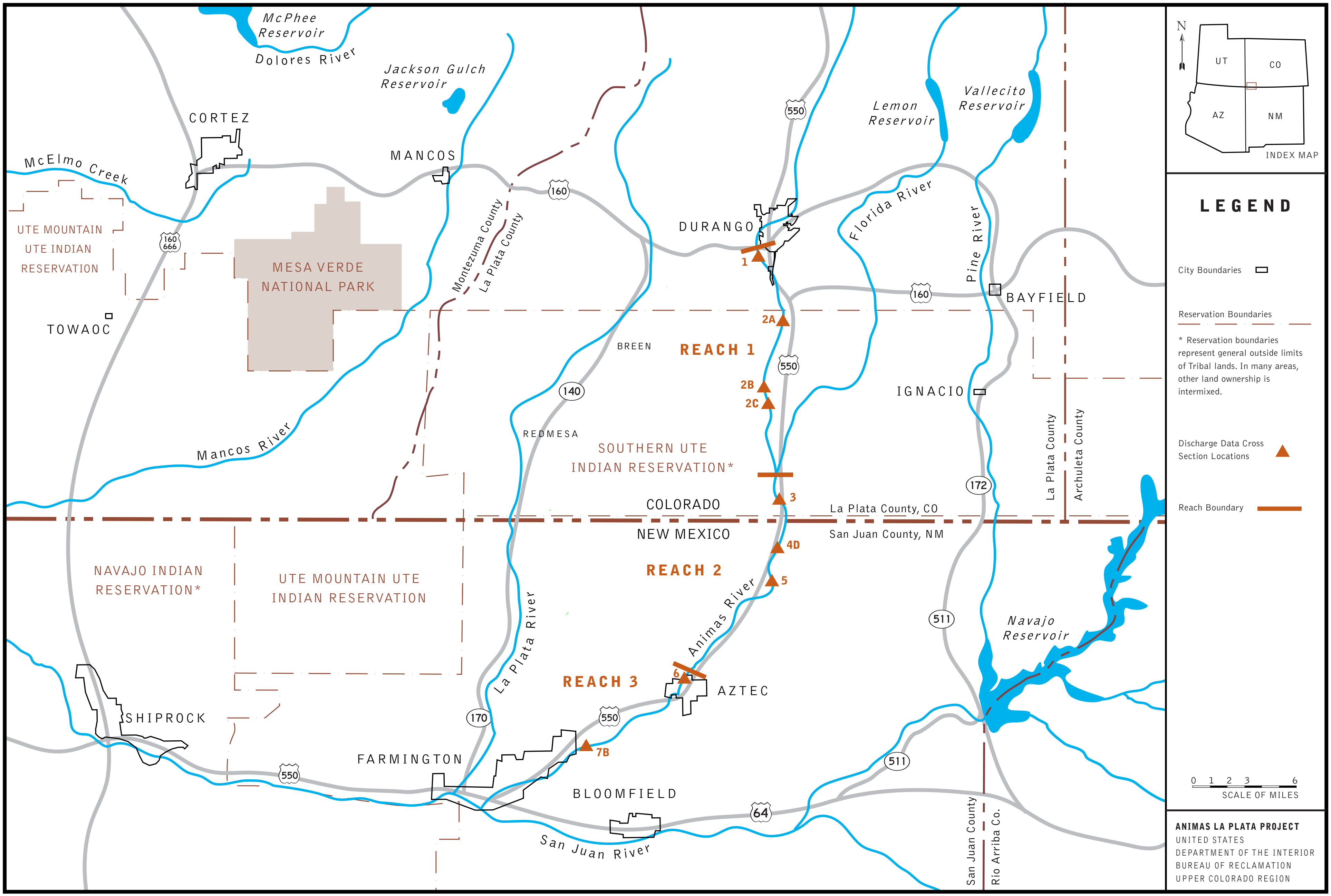
3.6.3 Affected Environment

This section discusses existing aquatic resources in the areas potentially affected by Refined Alternatives 4 and 6. The actions that may take place under the No Action Alternative are not fully known at this time, and consequently, it is not possible to completely define the affected environment for that alternative. However, many of the eventual actions that may occur as a result of the No Action Alternative would likely take place within the same geographic setting as that of Refined Alternative 4.

3.6.3.1 Trout Fishery

3.6.3.1.1 Animas River

The trout fishery in the Animas River is predominantly composed of stocked rainbow (*Oncorhynchus mykiss*), brown trout (*Salmo trutta*), Snake River cutthroat (*Oncorhynchus clarki* ssp.); and brook trout (*Salvelinus fontinalis*). The CDOW manages the trout fishery from the headwaters of the Animas River downstream to the Southern Ute Indian Tribe boundary, located about 3.5 miles downstream from the proposed Durango Pumping Plant. The Southern Ute Indian Tribe manages the Animas River fishery on tribal waters from that point to the Colorado/New Mexico state line. Within New Mexico, the New Mexico Department of Game and Fish (NMDGF) manages the Animas River fishery; however, this portion of the river has minimal recreational fishery value. Accordingly, fishing activities are very low.



MAP 3-2

Aquatic Resources Discharge Data Collection Locations on the Animas River

[back page for map]

Historically, the Animas River game fishery was entirely maintained through the stocking of both catchable-size and fingerling trout. Successful natural rainbow, brown and brook trout reproduction in the river has been recently documented, but the extent to which this reproduction augments the stocked population remains unknown (Japhet 1997, 1998a, 1998b). The highest density of naturally spawned trout fry has occurred in the section from Lightner Creek to Purple Cliffs. Natural spawning is limited by high heavy metals concentrations as well as large volumes of sediment that smother the spawning gravels and significantly reduce dissolved oxygen in spawning redds. This is a recurring condition associated with sediment deposition from natural sources within the Animas River drainage.

Natural recruitment of rainbow and cutthroat trout in the Animas River is also affected by whirling disease, a disorder caused by the microscopic parasite *Myxobolus cerebralis*. The parasite attacks the cartilage of infected fish and can cause young fish to swim in a circular "whirling" motion when alarmed. Severely infected fish can be killed by the disease or left with skeletal deformities. Whirling disease can cause dramatic reductions in wild rainbow trout populations. Therefore, whirling disease virtually eliminates any chances of natural recruitment of rainbow trout and cutthroat trout. The presence of the disease influences fishery management decisions, for example, by requiring that the size of trout to be stocked be greater than 4 inches long in order to prevent mortality from the whirling disease spore.

Improvement of the fishery in the Animas River is attributed primarily to better stocking techniques, including the use of stocking larger fingerling trout, acquiring hardier strains of rainbow trout, and distributing fish evenly by raft in relatively high (300 fish per acre) concentrations (1996 FSFES). In 1997, the Durango Fish Hatchery tested positive for whirling disease, and subsequently, no trout were stocked into the Animas River during 1997 or 1998. The hatchery has recently been certified whirling disease-free and stocking was resumed in 1999. The CDOW conducted a trout study in 1998 and verified that both trout biomass (total trout weight per unit area) and numbers were significantly lower due to the lack of stocking in 1997 and 1998.

A trout standing crop estimate in 1997 for the Animas River from Purple Cliffs to the town of Bondad, Colorado, was 41 kg/ha. Between 1992 and 1997, trout biomass exhibited an almost fourfold increase in this section of the river (Whiteman 1997). Most of the area is within the Southern Ute Indian Reservation.

A 3.5-mile reach of the Animas River from the Lightner Creek confluence to the Purple Cliffs has been designated as a Gold Medal Water by the Colorado State Wildlife Commission (CSWC). Anglers are restricted to the use of artificial lures and flies only, and to a possession limit of two trout with a minimum length of 16 inches. As a result, more and larger trout are now found in this section of the river. In 1995, the Southern Ute Indian Tribe established special regulations for the 2.8-mile section above Weaselskin Bridge (1996 FSFES).

3.6.3.1.2 La Plata River

Downstream of Hesperus, Colorado, the La Plata River supports a very small population of trout, consisting primarily of rainbow and brown trout. These were probable migrants from larger upstream populations of trout, most probably the result of CDOW's stocking program. Brown trout are probably self-sustaining in the river. During a 1998 study, only one percent of the fish captured were trout (Whiteman 1999). Natural reproduction of brown and brook trout in the La Plata River occurs only in the river upstream of Hesperus. These species probably do not successfully naturally reproduce downstream of that point because of chronic stream dewatering.

3.6.3.1.3 San Juan River

The San Juan River near the Animas River confluence contains a small and relatively insignificant trout fishery. The fishery is composed of primarily brown trout, with rainbow trout also occurring in small numbers. Natural reproduction in the area is likely negligible; therefore, most fish probably moved downstream from areas with higher trout concentrations.

3.6.3.1.4 Pine and Florida Rivers

The southern portion of the Pine River below Vallecito Reservoir contains a brook trout and brown trout fishery. Near Vallecito Dam, rainbow trout also occur. The lower Florida River, near the confluence with the Animas River, supports a brown trout fishery. At the headwaters of the Florida and within Lemon Reservoir and immediately downstream of the reservoir, cutthroat trout, rainbow trout, and brown trout occur. Non-native white suckers are also found in the upper portions of the Florida River.

3.6.3.1.5 Lemon Reservoir

Lemon Reservoir supports a fishery that includes cutthroat, rainbow, brook, and brown trout, as well as kokanee salmon.

3.6.3.2 Native Fishery

3.6.3.2.1 Animas River

Fishery studies conducted in 1992, 1993, 1994, and 1998 confirm that aquatic habitat in the Animas River for native fish species appears abundant from Durango downstream to the first several miles into New Mexico, where degradation from diversions, channelization, agricultural, and urban uses significantly limits habitat for native fish. During the irrigation season, diversions significantly deplete the flow in the Animas River downstream of Aztec, New Mexico. Channelization of the river has significantly reduced physical habitat, contributing to an increase in erosion and destabilized riverbanks. Run-off from agricultural fields and urban effluent has further degraded water quality in the river as it flows southward. The problem becomes more significant downstream of the Colorado/New Mexico state line where the area is more heavily populated (1996 FSFES).

Native fish species in the Animas River include the mottled sculpin (*Cottus bairdi*), speckled dace (*Rhinichthys osculus*), bluehead sucker (*Catostomus discobolus*), flannelmouth sucker (*Catostomus latipinnis*), and the roundtail chub (*Gila robusta*). The roundtail chub is protected in New Mexico under state law as an endangered species and is similarly protected within the Southern Ute Indian Tribe reservation.

Several nonnative species also occur within the Animas River drainage. Nonnative trout dominate the introduced species, with highest concentrations occurring near Durango and decreasing as the Animas River flows downstream toward Farmington, New Mexico. Nonnative species occurring in small numbers include white sucker (*Catostomus commersoni*), common carp (*Cyprinus carpio*), fathead minnow (*Pimephales promelas*), red shiner (*Cyprinella lutrensis*), channel catfish (*Ictalurus punctatus*), black bullhead (*Ameiurus melas*), and johnny darter (*Etheostoma nigrum*). The white sucker is a particularly troublesome management species because of its ability to hybridize with native suckers.

For a complete description of the native fishery studies conducted prior to 1996, refer to the 1996 FSFES.

3.6.3.2.2 Mancos River

All native fish identified for the Animas River occur in suitable habitat in the Mancos River. Flannelmouth sucker, roundtail chub, and speckled dace are the dominant species. Studies conducted in 1993-1994 indicate that roundtail chub occur from the confluence of Johnson Canyon downstream to the San Juan River. Chub appear to spawn throughout much of the length of the Mancos River. Downstream from Johnson Canyon, however, significant flow depletions during the irrigation season result in complete dewatering of large portions of the river during the late summer and early fall (1996 FSFES).

3.6.3.2.3 La Plata River

Fishery studies conducted by Reclamation in 1993-1994 found that in an approximate 10-mile reach of the La Plata River downstream from the confluence of Cherry Creek to 2 miles below the New Mexico state line, there is a significant native fish population, including roundtail chub. Few nonnative fish were collected. Most of the roundtail chubs were in a four-mile reach between the Long Hollow Creek confluence to about one mile upstream from the Colorado/New Mexico state line. The roundtail chubs captured included several age classes, indicating the presence of successful reproduction and recruitment.

Additional La Plata River native fish studies were done during 1996-1998. The primary purpose of these monitoring studies was to assess movement and growth of roundtail chubs and to monitor possible changes in native fish populations. More detailed information on the results of these studies can be obtained in the 1996 FSFES, Appendix I, and Whiteman 1999.

3.6.3.2.4 San Juan River

Aquatic habitat in the San Juan River varies both seasonally and throughout the river's length. Major habitat types include runs, riffles, chutes, pools, and low velocity habitats. These habitats are not equally distributed throughout the river. Run habitats are by far the most common, comprising the majority of available habitats during both high and low flows. Riffle habitats are more abundant at low flow than at high flow as are low velocity habitats. During low flows the highest concentrations of low velocity habitats in the San Juan River occur near Navajo Dam and between Farmington and Shiprock in New Mexico (Bliesner and Lamarra 1999).

The fish community includes both native and nonnative species. The two federally protected endangered fishes occurring in the San Juan River, the Colorado pikeminnow (*Ptychocheilus lucius*) and razorback sucker (*Xyrauchen texanus*), are discussed in Section 3.7, Special Status Species, and are not addressed here.

A total of 21 species of fish occur in the San Juan River, including 6 natives, 15 nonnatives, and 3 hybrid sucker forms (Ryden and Pfeifer 1995, Ryden 2000a). Further, eight of these species (four native and four nonnative) account for the majority of these species. In order of relative abundance, the flannelmouth and bluehead suckers and the speckled dace are the most common native fishes in the San Juan River from Farmington to Lake Powell (Ryden 2000a). Channel catfish, common carp, and red shiner are the most common nonnative species.

In addition, several fish species more often associated with lake environments have been collected from the San Juan River as far as 80 miles upstream from its confluence with Lake Powell. In particular, during 1995, striped bass (*Morone saxatilis*) and walleye (*Stizostedion vitreum*) were found to be relatively common in this section of river. Analysis of these fish indicated that they had been actively feeding on fish from the river, most commonly native fish.

3.6.3.2.5 McElmo Creek

The fishery in McElmo Creek consists of both native and non-native species. Flannelmouth sucker, bluehead sucker, and speckled dace are the major native species in the upper portions of the creek. Further downstream, near the confluence with the San Juan River, non-natives are more common. These include common carp and channel catfish, and occasionally black bullhead, bass, bluegill and green sunfish.

3.6.4 Environmental Consequences and Mitigation

The following sections discuss potential impacts to aquatic resources from Refined Alternative 4, Refined Alternative 6, and the No Action Alternative. In addition, mitigation measures are proposed to reduce or eliminate potential impacts to aquatic resources.

3.6.4.1 Refined Alternative 4

Refined Alternative 4 Aquatic Resources Impact 1 -Potentially Significant: Decreases in aquatic habitat due to chronic flow depletions could adversely affect the carrying capacity for trout in the Animas River.

Operation of the Durango Pumping Plant would deplete flows by up to 280 cfs (240 cfs in June) from the Animas River. For the representative years, significant monthly decreases in average depth occurred most often during October, but the total depth that remains does not impede fish passage (as shown in Technical Appendix 5, Aquatic Resource Data Tables). River diversions would continue throughout the year but pumping would cease when natural flow reaches seasonal bypass levels. Flow depletions were found to significantly affect average depths, especially during October. This reduction would not impede fish passage but would reduce the ability of the river to support fish.

Overall, for water years 1929-1993, there are no major changes in wetted perimeter nor average depth (Technical Appendix 5). The section of river between the Durango Pumping Plant and Basin Creek displayed the highest decreases. This section of river maintains high population of both non-native trout and native fishes. This section is not projected to receive any return flows from the use of project water. Accordingly, there would be a chronic reduction in carrying capacity of the river to support both trout and native fishes. Non-project related factors would continue to be the significant factors limiting the trout fishery. These include:

- ❑ Lack of sufficient natural reproduction and recruitment to sustain the population; and
- ❑ Possible water quality problems, including sedimentation and subsequent suffocation of incubating trout eggs and seasonal elevated water temperatures downstream of Durango.

Mitigation for Refined Alternative 4 Aquatic Resources Impact 1: Establish three seasonal bypass flows past the Durango Pumping Plant. Implement a stocking program for trout in the Animas River to compensate/replace loss of usable habitat due to flow depletions.

Three seasonal bypass flows would be honored. These would be: 225 cfs (April-September); 160 cfs (October-November) and 125 cfs (December-March). There would be no flow augmentation provided to the Animas River if natural flow went below any of these seasonal bypass flows. Pumping would stop once natural flow went to these levels as measured at the Durango Pumping Plant. A stocking program for trout in the Animas River would ensure a reliable source of rainbow trout and Snake River cutthroat trout to mitigate impacts to trout from reducing flows in the Animas River. Reclamation would fund the acquisition and stocking of wild strains of trout annually in the Animas within the boundaries of the Southern Ute Indian Reservation. Rainbow trout and cutthroat trout are currently stocked from state and federal hatcheries, but these sources may not be reliable in the future because of high demands on these facilities and a possible change in the mission of these hatcheries from coldwater fishes to native fish production. Construction or acquisition of a coldwater fish hatchery would help mitigate impacts of the ALP Project on trout in the Animas River, and provide a source for fish stocking in Ridges Basin Reservoir. Hatchery construction or acquisition and upgrade costs are estimated at $2.9 million, with annual operation costs estimated at $230,000.

Refined Alternative 4 Aquatic Resources Impact 2 - Less Than Significant: High summer water temperatures and reduced oxygen in dry water years may adversely affect trout in Ridges Basin Reservoir.

Ridges Basin would provide available usable habitat for the establishment of a new fishery, which would be managed solely for trout. The trout fishery would be maintained by stocking. Reclamation would commit to provide trout to be stocked at Ridges Basin Reservoir to provide the recreational fishery. At a full pool of 120,000 af, the reservoir would occupy 1,500 surface acres and have an average depth of approximately 181 feet. Based upon the reservoir layout and the relatively temperate climatic conditions of the area, the reservoir should be productive enough to support a good trout fishery. At a recreation pool level of 30,000 af, average depth of 101 feet and 757 surface acres, the trout fishery should still persist, although with reduced productivity.

Limnology studies show that during late summer in dry water years there may be a temperature oxygen squeeze in the reservoir that could be lethal to trout. Additional stocking may be required to offset losses of trout during these infrequent dry conditions. During average and wet water years there should be sufficient temperature and dissolved oxygen in the reservoir to maintain a trout fishery with carryover through both summer and winter periods. The reservoir is expected to be about 181 feet deep at full storage of 120,000 af, and about 101 feet deep at a minimum recreational pool of 30,000 af. At most storage levels, the reservoir is expected to stratify from about June through September with the thermocline located 20-25 feet below the surface, at a thickness of 12-15 feet. Water in the lower thermocline and the hypolimnion is likely to have dissolved oxygen concentrations below the required minimum for trout (5 mg/L).

Mitigation for Refined Alternative 4 Aquatic Resources Impact 2: If feasible, the reservoir inlet conduit could be extended to allow water to enter the reservoir below the thermocline to minimize fishery impact during dry years.

To reduce the effect of the low oxygen concentrations in the lower thermocline and the hypolimnion on trout, the inlet conduit for water from the Animas River could be designed to enter the reservoir below the elevation where the thermocline is likely to establish. The introduction of pumped water below the existing thermocline would need to be feasible at all reservoir elevations existing during late summer periods. With a dam crest elevation of 6,892 feet, the water inlet conduit would enter the reservoir below 6,852 feet elevation. The inflow of river water into this region would therefore disrupt the integrity of thermocline, mixing cooler hypolimnetic water with oxygenated epilimnetic water and river water, and provide more optimal oxygenated water for trout. Construction costs associated with this modification to the inlet conduit would be approximately $3 million.

Refined Alternative 4 Aquatic Resources Impact 3 – Potentially Significant: The introduction of trace elements into Ridges Basin Reservoir from the Animas River could lead to the bioaccumulation of these elements into the food chain.

It is known that the Animas River transports several trace elements that could, under certain conditions, contribute to elevated levels within the food chain. Mercury and selenium would be some of the trace elements of concern. The quality of the water pumped from the Animas River to Ridges Basin Reservoir would determine the potential magnitude of this impact. Depending on the severity of bioaccumulation, fish and wildlife resources could be adversely impacted. However, the degree to which trace elements can be bioaccumulated, if at all, is difficult to predict.

Microorganisms in soil and sediment can convert various forms of mercury to methyl mercury. As methyl mercury, it is available for biological uptake and transport through the food web, ultimately bioaccumulating in the top predators such as fish and fish-eating raptors. Methyl mercury is assimilated by direct absorption through the gills and by bioaccumulation through the food web by predation.

Mitigation for Refined Alternative 4 Aquatic Resources Impact 3: The reservoir basin would be cleared of all vegetation with stems (trunks) greater than 2" in diameter. Only trout would be stocked in the reservoir. A monitoring program would be initiated at Ridges Basin to assess the significance of bioaccumulation of trace elements within the reservoir and associated fish and wildlife.

The reservoir basin's vegetation would be largely cleared in order to reduce the magnitude of productivity and reduction potential. This, in turn, would limit the extent of mercury from becoming methylated, the form in which it is available to bioaccumulate within the food chain. Trout only would be stocked. Trout are not at the top of the fish food chain, therefore they would not be expected to accumulate significant levels of bioaccumulated trace elements.

The monitoring program would include sampling trace element levels within the water column of the reservoir, its sediments, and associated fish and wildlife species at varying trophic levels. The program would last four consecutive years and would be initiated two years after the reservoir is filled. If a significant bioaccumulation effect were identified, Reclamation would work with the appropriate local, state or federal agencies to either minimize the impact or otherwise offer protection to potentially impacted fish and wildlife species and to possibly post human fish consumption advisories at the reservoir.

Refined Alternative 4 Aquatic Resources Impact 4 - Potentially Significant: Reductions in Animas River flow would reduce physical habitat affecting the carrying capacity of the Animas River to support native fish.

It is a valid assumption that the native fishery of the Animas River is at or near carrying capacity of the river (1996 FSFES). While it therefore is also valid that a reduction in physical habitat (chronic flow reductions) would eventually reduce populations and/or biomass of native fishes, there is not sufficient information available to specifically quantify that impact. The degree of impact, although probably less than 15 percent, has been identified as significant because the resource impacted is indigenous to the river system. From a purely ecological standpoint, impacts to native species are considered more significant than impacts to non-natives. Colorado River native fish species are of an even higher concern because of the loss in their habitats throughout the West. Impacts to these native fishes could never be specifically quantified after project pumping is initiated because (1) dramatic changes in their physical habitat would not occur and (2) the inability to statistically enumerate or otherwise quantify the biomass of the native fishery that currently exists. Nevertheless, impacts to reproducing adult populations of native fishes would occur much sooner to shorter lived species such as the mottled sculpin and speckled dace. Effects to longer lived species (30 years+) such as the flannelmouth and bluehead sucker would take longer in terms of identifying impacts due to a reduction in reproduction and recruitment, although the reduction in usable habitat to adults would be realized sooner.

Base flow and project-related discharges for three Animas River locations are located in Technical Appendix 5. The section of the Animas River that would be most impacted by project flows is from Aztec, New Mexico, downstream to the confluence with the San Juan River (Reach 3) (Lyons 1994). This section of the river is subject to the lowest flows under existing conditions. These low flows routinely occur each year and may be one reason for the low abundance of native fish in this section of the river.

During the representative dry year (1951) the average depth in riffles and runs decreased from No Action conditions by 51 and 44 percent, respectively in some months (as shown in Technical Appendix 5). Wetted perimeter also decreased in dry years by 30 and 36 percent for riffles and runs, respectively (as shown in Technical Appendix 5). Wet (1949) and average (1945) flow years had significant decreases in both hydraulic parameters as well. These decreases in wetted perimeter and average depth impact adult native fish by:

- ❏ Reduction of available food through the dewatering of productive riffles and edge of channel areas;
- ❏ Greater risk of disease through increased environmental stress based upon elevated water temperatures in dry water years;
- ❏ Concentration of adult fish in the remaining suitable habitats; and
- ❏ Possible reduction in the ability of fish to navigate shallow riffles.

Small native fish species, such as the mottled sculpin and speckled dace, as well as young individuals of the larger native fishes, would be significantly impacted by a physical reduction in habitat. These small fish occupy riffles and low-velocity, shallow-edge habitats, which are most sensitive to reductions in flow.

The impacts on native fish in the Animas River from the Durango Pumping Plant downstream to Cedar Hill, New Mexico would be insignificant. Decreases in wetted perimeter and average depth would not be severe enough or occur frequently enough to limit the native fish in this section (as shown in Technical Appendix 5).

The section from Cedar Hill to Aztec, New Mexico would be moderately affected by project flows. Significant reductions, primarily in wetted perimeter and secondarily in average depth, would occur in this area in some months. The same impacts discussed above for the section from the San Juan River confluence upstream to Aztec would also impact this section, but to a lesser extent.

Mitigation for Refined Alternative 4 Aquatic Resources Impact 4: Reclamation would continue to monitor the native fish populations in the Animas River and would evaluate several methods of

compensating for impacts. This could include further modifying pumping operations, providing fish passage around barriers, reducing fish entrainment in irrigation diversions, and possibly protecting introduced flow in the La Plata River and/or protecting important native fish habitat by obtaining conservation easements.

Monitoring studies of project-affected waters on the Animas River would be implemented both prior to and continuing for at least four years after project operations begin (project pumping). These studies would be designed to better define the native fishery, to include better understanding apparent problems with native sucker recruitment, and to monitor trout populations. If it is concluded that the operation of the project is having significant adverse impacts to the downstream aquatic ecosystem, Reclamation would make every reasonable effort to modify project operations to either reduce or eliminate these impacts.

The potential impact to native fishes in the Animas River, especially the effects of chronic habitat reduction, would not be directly mitigatable on the Animas River. Investigations should be initiated to determine whether or not fish barriers and small fish/young-of-the-year fish are significantly lost through entrainment in canals and determine any significant loss to the trout fishery. A monitoring program would be initiated in 2000 that would incorporate these additional elements into a monitoring study currently being conducted on the Animas River. A firm recommendation for mitigation due to the effects on native fishes would be made no later than 2005, at least two years prior to project pumping from the Animas River.

It is expected that the operation of the Durango Pumping Plant would chronically reduce native fish populations and associated habitat. Although at this time, the effect is believed to be less than 15 percent, this impact should be mitigated. Although the loss of habitat could not be directly mitigated on the Animas River, there may be other ways to effectively mitigate this loss. Enhancing native fish recruitment may be one option. If it is determined there is no practical way to mitigate this loss on the Animas River, mitigation should be applied to other rivers within the San Juan Basin, such as the La Plata River. The La Plata River fishery is currently limited by seasonal flow depletions and man-caused effects on stream geomorphology. Although the La Plata River maintains populations of native fishes, their populations have been severely depleted due to these factors. It would therefore benefit greatly by flow augmentation and/or channel restoration.

In addition, conservation easements would be pursued with landowners in the La Plata River valley whose lands within the section of perennial flow are between the confluence of Cherry Creek to approximately two miles south of the Colorado/New Mexico state line. If acquired, these conservation easements would effectively protect important native fish habitat, particularly habitat for the roundtail chub.

Refined Alternative 4 Aquatic Resources Impact 5 - Potentially Significant: Stocked fingerling trout and native fish fry and fingerlings could be entrained or impinged on intake screens at the Ridges Basin Pumping Plant.

Because very little successful natural reproduction or recruitment occurs in the Animas River, this fishery relies heavily on stocking to sustain the trout populations. This stocking includes fingerling trout. Impacts due to the entrainment or impingement of small fish on the screens at the Ridges Basin Pumping Plant are another possible impact to the trout in the river. Entrainment occurs when a fish passes through the screen mesh or through gaps in the screen structure. Impingement occurs when a fish is pressed against the screen face. Similarly, small native fish species and younger life stages could also be impacted by entrainment at the Durango Pumping Plant.

Although never quantified, it is also likely that native fish naturally reproduce upstream of the proposed pumping plant site. Therefore, emerging young-of-the-year native fish could also be impacted by the operation of the pumping plant. Reclamation believes that most successful native fish reproduction occurs downstream of the proposed pumping plant, therefore, it believes the potential impact to young-of-the-year to be minor.

Mitigation for Refined Alternative 4 Aquatic Resources Impact 5: Reclamation would review and adopt established guidelines for screening facilities to minimize fish entrainment and impingement at the Ridges Basin Pumping Plant. Best Available Technology would be adopted at the time of construction.

To avoid entrainment of young-of-the-year native fish and small fish species, screen criteria require precise screen mesh sizes (for slotted openings) where fry or fingerlings are present. In addition, facility operation guidelines to design optimum controls for approach velocity and sweeping velocity to minimize fish entrainment and impingement would also be reviewed and adopted by Reclamation. Reclamation would monitor the intake facility to determine the success of this structure in reducing small fish entrainment and impingement.

Fish screens would be installed at the pumping plant and monitoring would be needed to determine the success of this structure in reducing the entrainment of small native fish. Trout stocked in the Animas River are from 4 to 6 inches long. The fish screens would be designed to keep fish greater than 2 inches out of the pumps.

Refined Alternative 4 Aquatic Resources Impact 6 – Potentially Significant: Stocked fingerling trout, and native fish fry and fingerlings could be stranded downstream of the Durango Pumping Plant if pumping rates are not staged.

Fish in rivers can be stranded and eventually lost if changes in flow occur suddenly and rapidly. If changes in flow are staged, the risk of this occurring would be minimized.

Mitigation for Refined Alternative 4 Aquatic Resources Impact 6: Reclamation would operate the Durango Pumping Plant in a manner to minimize the downstream stranding of fish in the Animas River.

To minimize downstream stranding of fish due to the operation of the pumping plant, changes in the pumping rate would be staged in the following manner: An increase in pumping not to exceed 50 cfs/hr stage decrease and a decrease in pumping not to exceed 100 cfs/hr (stage increase) when natural river flows are above 500 cfs (i.e., 50 cfs/hr = 10 percent and 100 cfs/hr = 20 percent of 500 cfs). At lower flow, these ramping rates could substantially change river stage. Therefore, when river flow is at or below 500 cfs, increases in pumping would not exceed 25 cfs/hr and decreases in pumping would not exceed 50 cfs/hr (i.e. 25 cfs/hr = 10 percent and 50 cfs/hr = 20 percent of expected normal low river flow of 250 cfs.

Refined Alternative 4 Aquatic Resources Impact 7 - Potentially Significant: Populations of native fish in the Animas and San Juan rivers and endangered fish in the San Juan River could be reduced by the competitive interaction with non-native fish species escaping from Ridges Basin Reservoir.

The proposed stocking of trout in Ridges Basin Reservoir would not pose a threat to native fish species including the endangered Colorado pikeminnow or razorback sucker in the San Juan River. However, the possibility does exist that escaping nonnative species, illegally stocked (or otherwise introduced) into Ridges Basin Reservoir, might compete with native fish in the Animas and San Juan Rivers and endangered fish in the San Juan River. Such nonnative fish could enter the Animas River and ultimately the San Juan in the water discharge from the reservoir. Because the majority of reservoirs in the area have received illegal stockings of nonnative species, it is assumed that Ridges Basin Reservoir could as well.

Mitigation for Refined Alternative 4 Aquatic Resources Impact 7: Reclamation would either screen or implement other physical structures to prevent live fish from being released from Ridges Basin Reservoir.

% The reservoir outlet system would be designed and fitted with devices to eliminate survival of fish escaping the reservoir. The release of all flows through a pressure dissipation valve is an example of such a device. The change in pressure should result in nearly 100 percent mortality of any fish that escape through the outlet works. To augment the effectiveness of this system, fish escapement from Ridges Basin Reservoir could be further prevented by designing dam outlet structures to take water from deeper water zones within the reservoir. The dam outlets would be located as deep in the reservoir as possible to draw primarily anoxic, hypolimnetic water. The hypolimnion zone is likely to be devoid of fish in summer and winter. Reclamation would monitor escapement from the reservoir and Basin Creek.

Refined Alternative 4 Aquatic Resources Impact 8 - Less than Significant: Construction of the NNMP could impact fisheries at stream crossings.

The proposed NNMP twice crosses the San Juan River, crosses the Fruitland Irrigation Canal at three locations and the Hogback Canal once, and crosses several ephemeral and intermittent creeks. The two largest of these intermittent channels crossed by the pipeline are at Ojo Amarillo Canyon and Baker Arroyo. In sequential order from Farmington toward Shiprock, these crossings are located at the:

a. San Juan River immediately upstream of the mouth of the La Plata River
b. Ojo Amarillo Canyon Creek (intermittent)
c. Fruitland Irrigation Canal
d. Fruitland Irrigation Canal near Sewage Disposal Pond
e. Fruitland Irrigation Canal near Jewett Valley Navajo Indian Reservation
f. San Juan River at the Hogback below Jewett Valley
g. Hogback Canal at Shiprock
h. Baker Arroyo at Shiprock (intermittent)

If constructed within the river, the disturbance to the river would temporarily increase the suspended sediment load in the river. Since downstream populations of native fish have evolved in systems with high sediment loads, the effect would be less than significant.

The potential impact is considered to be below the level of significance. However, the following measure would reduce the potential for the impact to occur.

Mitigation for Refined Alternative 4 Aquatic Resources Impact 8: Construction of San Juan River crossings could be scheduled to take place during a season when impacts to downstream native and/or endangered fish would be minimized.

Previous pipeline crossing of the San Juan River has shown that directional drilling is not feasible due to the deep cobble layers under the river. Most of the pipeline crossing would be constructed using trenching and diking techniques. The pipeline crossing construction could take place during a season when impacts to downstream native and/or endangered fish would be minimized. This would likely be either in the late summer or fall/winter periods.

3.6.4.2 Refined Alternative 6

Refined Alternative 6 Aquatic Resources Impact 1 - Less than Significant: During construction, raising of Lemon Reservoir Dam could increase erosion and cause short-term increases in water turbidity in the reservoir and downstream into the Florida River.

Various routine BMPs and standard construction procedures to control erosion and water turbidity would reduce the severity of this impact to a level less than significant. This impact is considered to be below the level of significance.

Mitigation for Refined Alternative 6 Aquatic Resource Impact 1: No mitigation is proposed.

Refined Alternative 6 Aquatic Resources Impact 2 - Potentially Significant: Reduced flow in the La Plata River above the Colorado/New Mexico state line as a result of conversion of water from irrigation to M&I use could reduce the habitat for native fish.

As described under Refined Alternative 6 Hydrology Impact 3, approximately 60 af of reduced flow in the La Plata River would result, relative to the no-project condition. Return flows from non-binding end uses would increase La Plata River flows below the state line; however, some of the return flows that would have been available in the New Mexico portion of the river with Refined Alternative 4 would not occur for this alternative, resulting in a reduction of flow in this reach compared to Refined Alternative 4 of about 560 af per year. The La Plata River is severely over-appropriated, contributing to further impacts to roundtail chub and other native fish.

Mitigation for Refined Alternative 6 Aquatic Resources Impact 2: Reclamation would pursue the establishment of compensatory mitigation to ensure increased flow in the La Plata River during summer months.

Benefits for native fish could be gained on the La Plata River by supplementing minimum flows by five cfs during the six month period of July 1 through October 15. This would provide habitat and passage for migration for flannelmouth suckers, bluehead suckers, and roundtail chub in the La Plata River and could expand populations of these native fishes downstream into historic habitat in New Mexico.
The La Plata River from Cherry Creek downstream to the Colorado/New Mexico state line currently supports a fish community that is nearly 100 percent native fish, including roundtail chub. This section of river also has very low summer base flows due to irrigation diversions. Additional flow in this section of the river during summer would provide a more stable habitat for the native fish community. This increase in flow would require protection from diversion to be a viable mitigation alternative. The increased streamflows would be consistent with the other mitigation proposed along the La Plata River for wetlands, riparian, and wildlife resources.

Refined Alternative 6 Aquatic Resource Impact 3 - Beneficial: Conversion of irrigation water to M&I uses in the Pine River Basin would increase the flow in the river.

The conversion of irrigation water to M&I uses with releases downstream to Navajo Dam would increase the flow in the Pine River during the irrigation months of April through October. The annual increase in flows is about 15,000 af. The approximate average monthly increase in Pine River flows is shown in

Table 3.6-1. Winter flows would not be altered. This gain is accomplished by transferring the depletion associated with 10,000 acres of irrigated land to M&I use.

The increased flows are less than 10 percent of the average baseline flow conditions. This would result in an immeasurable to slight benefit to the Pine River fishery.

Table 3.6-1
Approximate Average Monthly Increases in the Pine River Under Refined Alternative 6

Month	Flow (cfs)
April	7
May	32
June	55
July	54
August	47
September	28
October	9

% **Mitigation for Refined Alternative 6 Aquatic Resource Impact 3: No mitigation is proposed.**

3.6.4.3 No Action Alternative

The follow impacts of the No Action Alternative were taken from the 1996 FSFES.

Trout Fishery

Animas River - Under this alternative, the CDOW is expected to continue to manage the Animas River trout fishery in a manner similar to that of the last several years. Wild trout strains for stocking may become more difficult to obtain in future years. Barring changes in the relative success of natural reproduction by trout in the Animas River, reduced stocking concentrations of wild trout could eventually lead to a reduction in the numbers and overall biomass of trout. The Animas River within the confines of the Southern Ute Indian Tribe Reservation would maintain the potential for a better trout fishery throughout much of its length, if it were provided more and better strains of wild trout.[2] *At present, these fish are not available; therefore, in the foreseeable future, it is anticipated that the river's trout population within the Southern Ute Indian Tribe Reservation would remain low. The trout fishery downstream from the Colorado-New Mexico State line would remain low quality. This is because of an increase in seasonal water temperatures, other deteriorating water quality conditions and reduced physical habitat because of man-induced instream alterations and flow reductions related to municipal, industrial, and irrigation uses. (Page III-34)*

[2] Wild trout are species that have not been subjected to severe inbreeding due to artificial propagation. Therefore, "wild trout" exhibit wider genotypic and phenotypic characteristics that overall allow for greater survival in natural environments, when stocked.

<u>Native Fishery</u>

Animas River

It is anticipated that if the project is not constructed, the water rights currently held by project sponsors would eventually be exercised. It is not currently possible to identify how these water rights might be used. It is possible, however, that eventual depletion of flow in the Animas River, without instream flow protection for fish and wildlife resources, could impact aquatic resources, including native fish. (Page III-41)

La Plata River

The La Plata River downstream from Hesperus, Colorado has been subjected to extreme water depletions for decades due to seasonal irrigation demands. This has resulted in large portions of the river being dewatered throughout much of the irrigation season. The relatively short section of river that contains perennial flow, approximately 10 miles from its confluence with Cherry Creek to about 2 miles south of the State line provides limited aquatic habitat to a few native fish species. However, if water rights to the river were to change or point of diversion were relocated, this fishery could be eliminated. Most significantly, a small, isolated, but seemingly healthy population of roundtail chubs exists within unique, limited habitats near the Colorado-New Mexico State line. Reclamation believes that unless formal (legal protection under State water law) protection of instream flow is obtained along with the protection of natural stream physical habitats, it is likely the native fishery in the La Plata River would ultimately be lost.

No mitigation measures were identified for the No Action Alternative in the 1996 FSFES.

3.7 SPECIAL STATUS SPECIES

3.7.1 Introduction

This section addresses potential impacts to special status species that could result from actions associated with Refined Alternatives 4 and 6 and the No Action Alternative. Section 3.7.2 defines the Evaluation Methodology and significance criteria used for determining impacts, Section 3.7.3 describes the affected environment, Section 3.7.4 identifies potential impacts and mitigation measures that would serve to reduce or eliminate anticipated impacts.

Threatened and endangered species are plants and animals that are legally protected under the ESA. ESA compliance is required to avoid jeopardizing the existence of threatened and endangered species or their habitats. Pursuant to Section 7 of the ESA, a Biological Assessment (Miller 1999) was prepared for the %
proposed project. The Biological Assessment was used by the Service in its preparation of a Final %
Biological Opinion (Service 2000a). These documents are included in Volume 2, Attachment G. The %
2000 Biological Opinion supercedes all previous opinions prepared for the ALP Project. %

3.7.2 Evaluation Methodology

This section discusses the methodology used to determine potential impacts that could result from Refined Alternatives 4 and 6, and the No Action Alternative. Also discussed are specific criteria that were used to determine the significance of the impacts identified.

3.7.2.1 Methodology

Because most of the project area has been previously surveyed for proposed, threatened, and endangered species (plant, terrestrial wildlife, and fish) and there have been few additions to the list of protected species since the 1996 FSFES, the majority of this analysis was conducted using literature reviews. Several site surveys were conducted by experienced biologists using standard methods. On several occasions, professional judgement based on the available data was used.

- **Literature Reviews and Agency Consultation.** There is a vast library of literature concerning the ALP Project, including reports, documents, and survey results regarding threatened and endangered species. The structural components of Refined Alternative 4 are similar to components described in previous NEPA documents, although all are reduced in size in Refined Alternative 4. The only additional structural component of Refined Alternative 4 is the NNMP. Past studies have provided the necessary information regarding all structural components, except the NNMP, and all protected species, except those added to the threatened and endangered species list since 1996. Consultation with the CDOW provided information for Refined Alternative 6.

- **Site Surveys.** Site surveys were conducted along the route of the proposed NNMP to establish the presence/absence of protected plant species in regions where the proposed route crosses previously undisturbed ground. Surveys were also conducted to establish the presence/absence of protected animal habitat in the two areas where the proposed route crosses the San Juan River.

- **Professional Judgement.** In several cases, professional judgement based on the available data was used in this analysis.

3.7.2.2 Significance Criteria

For protected fish, failure of the project to meet the flow recommendations proposed by the seven-year research program component of the SJRBRIP would be significant. This program was one element of the 1991 Biological Opinion. The research included surveys to determine species composition for adult and younger life stages, radio telemetry to determine movement and habitat use by endangered fish, and experimental stocking of endangered fish to determine habitat use and response to the experimental flow regimes. Data gathered during the research period were considered to determine fish population and habitat responses to a variety of flow conditions that were to mimic the full, variable range of a natural hydrograph. Detailed results of the seven-year research program are presented in the San Juan River Flow Recommendation Report (Holden 1999) and in the individual final reports for each research component.

For protected plant and terrestrial wildlife species, the significance criteria used to determine significant impacts is the presence and potential loss of a federally listed or candidate species, or loss or degradation of its critical habitat in the project area.

The Service's Biological Opinion (Service 2000b) has concurred that Refined Alternative 4 may affect, but is not likely to adversely affect the southwestern willow flycatcher. The Service has also agreed that there would be no effect on the following species: Mexican spotted owl, mountain plover, Mancos milk-vetch, Mesa Verde cactus, Knowlton's cactus, boreal toad, and the Sleeping Ute milk-vetch. The Service has concluded that the proposed project may affect the Colorado pikeminnow, razorback sucker, and bald eagle; however the project is not likely to jeopardize the continued existence of these species and not likely to destroy or adversely modify designated critical habitat as long as all suggested conservation measures are included in the project plan. The conservation measures (for example, operation of Navajo Reservoir to mimic a natural hydrograph, preventing non-native fish escapement from Ridges Basin Reservoir, monitoring bioaccumulation of trace elements in bald eagle prey, and other factors) (see Volume 2, Attachment G) have been included in the project plan. %

3.7.3 Affected Environment

The sections below discuss existing special status species that could occur in the areas potentially affected by Refined Alternatives 4 and 6. The affected environment for the No Action Alternative has not been defined because the actions that could take place under the No Action Alternative are not fully known. However, many of the eventual actions that may occur as a result of the No Action Alternative would likely take place within the same geographic setting as that of Refined Alternative 4.

3.7.3.1 Federally Listed Plants

The most recent Service list of protected plant species that may occur in the ALP Project study area includes three federally listed species and one federal candidate species (**Table 3.7-1**).

Table 3.7-1
Special Status Plant Species Potentially Occurring
Within the Colorado and New Mexico Region of the Project Area

Common Name	Scientific Name
Federally Listed Species	
Mancos Milk-Vetch	*Astragalus humillimus*
Knowlton's Cactus	*Pediocactus knowltoni*
Mesa Verde Cactus	*Sclerocactus mesae-verdae*
Federal Candidate Species	
Sleeping Ute Milk-Vetch	*Astragalus tortipes*
Source: U.S. Fish and Wildlife Service (June 23, 1999 memorandum)	

3.7.3.1.1 Mancos Milk-Vetch

The range for this species is from Montezuma County, Colorado, southward into northwestern New Mexico. It occurs at 5,500 to 5,850 feet elevation in Colorado and 5,000 to 6,500 feet elevation in New Mexico on Point Lookout sandstone and on rock ledges in pinon-juniper woodlands. In 1976, floral field surveys conducted in the region of Refined Alternative 4 (Ridges Basin area) failed to identify the presence of any proposed, threatened, or endangered plant species with ranges potentially extending into the area. The Point Lookout sandstone and pinon-juniper soil/vegetation combination does not occur within the Florida, Pine, Mancos, La Plata, and McElmo River Basin areas potentially affected by Refined Alternative 6.

3.7.3.1.2 Knowlton's Cactus

This cactus occurs in northwestern New Mexico, San Juan County and eastern portions of the Colorado Plateau Province in southern Colorado, La Plata County. Habitat of the species is associated with tertiary alluvial deposits overlying the San Jose Formation. These deposits are typically characterized by rolling gravelly hills with pinon-juniper woodlands and sagebrush plant communities.

Surveys for the presence/absence for Knowlton's cactus are documented for a proposed pipeline in northern New Mexico and near the Florida River in southern Colorado. No cactus plants were found during these surveys. In addition, during the 1999 surveys in Ridges Basin and along the route of the NNMP, no Knowlton's cactus plants were found. Based on habitat associations, the species is likely to be absent from the areas within the Florida, Pine, Mancos, La Plata River Basins, and McElmo Creek potentially affected by Refined Alternative 6.

3.7.3.1.3 Mesa Verde Cactus

This species is sparsely distributed on dry areas consisting of shale or adobe clay within the Mancos and Fruitland Formations in Montezuma County, Colorado and northwestern New Mexico. Elevation distribution is between 4,000 and 5,000 feet. The plant is most likely to be present within the McElmo Creek area. Based on habitat conditions, however, there is a low probability that the species is located on the irrigated lands within the affected environment of Refined Alternative 6.

3.7.3.1.4 Sleeping Ute Milk-Vetch

Sleeping Ute milk-vetch is only known from the southern flank of Sleeping Ute Mountain where it grows in mixed desert shrub communities on Mancos Shale badlands. This species has not been found within Ridges Basin. Most of the proposed route of the NNMP crosses previously disturbed land, and much of the route parallels structures (roads or canals). In September 1999, field surveys for the species were conducted in the undisturbed regions along the proposed pipeline route. No endangered species were found.

3.7.3.2 Federally Listed Animals

3.7.3.2.1 Terrestrial Wildlife

Table 3.7-2 identifies special status wildlife species identified by the Service as having the potential to occur within areas potentially affected by Refined Alternatives 4 and 6.

<u>Bald Eagle, Peregrine Falcon, and Black-Footed Ferret</u>

In 1976, two studies identified the bald eagle (*Haliaeetus leucocephalus*) as the only threatened or endangered terrestrial species present in the project area. No peregrine falcon (*Falco peregrinus*) or black-footed ferret (*Mustela nigripes*), both of which were protected species at the time, were found. Historically, both species have been found in the project area. The Biological Opinion, prepared by the Service in 1996 under formal ESA consultation with Reclamation, concluded that the project may affect the bald eagle but is not likely to jeopardize the continued existence of the species. The 2000 Biological Opinion (Service 2000a) concluded, however, that Refined Alternative 4 was not likely to adversely affect the peregrine falcon or the black-footed ferret, provided that prairie dog communities are not affected.

Table 3.7-2
Special Status Wildlife Species Potentially Occurring
Within the Project Area

Common Name	Scientific Name
Federally Listed Species	
Bald Eagle	*Haliaeetus leucocephalus*
Southwestern Willow Flycatcher	*Empidonax traillii extimus*
Mexican Spotted Owl	*Strix occidentalis lucida*
Black-footed Ferret	*Mustela nigripes*
Federal Proposed Species	
Canada Lynx	*Lynx canadensis*
Mountain Plover	*Charadrius montanus*
Federal Candidate Species	
Boreal Toad	*Bufo boreas boreas*

Source: U.S. Fish and Wildlife Service (June 23, 1999 memorandum)

The peregrine falcon was officially delisted in 1999. There are no documented prairie dog colonies of sufficient size to support black-footed ferrets within the project area, nor have there been any recent confirmed sightings of black-footed ferrets in the project area.

The bald eagle is associated with aquatic ecosystems throughout its range, which formerly included most of the North American continent. Bald eagles are known to feed and roost at Lemon Reservoir and along the Animas and La Plata Rivers. Navajo Reservoir is an important wintering area in New Mexico and Colorado, as are the Animas and La Plata Rivers. Eagles utilize the Pine River and Florida River areas as well. Bald eagles arrive in the area by mid-November and leave by late March or early April. Only a small number of bald eagles remain in the southwest each spring to nest and rear young. An active bald eagle nest is reported near Lemon Dam (Stransky 2000).

Mexican Spotted Owl

On November 4, 1991, the Mexican spotted owl (*Strix occidentalis lucida*) was proposed for listing as threatened. The species is now listed. Reclamation, in conjunction with the Service, conducted a field survey designed to detect Mexican spotted owls in the Ridges Basin Reservoir area (1996 FSFES). No owls were detected, and it was determined that the species would not be affected by construction and operation of the project. The Service concurred with this finding in an August 3, 1992 memorandum (Service 1992) and in the 2000 Biological Opinion (Service 2000a).

Loggerhead Shrike

The loggerhead shrike (*Lanius ludovicianus*) was included as a candidate species on the Service's species list in a June 1, 1994, memorandum. Reclamation's Biological Assessment concluded the project would be unlikely to adversely affect the loggerhead shrike, and on July 7, 1995, the Service provided

Reclamation a memorandum concurring with the No Effect Determination for the loggerhead shrike (Service 1995).

Southwestern Willow Flycatcher

On July 23, 1993, the southwestern willow flycatcher (*Empidonax traillii extimus*), one of at least four subspecies of willow flycatcher, was proposed for federal listing as endangered. Since that time, the species has been listed. In 1994, Reclamation contracted with the National Biological Service (NBS) to conduct willow flycatcher surveys along the Animas, La Plata, and Mancos River drainages. Only six willow flycatchers, of indeterminate subspecies, were detected, all on the La Plata River in areas predicted to not be impacted by the project. The survey results suggest that very few willow flycatchers occur on these drainages, either during the breeding season or in migration. The Service has concluded that Refined Alternative 4 may affect, but is not likely to adversely affect the southwestern willow flycatcher (Service 2000a).

The entire route of the proposed NNMP was surveyed within a 200-foot wide corridor in October 1999. No endangered species were observed, although habitat for the southwestern willow flycatcher is present at the proposed San Juan River crossing.

Any potential impacts to southwestern willow flycatchers would be related to impacts to wetland/riparian vegetation along rivers, creeks, irrigation canals, and other areas supporting willow, cottonwood, or riparian shrub vegetation. Such areas include irrigated lands in the Pine River, Florida River, La Plata River, Mancos River, and McElmo Creek basins.

Canada Lynx, Mountain Plover, and Boreal Toad

The Service, in its June 23, 1999 memorandum, provided a list of endangered, threatened, proposed, and candidate species which may be affected by the project. Three of these species—Canada lynx, mountain plover, and boreal toad—are new to the list since the 1996 FSFES was completed. The Service believes it is unlikely that Canada lynx, mountain plover, or boreal toad occur within the project area. On rare occasions, lynx (recently reintroduced in mountainous northern and central Colorado) may travel across northern portions of the project area, but resident animals are improbable because the habitat is far from ideal for lynx, which prefer cooler, moister, more forested habitats. Therefore, the project would be unlikely to adversely affect the Canada lynx. In Colorado, the mountain plover occurs only in the northwestern corner of the state and would therefore be unlikely to be affected by the project. The boreal toad is found only in montane wetlands, none of which occur in the project area; therefore, the project would not affect the boreal toad.

3.7.3.2.2 Fish

The Service provided a list of endangered and threatened species that may be affected by project implementation. In its June 23, 1999 memorandum, the Service identified two aquatic endangered species (**Table 3.7-3**). The Service has concluded in their Biological Opinion (Service 2000a) that Refined Alternative 4 may affect the Colorado pikeminnow and razorback sucker but is not likely to jeopardize their continued existence nor destroy or adversely modify designated critical habitat considering the conservation measures that are included in the project plan.

Table 3.7-3
Special Status Fish Species Potentially Occurring Within the Project Area

Common Name	Scientific Name
Federally Listed Species	
Colorado Pikeminnow	*Ptychocheilus lucius*
Razorback Sucker	*Xyrauchen texanus*
Source: U.S. Fish and Wildlife Service (June 23, 1999 memorandum)	

Colorado Pikeminnow

Since 1991, a number of Colorado pikeminnow have been collected in the San Juan River as part of the San Juan River seven-year research plan and SJRBRIP. Nineteen (17 adult and 2 juvenile) wild Colorado pikeminnows were collected between 1991 and 1995 by electrofishing. %

Preliminary information from radio telemetry studies of adult Colorado pikeminnow (Ryden 2000a) indicate that adult Colorado pikeminnow are most abundant between Cudei and Four Corners. Fish captured and radio-tagged within the reach tend to stay in that section of river. Local movements of fish, however, have occurred and there is evidence that the range of the species extends up to the Hogback Diversion at RM 158.6. Miller and Ptacek (1999) reported that one radio-tagged fish moved above Cudei Diversion in July 1994, and two probable sightings also occurred between Shiprock (RM 148) and Hogback Diversion (RM 158.6) during research sampling (Ryden and Pfeifer 1995).

Fifty adult Colorado pikeminnows were stocked in the San Juan River in October 1997. These fish were released in the San Juan River near the confluence with the Animas River. Fifteen of these fish were implanted with radio transmitters prior to release and monitored for habitat use until late summer 1998. Sampling of young fish, conducted as part of the SJRBRIP, include drift collection of larvae at Mexican Hat (RM 52), near Four Corners (RM 119), and the "Mixer" (RM 129), and seining collections between Hogback (RM 159) and the San Juan Arm of Lake Powell (<RM 0). Since 1991, wild young-of-the-year Colorado pikeminnow have only been collected from the lowermost river reaches in or near the high water zone of Lake Powell. Larval Colorado pikeminnow have only been collected from the Mexican Hat drift site.

Experimental stocking of young Colorado pikeminnow was initiated in 1996. These fish were monitored for retention in the system and habitat use after stocking. A larger percentage of the fish stocked remained in the upper portion of the river than in the lower river. The fish were found in low-velocity habitats until they reached a size large enough to move to alternate habitats in the main channel of the river. These larger fish (approximately 125mm – 300mm) are beginning the show up in the ongoing river-wide monitoring and population estimate investigations.

The San Juan River flow recommendations developed by the SJRBRIP Biology Committee were designed to benefit the endangered fish and the native fish community on which they depend. The flow recommendations include flow magnitude, duration and frequency. The recommendations used historic hydrology and the research results as the basis for the flow levels. The flow recommendations mimic the shape of a natural hydrograph with a peak in late May or early June followed by a descending limb to base flow in late July or early August. The flow regime was designed to provide the channel forming and channel maintenance requirements of the San Juan River. These components are necessary to maintain the complex habitat required by the endangered fish. The flow regimes include the channel maintenance needed to clean the cobble and gravel areas used for spawning and to provide the low-velocity habitat for larval and young-of-the-year fish.

Razorback Sucker

Intensive ongoing collections between 1990 and 1994, part of a continuing research program by the SJRBRIP, have not resulted in the capture of any additional wild razorback suckers from riverine habitats in the San Juan River. Hatchery-raised razorback suckers (939 individuals) were introduced into the San Juan River between March 1994 and October 1996 (Ryden 2000b). Fifty-seven of the razorback suckers were implanted with radio transmitters and followed to determine habitat use and movement. The remainder of the stocked razorback suckers was implanted with PIT tags for identification before release. The fish originally stocked in 1994 are still being collected during the annual monitoring of the river (Ryden 2000b).

Results of this study provided insight into habitat use and behavior of razorback suckers in the San Juan River. Results of radio tracking indicated that fish used less complex, higher velocity habitats during warmer months, but used habitats with higher complexity (where they mostly occupied areas of low velocity) during the cold water months. Sections of the river that were apparently preferred by razorback suckers included two locations associated with backwater habitats (RM 38.6 and RM 77.3), and one location that may be associated with spawning (RM 100.2) (Ryden 2000b). During May 1997 two larval razorback suckers were collected downstream from RM 90. This represented the first documentation of successful spawning by razorback suckers in the San Juan River. A five-year plan for augmentation of razorback suckers in the San Juan River was initiated during 1997 (Ryden 2000b).

3.7.4 Environmental Consequences and Mitigation

The following sections discuss potential impacts to special status species of Refined Alternative 4, Refined Alternative 6, and the No Action Alternative. In addition, mitigation measures are proposed to reduce or eliminate potential impacts to special status species.

3.7.4.1 Refined Alternative 4

Refined Alternative 4 Special Status Species Impact 1 - Less than Significant: Flow alterations in the Animas River could alter riparian vegetation composition and abundance, and affect bald eagle perch or roost sites.

The bald eagles in the project area are primarily a wintering population, although nesting has occurred both to the north and south of the project area. Reclamation has conducted six years of aerial surveys to determine bald eagle use in the project area. Primary use sites include cottonwood trees along the Animas and La Plata Rivers and occasionally those adjacent to some irrigation canals. Results of Reclamation surveys indicate that currently, unrelated to the project, cottonwood trees are being felled and development is encroaching on areas of eagle use, reducing available habitat. Additional Reclamation studies of wetland/riparian impacts associated with altered flows in the Animas River indicate negligible impacts on cottonwood trees and bald eagle perch/roosting habitat.

This potential impact is considered to be below the level of significance. However, the following mitigation measure would reduce the potential for the impact to occur.

Mitigation for Refined Alternative 4 Special Status Species Impact 1: Incorporate bypass flows into ALP Project operations to reduce the possibility of impacts to cottonwood recruitment.

Refined Alternative 4 Special Status Species Impact 2 - Significant: Implementation of Refined Alternative 4 could potentially affect the food base of bald eagles.

Reclamation studies of bald eagle casts have indicated a high use of mammalian carrion in the diet of bald eagles; however, fish remains are less easily identifiable in casts. Ridges Basin Reservoir would expand the prey base of wintering eagles, when accessible, but contaminants could bioaccumulate in fish and affect bald eagles. Accordingly, Reclamation contracted with the NBS to conduct a contaminant impact analysis. The report evaluated data collected on water, sediments, invertebrates, and fish for the following: arsenic, boron, cadmium, chromium, copper, lead, lithium, molybdenum, mercury, nickel, selenium, silver, uranium, vanadium, and zinc. Results indicate mercury and selenium could be of some concern because they biomagnify through the food chain.

Based on the assumptions used in the analysis, mercury could represent a hazard to eagle reproductive success due to ingesting contaminated fish. However, mercury levels in the Animas River exceed concentrations in similar systems. Selenium concentrations in soil and water samples are of concern, but concentrations in fish do not appear to be high enough to create a problem for fish-eating birds. In September 1999, Reclamation collected sediments, vegetation, invertebrates, and fish from Farmington Reservoir (an off-stream reservoir which receives its inflow from the Animas River and is serving as a surrogate for Ridges Basin Reservoir) for contaminant analysis.

Mitigation for Refined Alternative 4 Special Status Species Impact 2: Develop and implement a monitoring program for potential adverse bioaccumulation of trace elements in bald eagle food items in conjunction with the Service, CDOW, NMDGF, and the Colorado Ute Tribes.

Refined Alternative 4 Special Status Species Impact 3 - Potentially Significant: Construction of the NNMP could impact southwestern willow flycatcher nesting habitat at two crossings of the San Juan River.

The southwestern willow flycatcher is known to nest in willows with a cottonwood overstory along rivers. Based on habitat structure, dense stands of Russian olive and tamarisk vegetation also provide the cover requirements for preferred willow flycatcher nest sites. The species occupies nest sites between about mid-May to about August. Willow flycatchers overwinter in Mexico, Central America, and possibly South America, and the species begins to migrate during late fall to these areas. Surveys conducted in October 1999 at the location of the proposed San Juan River crossing of the NNMP determined that flycatcher habitat would not be adversely affected during construction and operation of the pipeline. However, construction noise or physical disturbance of nest sites during the critical mid-May through August nesting period may adversely affect flycatcher breeding success.

Mitigation for Refined Alternative 4 Special Status Species Impact 3: Schedule construction of pipeline crossings to avoid construction during periods when the southwestern willow flycatcher is present.

Directional boring from the shoreline, using equipment placed outside of the line of trees lining the banks of the San Juan River would minimize the direct impact to riparian vegetation. Construction during the September to May time period would avoid the willow flycatcher-nesting season.

Refined Alternative 4 Special Status Species Impact 4 - Significant: The operation of the ALP Project without offsetting measures could adversely affect the Colorado pikeminnow and razorback sucker in the San Juan River.

Effects of the project on the listed Colorado pikeminnow and razorback sucker were the subject of the October 25, 1991 and February 26, 1996 Biological Opinions for the project. The Service determined that the project as described in 1991 and 1996 would likely jeopardize the continued existence of these species by appreciably reducing the likelihood of both survival and recovery of the species in the wild by further reducing its numbers, reproduction, and distribution.

The Service's Biological Opinions included a set of Reasonable and Prudent Alternatives (RPAs) to avoid jeopardizing the existence of the Colorado pikeminnow and razorback sucker. For the 1991 Biological Opinion (Service 1991), these RPAs were:

- ❑ An ALP Project that results in an initial depletion of 57,100 afy;
- ❑ Seven years of research to determine endangered fish habitat needs;
- ❑ Operation of Navajo Dam to provide a wide range of flow conditions for the endangered fish;
- ❑ A guarantee that the Navajo Reservoir would be operated for the life of the Project to mimic a natural hydrograph based on the research; and
- ❑ Legal protection for the reservoir releases to and through the endangered fish habitat to Lake Powell and a commitment to develop and implement a Recovery Implementation Program for the San Juan River.

The RPAs advanced by the 1996 Biological Opinion (Service 1996) were similar and included the following:

- ❑ A project that results in an initial depletion of 57,100 afy (Phase I, Stage A only);
- ❑ Research to determine endangered fish habitat needs;
- ❑ Operation of the Navajo Dam to provide a wide range of flow conditions for the endangered fish, including low winter flows;
- ❑ A procedure to implement flow recommendations;
- ❑ A commitment to release peak flows out of Navajo Dam as agreed upon with the Biology and . Navajo Dam Operating Committees;
- ❑ A guarantee that, based on the results of the research program and dependent upon the prevailing hydrology, Navajo Dam would be operated for the life of the ALP Project to mimic a natural hydrograph; and
- ❑ Legal protection for the reservoir releases instream to and through the endangered fish habitat to Lake Powell.

The new Biological Opinion from the Service supercedes previous Opinions and would be binding on Reclamation. The new opinion, with its associated conservation measures which are adapted by Reclamation, concludes that Refined Alternative 4 would not jeopardize the endangered fish species. The new opinion centers around operation of Navajo Reservoir to mimic a natural hydrograph, operation of the Durango Pumping Plant to bypass spring peaks, and other measures to conserve threatened and endangered species. Conservation measures in the 2000 Biological Opinion include:

❑ Reclamation will operate Navajo Reservoir to mimic the natural hydrograph of the San Juan River to benefit endangered fish. This will be achieved by following the San Juan River flow recommendations (Holden 1999) and subject to completion of the Navajo Operation EIS and execution of its Record of Decision.

❑ A RiverWare model is a key tool in analyzing endangered fish flows in the San Juan River. Reclamation, with the Service, will take actions to have an independent review of the model conducted.

❑ The 1991 Memorandum of Understanding to protect endangered fish releases remains in effect.

❑ The Durango Pumping Plant will be operated in a manner that facilitates meeting San Juan River flow recommendations.

❑ Reclamation will implement all actions necessary to prevent escapement of nonnative fish from Ridges Basin and will consider escapement of eggs and larvae in the design. Escapement will be monitored.

❑ Reclamation will monitor potential bioaccumulation of trace elements in bald eagle food.

❑ Reclamation will incorporate bypass flows at the Durango Pumping Plant to promote natural recruitments of cottonwood trees.

The seven-year research program has been completed and final study reports are being prepared. Flow recommendations to benefit the endangered fish based on this research were made by the SJRBRIP Biology Committee and adopted by the SJRBRIP Coordination Committee. Reclamation has operated Navajo Dam in accordance with the flow recommendation from the SJRBRIP during the research period and continues to follow the recommendations based on the hydrologic conditions to benefit the two endangered fish in the San Juan River. The flows have included both peak flows and low winter flows. Reclamation has completed a study of low winter flows downstream of Navajo Dam.

Refined Alternative 4 includes a 120,000 af reservoir at Ridges Basin and annual depletion of not more than 57,100 afy. This depletion meets the requirements of the 1991 and 1996 RPAs. The project includes the commitment to operate Ridges Basin Reservoir with the intent to meet or exceed the flow recommendations for the San Juan River, which should benefit the endangered fish and their critical habitat. Under this alternative there should be no significant impact to either endangered fish species due to flow reductions.

This potential impact is considered to be below the level of significance because the offsetting measures have been incorporated into the project design and operation plans. The following mitigation measure, however, would reduce the potential for the impact to occur.

Mitigation for Refined Alternative 4 Special Status Species Impact 4: Reclamation would operate Navajo Reservoir and the Durango Pumping Plant to mimic the natural hydrograph of the San Juan River for the benefit of the Colorado pikeminnow and razorback sucker.

The result of the seven-year research study was a flow recommendation for modified operation of Navajo Dam releases (Holden 1999). Reclamation is preparing an EIS to address the long-term environmental consequences of the reoperation of Navajo Dam. The Service and Reclamation would review these flow recommendations and a new Biological Opinion would be prepared on the modified operation of Navajo Dam incorporating these flow recommendations.

Refined Alternative 4 Special Status Species Impact 5 - Potentially Significant: Survival and recovery of endangered fish in the San Juan River could be jeopardized by competitive interaction with non-native fish released from Ridges Basin Reservoir to the Animas River.

A possible impact to the endangered fish in the San Juan River is the interaction with nonnative fish species escaping from Ridges Basin Reservoir. The proposed CDOW stocking of trout in Ridges Basin Reservoir would pose no threat to either the Colorado pikeminnow or razorback sucker in the San Juan River. However, the possibility does exist that other nonnative species that might compete with the San Juan River endangered species may be illegally stocked into the reservoir and subsequently escape. Because the majority of reservoirs in the area have received illegal stockings of nonnative species, it is assumed that Ridges Basin Reservoir would also.

Mitigation for Refined Alternative 4 Special Status Species Impact 5: The reservoir outlet system would be designed and operated to eliminate survival of predatory or competitive fish from escaping the reservoir.

To minimize entrainment of fish, the dam outlets would be located as deep in the reservoir as possible to draw primarily anoxic hypolimnetic water, a zone likely to be devoid of fish in summer and winter. Water released from the reservoir would be directed at a high velocity splash pool to ensure mortality of any escaping fish. Reclamation may also consider adopting other, more effective measures if such are deemed feasible. Water released through a delivery system from the reservoir would also be released from as deep in the reservoir as possible. This water could also be physically treated to ensure mortality of any escaping fish. Small volumes of water (i.e., less than 50 cfs) could be passed through a sand/gravel filter, particularly if the water is to flow into any existing surface waters, such as the La Plata River. Water destined for a water treatment plant would be treated to eliminate fish as part of the treatment process.

3.7.4.2 Refined Alternative 6

Implementation of Refined Alternative 6 is expected to have no effect on the Colorado pikeminow and razorback sucker in the San Juan River. The increase in mean flows transferred down the Pine River to Navajo Reservoir would not change the flow statistics over that of Refined Alternative 4. Under Refined Alternative 6, there would be no Ridges Basin Reservoir, as the alternative would avoid the potentially significant impact of releasing competing non-native fish from the reservoir to the Animas River, with the risk of the fish adversely interacting with the Colorado pikeminnow and razorback sucker in the San Juan River.

This section discusses the potential effect of Alternative 6 on the bald eagle and southwestern willow flycatcher.

Refined Alternative 6 Special Status Species Impact 1 - Potentially Significant: Raising Lemon Reservoir Dam could result in short-term construction-related disturbance to bald eagle roosting, nesting, and feeding behavior.

Sensitive wildlife species such as bald eagles and other raptors are known to nest in the general region. It is suspected that a nest maybe located on the west side of Lemon Reservoir (pers. comm., Scott Waite, CDOW 1999 and Kip, Stransky CDOW 2000). The reservoir may provide a food base for eagles. The surrounding trees in the ponderosa forest may provide perch and roosting habitat. Construction-related activities, noise, and line-of-site visual disturbances may affect eagles and other raptors, such as osprey. Ospreys are known to nest in the vicinity of Lemon Reservoir. A confirmed nest site has been active for the past eight years adjacent to Lemon Reservoir (pers. comm., Scott Waite CDOW 1999).

Mitigation for Refined Alternative 6 Special Status Species Impact 1: Prior to construction, field surveys would be conducted to identify bald eagle and osprey nest and use sites within the construction influence zone. A wildlife protection plan would be developed that would incorporate procedures and recommendations for the control of noise and human disturbance. Consultation may be required under the ESA concerning bald eagle impacts.

At the time construction plans and designs become available, a constraints and opportunities analysis would be conducted to determine the most practicable, least damaging construction techniques and facility siting to be incorporated into project plans and specifications. The wildlife management plan would identify and locate the zones of bald eagle and osprey sensitivity, recommend methods and procedures for impact avoidance, establish BMPs for noise control and minimization, and provide procedures for construction monitoring.

Refined Alternative 6 Special Status Species Impact 2 - Potentially Significant: Construction of the NNMP could impact southwestern willow flycatcher nesting habitat at two crossings of the San Juan River.

This is the same impact as Refined Alternative 4 Special Status Species Impact 3.

Mitigation for Refined Alternative 6 Special Status Species Impact 2: Schedule construction of pipeline crossings to avoid construction during periods when the willow flycatcher is present.

Mitigation is the same as Refined Alternative 4 Mitigation for Special Status Species Impact 3.

Refined Alternative 6 Special Status Species Impact 3 - Potentially Significant: Acquisition of water rights resulting in the abandonment and dewatering of irrigation canals and altering existing hydrology within the Pine, La Plata, Mancos, and McElmo River Basins may adversely affect southwestern willow flycatcher habitat near surface waters.

Conversion of approximately 1,200 acres of riparian wetlands, particularly those with extensive stands of willows near existing surface water, may contribute to the loss of willow flycatcher habitat. The species breeds in dense riparian habitats, not only along rivers and streams, but in other wetlands as well. The vegetation can be dominated by dense growths of willows or other shrubs and medium-sized trees. Almost all flycatcher-breeding habitats are within proximity (less than 20 yards) to water or very saturated soil. This water may be in the form of large rivers, smaller streams, springs, or marshes. It is recognized that only a portion of the estimated 1,200 acres of wetland/riparian habitat may provide the density and type of vegetation near surface waters that would be optimal for flycatchers. However, the areas around some of the larger irrigation canals, ponds and rivers, particularly those with dense patches of willow and shrubs, may provide suitable willow flycatcher habitat. At some of these sites, surface water may be present in the early part of the nesting season, gradually drying up as the season progresses. Ultimately, the breeding site must have a water table high enough to support riparian vegetation.

Mitigation for Refined Alternative 6 Special Status Species Impact 3: Enhancing, restoring, and protecting suitable near-site wetlands would compensate the loss of wetland/riparian habitat along abandoned irrigation ditches.

Near-site habitat restoration would compensate for the wetlands lost due to the abandonment of existing irrigation or water distribution canals, or altered hydrology. Prior to the acquisition of water rights on a parcel within the Pine, La Plata, Mancos, and McElmo River Basins, existing wetlands would be delineated and suitable nearby wetland/riparian sites would be identified from which to restore, enhance, and protect compensatory wetlands if water were removed from the irrigation lands and ditches. Such enhancement would occur through a combination of hydrologic and topographic enhancements. A legal and planning mechanism would be established to monitor the wetlands to be enhanced and protected and to provide long-term preservation of wetland habitat.

If after acquisition of irrigated parcels, water were allowed to remain in the irrigation ditches, there would be no significant impact to canal-associated wetlands or riparian vegetation. In such cases, there would be no need to implement this mitigation measure for the loss of wetland/riparian habitat.

3.7.4.3 No Action Alternative
% No impacts to special status species were identified in the 1996 FSFES. Navajo Reservoir would
% continue to be operated to mimic a natural hydrograph to help recover endangered fish species.

3.8 GEOLOGY AND SOILS

3.8.1 Introduction

This section addresses potential impacts to geology and soils that would result from actions associated with Refined Alternatives 4 and 6 and the No Action Alternative. Section 3.8.2 defines the Evaluation Methodology and significance criteria used for determining impacts, Section 3.8.3 describes the affected environment, and Section 3.8.4 identifies potential impacts and mitigation measures that would serve to reduce or eliminate anticipated impacts to geology and soils.

3.8.2 Evaluation Methodology

This section discusses the methodology used to determine potential impacts that could result from Refined Alternatives 4 and 6, and the No Action Alternative. Also discussed are specific criteria that were used to determine the significance of the impacts identified.

3.8.2.1 Geology

3.8.2.1.1 Methodology

The following is a list of geological criteria considered in this analysis:

- Seismicity/Discontinuities
- Ground Failures/Erosion and Sedimentation

- # Geologic Reservoir Feasibility
- # Oil and Gas Development
- # Coal and Coal-bed Methane
- # Mineral Deposits/Construction Material

No geological impacts would be expected to occur from implementation of the non-structural components of both Refined Alternatives 4 and 6. As such, this issue was eliminated from further analysis.

3.8.2.1.2 Significance Criteria

The determination of potential impacts and their significance considered the following:

- ❏ Facilities proximity to an active seismic area
- ❏ Significant risk potential of reservoir induced seismicity (RIS)
- ❏ Significant risk potential of harmful erosion and sedimentation
- ❏ Significant risk potential of catastrophic slope failures
- ❏ Geologic conditions not suitable for a reservoir to sustain water for the purposes of the project
- ❏ Current oil and gas mineral development affecting the intended integrity of the project
- ❏ Restriction of recovery of mineral resources which could not be recovered by any other means
- ❏ Current coal and coal-bed methane development affecting the intended integrity of the project

3.8.2.2 Soils

3.8.2.2.1 Methodology

The Soil Survey of La Plata County Area, Colorado (Soil Conservation Service 1982), the Soil Survey of Montezuma County, Colorado (Soil Conservation Service 1982), and the Soil Survey of San Juan County, New Mexico (Soil Conservation Service 1982) were used to identify potentially affected soil resources. Applicable soil survey maps, map unit descriptions, and supporting tabular information were summarized, based on the extent of physical environmental impact that would result from the construction and operation of Ridges Basin Reservoir, the inlet conduit, Durango Pumping Plant, and NNMP. Impacts associated with the inundation of the reservoir site, nearby excavation and transport of borrow materials, pipeline excavation and backfilling, pumping plant construction, and land conversion under the non-structural component, were quantitatively assessed from current project plans as overlain on soil survey map units.

These potential end use locations (shown on Map 2-1 in Chapter 2) were compared to the same locations on soil survey maps prepared for the Soil Survey of La Plata County Area, Colorado (Soil Conservation Service 1982). Soil map units and the corresponding soils were then identified as potentially affected by development of the particular end uses identified under the scenario.

3.8.2.2.2 Significance Criteria

Soil resources are valuable because of the variety of land uses they support. Physical construction and operation of project structural components could generally disturb soil resources by either displacing them or degrading their ability to support land uses. Soil displacement occurs through either water- or wind-caused erosion. Eroded soils can subsequently lead to secondary water and/or air pollution. Large soil disturbances, such as mudslides or landslides, can also expose people to related physical hazards. The following significance criteria were applied because of the value of avoiding displacement or degradation of soil resources. Potential soil impacts were considered significant if they would:

- ❑ Expose people to soil liquefaction, mass failure, or related soil stability hazards;
- ❑ Result in substantial soil losses due to wind and water erosion; and
- ❑ Irreversibly degrade soil productivity.

3.8.3 Affected Environment

The sections below discuss existing geologic and soils conditions in the areas potentially affected by Refined Alternatives 4 and 6. The actions that may take place under the No Action Alternative are not fully known at this time and, consequently, it is not possible to completely define the affected environment for this alternative. However, many of the eventual actions that may occur as a result of the No Action Alternative would likely take place within the same geographic setting described below.

3.8.3.1 Geology

The project would be located in the eastern portion of the Colorado Plateau Province along the northwest edge of the San Juan Basin. The 7,500-square-mile San Juan Basin is a circular structural feature found in northwest New Mexico and southwest Colorado. The exposed rocks are mainly of sedimentary origin and range in age from Quaternary Era (period representing 3 million years ago to the present) to Permian Era (period between 225 to 280 million years ago).

3.8.3.1.1 Structural Components

Durango Pumping Plant and Ridges Basin Inlet Conduit

The Durango Pumping Plant site is underlain by alluvial deposits consisting of clayey sand containing some boulders, overlying eight feet of gravels, cobbles, and boulders.

The Upper Cretaceous rocks within the area include the older Point Lookout Sandstone and the younger Menefee Formation. The pumping plant location is along the southeast edge of the Durango Anticline where beds dip approximately 10 degrees to the southeast (1980 FES).

The proposed Ridges Basin inlet conduit alignment is underlain by formations of the Mesa Verde group, Lewis Shale, and unconsolidated fluvial and slopewash deposits. A large part of the conduit alignment is in the Lewis Shale, which is susceptible to erosion and contains some weathered zones. Some faults trend northeast-southwest across the inlet alignments; however, the faults probably have not been active in recent times (1980 FES).

Ridges Basin Dam and Reservoir

Ridges Basin was formed by the erosion of uplifted sedimentary beds on the southeast side of the Durango Anticline. The Lewis Shale and the Cliff House Sandstone underlie the reservoir site. Bedrock in the valley consists predominantly of siltstone with sandstone and shale (Reclamation 1992a). The Lewis Shale is a dark grey to greenish grey marine shale with some sandy shale layers and occasional thin layers of impure limestone. The underlying Cliff House Sandstone is a buff to tan, massive marine sandstone that is predominantly a hard, cliff-forming rock. The Lewis Shale extends north from the dam location across the proposed reservoir area until it grades into the Cliff House Sandstone approximately 1.5 miles north of the dam site.

Unconsolidated alluvial deposits consisting of sands and silts overlie the bedrock in the valley bottom. These deposits have a maximum depth of approximately 70 feet and a cut-off trench would be required through these deposits to prevent seepage and potential subsurface erosion. The reservoir basin surficial deposits should form a relatively impermeable bottom for the reservoir. The valley floor of the reservoir project area is approximately 6,800 feet above mean sea level (msl).

The general dip of the beds is downstream to the southeast and ranges from 20 to 35 degrees at the dam site. Outcrops at the dam site consist of the Lewis Shale, Pictured Cliffs Sandstone and the Fruitland Formation of Cretaceous age. A majority of the proposed dam site foundation is Pictured Cliffs Sandstone, a hard, quartzose, marine sandstone. A few coal beds are exposed high on the right abutment above the high-water elevation. Bedrock at the dam site appears to be structurally sound for supporting the weight of a dam and providing a suitable foundation, with the added safety of a cut-off trench and grouting.

Coal occurs primarily in the Fruitland and Menefee Formations in the Ridges Basin area. At the Ridges Basin Dam site, an outcrop of the Fruitland Formation in the right abutment contains a non-operational coal mine with a collapsed portal. According to the 1980 FES, page B-25, the visible section contained more sand and shale than coal. Because of the poor quality and relatively small areas of exposure, the coal reserve was considered to have no current economic significance. Menefee Formation coal at the Ridges Basin Reservoir site is estimated to be at a depth of 900 feet at the center of the reservoir. This makes recovery uneconomic under present conditions (1980 FES).

Two unsuccessful natural gas exploration wells have been drilled in Ridges Basin and were eventually abandoned (Corewood, Inc. 1990).

Methane production in the San Juan Basin has been predominantly centered on extraction from coal beds of the Fruitland Formation. Ridges Basin is not underlain by the Fruitland Formation, but lies next to the edge of the San Juan Basin. Methane gas naturally escapes to the atmosphere from adjacent Fruitland outcrops. During previous design data collection activities, several test holes were drilled in the vicinity of the Ridges Basin Dam site to collect subsurface data, and showed signs of gas release. The San Juan Basin is active with commercial drilling and production operations. In 1995, 15 coal-bed methane wells had been drilled within 2 miles of the proposed dam site (1996 FSFES, pg. III-11).

Several studies are currently being conducted to better understand the groundwater quality and gas leakage from the San Juan Basin rim outcrops of Fruitland Formation. The 3M Project is a research study being jointly conducted by the Bureau of Land Management (BLM), Southern Ute Indian Tribe, and the Colorado Oil and Gas Conservation Commission. The project seeks to understand, predict, and if necessary, mitigate the subsurface and surface impacts resulting from the continuing production of coal-bed methane in the San Juan Basin. A cluster of three new pressure-monitoring wells are being sited for installation along Basin Creek in order to monitor subsurface pressure and groundwater levels that may be affected by down-basin production. It is possible that as gas production increases in an area, surface gas seepage could also increase. Since 1996, several permanent soil-gas probes have been installed under the direction of BLM in the immediate vicinity of the Ridges Basin Dam site. Another priority study scheduled to be conducted by the BLM is an Environmental Impact Statement for federal oil and gas mineral development.

A mixture of methane and hydrogen sulfide gases seeps to the surface immediately downstream from the Ridges Basin Dam site in the vicinity of Fruitland Formation outcrops. During shallow aquifer testing in this area, it was noted that the gas and water in the alluvial observation wells reacted to pumping water from the bedrock and surficial deposits by sporadically spewing from the observation wells (1996 FSFES).

A fault extends along the contact between the Lewis Shale and the Cliff House Sandstone in the middle part of the reservoir. This fault is part of a fault zone that extends across the south edge of the City of Durango. "The fault is observed only in bedrock, Cretaceous Lewis Shale and Cliff House Sandstone, and no known Quarternary or younger deposits show displacement" (Ridges Basin Reservoir Geologic Design Data Report, Report #G-500, dated Dec. 1992, page 35). No construction problems are anticipated and only minor seepage is expected along the fault zone (1980 FES).

% The project area is located in an area considered to be subject to only minor seismicity (1980 FES, page
% B-27). **Map 3-3** shows recorded earthquake activity from 1849 to 1999 within a 200-mile radius of Ridges Basin. Magnitudes range from 2.3 (1966) to 5.7 (1983) on the Richter Scale, and from II (1975 etc.) to VI (1967 etc.) on the Modified Mercalli Intensity Scale. No recorded epicenters are located within the project area. Because none of the faults or lineaments within or near Ridges Basin exhibit evidence for late Quaternary displacements, none are considered seismic sources for the dam site. This data set of magnitudes indicates minimal risk. The cluster of earthquakes located 35 to 55 miles southeast of the project area is purported to have been caused by the removal of oil and gas.

Navajo Nation Municipal Pipeline

The area between Farmington and Shiprock is underlain by alluvial deposits containing clayey sands consisting of some boulders, overlying gravels and cobbles. These unconsolidated deposits are typically associated with the San Juan Basin and are moderately deep, poorly drained soils. The area is considered to have only minor seismicity.

Lemon Reservoir

A landslide upstream of the spillway approach channel of Lemon Reservoir has been monitored for several years. Studies have indicated that the slide appears to have stabilized. (Ehler 1985).

Map 3-3. Seismic Activity Recorded Within 200 Miles of Ridges Basin

Page holder for back of Map 3-3.

3.8.3.2 Soils

3.8.3.2.1 Structural Components

Ridges Basin Reservoir and Adjacent Areas

General Soil Map Units

The potentially affected environment for project structural components includes the soils of Ridges Basin, soils between Ridges Basin and the Animas River that could be affected by inlet conduit and pumping plant construction, soils underlying the routes to be used for water conveyance laterals and utility line relocations, and soils that would be affected by raising Lemon Reservoir. The potentially affected soils environment is based on information from the Soil Survey of La Plata County Area, Colorado, the Soil Survey of Montezuma County, Colorado, and the Soil Survey of San Juan County, New Mexico.

The General Soil Map contained in the Soil Survey of La Plata County Area, Colorado, the Soil Survey of Montezuma County, Colorado, and the Soil Survey of San Juan County, New Mexico show areas with distinctive patterns of soils, relief, and drainage. Each map unit on the General Soil Map is a unique natural landscape. The General Soil Map is used for broad planning and comparisons between large areas.

Soils in the Ridges Basin area are generally referred to as cool soils on hills and mountains and in inter-montane valleys. Those lying between the proposed reservoir site and the City of Durango are characterized by the Archuleta-Goldvale-Hesperus map unit. This map unit consists of shallow (less than 20 inches to parent material or bedrock) to deep (greater than 60 inches to parent material or bedrock), well-drained, gently sloping to steep, medium-textured and moderately coarse-textured soils. They are located in valleys and on hills, ridges, and mountainsides. The map unit is typically about 40 percent Archuleta and similar soils, 25 percent Goldvale and similar soils, and 15 percent Hesperus and similar soils. The remaining 20 percent is other soils or miscellaneous areas of minor extent.

The names Archuleta, Goldvale, and Hesperus and other proper names are used to refer to more specifically mapped soils, also called individual soil series. Examples include river wash, badland, rock outcroppings, and gravel pits.

Archuleta and similar soils are found on hills, ridges, and mountainsides. They are shallow and well-drained. They formed in a residuum derived predominantly from interbedded sandstone and shale. The surface layer is loam and the underlying layer is clay loam. Interbedded sandstone and shale are at a depth of 10 to 20 inches. The similar soils are in the Valto and Sanches series.

Goldvale and similar soils are found on mountainsides. These soils are deep and well-drained. They formed in an alluvium derived predominantly from interbedded sandstone and shale. The surface layer is very stony fine sandy loam, and the subsoil to a depth of 60 inches or more is stony clay. The similar soils are in the Pinata, Zau, and Fortwingate series.

Hesperus and similar soils are on alluvial fans and valley bottoms. These soils are deep and well-drained. They formed in a medium-textured alluvium derived predominantly from sandstone and shale. The surface layer is loam, the subsoil is clay loam, and the substratum is loam. The similar soils are in the Nutriosa and Herm series.

Potentially Affected Detailed Soil Map Units

The Soil Surveys of La Plata County Area, Colorado, Montezuma County, Colorado, and San Juan County, New Mexico were used to determine the representation of an area dominated by one or more major kinds of soil within the area affected by Refined Alternative 4. A detailed map unit is identified and named for the dominant soil series or miscellaneous area. Other included soils and miscellaneous areas, however, have properties and behavior divergent enough to affect use or to require different management. They are generally in small areas and could not be mapped separately because of the mapping scale used. The descriptions summarized in **Table 3.8-1** provide an adequate summary of the range of variability that can be expected for each map unit that could be affected by project implementation.

Navajo Nation Municipal Pipeline

Soils along the NNMP alignment are fairly homogeneous and fall under the general map units of Persayo-Fruitland-Sheppard (Map Unit 1) and Fruitland-Riverwash-Stumble (Map Unit 2). Map Unit 2 is the majority soil unit, of which Fruitland sandy loam is the predominant soil. This soil is characterized as deep and well-drained, and is found on fans and valleys.

Lemon Reservoir

Lemon Reservoir is located in General Soils Map Unit 11, Horesethief-Uinta-Rock Outcrop soils. These soils are described as cool soils on hills and mountains and in intermontane valleys. They are deep and well-drained, gently sloping to steep, medium textured and moderately coarse textured soils, and rock outcrop.

This map unit is in the northern and northeastern parts of La Plata County in the vicinity of Vallecito Reservoir, Lemon Reservoir, and Electra Lake. It is moderately steep to steep areas on mountainsides, cuestas, and hogbacks and in gently sloping to sloping areas on alluvial fans. Its slope is 5 to 65 percent. The native vegetation is dominantly spruce, fir, aspen shrubs, and grasses. The elevation is 7,800 to 10,000 feet.

Horsethief and similar soils are on cuestas, hogbacks, and mountainsides. These soils are deep and well-drained. They formed in stony colluvium derived dominantly from sandstone and shale. The surface layer is very stony fine loam. The subsoil is extremely stony clay loam. The substratum is very stony clay loam.

Uinta and similar soils are on mountainsides and alluvial fans. These soils are deep and well-drained. They formed in alluvium-derived dominantly from interbedded red sandstone and shale. The surface layer is loam; the subsoil is sandy clay loam in the Anvik series. These soils have virtually no crop production capability and support only natural vegetation, trees, and upland grasses.

3.8.3.2.2 Non-Structural Component

Water rights acquisitions needed for the implementation of non-structural project components of Refined Alternatives 4 and 6 would affect agricultural lands. The affected environment for non-structural component impacts includes presently irrigated agricultural soils. Agricultural soils along the Pine, Mancos, La Plata, and San Juan River Basins and McElmo Creek could be affected by land purchases and activities associated within the non-structural components. These soils are discussed in Section 3.10 (Agriculture) as impacts would be primarily associated with agricultural productivity.

Table 3.8-1
Properties of Soil Map Units Potentially Affected by Project Implementation

Map Unit Name	Slopes, Depth (Percent/ Inches)	Topographic Position	Surface Layer Texture	Subsoil Textures	Permeability	Available Water Capacity	Runoff or Erosion Hazard	Main Uses
Alamosa Loam	0-2% 60+	Valley floors, fans, bottom lands	Clay loam	Sandy and silty clay loams	Moderately slow	High	Slow to slight	Irrigated hay, pasture, rangeland
Archuleta-sanchez Complex[a]	12-65% 10-20	Hills, ridges, mountainsides	Organic matter and loam; clay loam and stony clay loam	Clay loam and very stony sandy clay loam	Moderate to moderately slow	Low to very low	Rapid to moderate	Wildlife habitat, livestock grazing, woodland, homesites
Horsethief-uinta Rock Outcrop	5-65% 50+	Cuestas, hogback, mountainsides	Very stony clay loam	Extremely stony clay loam	Moderate	Low	Medium to moderate	Rangeland and wildlife habitat
Big Blue Clay Loam	0-6% 60+	Low terraces and valley bottoms	Clay loam	Silty clay	Slow	High	Slow to slight	Irrigated pasture and rangeland
Lazear-rock Outcrop Complex	12-65% Shallow	Edges of mesas and breaks	Very stony loam	Loam	Moderate	Very low	Medium to moderate	Rangeland and wildlife habitat
Mikim Loam	3-12% 60+	Alluvial fans and foothill valleys	Loam or sandy loam	Loam	Moderate	High	Medium to high	Irrigated field crops, pasture, unirrigated crops and rangeland
Plome Fine Sandy Loam	3-12% 60+	Mountainsides and mesas	Organic matter and fine sandy loam	Clay loam	Moderate	High	Medium to moderate	Irrigated and unirrigated crops, woodland and rangeland
Sili Clay Loam	3-6% 60+	Upland valley bottoms and fans	Clay loam	Clay loam	Moderately slow	High	Medium to moderate	Irrigated cultivated crops and pasture
Vosburg Fine Sandy Loam	3-8% 60+	Swales and upland foot slopes	Fine sandy loam	Clay loam and sandy clay loam	Moderate	High	Medium to moderate	Irrigated and unirrigated crops, wildlife habitat and rangeland
Zyme Clay Loam	3-25% Shallow	Ridges and hills	Clay loam	Clay loam	Slow	Low	Rapid to high	Livestock grazing and wildlife habitat
Zyme-rock Outcrop Complex	12-65% Shallow	Ridges	Clay loam	Clay loam	Slow	Low	Rapid to high	Livestock grazing and wildlife habitat

[a]A complex is a map unit where both soils are of roughly equal dominance.

%

3.8.3.2.3 Non-Binding M&I Water End Uses and Distribution Systems

Five general soil map units are most likely to be affected by representative housing, industrial park, resort hotel complex, dude ranch, coal mine/power plant, or gas power plant water uses in the region under both Refined Alternatives 4 and 6. Each of these units is described below.

The Witt-Lazear-Pulpit map unit includes warm soils on mesas, foothills, and breaks in upland valleys. They are shallow to deep, well-drained, gently sloping to steep, medium-textured soils on mesas, uplands, and breaks. The unit is about 50 percent Witt soils, 20 percent Lazear soils, and 10 percent Pulpit soils. The remaining 20 percent are components of minor extent. Witt soils formed in silty calcareous loesses derived predominantly from red-bed sandstone. The surface layer is loam, the subsoil is silty clay loam, and the substratum is loam. Lazear soils formed in a residuum derived predominantly from sandstone. The surface layer is stony loam, and the underlying material is loam. Pulpit soils formed in loesses derived predominantly from red-bed sandstone. The surface layer is stony loam, the subsoil is silty clay loam, and the substratum is loam. Sandstone is at a depth of 20 to 40 inches.

The Dulce-Travessilla-Rock Outcrop map unit includes warm soils on mesas, foothills, and breaks in upland valleys. They are shallow, well-drained, sloping to steep, moderately coarse-textured soils and rock outcroppings on foothills and ranges. The unit is about 30 percent Dulce and similar soils, 25 percent Travessilla and similar soils, and 20 percent rock outcrop. Dulce and similar soils formed in a residuum derived from sandstone. The surface layer and underlying material are sandy loam. Soft sandstone is at a depth of 10 to 20 inches. The similar soils are in the Zyme series. Travessilla and similar soils formed in a residuum derived from sandstone. The surface layer and underlying material are sandy loam. Hard sandstone is at a depth of 6 to 20 inches. Rock Outcrop is on cliffs, ridges, breaks, and ledges. It consists of exposed sandstone. The similar soils are in the Lazear series.

The Zyme-Rock Outcrop-Ustic Torriorthents map unit includes warm soils on mesas, foothills, and breaks in upland valleys. They are shallow and deep, well-drained and somewhat excessively drained, gently sloping to steep, moderately fine-textured and moderately coarse-textured soils and rock outcroppings on foothills, ridges, and terrace escarpments. The unit is about 50 percent Zyme and similar soils, 20 percent Rock Outcrop, and 15 percent Ustic Torriorthents and similar soils. The remaining 15 percent are components of minor extent. Zyme soils formed in a residuum derived from shale. The surface layer and underlying material are clay loam. Shale is at a depth of 6 to 20 inches. Rock Outcrop is on cliffs, ridges, breaks, and ledges. It consists of exposed sandstone. Ustic Torriorthents formed in a gravelly and cobbly alluvium. The surface layer is gravelly loam, cobbly loam, or fine sandy loam. The underlying material is a very gravelly mixed alluvium.

The Shalona-Sedillo-Mikim map unit includes warm and cool soils on floodplains, terraces, and alluvial fans. They are deep, well-drained, nearly level to sloping, medium-textured soils on terraces and alluvial fans. The unit is about 35 percent Shalona and similar soils, 30 percent Sedillo and similar soils, and 10 percent Mikim soils. The remaining 25 percent are components of minor extent. Shalona soils formed in a mixed alluvium derived predominantly from sandstone and shale. The surface layer is loam, the subsoil is clay loam, and the substratum is loam. Sedillo and similar soils formed in cobbly glacial outwash. The surface layer is gravelly loam, the subsoil is very gravelly clay loam, and the substratum is very cobbly sandy clay loam. Mikim soils formed in an alluvium derived predominantly from sandstone and shale. The surface layer and underlying material are loam.

The Archuleta and similar soils are on hills, ridges, and mountainsides. They are shallow and well drained. They formed in a residuum derived predominantly from interbedded sandstone and shale. The surface layer is loam, and the underlying layer is clay loam. Interbedded sandstone and shale are at a depth of 10 to 20 inches. The Archuleta-Goldvale-Hesperus map unit is described above in Section 3.8.3.2.1.

3.8.4 Environmental Consequences and Mitigation

The following sections discuss potential impacts to geology and soils that could occur as a result of Refined Alternatives 4 and 6. In addition, proposed mitigation measures to reduce or eliminate potential impacts to geology and soils, when feasible, are included.

3.8.4.1 Refined Alternative 4

3.8.4.1.1 Geology

Refined Alternative 4 Geology Impact 1 - Less than Significant: Seismic events within the project area would have the potential to damage project facilities.

The annual probability of occurrence for the closest seismic source to Ridges Basin Dam site is 2×10^{-5}. Seismic events, including earthquakes or other ground shaking, could occur within the project area and result in damage and/or failure of project facilities including Ridges Basin Dam, water conveyance structures (including the NNMP), and other project-related infrastructure. However, seismic events within the areas that facilities would be located would not be expected to be a magnitude greater than the design of facilities could withstand.

Mitigation for Refined Alternative 4 Geology Impact 1: Reduce or eliminate the potential for damage to project facilities through specific dam design specifications to withstand maximum credible earthquake.

Those design specifications would require design performance to withstanding a maximum credible earthquake for seismic sources in the vicinity of Ridges Basin Dam site.

Refined Alternative 4 Geology Impact 2 - Less than Significant: Rapid filling and discharges from Ridges Basin Reservoir could cause reservoir-induced seismicity.

Reservoir-induced seismicity is an undesirable environmental condition associated with the operation of some dams and can be instigated by rapid impoundment of water and from filling new water storage. The probability of reservoir-induced seismicity resulting from the project is considered remote because the proposed Ridges Basin Reservoir lacks attributes, such as depth and volume, geologically recent fault activity, and local seismicity, that are typically associated with reservoir-induced seismicity. This impact would be less than significant due to the low potential for reservoir-induced seismicity occurrence.

Mitigation for Refined Alternative 4 Geology Impact 2: Provide a controlled water rate program for filling the Ridges Basin Reservoir to offset the potential of induced-seismic impacts.

Refined Alternative 4 Geology Impact 3 - Less than Significant: Wave action and drawdown runoff from the exposed Ridges Basin Reservoir shoreline could create landslides and slumping potential.

The development of Ridges Basin Reservoir would result in exposed soils surrounding much of the reservoir shoreline. Soils undercutting caused by wave action and water run-off during reservoir drawdown periods would create conditions that could cause slope destabilization and small, localized landslides, or slumping. Due to the low magnitude of the landslide and slumping that could occur, this impact would be less than significant. It is also expected that the reservoir shoreline would attain a new state of depositional equilibrium within the first few years of reservoir completion.

Mitigation for Refined Alternative 4 Geology Impact 3: Develop and implement a facilities operations program that includes monitoring the reservoir shoreline and slopes for landslide and slumping, and provide for public notification and control of public access in areas where high landslide and slumping potential exists.

Landslides would be monitored during reservoir filling as part of the filling criteria and after filling as part of Reclamation's annual landslide survey. A site-specific geologic investigation would be conducted to identify areas with landslide potential. Those slopes having the potential to slide would be identified. Public access on and below these slopes could be restricted with fencing, as necessary. Costs associated with this avoidance activity would be part of the facility O&M costs and would not exceed $500 annually.

Refined Alternative 4 Geology Impact 4 - Potentially Significant: Dewatering for construction of Ridges Basin Dam and filling of the reservoir could increase the natural seepage and surface release of coal-bed methane gas.

During construction of Ridges Basin Dam, the groundwater table beneath the foundation of the dam would be drawn down below the top of bedrock to allow the removal of overburden and placement of fill and a cut-off wall. During drawdown, groundwater could be pumped to the surface and released down Basin Creek. However, if the quality of this water is not sufficient to allow direct discharge to Basin Creek it could be land applied within Ridges Basin. It is anticipated that dewatering this portion of the foundation would likely increase the natural seepage of methane gas in the area, and gaseous conditions could be encountered during excavation at the downstream toe of the dam. This impact would be associated with construction of the dam, and increased seepage resulting from dewatering would not be expected to be a long-term occurrence. An additional potential for increased coal-bed methane seepage would result from filling of the reservoir and the pressure that the dam and impounded water could exert on nearby coal-bed methane deposits. The potential would exist for long-term increased seepage from these activities; however, the probability of seepage occurrence or seepage rates is not known.

Mitigation for Refined Alternative 4 Geology Impact 4: Monitor methane seepage during construction and facility operations and implement a process plan to manage dam site methane releases during construction.

This impact would be mitigated by way of an engineered process plan to limit, control, and manage dam site methane gas releases during construction. Appropriate construction safety standard requirements would be implemented for the construction program (Reclamation 1999). The long-term impacts of coal-bed methane gas seepage need to be identified. Data gathering as part of a monitoring study by BLM in conjunction with Colorado Oil & Gas Conservation Commission is currently under way. Construction monitoring would be part of construction safety costs, and long-term facility monitoring costs would be defined as monitoring methods and technology are determined.

Refined Alternative 4 Geology Impact 5 - Less than Significant: The presence of existing man-made intrusions into areas within Ridges Basin could release methane and hydrogen sulfide gas and could impair integrity of the dam.

Two abandoned exploration wells are located within the proposed reservoir area. One of these wells currently acts as a conduit for methane and hydrogen sulfide gas, allowing these gases to escape to the surface. This well could release these gases to the reservoir, resulting in potential degradation of water quality. In addition, the abandoned Gates Coal Mine, which is located near the proposed southern dam abutment, could affect the structural integrity of the dam. Best engineering practices would be used for sealing the intrusions and constructing project facilities which would reduce the potential for this impact to less-than-significant levels.

Mitigation for Refined Alternative 4 Geology Impact 5: Investigate for the potential of gas release due to man-made intrusions and monitor excavations for the presence of gas, and employ safety measures as needed.

If necessary, to alleviate the potential of water accessing the Gates Coal Mine, mitigation could include plugging access to reduce the chance of water entry. Cut slope location and angle should be developed so that the mine is not affected by construction activities. Exploration wells would be plugged. Costs associated with this avoidance would be associated with construction planning.

3.8.4.1.2 Soils

Refined Alternative 4 Soils Impact 1 - Significant: Ground disturbance during construction of structural and non-binding components would expose soils to potential increases in wind and water erosion and increase risk of slope instability.

Ground disturbance associated with reservoir basin development and construction of the physical project facilities (structural components, including Ridges Basin Reservoir and the Navajo National Municipal Pipeline, and non-binding water end-uses and conveyance pipelines) would expose soils to potentially significant water and wind erosion from grading, excavation, alteration of surface hydrology, and vegetation removal.

Construction disturbance could increase soil erosion through disturbed soils exposure. The development of roads for pipeline and facilities construction, access, staging and parking areas, and clearing, grading, and construction could substantially increase soil losses through both water and wind erosion. This impact would be significant due to the large amount of total disturbance that could occur and the potential secondary effects of water and air quality degradation from sedimentation and particulate matter releases.

Mitigation for Refined Alternative 4 Soils Impact 1: Implement measures contained within erosion control guidelines and BMPs to reduce impacts from construction of structural and non-binding components.

This impact can be mitigated by using responsible erosion control guidelines and BMPs to reduce erosion and sedimentation resulting from construction of all structural components. Measures to be implemented, as appropriate, would include, but not necessarily be limited to, the following activities for all soils affected from Ridges Basin Reservoir and associated facilities, the NNMP, and the end-use and conveyance structures:

❑ Using water trucks to minimize wind erosion and dust during construction

❑ Conducting soil-disturbing activities only from May 1 through October 15

- ❑ Avoiding the disturbance of steep slopes whenever feasible
- ❑ Constructing fill slopes to a 2 (horizontal) to 1 (vertical) ratio gradient or flatter
- ❑ Constructing V-ditches above all cut or fill slopes to divert water from newly exposed slope faces
- ❑ Revegetating exposed slope faces before the rainy season
- ❑ Locating straw bale dikes or filter fabric barriers downslope of disturbed areas to act as sediment traps
- ❑ Constructing temporary or permanent sedimentation basins as needed
- ❑ Selectively removing, stockpiling, and replacing top soil as a surface medium for revegetation
- ❑ Stabilizing drainage channels using rock lining or similar natural materials

One or more of these measures and any other BMPs needed to control soil erosion would be specified as conditions of approval for site-specific construction activities, based on the Environmental Commitments Plan that would describe Reclamation's responsibilities for mitigation implementation, funding, bonding, reporting, and verification. Implementation of the applicable measures as described in the Environmental Commitments Plan would reduce this impact to a less-than-significant level. Costs associated with this mitigation are included within estimated construction costs.

Refined Alternative 4 Soils Impact 2 - Less than Significant: Wave action and rapid reservoir surface elevation changes could cause sedimentation and erosion along the reservoir shoreline.

Exposed soils along the reservoir shoreline would be continuously exposed to reservoir surface movement through wave action, human and animal activity, and reservoir drawdown. These actions would result in shoreline erosion and sedimentation; however, this effect is not expected to be a significant impact to soils as a relatively small quantity of soils would be affected and sedimentation rates would likely be low.

Mitigation for Refined Alternative 4 Soils Impact 2: Implement a program in which reservoir filling and drawdown would be controlled at rates sufficient to reduce significant erosion and sedimentation impacts.

3.8.4.2 Refined Alternative 6

3.8.4.2.1 Geology

Refined Alternative 6 Geology Impact 1 - Less than Significant: Seismic events within the project area would have the potential to damage project facilities.

Seismic events, including earthquakes or other ground shaking, could occur within the project area and result in damage and/or failure of project facilities including the modified Lemon Reservoir Dam, water conveyance structures (including the NNMP), and other project-related infrastructure. However, seismic events within the areas where facilities would be located would not be expected to be of a magnitude greater than the design of facilities could withstand.

Mitigation for Refined Alternative 6 Geology Impact 1: No mitigation is proposed.

Refined Alternative 6 Geology Impact 2 - Less than Significant: Wave action and drawdown runoff from the new shoreline of Lemon Reservoir would create new landslide and slumping potential, including that from existing landslides.

Soils undercutting caused by wave action and water runoff during reservoir drawdown periods would modify existing conditions at the reservoir (i.e., wave action and runoff would occur at a higher average elevation than at present) that could cause slope destabilization and small, localized landslides or slumping. Due to the low magnitude of the landslide and slumping that could occur, this impact would be less than significant.

Mitigation for Refined Alternative 6 Geology Impact 2: Develop and implement a facilities operation program that includes monitoring the reservoir shoreline and slopes for landslide and slumping; and provide for public notification and control of public access in areas where high landslide and slumping potential exists.

Same as mitigation for Refined Alternative 4 Geology Impact 3, with the addition of monitoring existing landslides.

3.8.4.2.2 Soils

Refined Alternative 6 Soils Impact 1 - Less than Significant: Ground disturbance during construction of the structural and non-structural components would expose soils to potential increases in wind and water erosion and increase risk of slope instability.

This impact would be similar to Refined Alternative 4 Soils Impact 1; however, disturbance and slope instability potential would be reduced due to the reduction in ground disturbance associated with raising Lemon Dam and Reservoir as compared to disturbance associated with Ridges Basin Dam and Reservoir and associated facilities' construction.

Mitigation for Refined Alternative 6 Soils Impact 1: Implement measures contained within erosion control guidelines and BMPs to reduce impacts from construction of structural and non-binding components.

Same as mitigation for Refined Alternative 4 Soils Impact 1.

Refined Alternative 6 Soils Impact 2 - Less than Significant: Wave action on Lemon Reservoir shoreline could cause sedimentation and erosion.

Similar to Refined Alternative 4 Soils Impact 2.

Mitigation for Refined Alternative 6 Soils Impact 2: No mitigation is proposed.

Refined Alternative 6 Soils Impact 3 - Less than Significant: Increased wind and water erosion could occur as a result of removing or reducing irrigation from currently irrigated lands.

The purchase of irrigated agricultural lands under the non-structural component of Refined Alternative 6 could remove or substantially reduce the amount of irrigation water applied to agricultural lands which, in turn, could result in reduced vegetative cover and reduced soil moisture. The reduced physical protection associated with vegetative cover, combined with drier surface soils, could increase the amount of soil subject to wind erosion. The potential increase in soil losses that could result from increased wind erosion is considered less than significant because, in some cases, less intensive agricultural management may result in a denser overall weed cover than would occur under cultivated conditions that often require some bare soils for farm management purposes (e.g., roads, irrigation ditches, berms, or parking areas).

Reduced vegetative cover could also increase surface soil water erosion. Specifically, lessened physical protection associated with vegetative cover also reduces the physical strength afforded by plant roots as they bind to soil particles. Dense, shallow-rooted systems often provide the most beneficial soil binding. Soil losses that could result from increased water erosion are considered less than significant because, in some cases, less intense agricultural management may result in fewer opportunities for water erosion, specifically, erosion associated with irrigation water runoff. Reduced irrigation applications, combined with the establishment of dense, weedy covers associated with less intensively cultivated fields, could reduce the amount of water erosion that would otherwise result from irrigation.

Mitigation for Refined Alternative 6 Soils Impact 3: Develop procedures to incorporate an erosion protection program for acquired lands.

Refined Alternative 6 Soils Impact 4 - Less than Significant: Increased erosion and slumping potential could occur along the Pine River due to increased flows.

As discussed in Section 3.2, Water Resources/Hydrology, flows in the Pine River would increase an average of 9 cfs, with increases ranging from 55 cfs in July to 7 cfs in April and October. This increase in flow would stay within the present river channel and would not occur during peak runoff. As such, increased erosion and slumping potential are not considered significant.

Mitigation for Refined Alternative 6 Soils Impact 4: No mitigation is proposed.

3.8.4.3 No Action Alternative

The following impacts of the No Action Alternative have been taken from the 1996 FSFES.

Geology

If no project features are built, there will be no impact on coal-bed methane gas resource. (Page III-11.) *If no project features are built, there will be no impact on Fruitland Formation coal development at the La Plata coal mine.* (Page III-13.)

Soils

Approximately 17,600 acres in the project area receive a partial water supply from the La Plata River and its tributaries. It is anticipated that similar farming practices would continue in the future. A small amount of additional development could occur with the rehabilitation of the existing irrigation system and more efficient irrigation methods being used. (Page III-16.)

3.9 Cultural and Paleontologic Resources

3.9.1 Introduction

This section addresses potential impacts to cultural and paleontologic resources that could result from actions associated with Refined Alternatives 4 and 6 and the No Action Alternative. Section 3.9.2 defines the Evaluation Methodology and significance criteria used for determining impacts, Section 3.9.3 describes the affected environment, and Section 3.9.4 identifies potential impacts and discusses mitigation measures that would serve to reduce or eliminate anticipated impacts to cultural and paleontologic resources.

3.9.2 Evaluation Methodology

This section discusses the methodology used to determine potential impacts that could result from Refined Alternative 4 and Refined Alternative 6. Also discussed are specific criteria that were used to determine the significance of the impacts identified.

3.9.2.1 Cultural Resources

Cultural resources are physical or other expressions of human activity or occupation. Such resources include culturally significant landscapes, prehistoric and historic archaeological sites and isolated artifacts or features, historic structures, human burials, sacred sites and traditional cultural properties (TCPs). TCPs are sites or areas of important cultural value to existing communities. They may not have actual physical remnants associated with their existence. Cultural resources that are eligible for inclusion in the National Register of Historic Places (NRHP) are protected under the National Historic Preservation Act of 1966, as amended in 1992 (NHPA). Cultural resources may also be protected under the Native American Graves Protection and Repatriation Act of 1990 (NAGPRA), and Executive Order 13007, Protection of Native American Sacred Sites, and other state, agency, or tribal laws and policies.

Other subject matter is relevant to and sometimes included with cultural resources but addressed separately in this document under Recreation (3.11), Socioeconomics (3.12), Visual Resources (3.20), and Environmental Justice and Indian Trust Assets (4.4).

3.9.2.1.1 Methodology

The methods used to determine the presence of cultural resources sites located within the project area consisted of a literature review, limited archaeological field surveys, and supplemental ethnographic evaluation. These studies were conducted to provide additional information for components that had not undergone previous examination, and to verify previous results. For those areas within Refined Alternatives 4 and 6 which were not covered by any of these or other similar studies, additional studies were conducted.

Archaeological and Historical

The 1992 Technical Specialist Report (Hurley 1992) (TSR), the historic archaeological evaluation (Stein and Ballagh 1995), and the 1996 cultural resource survey (Chenault 1996) were primary sources of information. The TSR includes a case study of the project area, and a discussion of the Ridges Basin District, which has been designated a district eligible for inclusion to the NRHP. The remaining studies focused on other resource types and other components of the project area as it was envisioned in 1996 (i.e., Alternative 7). Additionally, numerous early plat and county maps of the area were examined to determine plots of early roads, buildings, and other historical components that exist or may have existed in the study area. The supplemental identification and analysis of prehistoric and historic - period resources, as they pertain to Refined Alternatives 4 and 6 (Shaffrey et.al., in preparation), followed standard survey techniques.

Ethnographic

An ethnographic evaluation was conducted of traditional cultural properties eligible for the NRHP that may be affected by the proposed project. SWCA's study was intended to assist compliance with the NHPA, using guidelines in National Register Bulletin 38 (Parker and King 1990) and National Register Bulletin 15 (National Park Service 1991). It was also done in accordance with Bureau of Reclamation Guidance for Implementing Indian Sacred Sites Executive Order 13007, and to solicit tribal input on the treatment of human remains and cultural items covered under NAGPRA. This research was conducted for the 1996 FSFES (NAU and SWCA 1996) and follow-up research, to address changes in project configuration, was conducted in 1999. A total of 26 Native American tribes were consulted. The 1999 initial consultation identified and documented which tribes wanted further involvement in the ALP Project, and gathered tribal input on the ALP Project alternatives being considered at the time of the consultations. The ethnographic team also elicited comments from the consulted tribes regarding their concerns about potential impacts of the project on TCPs, sacred sites, and burials that may be in or adjacent to the project area.

Tribal Contact

A letter describing the project and a request for input on traditional cultural use and/or history of the area was sent to the consulting tribes. The ethnography team followed up these letters with telephone calls in order to elicit a response concerning the need for further work with the specific tribe.

Using past projects in the vicinity as examples, the ethnography team believed that many of these tribes (i.e. some of the Eight Northern Pueblos), would not pursue consultation beyond this phase. This proved to be true in some cases, but the majority of the tribes contacted requested to be notified after the preferred alternative had been chosen.

When requested by tribal officials, the ethnography team met with tribal representatives to discuss the potential for traditional, religious, or cultural properties that may be affiliated with their specific tribe and that may be located within the project area. These meetings also helped determine the level of effort necessary to identify specific properties that may be eligible for or listed in the National Register and that may be potentially affected by the project.

3.9.2.1.2 Significance Criteria

For cultural resources, a significant environmental effect occurs when the proposed project will disrupt or adversely affect a prehistoric or historic archaeological site or a property of historic interest or cultural significance to a community or ethnic or social group. Adverse impacts to cultural resources could include destruction, disturbance, inundation or vandalism to significant resources. These impacts were considered significant if they would occur to cultural resource sites that are eligible, or listed, for inclusion on the NRHP. It should be noted that while significant impacts to cultural resources may be "resolved" through treatment measures of encountered resources such as data recovery in compliance with applicable regulations and guidelines, such resolution would not reduce impacts to less-than-significant levels. As such, significant impacts which may be resolved would remain significant and unavoidable. Other adverse impacts would include disturbance to graves and cultural items protected under NAGPRA, and destruction of, or, preventing access to, sacred sites protected under Executive Order 13007.

3.9.2.2 Paleontologic Resources

Paleontologic resources are fossils or other remnants of non-human life from past geologic periods and are protected under Interior policy.

3.9.2.2.1 Methodology

To determine existing paleontologic resources within the project area, information was sought through personal contacts (including government agencies and museum and university researchers); review of existing unpublished (including environmental reports and other agency) studies; review of published scientific works (papers and maps); and drive-by inspection of proposed facility locations. Geologic deposits within the project area were identified and classified based upon their potential to contain vertebrate fossils or noteworthy occurrences of invertebrate or plant fossils. Classification of geologic deposits were made according to the following conditions (conditions are defined as established by the BLM):

> **<u>Condition 1</u>:** Areas that are known to contain vertebrate fossils or noteworthy occurrences of invertebrate or plant fossils. Consideration of paleontological resources will be necessary if the Field Office review of available information indicates that such fossils are present in the area.
>
> **<u>Condition 2</u>:** Areas with exposures of geological units or settings that have high potential to contain vertebrate fossils or noteworthy occurrences of invertebrate or plant fossils. The presence of geologic units from which such fossils have been recovered elsewhere may require further assessment of these same units where they are exposed in the area of consideration.
>
> **<u>Condition 3</u>:** Areas that are very unlikely to produce vertebrate fossils or noteworthy occurrences of invertebrate or plant fossils based on their surficial geology, igneous or metamorphic rocks, extremely young alluvium, colluvium or aeolian deposits, or the presence of deep soils. However, if possible, it should be noted at what depth bedrock may be expected in order to determine if fossiliferous deposits may be uncovered during surface-disturbing activities.

Following the classification of geologic deposits within the project are, the potential for these deposits to be disturbed, destroyed or inundated during construction or operational activities was assessed.

3.9.2.2.2 Significance Criteria

Potential disturbance, destruction, or inundation of fossils of scientific significance, or potential disturbance to geologic formations that satisfy Conditions 1 and 2 were considered potentially significant for the purposes of this evaluation.

3.9.3 Affected Environment

The sections below discuss existing cultural and paleontologic resources in the areas potentially affected by Refined Alternatives 4 and 6. Due to unknown actions that may eventually take place under the No Action Alternative, it is not possible to determine the specific affected environment for this alternative. However, many of the eventual actions that may occur as a result of the No Action Alternative would likely take place within the same geographic context as that of Refined Alternatives 4 and 6.

3.9.3.1 Cultural Resources

Archeological and historic resources found within the ALP Project area (as proposed in 1979) were described in the 1979 Definite Plan Report (DPR) and in the 1980 FES. The 1996 FSFES summarized the information contained within the previous reports and supplemented it with general information concerning traditional cultural properties, sacred sites, and burial sites. As such, the affected environment, and discussion of potential impacts presented below provide a stand-alone summary of potential impacts that could result from the project. Changes in the size and locations of certain project features and the redefined end-uses and delivery systems of project water, and the geographic scope in which impacts would occur, are addressed.

Numerous cultural resource sites are known to exist within the area encompassed by the components of the proposed project. In 1995 the National Trust for Historic Preservation listed the Colorado Plateau, which the project area is a part, among the most endangered Historic Treasures in the United States due to trends of looting and development. A case study of the project area (Hurley 1992) found that the project (as described in the 1980 FES and the 1996 FSFES) would result in an adverse effect to historic and cultural properties. While the scale of impacts would be lessened somewhat from those described in Alternative 7, the alternatives currently under consideration could result in impacts to similar types of resources. The case study, and subsequent surveys (Chenault 1996) identified a cultural resource base which corresponds to seven periods of occupation: 1) Archaic; 2) Basketmaker II; 3) Basketmaker III; 4) Pueblo I; 5) Pueblo II and Pueblo III; 6) Protohistoric; and 7) Euro-American Historic.

The Archaic period in the region is typified by a change from a big-game hunting emphasis to the hunting of smaller, modern game and the intensive collection of plant foods. Most sites of this period date between 8000 and 2000 BP (Before Present).

The Basketmaker II period is characterized by the adoption of structures and features for habitation and storage of surplus foods. Basketmaker culture was named for its finely woven baskets and lack of pottery. Basketmaker II sites appear to date between A.D. 200 and 400.

The Basketmaker III period (A.D. 400 to 700) marks the beginning of a more sedentary agricultural lifestyle and the use of ceramics and adoption of the bow and arrow. This period also represents the beginnings of the typical Anasazi (Ancestral Pueblo) site layout.

The Pueblo I period (A.D. 700 to 900) is well represented with small hamlets scattered across the project area. It is during this period that surface structures, identified as pueblos, become increasingly common.

The Pueblo II and Pueblo III periods (A.D. 900 to 1300) are characterized by larger pueblos which usually include masonry roomblocks and larger semi-circular pit structures, called kivas. They are the ruins familiar to most modern visitors to the area, such as the sites on display at Mesa Verde National Park.

Two Native American protohistoric traditions are found in the region, the Navajo and the Ute. The earliest evidence for the Navajo occupation is the 1500s, and the evidence suggests the Ute occupation of the area began in the 1600s.

Three contexts for Euro-American historical archaeological remains have been identified: railroading, coal mining, and agriculture (Stein and Ballagh 1995).

Research conducted indicates that 26 Native American tribes have ancestral and contemporary ties to the project area. Archaeological data provide some information about prehistoric and historic aboriginal use of the region; however, each tribe has its own account of the tribe's traditional use of the area. While direct evidence for the existence of burial sites in the project area is lacking, knowledge of the cultural resources indicates a high likelihood of encountering human remains during archaeological excavation or construction activities. Burials on Puebloan archaeological sites are rather common and are to be expected.

These 26 tribes are as follows:

- Hopi Tribe
- Jicarilla Apache Tribe
- Navajo Nation
- Pueblo of Acoma
- Pueblo of Cochiti
- Pueblo of Isleta
- Pueblo of Jemez
- Pueblo of Laguna
- Pueblo of Nambe
- Pueblo of Picuris
- Pueblo of Pojoaque
- Pueblo of San Felipe
- Pueblo of San Ildefonso
- Pueblo of San Juan
- Pueblo of Sandia
- Pueblo of Santa Ana
- Pueblo of Santa Clara
- Pueblo of Santo Domingo
- Pueblo of Taos
- Pueblo of Tesuque
- Pueblo of Zia
- Pueblo of Zuni
- San Juan Southern Paiute
- Southern Ute Tribe
- Uintah-Ouray Ute Tribe
- Ute Mountain Ute Tribe

Field Results and Consultation

The results of the 1996 study are applicable to the 1999 configuration of the project. Generally, the consulted Tribes expressed concerns about the human remains and cultural items that may be affected by the project. Intact Basketmaker and Puebloan habitation sites were of particular concern to a number of Tribes and are considered TCPs. These sites are extant across all features/elements of the project. At least nine of the consulted Tribes have requested to be actively involved; they have requested to visit the project area to determine if ground disturbance will impact TCPs, traditional use areas, or sacred sites, and this fieldwork is ongoing. Further identification and treatment efforts will be in consultation with these and other consulting Tribes as appropriate, and will be done in accordance with the provisions of the Programmatic Agreement included as Attachment H of this document.

In dealing with the discovery and disposition of human remains, the regulations in the Native American Graves Protection and Repatriation Act must be followed on federal projects. NAGPRA requires consultation with Indian tribes and a permit under the Archaeological Resources Protection Act (ARPA) before human remains and associated funerary objects are exhumed from federal lands and Indian trust lands (state permits are required for state and private lands). Consultation has resulted in the

% development of a draft NAGPRA Plan (see Attachment H). This draft plan is being distributed among
% the consulting tribes, whose comments will be incorporated into the final version.

% Chapter 6 provides additional information with regard to the current status of tribal consultation.

The following discussion of cultural resources within the project is focused on (1) Ridges Basin and adjacent areas, (2) areas east of Ridges Basin, and (3) areas west of Ridges Basin. These subdivisions are provided to present a general description of the cultural resources that are located within areas that could be affected by both the structural and non-structural components, as well as the potential end-use and conveyance systems, of both Refined Alternatives 4 and 6.

3.9.3.1.1 Ridges Basin

Ridges Basin has been determined a District for its eligibility to the National Register of Historic Places. Archaeological resources in the Ridges Basin District (a total of 230 sites) are of the quality and variety needed, and have the degree of preservation necessary, for addressing many of the key questions pertinent to the prehistory of the Southwest. The period of time significant for the district extends from the prehistoric to the protohistoric, with four discrete periods of occupation representing four historic contexts. Those contexts are: (1) Archaic, (2) Basketmaker II, (3) Pueblo I, and (4) Protohistoric (Hurley 1992). In addition, three sub-contexts can be added for historical (Euro-American) archaeological remains, and another for its traditional cultural/religious value. Cultural resources in the Ridges Basin area have the potential to provide data pertinent to addressing questions related to those contexts.

Sixty-one sites with Archaic materials are found in Ridges Basin, with the highest frequencies indicating a Late Archaic occupation.

Twenty-eight (both habitation and nonhabitation) Basketmaker II sites are present in the basin . Habitation sites vary in size and are distributed across the lower slopes, upper slopes and ridges, and the terraces above the basin.

The 170 Pueblo I period sites in the Ridges Basin area provide an excellent laboratory for addressing questions related to aggregation, abandonment, and mobility. A large population colonized the area, aggregated into large villages, and then abandoned the area after a short period of occupation.

Fourteen sites with limited protohistoric remains have been identified in the Ridges Basin area. Historical archaeological sites in Ridges Basin can be assigned to three basic historic contexts. The first of these is Railroading in Ridges Basin, 1890 to 1951, and consists of cultural resources related to construction and operation of railroad lines within the basin. The railroads were also closely associated with resources assignable to the second context, Coal Mining in Ridges Basin, 1886 to circa 1930. The second context is concerned with resources related to the extraction of coal and would include mines, tailings piles, and other features associated with that activity. The third historic context is Agriculture in Ridges Basin, circa 1880 to the Present, and includes such cultural resources as historic homesteads and agricultural fields and ditches (Stein and Ballagh 1995).

Tribal consultation identified the Puebloan habitation and ceremonial archaeological sites in the basin as TCPs. A segment of the Old Ute Trail that passes through Ridges Basin is considered a TCP. The approximately 4-mile segment of the Old Ute Trail that passes through Ridges Basin is a portion of a much longer trail that stretched from Ignacio to Towaoc. One site warranting protection under EO 13007, a mineral collecting area, was also identified (NAU and SWCA 1996).

There is also strong evidence that the Old Ute Trail was used by the Dominquez-Escalante Expedition. Ridges Basin is interpreted as the "narrow valley of abundant pastures" that the expedition passed through on August 9, 1776 (Delaney and McDaniel in Miller, 1976).

Under Refined Alternative 4, it is estimated that 80 to 90 cultural resource sites will be impacted by a 120,000 af Ridges Basin Reservoir and appurtenant facilities.

3.9.3.1.2 Areas West of Ridges Basin

Much of the area west of Ridges Basin, including Red Mesa, the Mancos River, and Montezuma Valley between Cortez and Towaoc, was densely occupied in prehistoric times. Distinct patterns have been identified concerning the settlement patterns of the region. Mormon settlers arrived in the area in the late 1800s. Historic resources, comprised mostly of homesteads, were located exclusively within the La Plata River drainage.

Prehistoric sites were most abundant in the eastern portion of the Mancos River Drainage, generally located between and near canyons that drain into the Mancos River. In this area, the site density is estimated between 11 and 20 sites per 160 acres (¼ section), though it varies with a site density less than 10 sites per 160 ac in some areas and other areas exceeding 20 sites/160 ac. Areas within the La Plata River drainage generally had between 1 and 10 sites per 160 ac, including numerous historic period resources. The majority of the prehistoric sites date to the Basketmaker III, Pueblo II, or Pueblo III time periods (Chenault 1996).

Under Refined Alternative 4, activities associated with water acquisition in the La Plata River Basin and the Mancos River Basin are estimated to encompass 550 to 600 cultural resource sites. Construction of conveyances associated with Refined Alternative 4 is estimated to encompass another 55 to 65 cultural resource sites. Potential end uses are estimated to encompass between 60 and 70 cultural resource sites. Therefore, a total of up to 735 sites are estimated to be within areas west of Ridges Basin.

Under Refined Alternative 6, activities associated with water acquisition, depletion, and supply in the La Plata River Basin, the McElmo Creek Basin and the Mancos River Basin are estimated to encompass 675 to 725 cultural resource sites. Construction of conveyances associated with Refined Alternative 6 is estimated to encompass another 55 to 65 cultural resource sites. Potential end uses are estimated to encompass between 60 and 70 cultural resource sites. Therefore, a total of up to 860 sites are estimated to be within areas west of Ridges Basin.

3.9.3.1.3 Areas East of Ridges Basin

Cultural resources found east of Ridges Basin are similar to those found within the basin and include mainly Pueblo I and historic era resources. Several Basketmaker III , Pueblo II/Pueblo III, and a few Protohistoric resources are also known from the area.

For the area east of Ridges Basin, the site density is similar to that in Ridges Basin. The site density for Ridges Basin, based on earlier work by Winter et al. (1986), was approximately 22 sites per section, or 5.5 sites per ¼ section (160 acres). This site density is similar to that identified for the La Plata drainage area west of Ridges Basin, suggesting a density between 1 and 10 sites per 160 acres. Portions of a recent sample inventory performed by SWCA (Shaffrey et al. in prep.) in La Plata County suggests a site density similar to that within Ridges Basin.

Hispanic settlers began settling the area in the late 1800s. The arrival of the railroads in the 1880s generated increased opportunities for settlement in the region. Many small towns, farms/homesteads, and wagon roads are associated with the historic occupation of the region.

For areas that may be purchased for water rights in the area as part of Refined Alternative 4 it is estimated that between 350 and 400 cultural resources sites are within areas that could be affected by project activities. Areas east of Ridges Basin where conveyances may be constructed to transport water may include between 15 and 20 cultural resources. Potential end uses are estimated to encompass between 70 and 90 cultural resource sites. Therefore, a total of up to 510 sites are estimated to be within areas potentially impacted .

For areas that may be purchased for water rights, and other water depletion and water supply activities as part of Refined Alternative 6 it is estimated that between 900 and 1,000 cultural resource sites are within areas that could be affected by project activities. Areas east of Ridges Basin where conveyances may be constructed to transport water may include between 15 and 20 cultural resources. Potential end uses are estimated to encompass between 70 and 90 cultural resource sites. Therefore, a total of up to 1,110 sites are estimated to be within areas potentially impacted.

3.9.3.1.4 Navajo Nation Municipal Pipeline

Sixteen cultural resources sites were identified within the pipeline corridor that may be impacted by pipeline construction. Most of these sites date to the Pueblo I and Pueblo III time periods.

3.9.3.1.5 Summary of Impacts, Refined Alternatives 4 and 6

In his 1996 report on what is now referred to as Alternative 7, Chenault (1996) estimated that development activities (not including those at Ridges Basin reservoir) would result in a 43.5 percent impact rate to cultural resources (pp 283-296). While that study was oriented towards irrigation development, which is not an element of either Refined Alternative 4 or 6, the types of activities are similar enough that the 43.5 percent figure is still considered valid. Therefore it is estimated that Refined Alternative 4 will impact up to a total of 639 sites; Refined Alternative 6 will impact up to 864 cultural resource sites. Either Alternative will result in impacts significantly less than those estimated for Alternative 7, which was estimated to impact up to 1,600 cultural resource sites.

Since many of the prehistoric sites for either Refined Alternative are habitation sites which date between the Basketmaker II to Pueblo III time periods, and others represent protohistoric Navajo and Ute sites, they also may be considered TCPs (and likely to contain burials); their identification and treatment are of considerable concern to many of the consulting Tribes.

3.9.3.2 Paleontologic Resources

Geologic mapping (Condon 1990, Manley et al. 1987; O'Sullivan and Beikman 1963; Ward 1990) document that the rocks underlying the study area range from Late Cretaceous to Early Cenozoic in age and include the following geologic units identified in **Table 3.9-1.** The geology and paleontology of these geologic units is well-documented in published reports and geologic maps, many of which are listed in the references cited section. Information on geologic units within the study area, their known paleontologic resources, and recommendations for treatment are also provided in Table 3.9-1. Additional information on each of the units are summarized in paragraphs below.

Table 3.9-1
Summary of Surface Geologic Deposits and Paleontologic Resources in the Study Area

Deposit	Geologic Age	Type of Deposit/ Environment of Deposition	Area Present	Fossil Resources[a]	Rating	Level of Survey Recommended
Soil	Recent	Modern soils	Widespread	None	Condition 3	None
Alluvium	Recent	Unconsolidated silts, sands of valleys and plains; terrestrial	Widespread	None	Condition 3	None
Terrace gravels	Recent-Pleistocene	Gravels, silts, and sands that predate current erosional cycle; terrestrial, river	NNMP, Durango Pumping Plant, Ridges Basin Inlet Conduit	None	Condition 3	None
Older Alluvium	Pleistocene	Silts and sands that predate the present erosional cycle; terrestrial, river	NNMP	None Known	Condition 2	None, discovery contingency
Animas Formation	Early Tertiary (Paleocene)	Olive, brown, gray, red, green, and purple conglomerate, volcanic sandstone, tuff, and shale; terrestrial, river, flood plain	M&I Pipelines	Vertebrates Invertebrates Plants Trace fossils	Condition 2	Detailed
	Latest Cretaceous	Reddish-brown to purple very coarse breccia, volcanic conglomerate and sandstone, shale and tuff; terrestrial, river.	Durango Pumping Plant and Reservoir Inlet Conduit	Plants	Condition 2	Detailed
Kirkland Formation	Latest Cretaceous	Green-gray, purple, dark gray shales and mudstone and yellow-orange to gray sandstone; terrestrial, river, flood plain, coastal plain.	NNMP and M&I Pipelines	Vertebrates Invertebrates Plants Trace fossils	Condition 2	Detailed
Fruitland Formation	Latest Cretaceous	Light gray, olive, brown, sandstone, yellow-brown and olive siltstone and shale, coal, limestone coquina in lower part; brackish-water lagoon and coastal plain.	NNMP and M&I Pipelines	Vertebrates Invertebrates Plants Trace fossils	Condition 2	Detailed

Table 3.9-1 (continued)
Summary of Surface Geologic Deposits and Paleontologic Resources in the Study Area

Deposit	Geologic Age	Type of Deposit/ Environment of Deposition	Area Present	Fossil Resources[a]	Rating	Level of Survey Recommended
Pictured Cliffs Formation	Late Cretaceous	Yellow-orange to gray sandstone, interbedded sandstone and shale in lower part; marine, shoreline	NNMP and M&I Pipelines	Vertebrates Invertebrates Trace fossils	Condition 2	Detailed
Lewis Shale	Late Cretaceous	Dark gray to green gray shale, minor beds of sandstone, silty limestone and bentonite; marine, offshore to near shore.	Ridges Basin, Ridges Basin Inlet Conduit and NNMP	Vertebrates Invertebrates Trace Fossils	Condition 2	Spot check
Cliff House Sandstone	Late Cretaceous	Tan and gray crossbedded sandstone with varying amounts of interbedded gray shale; marine, nearshore; terrestrial river, deltaic	NNMP and M&I Pipelines	Vertebrates Invertebrates Trace Fossils	Condition 2	Detailed
Menefee Formation	Late Cretaceous	alternating beds of tan and brown sandstone, gray and brown claystone and shale, coal. terrestrial, river, flood plain, coastal plain.	NNMP, Ridges Basin Inlet Conduit and M&I Pipelines	Vertebrate Invertebrate Plants	Condition 2	Detailed
Point Lookout Sandstone	Late Cretaceous	Tan and brown sandstone and gray shale; marine nearshore, shoreline, river	NNMP, Durango Pumping Plant and Ridges Basin Inlet Conduit	Vertebrate Invertebrate	Condition 2	Detailed
Mancos Shale	Late Cretaceous	Light to dark gray shale lesser amount, tan fine grained sandstone and siltstone; marine.	NNMP and M&I Pipelines	Vertebrates, Invertebrates Trace fossils	Condition 2	Spot check

[a]Based on database and literature review, no known fossil localities in study area.

3.9.3.2.1 Paleontologic Potential of Geologic Units

No paleontologic resources are known to occur within geologic units underlying the study area; thus there are no geologic units that satisfy Condition 1. However, elsewhere in Colorado and New Mexico, fossil resources of significance are known to occur within the Animas, Kirtland, Pictured Cliffs Sandstone and Lewis Shale deposits. These units, therefore, satisfy Condition 2 and are considered to have a moderate to high potential to produce fossil resources. Geologic units satisfying Condition 2 are discussed below. Soil, alluvium, and terrace gravels are too young to contain significant fossils and satisfy Condition 3 and are not discussed further.

Animas Formation

A wide variety of fossil plants are known from the Animas formation (Knowlton 1917). The Tiffany beds, originally described by Granger (1917), probably belong to a distal facies of the Animas Formation (Archibald et al. 1987). These beds have produced a rich fossil vertebrate fauna , including at least 18 species at the Mason Pocket locality, near the town of Ignacio, Colorado. This fauna typifies the Late Paleocene Tiffanian North American Land Mammal Age.

Kirtland Formation

The Kirtland Formation produces the remains of a variety of vertebrates, invertebrates, and plants as well as their traces. Most of the fossils thus far described from the formation have been found in the San Juan Basin south of the study area.

The lower part of the Kirtland below the Farmington Sandstone Member in New Mexico produces a vertebrate and invertebrate fossil faunal assemblage nearly as diverse as that of the Fruitland Formation described below (Hunt and Lucas 1992). Near Alamo Wash, south of Farmington, the Farmington Sandstone, referred to as the De-na-zin or Naashoibito Member, is quite fossil rich.

The member has also produced the fragmentary remains of ankylosaur, theropod and sauropod dinosaurs. Four genera of fossil mammal are also known from the Alamo Wash local fauna, as are the bones of a variety of crocodilians and one cyprinid fish. Fossil plants of the Kirtland Formation are dominated by flowering plants.

Fruitland Formation

The Fruitland Formation accumulated in terrestrial, coastal swamp, alluvial and lacustrine environments during the Late Campanian part of the Latest Cretaceous. The Fruitland has produced a large and diverse vertebrate fossils fauna of Late Campanian age from localities in San Juan County, New Mexico . The fossils come primarily from the upper two-thirds of the formation along its outcrop belt between the San Juan River and Kimbeto Wash in the west central part of the basin (Armstrong -Ziegler 1980; Rigby and Wolberg 1987**;** Hunt and Lucas 1993; Lucas and Williamson 1993; Hall, 1993). Fossil plants remains are also well known from the Fruitland.

The presence of diverse, well-preserved, and well-documented fossils clearly establishes the high paleontologic significance of the Fruitland Formation. The BLM has even set aside one particularly fossiliferous area of badlands developed in the formation as a Research Natural Area. This area, called the Fossil Forest, was established as part of the Wilderness Act of 1984 and includes about 2,770 acres north of Chaco Canyon and south of Farmington (Wolberg et al. 1988a).

Pictured Cliffs Sandstone

The Pictured Cliffs Sandstone of southwestern Colorado and northwestern New Mexico accumulated during the final withdrawal of the late Cretaceous epicontinental seaway during Late Campanian time. The ammonite *Didymoceras nebraskcense* found in the sandstone indicates a middle late Campanian age for the sandstone.

Trace fossils, including *Ophiomorpha* and *Thalassinoides*, occur commonly in the Pictured Cliffs (Hutchinson and Kues 1985), which has also produced a diverse vertebrate fossil fauna of Late Campanian age from a locality in San Juan County, New Mexico. This locality at Mesa Puertales, south of Cuba (Fassett 1966, Lucas and Williamson 1993) has produced the fossils of 14 species of cartilagenous fish (sharks, skates and rays), two species of bony fish, and a single species each of turtle, crocodile, plesiosaur, ornithischian (bird-hipped) and saurischian (lizard-hipped) dinosaur, and multituberculate and placental mammals. Most of the terrestrial vertebrate material is fragmentary and cannot be identified below family level, but is an important indicator of additional fossil potential.

Lewis Shale

The Lewis Shale of southwestern Colorado and northwestern New Mexico consists of as much as 2,000 feet of fossiliferous, light to dark gray shale, concretionary beds of limestone and thin, platy sandstone. The formation accumulated in marine nearshore to offshore environments following the Late Cretaceous transgression of the Lewis Sea in Late Campanian time (Hutchison and Kues 1985). The Lewis underlies and intertongues with the Pictured Cliffs Sandstone, which accumulated in shoreline environments adjacent to the seaway.

The fossil remains of two species of mosasaur (marine lizards) cf. *Plioplatecarpus* sp. and cf. *Prognathodon overtoni* have been reported from the Lewis in New Mexico (Lucas and Reser 1981; Kues and Lucas 1985). Fossil shark's teeth have also been collected from the formation in the state (Lucas and Reser 1981). Four additional species of plesiosaurs named by Cope in 1887 may in fact have been based on remains derived from the Lewis in northern New Mexico, but this is uncertain (Lucas and Williamson 1993). Invertebrate fossils occur commonly in the Lewis, including ammonites, bivalves, foraminifera, ostracods, and sponges (Hutchinson and Kues 1985; Sealey and Lucas 1997). *Ophiomorpha* trace fossils are also locally abundant. The ammonites, including species characteristic of the zones *Baculites scotti* through *Baculites compressus* indicate the Lewis and, thus, the laterally equivalent parts of the Pictured Cliffs and Fruitland are Late Campanian in age (Cobban et al. 1974**;** Lucas and Sealey 1992).

3.9.4 Environmental Consequences and Mitigation Measures

The following sections discuss potential impacts to cultural and paleontologic resources that could occur as a result of Refined Alternatives 4 and 6 and the No Action Alternative. Also included is a discussion of proposed mitigation measures that could reduce or eliminate potential impacts to cultural and paleontological resources.

3.9.4.1 Refined Alternative 4

3.9.4.1.1 Cultural Resources

Refined Alternative 4 Cultural Impact 1 - Significant: Historic properties would be adversely affected. Construction activities associated with the structural components and inundation of Ridges Basin could disturb or destroy cultural resources eligible for inclusion in the NRHP.

Ground disturbance and other activities associated with construction of structural components would disturb and/or destroy cultural resources located in these areas. Due to the known significance of the area (Ridges Basin is a National Register-eligible District) , the impacts to an estimated 80-90 sites is considered significant.

Sites would be directly affected by construction of Ridges Basin Reservoir and its associated features. The potentially affected sites include Archaic period sites, Anasazi (Ancestral Pueblo) habitation and limited-use sites, historic Native American sites, a portion of the Old Ute Trail (also the route of the Dominguez-Escalante Expedition), and historic Euroamerican sites.

Mitigation for Refined Alternative 4 Cultural Impact 1 is discussed following Impact 3.

Refined Alternative 4 Cultural Impact 2 - Significant: Operations and recreation activities associated with Ridges Basin Reservoir would create potential for disturbance of cultural resources eligible for inclusion in the NRHP. %

Fluctuating reservoir surface levels and wave action could expose cultural resources to destruction by water forces or unauthorized collection by visitors to the reservoir. As stated in the 1996 FSFES, "*Pool fluctuation, a consequence of the O&M of Ridges Basin Reservoir, may uncover prehistoric Native American sites and burials and expose them to erosion and vandalism*" (pg. III-118). Impacts to these sites would be significant.

Mitigation for Refined Alternative 4 Cultural Impact 2 is discussed following Impact 3.

Refined Alternative 4 Cultural Impact 3 - Potentially Significant: Historic properties would be affected. Construction disturbance and other activities associated with land acquisition, the potential end uses, and conveyance systems would create potential for disturbance and increased public access to cultural resources eligible for inclusion in the NRHP.

Historic properties would be affected by these activities. Specific effects would be identified upon complete inventory of these actions. Ground disturbance and other related activities would create the potential for disturbing or destroying cultural resources within the areas of potential water end uses and conveyance pipelines. Roads in right-of-way corridors along pipelines and canals would also afford greater public access to previously undisturbed areas. Damage to sites could occur in the form of off-road vehicle use on cultural resources sites, vandalism, or erosion from tertiary roads or trails. Other uses such as proposed golf courses and the purchase of land for water rights would subject cultural resources to adverse impacts.

Mitigation for Refined Alternative 4 Cultural Impacts 1-3: Implement the Historic/Archaeological treatment measures and publication of results pursuant to the Programmatic Agreement cited below.

The preferred mitigation of these impacts would be avoidance and in-place preservation of archaeological sites and other cultural resources sites to the degree possible. When this is unavoidable, the impacts on historic properties would be mitigated by completing resource data recovery, HABS/HAER recordation, written and/or oral histories, site stabilization, and/or ethnographic studies, as appropriate. In addition to the archaeological interpretation of the site data, consulting tribes will be given the opportunity to provide input to the treatment of sites of cultural importance and to form their own interpretation of these data, in the form of continued consultation between Reclamation and the consulting tribes. Tribal consultation is also recommended regarding data collection at certain cultural resources sites (collection areas, ceremonial sites, trails, etc.) when avoidance is not possible.

Mitigation of impacts to cultural sites could be accomplished through archaeological excavation and the study and publication of the results. Through consultation with the Advisory Council on Historic Preservation, interested Tribes, the state SHPOs, and involved agencies, a research design and work plan would be produced that, along with the programmatic agreement and the cultural resource management plan (or historic preservation management plan), would guide the mitigation efforts.

A Programmatic Agreement for the project has been formulated in consultation with the Advisory Council on Historic Preservation, the Bureau of Indian Affairs, The Southern Ute Indian Tribe, The Ute Mountain Ute Indian Tribe, the Navajo Nation, and the SHPOs of Colorado and New Mexico. The Programmatic Agreement will set forth the procedures that must be adhered to in order to ensure compliance with historic preservation laws. A draft Programmatic Agreement for the ALP Project is included as Attachment H.

A Historic Preservation Management Plan (HPMP) that stipulates the procedures for development, review, and implementation of mitigation plans has been developed for the ALP Project (see Technical Appendix 8). The preservation plan would include measures to minimize and avoid impacts to cultural resources, such as in-place preservation, monitoring, distribution of information, and public and Native American involvement. If cultural resource sites cannot be avoided and protected in place, a program to compensate for losses to sites as a result of ALP Project construction would be needed. This program would include archaeological excavations and publications and reports detailing the findings of those excavations. Educational programs and public access to the excavations will be part of the mitigation plan.

As stated in the 1980 FES and 1996 FSFES:

> *The Project would include a program to compensate for losses of archaeological sites that would occur as a result of construction and operation. This program would be undertaken in coordination with the Colorado and New Mexico State Historic Preservation Officers and the Advisory Council on Historic Preservation....The proposed program would consist of data recovery, analysis, technical publication, and providing for storage and curation facilities for permanent maintenance of the artifact collection and other related information. In addition to the scientific value, this would produce information of considerable public interest.* (Page II-13.)

Impacts would involve treatments as recommended by the tribes (NAU and SWCA 1996) regarding the documentation of the history of these areas. This mitigation will be funded from the legislated ceiling of 4 percent total authorized Project costs provided for a Cultural Resources Program.

Reclamation, within two years of completion of the construction of Ridges Basin Reservoir, will prepare a Cultural Resources Management Plan which will provide for the long-term management of historic properties under Reclamation jurisdiction. It will include: %

- provisions for in-place preservation of historic properties and materials (including monitoring and remedial measures); %
- means to manage for future recreational development; %
- means to manage of operations and maintenance of Reclamation facilities; %
- proposed methods for public interpretation and public involvement. %

Refined Alternative 4 Cultural Impact 4 - Significant: Activities described in Refined Alternative 4 Cultural Impacts 1-3 could result in adverse impacts to exposed human remains and sacred sites.

Activities described in Refined Alternative 4 Cultural Impacts 1-3 could disturb or expose Native American Human Remains and Cultural Items protected under NAGPRA, or prevent access to sacred sites protected under Executive Order 13007.

Mitigation for Refined Alternative 4 Cultural Impact 4 - Follow mitigation measures in accordance with NAGPRA and EO 13007.

The preferred mitigation would be the avoidance and in-place preservation of graves and sacred sites to the degree possible. When this is unavoidable, Reclamation will consult with affected Tribes to determine the most appropriate action. Since no sacred sites have yet been identified that would be impacted by the alternative, no specific mitigation measures are described. However, since it is likely that human remains will be encountered, a NAGPRA Plan, developed in consultation with the potentially affected tribes, will be developed. The NAGPRA Plan will describe the procedures that are to be followed in the event that human remains or cultural items are encountered during the course of project activities. A draft NAGPRA Plan is included within this document in Attachment H. %

3.9.4.1.2 Paleontologic Resources

Refined Alternative 4 Paleontologic Impact 1 - Potentially Significant: Construction activities associated with the structural components and inundation of Ridges Basin could disturb or destroy fossils of scientific significance in Late Cretaceous and Early Cenozoic age.

Ground disturbance associated with construction of Refined Alternative 4 could encounter fossils of scientific significance in underlying bedrock of Late Cretaceous and Cenozoic age. Direct impacts to fossils could include damage or destruction of important fossils during construction with subsequent loss of scientific information. Adverse indirect impacts could include fossil damage or destruction by accelerated erosion due to surface disturbance. Fossil resources are unlikely to be encountered in areas underlain at the surface or near the surface by Quarternary deposits that are Holocene or Recent in age.

Mitigation for Refined Alternative 4 Paleontologic Impact 1: Field survey areas prior to construction disturbance and construction monitoring if deemed appropriate.

Areas underlain by the Animas, Kirtland, and Fruitland foundations, and underlain by Pictured Cliffs Sandstone would be field-surveyed prior to construction. Areas underlain by Lewis Shale will be field spot-checked for fossils following construction of the dam and prior to filling the reservoir. If vertebrate fossils are discovered during construction, the project paleontologist would be notified immediately to evaluate the discovery.

Refined Alternative 4 Paleontologic Impact 2 - Potentially Significant: Operation and recreation activities that would be associated with Ridges Basin Reservoir would create potential for disturbance of important paleontologic resources within Ridges Basin.

Improved access and increased visibility associated with additional use of the Ridges Basin area as a result of the recreational facilities could result in increased discovery and unauthorized fossil collection or vandalism.

Mitigation for Refined Alternative 4 Paleontologic Impact 2: Conduct periodic shoreline monitoring as part of the facilities operations plan.

All associated costs will be absorbed by organizations responsible for operation and maintenance. Periodic shoreline monitoring could serve to identify exposed fossils and allow for their proper treatment.

Refined Alternative 4 Paleontologic Impact 3 - Beneficial: Increased discovery could add to scientific database and knowledge.

Beneficial impacts could occur if survey or excavation reveals fossils of scientific significance that would have otherwise remained unavailable for scientific study. Beneficial and significant positive impacts, including the unanticipated discovery of previously undetermined scientifically significant fossils, are possible anywhere in the project area. Newly discovered fossils should be properly collected and catalogued into the collections of a museum repository so that associated geologic data is preserved and the fossils are available for future scientific study.

Refined Alternative 4 Paleontologic Impact 4 - Less than Significant: Construction disturbance associated with the potential end uses and conveyance systems would create potential for disturbance to important paleontologic resources.

Ground disturbance and other related activities would create the potential for disturbing or destroying paleontologic resources within the areas of potential water end uses and conveyance pipelines. Roads in right-of-way corridors along pipelines and canals would also afford greater public access to previously undisturbed areas. Damage to paleontologic resources could occur in the form of off-road vehicle use, vandalism, or erosion from tertiary roads or trails.

Mitigation for Refined Alternative 4 Paleontologic Impact 4: Field survey areas prior to construction disturbance, and construction monitoring if deemed appropriate.

3.9.4.2 Refined Alternative 6

3.9.4.2.1 Cultural Resources

Refined Alternative 6 Cultural Impact 1 - Significant: Historic properties could be affected. Construction activities associated with the structural components and inundation of additional shoreline surrounding Lemon Reservoir could disturb or destroy cultural resources eligible for inclusion in the NRHP.

This impact may be similar to Refined Alternative 4 Cultural Impact 1; however, the area around Lemon Reservoir has not been inventoried for cultural resources. The potential and frequency of impacts associated with Lemon Reservoir shoreline and replacement of surrounding facilities would be much less than Refined Alternative 4 due to the much larger areas of disturbance and inundation associated with Ridges Basin Dam and Reservoir, the Durango Pumping Plant and inlet conduit, utility realignments, and recreation areas.

Mitigation for Refined Alternative 6 Cultural Impact 1 is discussed following Impact 3.

Refined Alternative 6 Cultural Impact 2 - Potentially Significant: Historic properties could be affected. Operation and activities at relocated recreation areas at an enlarged Lemon Reservoir would create potential for disturbance and increased public access to cultural resources eligible for inclusion in the NRHP.

This impact could be similar to that discussed under Refined Alternative 4 Cultural Impact 2; however, the area around the reservoir has not been inventoried for cultural resources. Recreational facilities may not be expanded beyond their existing occurrence at Lemon Reservoir. Therefore, it is possible that no additional increased potential for disturbance would exist.

Mitigation for Refined Alternative 6 Cultural Impact 2 is discussed following Impact 3.

Refined Alternative 6 Cultural Impact 3 - Significant. Historic properties could be affected. Construction disturbance associated with land acquisition, the potential end uses, and conveyance systems would create potential for disturbance and increased public access to identified and unidentified cultural resources with known or unknown eligibility for inclusion in the NRHP.

The impact would be similar to that described in Refined Alternative 4 Cultural Impact 3.

Mitigation for Refined Alternative 6 Cultural Impacts 1-3: Same as mitigation for Refined Alternative 4 Cultural Impacts 1-3.

Refined Alternative 6 Cultural Impact 4 - Significant: Construction and operation activities described in Refined Alternative 6 Cultural Impacts 1-3 could result in adverse impacts to exposed human remains and sacred sites.

Activities described in Refined Alternative 6 Cultural Impacts 1-3 may disturb or expose Native American Human Remains and Cultural Items protected under NAGPRA, or prevent access to sacred sites protected under Executive Order 13007.

Mitigation for Refined Alternative 6 Cultural Impact 4: Follow mitigation measures in accordance with NAGPRA and Executive Order 13007.

Mitigation would be the same as that described under Mitigation for Refined Alternative 4 Cultural Impact 4, and would be funded from the legislated ceiling of 4 percent total authorized project costs provided for a Cultural Resources Program.

Refined Alternative 6 Cultural Impact 5: Potentially Significant: Historic properties might be affected. Eliminating agricultural irrigation from certain lands could alter farming practices in

these areas and change the potential for cultural resource disturbance within these agricultural areas.

Mitigation for Refined Alternative 6 Cultural Impact 5: Commit to the Historic/Archaeological treatment measures and publication of results pursuant to a Programmatic Agreement.

Mitigation would follow similar procedures as mitigation described under Refined Alternative 4 Cultural Impacts 1-3, above, and would be funded from the legislated ceiling of 4 percent total authorized project costs provided for a Cultural Resources Program.

3.9.4.2.2 Paleontologic Resources

Refined Alternative 6 Paleontologic Impact 1: Less than Significant. Disturbance of paleontologic resources could occur during construction activities associated with raising Lemon Reservoir, the NNMP and development of non-binding end uses and conveyance systems.

Mitigation for Refined Alternative 6 Paleontologic Impact 1: Same as mitigation for Refined Alternative 4 Paleontologic Impact 1.

Refined Alternative 6 Paleontologic Impact 2 - Less than Significant: Eliminating agricultural irrigation from certain lands could alter farming practices in these areas and change the potential for paleontologic resources disturbance.

Mitigation for Refined Alternative 6 Paleontologic Impact 2: No mitigation is proposed.

Refined Alternative 6 Paleontologic Impact 3 - Beneficial: Increased discovery could add to scientific database and knowledge.

Beneficial impacts could occur if survey or excavation reveals fossils of scientific significance that would otherwise remain unavailable for scientific study. Beneficial and significant positive impacts, including the unanticipated discovery of previously undetermined scientifically significant fossils, are possible anywhere in the project area. Newly discovered fossils should be properly collected and catalogued into the collections of a museum repository so that associated geologic data is preserved and the fossils are available for future scientific study.

3.9.4.3 No Action Alternative

The cultural resources impacts identified below have been extracted from the 1996 FSFES. No Paleontologic Resources impacts were identified in the 1996 FSFES.

Under the No Action Alternative, current trends which have an impact to cultural resources would continue. The Colorado Plateau (of which the Project area is a part) as one of the 11 most endangered historic treasures in the United States. Archeological and historic sites which are important to the Native American heritage of the region are particularly threatened. Trends of looting and development would continue without the Project. This is particularly true on the private land portions of the Project, where legislation protecting cultural resources against these trends is virtually nonexistent. Reclamation studies show that the frequency of cultural resources sites on the privately owned portions of Project lands is quite high; without the Project there is no mechanism in place to ensure their protection. (Page III-117)

3.10 AGRICULTURE

3.10.1 Introduction

This section addresses potential impacts to agriculture that would result from actions associated with Refined Alternatives 4 and 6, and the No Action Alternative. Section 3.10.2 defines the Evaluation Methodology and significance criteria used for determining impacts, Section 3.10.3 describes the affected environment, and Section 3.10.4 identifies potential impacts and mitigation measures that would serve to reduce or eliminate anticipated agricultural impacts.

3.10.2 Evaluation Methodology

This section discusses the methodology used to determine potential impacts that could result from Refined Alternatives 4 and 6. Also discussed are specific criteria that were used to determine the significance of the impacts identified.

3.10.2.1 Methodology

3.10.2.1.1 Structural Component

Ridges Basin Reservoir

To determine impacts that could result from construction and operation of Ridges Basin Reservoir, a visual inspection was made of the area in which Ridges Basin Reservoir and physical support structures would be constructed. Additionally, farm records were reviewed to determine past and current land usage within the Ridges Basin area and discussions were held with the Natural Resource Conservation Service (NRCS), the U.S. Department of Agriculture (USDA), and La Plata County Agricultural extension agents. NRCS soils maps for the affected environment were reviewed and annual crop values obtained from the Farm Service Agency. From this information, the amount of irrigated crop land was determined.

Lemon Dam

The area surrounding Lemon Dam is predominantly Forest Service land. However four private %
landowners along the reservoir utilize this property for summer grazing and one landowner has irrigated %
and dry land pastures. %

Navajo Nation Municipal Pipeline

The U.S. Department of the Interior 7.5-minute series Shiprock quad map was used for reference. The alignment of the proposed NNMP was drawn on the map and notations were made of irrigated cropland, canals, and ditches that would be impacted during construction. Additionally, discussions were held with NRCS and county extension personnel concerning affected agricultural lands, soils, crops, and production. From this information, the amount of potentially impacted irrigated crop land was determined.

3.10.2.1.2 Non-Structural Component

The identified depletions associated with each river basin were used to determine the amount of lands having water rights necessary for procurement as part of the non-structural component of Refined Alternatives 4 and 6. This approach assumes that water rights would be obtained through purchase of irrigated lands proximal to the Colorado Ute Tribes' Reservations. Under the non-structural component of Refined Alternative 4, an additional 13,000 afy of depletions not provided for by the structural component could be acquired through the purchase of land having senior water rights. It was assumed that 6,500 afy of water rights would be allotted for each of the Colorado Ute Tribes. **Table 3.10-1** shows the depletions necessary to satisfy the Ute Tribal settlement claims. The amount of irrigated land attributed to each of the Colorado Ute Tribes is a function of the depletion associated with each of the river drainage basins. Depletions per basin and per irrigation district were determined and the amount of farmland necessary to acquire sufficient water rights was estimated. This estimate was derived by determining the average depletion per acre on each river basin and multiplying this amount by the amount of acreage required to satisfy the amount of depletion credited to each river basin. Acreages needed to satisfy water rights for each basin are shown. In total, 10,300 acres of irrigated farmland would need to be purchased under Refined Alternative 4 and 20,647 acres would need to be purchased under Refined Alternative 6.

Table 3.10-1
Estimated Land Purchases under Refined Alternatives 4 and 6

	Refined Alternative 4				Refined Alternative 6			
Diversion Location	**Depletion (afy)**	**Acres**	**Usage**	**Buyer**	**Depletion (afy)**	**Acres**	**Usage**	**Buyer**
Red Mesa Reservoir	0	0			200	0	M&I	UMUT
Pine River	3,250	2,300	Irr	SUIT	15,114	10,000	M&I	SUIT/ UMUT
Animas and Florida Basin	3,250	2,300	Irr	SUIT	6,500	4,643	Irr	SUIT
La Plata Basin	2,200	2,400	Irr	UMUT	521	785	M&I	UMUT
Mancos Basin	4,300	3,300	Irr	UMUT	761	500	M&I	UMUT
McElmo Creek Basin	0	0	NA	NA	6,500	4,062	Irr	UMUT
McElmo River Basin	0	0	NA	NA	1,051	657	M&I	UMUT
Totals	**13,000**	**10,300**	**NA**	**NA**	**30,647**	**20,647**	**NA**	**NA**

UMUT = Ute Mountain Ute Tribe
SUIT = Southern Ute Indian Tribe
Irr = irrigation
M&I = municipal and industrial
NA = not applicable

In order to apply a more detailed analysis to determining the impacts to agriculture from conversion to non-irrigated land under Refined Alternative 6, illustrative ditches in the Pine, Mancos, and La Plata River Basins and McElmo Creek Basin were selected for detailed analyses. These ditches and associated agricultural production are described in Section 3.10.3.5. As shown in Table 3.10-1, it was assumed that under Refined Alternative 4 all of the lands purchased would remain in irrigation. It was also assumed that agricultural productivity would not be affected through change of ownership. As such, impacts resulting from the non-structural component were only identified under Alternative 6 where it was assumed that some lands would not remain in irrigation due to the transference of water rights to other purposes.

3.10.2.1.3 Non-Binding Water End Use and Conveyance System

A visual survey of accessible areas was made of the potential end use locations and water conveyance pipeline alignments, and available land use maps and soils surveys were examined. Estimates of construction and permanent disturbance necessary for these facilities were made and approximate areas of potential agricultural lands (crop and rangeland) affected were quantified. Production values of these lands were then determined using generalized soil map units.

3.10.2.2 Significance Criteria

Irrigated agricultural production in southwest Colorado and northwest New Mexico, as an economic endeavor, is shifting from larger farms that are self-sustaining to smaller land holdings with less emphasis on an economic enterprise as to a "way of life," supplemented with outside employment. Impacts to agricultural production through changes in water utilization are important to measure as this may indicate a potential acceleration toward residential land use.

Project impacts to agriculture were considered significant if, as a result of project implementation, the following were to occur:

- ❑ Greater than 10 percent of prime farmland within a county would be taken out of production;
- ❑ Greater than 20 percent of irrigated agricultural land within a river basin would be purchased and transferred to non-irrigated land or taken out of production;
- ❑ Greater than 15 percent reduction would occur in county marketed crop production;
- ❑ Ten percent of the county's agricultural land would be taken out of production due to the construction and operation of the NNMP; or
- ❑ A reduction of 10 percent would occur in the county-wide agricultural revenue from crops sold.

3.10.3 Affected Environment

The sections below discuss the existing agricultural resources in the areas potentially affected by Refined Alternatives 4 and 6. The actions that may take place under the No Action Alternative are not fully known at this time, and consequently it is not possible to determine the specific affected environment for that alternative. However, many of the eventual actions that may occur as a result of the No Action Alternative would likely take place within the same geographic setting as that of Refined Alternatives 4 and 6.

Under Refined Alternative 4, the structural component would affect two geographical environments that could impact agriculture: the first is the area within and adjacent to Ridges Basin, including that area lying within the construction zone and the ultimate surface water level of the reservoir, and land lying within or adjacent to the other support structures (i.e., the Durango Pumping Plant, inlet conduit, roads, potential camp sites, and other recreational areas). The second area is the area within the right-of-way of the NNMP.

Under Refined Alternative 6, the structural component would affect two geographical environments that could impact agriculture: the first is the new area inundated by raising Lemon Reservoir. The second area is the area within the right-of-way of the NNMP.

Activities associated with the non-structural component are expected to be located within La Plata and Montezuma Counties in Colorado. Specifically, land purchases for acquisition of water rights would most likely occur within the Pine, Florida, Animas, La Plata, and Mancos River and McElmo Creek corridors.

Potential development associated with the end use of Tribal and non-Tribal water made available through the project could occur within La Plata and Montezuma Counties in Colorado.

3.10.3.1 La Plata County, Colorado

La Plata County lies in the southwest section of Colorado and has the largest population in Colorado's Region 9 of the State of Colorado Demographic Section of the Department of Local Affairs (Region 9) (comprising the five southwestern most counties), with an estimated 41,715 people, of whom approximately 23,000 are employed, producing input for an estimated $769,000,000 in retail sales (Colorado State Information Services 1998). La Plata County has 1,081,616 acres of land, of which 41.1 percent are under private ownership, 17.8 percent are tribal lands, and 41.1 percent are state and federal lands. The southern part of the county is composed of mesas, foothills, and valleys and the northern part consists of high mountains and valleys. The Animas, La Plata, Florida, and Pine Rivers flow through the county and join the San Juan River in New Mexico.

The 1997 Census of Agriculture shows that 580,135 acres of land in La Plata County were under some form of agriculture including range operation and dry land and irrigated farming. The 1981 USDA soil survey of La Plata County estimated that about 133,000 acres within the county could be considered as having prime farmland soils. Prime farmland is defined as having soils that are best suited to producing food, seed, forage, fiber and oilseed crops. The soils need only be treated and managed using acceptable farming methods. Prime farmland soils produce the highest yields with minimal units of energy and economic resources, and farming these soils results in the least damage to the environment. Prime farmland commonly receives an adequate and dependable supply of moisture from precipitation or irrigation. The soils are not excessively erodible or saturated with water for long periods and are not flooded during the growing season (although flooded or drought conditions can be offset by drainage, flood control, or irrigation). Slope ranges mainly from zero to 6 percent.

Of the approximately 781 farms in the county in 1999, 681 were involved in crop production on a total of 91,129 acres, of which 71,855 acres were under irrigation. Crop production areas are subject to change from year to year for a number of reasons including management, financial, and market considerations. Principal crops grown were pasture, oats, grass hay, wheat, and alfalfa (Colorado Agricultural Statistics 1999). The county value of crop production was $4,948,000. Agricultural products and agriculture-related services provided approximately $5,596,000 in wages and employment for 1,175 people (4 percent of the total work force). Of these, 339 are principal farm operators. There are 326 farm operators who worked 200 days or more off-farm to supplement farm income (Census of Agriculture, Vol. 1 Geographic Area Series, Table 1 County Summary Highlights 1997).

3.10.3.2 Montezuma County, Colorado

Montezuma County lies in the southwest corner of Colorado and has a total land area of 1,333,888 acres of which 30 percent are private lands, 33 percent are tribal (Ute Mountain Ute Tribe), and 37 percent are state or federal lands. The county has the second largest population in Region 9 with 22,466 people, of whom 10,396 are employed. The area is generally characterized as a sloping plain called the Dolores plateau. This plain slopes to the southwest part of the county, where it is dissected by numerous deep canyons all of which drain into McElmo Creek. A relatively small area at the eastern end of the county is drained by the Mancos River. The approximately 935,000 acres of land in farms within the county consist of rangeland and irrigated and non-irrigated crop and pasture land (1998 Region 9 Report).

Approximately 935,000 acres of land are under some type of farming operation within the county. About 170,000 acres (22 percent) within the county would meet the requirements for prime farmland if an adequate and dependable supply of irrigation water was available. Approximately 45,000 acres within the county currently have adequate irrigation water supplies, and thus qualify as prime farmland. This farmland is primarily located between Cortez and Dove Creek and is irrigated by water stored in McPhee Reservoir.

The USDA designates 13 general soil map units for the county. The map units consist of one or more major soils or miscellaneous areas and some minor soils or miscellaneous areas that are unique to a natural landscape and are named for the major soils or miscellaneous areas.

There are 718 farms in the county with 572 in irrigation. Irrigated acreage is 61,081 acres or about 4.6 percent of total county land. Market value of production is $21,874,000. Crop production accounted for $12,913,000 and livestock $8,961,000. Agricultural products and services employed 1,521 or 11 percent of the county's jobs and $1,972,000 or only 1 percent of county earnings. Principal crops grown are pasture, grass hay, wheat, dry beans, and alfalfa (Colorado Agricultural Statistics 1999).

In 1997, 333 principal farm operators and an additional 291 operators worked 200 or more days employed off the farm.

3.10.3.3 San Juan County, New Mexico

San Juan County forms the northwestern corner of New Mexico and borders Utah, Colorado, and Arizona. The county has a land area of about 5,514 square miles and is situated on the semiarid Colorado plateau. Approximately 7 percent of the land is held in private ownership, 30 percent is federally owned, and 63 percent is owned by the Navajo Nation.

Approximately 65,000 acres (does not include the acres in the NIIP Project) were identified in the 1987 %
NRCS survey as being used for irrigation by private landowners. About 55,000 of these acres lie along %
the San Juan, La Plata, and Animas Rivers. These lands have been irrigated for years from water
delivered by canal from diversions and dams along the rivers. Adequate irrigation water is essential for %
crop production and yields are good in all areas except those lying along the La Plata River, which has little flow during July and August. The main crops grown in the area are alfalfa for hay, improved grasses for pasture, small grain, and corn for silage. Potential is high for good yields of vegetable crops such as carrots, onions, and potatoes.

The 1997 agricultural census of San Juan County estimated there were approximately 660 farms in the county totaling about 1,857,223 acres of land, including crop production and range operations. About

85 percent of these farms were under 179 acres in size. Total cropland amounted to 84,000 acres of which approximately 68,500 acres were irrigated and about 61,000 were harvested.

In addition, the Navajo Nation is planning development of a total of 110,000 acres of former grazing lands to irrigated acreage under the NIIP project with water from Navajo Reservoir being delivered to fields by a system of tunnels, canals, and siphons. Approximately 80,000 acres in the NIIP project have been developed to date.

Market value of agricultural crops sold amounted to $38,193,000. San Juan County ranks eighth in agricultural production among counties within New Mexico with a cash receipt from all farm commodities of $59,121,000 (1995). Agriculture makes up about 0.1 percent of county gross receipts. Mining and wholesale and retail trade and services are the predominant industries.

The proposed NNMP would potentially affect existing irrigated farms and irrigation canals that lie within the pipeline construction right-of-way and operations. An existing pipeline extends from the municipal water treatment plant at Farmington to Shiprock in northwestern New Mexico.

3.10.3.4 Structural Components

3.10.3.4.1 Ridges Basin - Refined Alternative 4

Under Refined Alternative 4, Ridges Basin Reservoir would be 120,000 af in volume with a maximum surface area of approximately 1,488 acres and a minimum surface area of approximately 871 acres. Estimated agricultural production land within the basin is approximately 500 acres. Soils in the basin are grouped as Archuleta-Goldvale-Hesperus and indicated on the USDA Soil Conservation General Soil Map, La Plata County Area (1985), General Map Unit No. 10. The predominant inclusion soil (Map Unit No. 63 on the NRCS soils map, Sheet No. 13) found along the floor of Ridges Basin is Sili Clay Loam (3 to 6 percent slope). This soil unit is used mainly for irrigated and non-irrigated crops, pasture and rangeland. Sili loam soils have two land capability classifications:

- I'VE (non-irrigated), which means the soils have very severe limitations that reduce the choice of plants and require very careful management.

- IIIe (under irrigation), which means there are severe limitations that reduce the choice of plants or that require special conservation measures, or both. Sili loam, under irrigation, is considered to belong to the prime farmland class of soils.

Areas within the proposed Ridges Basin Reservoir area were historically used for pasture and hay production. However, this land is currently owned by Reclamation and is used as a winter range for wildlife. There is currently no sustained agriculture production within Ridges Basin, nor has there been sustained agricultural production since Reclamation began purchasing the land in 1992. Prior to Reclamation’s acquisition, the former owner used the land for ranching, with an estimated 350 acres in irrigated hay production and an estimated 150 acres in irrigated pasture. This irrigated area lies directly within the reservoir and would be lost to future production. In 1999, a share crop arrangement was entered into for harvesting of perennial grasses primarily as a measure to control the potential fire hazard of standing dry grass.

The proposed Durango Pumping Plant and inlet conduit locations from the pumping plant are not in agricultural production due to steep terrain, poor soils and a lack of irrigation.

3.10.3.4.2 Navajo Nation Municipal Pipeline - Refined Alternative 4 and Refined Alternative 6

The proposed NNMP pipeline is approximately 28.7 miles long and is designed to serve the needs of 25,450 persons, or 50 percent of the Shiprock projected population in 2040. The pipeline route goes directly through and supports the water needs of the Shiprock, Cudei, Hogback, Upper Fruitland, San Juan, and Nenahnezad Chapters. The route of the new pipeline starts near the confluence of the La Plata River and extends southwest 1.5 miles where it crosses the Farmer's Mutual Ditch, the Fruitland Irrigation Canal, and irrigated farmland. It then crosses the San Juan River and turns westerly about 2.5 miles running on unfarmed land until it again crosses the Fruitland Canal at a pumping station site and essentially follows along the alignment of this canal across reaches of irrigated farmland for another four miles. It then swings southwest for 1.5 miles before aligning with the Fruitland Canal for approximately another three miles (but not crossing irrigated farmland). It again swings south for approximately 1.5 miles before aligning again with the Fruitland Canal for 3 miles, crossing southern reaches of irrigated farmland before swinging northward one mile across irrigated farmland where it crosses the San Juan River and aligns with the Hogback Canal. It extends along the Hogback Canal, crossing irrigated farmland for approximately 3 miles, until it runs along Highway 550. It extends along the highway for approximately 6 miles until it turns northward at Shiprock and runs another 4 miles to the Cortez tanks. The pipeline would run approximately 22 miles on or near irrigated farm lands. If the pipeline right-of-way is 100 feet wide, approximately 273 acres of irrigated farm land lying within the pipeline right-of-way may potentially be impacted during the pipeline's construction.

Crop production within the area affected by the pipeline is a function of soils, water, and management. Since this is a semi-arid region, meaningful crop production depends on irrigation water. All the cropland within the affected environment is irrigated by a series of canals and ditches. The Fruitland and Hogback canals may be impacted during pipeline construction, as well as numerous ditches. The soils in the affected environment are fairly homogeneous and fall under the general map units of Persayo-Fruitland-Sheppard (Map Unit 1) and Fruitland-Riverwash-Stumble (Map Unit 2). Map Unit 2 is the majority soil unit of which Fruitland sandy loam is the predominant soil. This soil is characterized as deep and well-drained and is found on fans and valleys. Associated precipitation is about 8 inches and the average frost-free period is about 150 days. Effective rooting depth is 60 inches, and where the soil has a vegetative cover, the average annual percolation depth is 20 inches. This soil is used for irrigated crops, mainly alfalfa and pasture, but also supports some corn, small grain, and fruit. Production values per acre associated with Fruitland soil are 6 tons of alfalfa, 25 tons of corn silage, and 14 Animal Unit Months (AUM) of pasture.

3.10.3.4.3 Lemon Reservoir - Refined Alternative 6

The area surrounding Lemon Dam is predominantly U.S. Forest Service land. However, there are four %
tracts of private land lying along the reservoir that would be affected either by rising reservoir levels, %
relocated roads or buffer zones. One landowner in particular has a 122 acre parcel at the north end of the %
reservoir, of which 11.04 acres are irrigated and 111.34 acres are non-irrigated pasture in the river %
bottom. The amount of land lost to this landowner due to raising of Lemon Dam would include all of the %
irrigated acreage and 45.69 acres of non-irrigated pasture. The other affected landowners have either %
minor acreage not in production, or have larger parcels of forest land which may provide for summer %
grazing. The largest of these parcels is 51.06 acres, of which 46.06 acres are hillside forest. Due to %
repositioning of the existing road, it may become necessary for Reclamation to purchase the entire parcel. %

3.10.3.5 Non-Structural Component

Agriculture is a predominant activity within the two-county area (La Plata and Montezuma) that would likely be affected by the non-structural component of Refined Alternative 6. However, with the exception of moderately large farms (i.e., over 200 acres), irrigated agriculture is not generally considered sufficient to meet an economic level commensurate with median incomes found throughout the respective counties due to low production from a limited growing season. Thus, agriculture is more of a way of life, or hobby, than a stand-alone economic enterprise, and the value of land is more aligned toward residential than production values.

The irrigated lands served by direct flow rivers or supplemental reservoirs lying within the river drainage basins taken into account for this analysis are:

- Pine River 45,000 acres
- Florida and Animas Rivers 35,000 acres
- La Plata River 21,000 acres
- Mancos River 12,000 acres
- McElmo Creek/Montezuma Valley 52,000 acres

Depletions associated with these river basins are the amount of water utilized for the consumptive use of crops grown on the irrigated lands taking into account dry year firm yield. The amount of depletion is directly related to the seniority of water rights associated with a particular irrigation ditch and becomes of primary importance in water-deficit years, when senior water rights holders receive priority diversions of available water within a river drainage basin into their particular irrigation ditch.

3.10.3.5.1 La Plata River

Available soils maps and discussions with NRCS personnel in the Durango office indicate that 21,000 acres of irrigated land lie within the La Plata River Basin. The general soil map unit for lands lying within the river basin is map unit No.1, Witt-Lazear-Pulpit. These soils are characterized as shallow to deep, well drained, gently sloping to steep, with medium textured soils on mesas, uplands, and breaks.

The illustrative ditch examined within the La Plata River Basin serves about 1,500 acres and has an average diversion flow of 7.92 cfs off the La Plata River. NRCS Soil Sheet No. 11, which covers the irrigation district and delineates soil units, shows the predominant soil lying along the illustrative ditch as Witt loam on 3 to 8 percent slopes. Witt loam has a land classification of lVe both irrigated and non-irrigated and is suitable for irrigated and non-irrigated crops and for rangeland. Irrigated crops are alfalfa, barley and oats; non-irrigated crops are wheat, pinto beans, and alfalfa. The predominant crop grown on the illustrative ditch is grass pasture.

3.10.3.5.2 Pine River

NRCS Soil Sheet No. 16, which covers the irrigation district and delineates soil units, indicates that approximately 30 percent of the soils are Arboles silty clay loam, which, when irrigated, has a soils capability of IIIe and a capability of IVc when not irrigated. Approximately 20 percent of the soil is Bayfield silty clay loam. This soil has a capability of IIIe when irrigated and VIe non-irrigated. The majority of the soil found in this area (generally found from the Pine River to Dry Creek) is Witt clay loam, which is an inclusive soil with a capability of VIe both irrigated and non-irrigated. This soil makes up about 50 percent of the soils served from the illustrative ditch. Bayfield silty clay loam is suitable for rangeland and for irrigated alfalfa hay, pasture, and small grains. Arboles silty clay loam is suitable for rangeland and non-irrigated wheat and irrigated alfalfa hay, pasture, and field crops. When irrigated, both these soils are considered prime farmland. Witt clay loam is suited for irrigated alfalfa, barley, and oats, and non-irrigated wheat, alfalfa, and rangeland. This is not considered prime soil.

The illustrative ditch examined within the Pine River Basin serves about 3,500 acres and runs from about 1.5 miles north of Bayfield south to Spring Creek. A visual inspection was made of the agricultural production and practices lying along the ditch. Soil maps indicate that soils found lying along the Pine River and in the river bottom are designated Map Unit 8 Pescar-Tefton-Fluvaquents. Soils outside the river bottom are designated as Map Unit 2 Arboles-Bayfield-Zyme. The ditch meanders away from the Pine River with the majority of the served farms lying on General Map Unit 2 soils which are found on foothills and upland valleys, including:

- ❑ Non-irrigated Pescar, Bayfield, and Arboles soils are not conducive to crop production, and thus all areas associated with these soils would have to be taken out of production

- ❑ Non-irrigated Witt clay loam can produce grass pasture under careful management, and thus all areas associated with this soil would remain in production.

3.10.3.5.3 Mancos River

Available soils maps and discussions with NRCS personnel in the Cortez office indicate that the 12,000 irrigated acres within the Mancos River basin are made up of 3,000 acres of Map Unit 5 of which the Collide Series (Map Symbols 25 and 26) is the predominant inclusive soil. This soil has a classification of 3c and 3s both irrigated and non-irrigated. The remainder of the 9,000 acres is made up of Sideshow, which has a classification of 3s and 3e (3 to 6 percent slope) both irrigated and non-irrigated. Both of these soils are considered prime both with and without irrigation. There are also small quantities of Lillings-Reaper- Fluents (Map Unit 2) on the river bottoms.

The illustrative ditch examined within the Mancos River drainage lies about 1.5 miles west of the Mancos River and about one-half mile south of Highway 160. The ditch serves 478 acres and has some of the highest-priority water rights in the Mancos River Basin. A visual inspection was made of the ditch to determine agricultural production and practices. The soil landscape of farmland served by the ditch is Map Unit 5, Wetherill-Pulpit-Gladel, of which the Collide series is a major inclusive soil. NRCS sheet maps are not available, so a generalization has been made that the soils have uniform characteristics pertaining to production and that they are suited for irrigated and non-irrigated cropland. When irrigated, the soils associated with this map unit are considered prime farmland. Principal crops are alfalfa hay, pasture, and winter wheat. All the land along the illustrative ditch could be converted to non-irrigated crops and the soil capabilities would retain a prime characteristic.

3.10.3.5.4 McElmo Creek

McElmo Creek provides irrigation water for about 1,000 acres of farmland. The NRCS soil map which covers the area and delineates soil units indicates that predominant soil map units in the area are Lillings-Ramper-Fluvents.

The illustrative ditch examined within the McElmo Creek basin serves approximately 488 acres and has a decreed diversion of 36.92 cfs. Discussions with county NRCS personnel indicate that the general soil map unit for the illustrative ditch is No. 2 Lillings-Ramper-Fluvents. Ramper series are the predominant soils found in the irrigated areas. This soil is characterized as very deep and well-drained, and found on alluvial fans, drainageways, and floodplains on 0 to 3 percent slope at 6,000 to 7,000 foot elevations. It is classed as fine-loamy, mixed superactive, calcareous, mesic Aridic Ustifluvents. Ramper clay loam is the predominant soil in the area and has a capability class of lllc both irrigated and non-irrigated. This is a good soil, limited in production by growing season and natural precipitation. Irrigated crop production is alfalfa and grass pasture.

3.10.3.6 Non-Binding Water End Use and Conveyance System

3.10.3.6.1 Refined Alternative 4

The agricultural production that would be affected due to the construction and operation of end-use facilities, M&I growth, and conveyance pipelines would be rangeland irrigated and non-irrigated farmlands within the pipeline rights-of-way, irrigation canals, and ditches that would be crossed by the pipelines, and land areas on which end-use development would occur. The following sections describe agricultural lands in the areas that could be affected by the identified non-binding water uses.

Gas Power Plant

The conveyance pipeline corridor identified for providing water to the gas power plant contains a limited amount of farmed land near the Farmer's Mutual Water Ditch. However, no farming is being conducted in most of the corridor. During field review, some evidence of livestock grazing and a few stock ponds were identified in the area. The grazing value of the land is low due to lack of precipitation. The footprint of the power plant would require approximately 200 acres of dedicated land identified as low-impact range land.

Conveyance for Town of La Plata, New Mexico

The conveyance pipeline corridor identified for providing water to the town of La Plata to meet M&I growth demand potential would likely parallel an existing roadway, but may encroach on some bordering agricultural lands. Irrigated crops found along the La Plata River Basin are primarily alfalfa, grass hay, and some corn. The 200 residential units would impact approximately 50 acres and would most likely be sited outside of town on non-farmed land.

West Side Lateral

The main pipeline out of the west side of Ridges Basin Reservoir would be sized to serve the coal-fired power plant and mine, a resort complex, residential development and livestock watering sites. Irrigated crops in the area are primarily alfalfa, grass hay, and corn silage. Dryland is farmed in pasture grass and wheat. There are considerable amounts of land on the mesas, where the principal usage is livestock grazing or wildlife habitat. There are some higher-value cultivated crops in the area but these are not predominant.

Coal-Fired Power Plant and Water Conveyance

The potential coal-fired power plant site identified under the non-binding scenario lies approximately 18 miles southwest of Ridges Basin on the Southern Ute Indian Reservation. The pipeline corridor identified to supply water to the power plant would impact approximately 108.5 acres of land bordering the Southern Ute Reservation. An approximate estimate is that 80 percent of the land along the corridor is used for grazing or wildlife habitat and the remaining 20 percent is in grass hay or pasture. This plant site would be on lowland that currently provides wildlife habitat and seasonal grazing.

Breen to La Plata Lateral

The Breen to La Plata Lateral as identified under the non-binding scenario would separate from the main lateral and continue south along the La Plata River basin for approximately 24 miles to near the town of La Plata in San Juan County. An estimated 75 percent of this lateral would run through irrigated crop land with the remaining 25 percent in range land.

Alkali Gulch Lateral

The Alkali Gulch Lateral would run west across Red Mesa approximately 4 miles from a bifurcation point with the Breen to La Plata Lateral to serve the Ute Mountain Ute Tribe's development of a resort and golf course identified under the non-binding scenario. The pipeline corridor, while located primarily along county roads, would cross irrigated crop lands and irrigation canals at several places in the La Plata River corridor until it rises onto a plateau where there is dry land farming and range land. The Alkali Gulch Lateral crosses approximately 24 acres of land, of which an estimated 50 percent is in irrigated crop production, 20 percent is in dry land hay production, and the remaining 30 percent is range land. The resort and golf course would take up approximately 200 acres and would be located in an area used for wildlife habitat and livestock grazing.

Grass Canyon Lateral

The Grass Canyon Lateral would separate from the Breen La Plata Lateral and run southwest approximately 30 miles to Grass Canyon on the Ute Mountain Ute Reservation southeast of the town of Towaoc. This lateral would serve a resort complex, residential units, and livestock watering sites identified in the non-binding scenario and would be located on approximately 180 acres of land of which an estimated 90 percent is in grazing or wildlife habitat and the remaining 10 percent is in crop production. With the exception of two miles of this lateral which lies in the La Plata River Basin, and which could impact ditches and some irrigated crop lands, the remainder of the lateral would cross lands used for wildlife habitat or grazing. The resort complex would have a development area of approximately 200 acres located on approximately 40 acres currently used for livestock grazing and wildlife habitat.

East Side Laterals (La Plata County)

M&I water released from the east side of Ridges Basin would be used for residential development on or near the Southern Ute Reservation on the Florida Mesa. The Florida Mesa Lateral would be approximately 9 miles long and would potentially serve two residential units with 200 homes in each. This lateral would be located on approximately 54 acres of land of which an estimated 50 percent is non-productive land lying along Highway 160 and the rest is irrigated crop land. The Sunnyside Lateral would be approximately 7 miles long and would be located generally parallel to Highway 550. The pipeline right-of-way would require approximately 42 acres of land of which an estimated 80 percent is in irrigated crop production and the remaining 20 percent in non-farmed land. This lateral would potentially serve a residential development of 200 homes. The land affected would most likely not be farmland.

3.10.3.6.2 Refined Alternative 6

The conveyance structures for the Refined Alternative 6 would be different than those in Refined Alternative 4 due to different water sources. **Table 3.10-2** is a summation of the amount of agricultural lands located along the conveyance pipelines leading from water sources to end use and the impacts to irrigated crop production lands.

Table 3.10-2
Refined Alternative 6 Non-Binding Water Pipelines

End Use	Pipeline Distance (Miles)	Total Acreage	Total Agricultural Land in Right-of-Way[a]
Power Plants and Coal Mine	32.0	193.4	20
Florida Mesa Residences	17.6	106.4	80
Horse Gulch	2.1	12.7	0
Industrial Park	7.1	43.0	0
Ridges Basin Resort	3.8	23.0	0
Ute Housing	12.6	76.0	0
Hotel Complex	17.4	105.0	0
Dude Ranch	12.6	76.15	0

[a]Does not include rangeland.

3.10.4 Environmental Consequences and Mitigation

The following sections discuss potential impacts to agriculture of Refined Alternative 4 and Alternative 6. No Action Alternative impacts are also included as presented in the 1996 FSFES. In addition, mitigation measures are proposed to reduce or eliminate potential impacts to agriculture.

3.10.4.1 Refined Alternative 4

3.10.4.1.1 Structural Component

Refined Alternative 4 Agriculture Impact 1 - Less than Significant: Construction and operation of structural components would eliminate the agricultural productivity potential of lands within Ridges Basin.

Assuming the agricultural land lying within Ridges Basin was in current, sustainable crop production, this 500 acres, if added to the La Plata County irrigated land totals, would bring the amount of irrigated farmland in the county to 72,355 acres, with the land within Ridges Basin representing 0.7 percent of total irrigated farmland in the county. Further assuming there were sustained production within Ridges Basin, this production would have an estimated gross value of $94,500. Assuming the irrigated gross production value of $94,500, this then would represent an additive value of 1.9 percent to the county's total crop production. This gross amount was derived using the following assumptions:

❑ 350 acres of irrigated perennial grass crop, general irrigation period three to four weeks, one cutting per year, average yield three tons. Value of grass hay has ranged from $75 to 90 a ton over the last five years. Estimated value of irrigated hay (350 acres x 3 tons/acre x $82.50) = $86,625.

❑ 150 acres of irrigated pasture supporting 1 AUM for a grazing duration of three to four months. Value of 1 AUM averages $15. Estimated value of irrigated pasture (150 acres x 3.5 AUM/acre x $15) = $7,875.

Mitigation for Refined Alternative 4 Agriculture Impact 1: No mitigation is proposed. The lands would be permanently lost to agriculture during construction and filling of the reservoir.

Refined Alternative 4 Agriculture Impact 2 - Less than Significant: Construction and operation of the pipeline could eliminate agricultural production along the NNMP right-of-way.

Assuming that in a worst-case scenario the construction and operation of the NNMP would permanently remove the crop production capability of land within the right-of-way, then potentially 273 acres of irrigated crop land would be taken out of production. Further, if the indicator production crop on this land is assumed to be alfalfa, then the following could be measured as impacts:

- The amount of irrigated crop land within the county would be reduced from 68,500 acres to 68,227 acres, or a reduction of 0.4 percent.
- The amount of crop value lost would be $163,800 (273 acres at 6 tons per acre at $100 per ton).
- The amount of reduced crop value county-wide would be 0.4 percent.

Additionally, during construction, disruption of canal and ditch water flows would affect the acreage served. The degree of impact would be a function of when the disruption occurred during the growing season and for how long the disruption of water flows occurred. The impacts could range from total loss of crop to no loss. Data on construction scheduling are not available to support an analysis of crop loss resulting from impacts to the canals and ditches. However, in the mitigation section, this is addressed and options for mitigation are recommended.

A more realistic impact scenario would suggest that pipeline construction would take place over a period of time and that only the irrigated croplands impacted during a reach of construction would be affected. Under the assumption that the pipeline would take five years to complete and that the reach of construction was equal for all five years, then approximately 55 acres would be affected each year. Further assuming that full production was lost on this land during the year of construction and that this full production was reinstated on the pipeline right-of-way in the ensuing years, the resulting impact per year of construction would amount to a county-wide loss of production of $36,575. This loss would be reinstated in year six.

Mitigation for Refined Alternative 4 Agriculture Impact 2: Schedule construction during periods of non-production.

Construction scheduling during periods of non-production would eliminate impacts occurring to production lands and canals and ditches. Additionally, a recorded condition on pipeline rights-of-way allowing overlaying crop production to continue would avoid permanent impacts.

3.10.4.1.2 Non-Binding End Uses and Water Conveyance

Refined Alternative 4 Agriculture Impact 3 - Less than Significant: Construction of Colorado Ute Tribe and non-Colorado Ute Tribe water end uses and conveyance facilities could temporarily and permanently reduce crop production, pasture, and rangeland within La Plata, Montezuma and San Juan Counties.

As discussed in Chapter 2, a scenario was developed for the purposes of this analysis which provided an array of potential end uses and conveyance systems of Tribal and non-Tribal water that would be made available for use as a result of the project.

Pipelines used for conveyance would likely parallel existing roads or utility rights-of-way; however, in some cases they would cross agricultural lands. It is anticipated that the average land disturbance necessary for pipeline construction would be approximately 50 feet. Including access roads and staging areas, approximately 8 to 10 acres of land per mile of pipeline could be disturbed during construction. This disturbance, when located on agricultural lands, would reduce productivity on lands disturbed and on lands that could be temporarily inaccessible for farming activities. The pipelines could also cross irrigation canals and ditches, which could disrupt service during construction of a particular pipeline segment. Due to the limited amount of agricultural lands located within the areas anticipated for conveyance pipeline construction and the short term of construction (no one area would be expected to be affected for more than one growing season), impacts resulting from pipeline construction would be less than significant.

There would be a positive impact from water sites on rangeland; however, this could be negatively offset if range management were not applied. Left unsupervised, water sites would increase range accessibility and grazing duration that could lead to overgrazing.

The permanent impacts resulting from the development of the identified end uses would be the removal of agricultural production lands and grazing lands lying under the physical structures along with the surrounding inclusion zone. The amount of acreage thus impacted is estimated to be 1,900 acres. The majority of the development sites should be sited on grazing lands, on stable soils. The impacts resulting from lost grazing would be less than significant given the total amount of grazing land in both La Plata and Montezuma Counties.

Mitigation for Refined Alternative 4 Agriculture Impact 3: Schedule construction during periods of non-production, or restore farmland to original condition.

Construction scheduling during periods of non-production would eliminate impacts occurring to production lands and canals and ditches. Additionally, a recorded condition on pipeline rights-of-way allowing overlaying crop production to continue would avoid permanent impacts.

3.10.4.2 Refined Alternative 6

3.10.4.2.1 Structural Component

% **Refined Alternative 6 Agricultural Impact 1 - Less than Significant: Raising Lemon Dam by 11.5**
% **feet would eliminate 45.06 acres of non-irrigated pasture and 11.04 acres of irrigated pasture from**
% **the north end of Lemon Reservoir.**

% **Mitigation for Refined Alternative 6 Agriculture Impact 1: There is no mitigation for this loss in**
% **terms of production foregone. However, a plan would be developed to compensate the landowner**
% **for the property loss.**

Refined Alternative 6 Agriculture Impact 2 - Less than Significant: Construction and operation of the pipeline could eliminate agricultural production along the NNMP right-of-way. %

Mitigation for Refined Alternative 6 Agriculture Impact 2: Schedule construction activities during periods of non-production. %

Same as Refined Alternative 4 Agriculture Impact 2.

3.10.4.2.2 Non-Structural Component

Refined Alternative 6 Agriculture Impact 3 - Potentially Significant: Purchase of irrigated farmland on any irrigation ditch could cause disruption of historic irrigation practices to remaining appropriators. %

This potential impact involves the hydrology of irrigation ditches serving lands that would be acquired. Purchases of up to 20 percent of total ditch diversions of any ditch and removing conveyance of the diversion from the ditch would likely not cause disruptions to other users along the ditch. However, removal of diversions greater than 20 percent could affect the hydrology of the ditch and affect its conveyance efficiency. Each ditch has a complicated systems dynamic involving priority of water rights, location of farm turnouts, junior appropriators, groundwater recharge, riparian vegetation, return flows, and downstream impacts.

Mitigation for Refined Alternative 6 Agriculture Impact 3: Develop Land Acquisition and Mitigation Plan. %

Conversion of irrigation water to M&I use or changing the point of diversion of water rights would require the approval of the respective state. As such, specific state statutes concerning avoidance of injury to other water rights holders would have to be adequately addressed to gain such approval. The statutes could be incorporated into a land acquisition plan to assist in assessing acquisition feasibility on a case-by-case basis.

Refined Alternative 6 Agriculture Impact 4 - Less than Significant: Purchase of irrigated lands and transfer of the irrigation water off the land to M&I purposes would decrease agricultural productivity in La Plata and Montezuma Counties. %

As shown in Table 3.10-1 the total amount of irrigated agricultural land that would need to be purchased in order to provide 30,647 afy of depletion would be 20,647 acres. The land purchased in the Animas and Florida River Basins would remain in irrigation along with 4,062 acres in the McElmo Creek Basin. However, the land in the Pine, La Plata, and Mancos River Basins, and 657 acres within McElmo Creek Basin would have all the water rights associated with the land transferred to M&I use and the associated water would be removed from the land. These lands would thus be dried up and would be impacted. In this analysis, the impact is measured by the loss in production associated with moving from irrigated production to non-irrigated production.

Average production for principal crops grown in each county and in association with each soil unit are shown in **Table 3.10-3.** For the purpose of this analysis, the assumption is made that the principal crops affected (in both counties) by conversion from irrigated to non-irrigated farmland are alfalfa hay and grass hay. The non-irrigated crops that would result are pasture and grass hay.

<table>
<tr><th colspan="9">Table 3.10-3
Crop Production</th></tr>
<tr><th colspan="9">La Plata County (1997)</th></tr>
<tr><th rowspan="3">Soil Unit</th><th colspan="8">Crop</th></tr>
<tr><th colspan="2">Alfalfa</th><th colspan="2">Wheat</th><th colspan="2">Oats</th><th colspan="2">Pasture</th></tr>
<tr><th>Irrigated</th><th>Non-Irrigated</th><th>Irrigated</th><th>Non-Irrigated</th><th>Irrigated</th><th>Non-Irrigated</th><th>Irrigated</th><th>Non-Irrigated</th></tr>
<tr><td>Arboles</td><td>3.5t</td><td>0</td><td>50 Bu</td><td>0</td><td>55 Bu</td><td>0</td><td>5.0 AUM</td><td>0 AUM</td></tr>
<tr><td>Bayfield</td><td>2.5t</td><td>0</td><td>35 Bu</td><td>0</td><td>45 Bu</td><td>0</td><td>5.0 AUM</td><td>0 AUM</td></tr>
<tr><td>Pescar</td><td>2.5t</td><td>0</td><td>0</td><td>0</td><td>40 Bu</td><td>0</td><td>0 AUM</td><td>0 AUM</td></tr>
<tr><td>Witt</td><td>4.0t</td><td>1.5t</td><td>45 Bu</td><td>25 Bu</td><td>55 Bu</td><td>45 Bu</td><td>4 AUM</td><td>0.70 AUM</td></tr>
<tr><th colspan="9">Montezuma County (1997)</th></tr>
<tr><th rowspan="2">Soil Unit</th><th colspan="4">Alfalfa</th><th colspan="4">Pasture</th></tr>
<tr><th colspan="2">Irrigated</th><th colspan="2">Non-Irrigated</th><th colspan="2">Irrigated</th><th colspan="2">Non-Irrigated</th></tr>
<tr><td>Collide</td><td colspan="2">4t</td><td colspan="2">0</td><td colspan="2">5.5 AUM</td><td colspan="2">0.80 AUM</td></tr>
<tr><td>Ramper</td><td colspan="2">4t</td><td colspan="2">0</td><td colspan="2">6 AUM</td><td colspan="2">1 AUM</td></tr>
<tr><td>Sideshow</td><td colspan="2">4.5t</td><td colspan="2">0</td><td colspan="2">6.0 AUM</td><td colspan="2">0.70 AUM</td></tr>
<tr><td colspan="9">t= Ton
Bu = Bushel
AUM = Animal Unit Month</td></tr>
</table>

The amount of land in each county under irrigation (using 1997 figures) would be reduced as a result of the transference of water rights on the Pine, and Mancos Rivers, and in McElmo Creek Basin. Additionally, the county agricultural production would be reduced both in terms of quantity and value. A total of 10,000 acres in the Pine River Basin, 785 acres in the La Plata Basin, 500 acres in the Mancos River Basin, and 657 acres in the McElmo Creek Basin would be transferred from irrigated to non-irrigated farmland. Because of soil conditions and natural precipitation constraints, it is estimated that % approximately 30 percent of the private irrigated land in the Pine River Basin would go out of production. The land on the remaining river basins would convert from principal crops under irrigation to a dry land pasture production.

Based on the production tables and on average prices over the last five years, the average production value impact would be:

1. La Plata County: the Pine River Basin would sustain a loss of $395 per acre on 5,000 acres equaling $1,975,000, and a loss of $369.50 on 5,000 acres for a loss of $1,847,500. Although there is a slightly longer growing season in the La Plata River Basin, the predominant soil types are essentially the same and thus the same loss in production values as assigned to the Pine River Basin was used in the analysis. Loss in the La Plata River Basin would amount to 785 acres times $369.50, or a total of $290,057. Total loss in crop value for La Plata County would be $2,137,557.

2. Montezuma County: the Mancos River Basin would sustain a loss of $368 per acre on 500 acres equaling $184,000. In the Mc Elmo Creek Basin the loss would amount to $365 per acre times 657 acres, equaling $239,805. Total loss in crop production value for Montezuma county would be $423,805.

Using the same convention as in Refined Alternative 4, these figures were converted to the equivalency used in the 1997 agricultural census report in order to compare against the county crop production values. **Table 3.10-4** shows the impacts to the respective counties as a result of either retiring formerly irrigated lands from production or reverting to non-irrigated pasture. As indicated in the table, on a county-wide basis, the decreases in production would not reach levels that were considered significant for the purposes of this analysis.

Table 3.10-4
Refined Alternative 6 Crop Production

	Acres Farmed	With Project	Production	With Project	Percent Change
La Plata County					
Total Land in Farms	580,135	575,135	$15,797,000	$14,648,250	(7.3)
Total Cropland	91,129	86,129	$4,948,000	$3,711,024	(7.4)
Irrigated Lands	71,855	61,070		($1,236,976)	(15.0)
Non-Irrigated Lands	19,274	25,059			30
Montezuma County					
Total Land in Farms	935,330	935,330	$21,874,000	$21,668,868	(1.6)
Total Cropland	102,915	102,915	$12,913,000	$12,322,300	(1.6)
Irrigated Lands	61,081	59,924		($205,132)	(1.0)

Mitigation for Refined Alternative 6 Agriculture Impact 4: Develop procedures for taking lands out of production. %

It is recommended that any irrigated farmland purchased—from which water rights are transferred in whole or in part to other uses—be converted under a formal process to dryland farming or be put into a recognized conservation program that is either in effect or created ad hoc to satisfy water rights from the non-structural component of Refined Alternative 6. The reason for this is to preserve ground cover and to curtail invasion by undesirable plant species. The Conservation Reserve Program (CRP) currently in effect is managed by the NRCS and allows only cultivated cropland that has been in production for two of the last five years to be eligible for participation. Very little, if any, of the cultivated cropland in the Pine, Mancos, La Plata, Florida, and Animas River Basins or the McElmo Creek Basin is row cropped and, therefore, it would not be eligible for a CRP.

3.10.4.2.3 Non-Binding Water End Uses and Conveyance Systems

Refined Alternative 6 Agriculture Impact 5 - Less than Significant: Construction of Colorado Ute Tribe and non-Colorado Ute Tribe water end uses and conveyance facilities could temporarily and permanently reduce crop production, pasture and rangeland within La Plata, Montezuma and San Juan Counties. %

This impact would be similar to that of Refined Alternative 4 Agriculture Impact 3.

Mitigation for Refined Alternative 6 Agriculture Impact 5: Schedule construction during periods of non-production, or restore farmland to original condition.

Mitigation would be the same as that described for Mitigation for Refined Alternative 4 Agriculture Impact 3.

3.10.4.3 No Action Alternative

The impacts identified below have been extracted from the 1996 FSFES.

General Agriculture

The No Action Alternative would require that the federal reserved water rights in the area to be negotiated. This renegotiation could result in the loss of water rights to currently irrigated (non-Indian) land. Farmers would be forced to return to a dryland farming operation, which greatly diminishes income, jobs, and the need for agricultural production services, or abandon their farms. Much of the land would return to fallow conditions. Estimates of the impacted land and resources could only be quantified at the conclusion of litigation and at the time a settlement was agreed upon. **(**Page III-102.)

3.11 RECREATION

3.11.1 Introduction

This section addresses potential impacts to reservoir and river-related recreation that could result from actions associated with Refined Alternatives 4 and 6. Impacts of the No Action Alternative are also included as presented in the 1996 FSFES. Section 3.11.2 defines the Evaluation Methodology and significance criteria used for determining impacts, Section 3.11.3 describes the affected environment, and Section 3.11.4 identifies potential impacts and discusses mitigation measures that would serve to reduce or eliminate anticipated recreation impacts.

3.11.2 Methodology

This section discusses the methodology used to determine potential impacts that could result from Refined Alternatives 4 and 6. Also discussed are specific criteria that were used to determine the significance of the impacts identified. Due to similarities between the current No Action Alternative and the No Action Alternative discussed in the 1996 FSFES, impacts of this alternative were not re-analyzed, but are included in Section 3.11.4 (Environmental Consequences and Mitigation) for comparative purposes.

3.11.2.1 Evaluation Methodology

3.11.2.1.1 Animas River Recreation - Commercial Rafting

The methodology used to determine impacts to commercial rafting on the Animas River, described in the 1996 FSFES, Appendix G, was used to estimate: (1) the number of lost rafting user-days; (2) the number of lost floatable days; and (3) the reduction in river miles available for commercial rafting. *Rafting user-days* refer to the number of commercial rafting customers (commercial passengers but not commercial guides) on the Animas River per day. *Floatable days* refer to the number of days that river flows are adequate to sustain commercial rafting activities. A river mile is a unit of measurement (in miles) used to measure distances between specific points along rivers and streams.

Based on the study included in Appendix G of the 1996 FSFES, and on communications with current commercial operators, the minimum flow necessary to support rafting on the Animas River is estimated to be 300 cfs or greater. These minimum flows are referred to as *floatable flows*. However, historical data and observations made in 1994 indicate that some rafting does in fact occur on the Animas River when streamflow decreases to below 300 cfs.

To determine the average distribution of commercial rafting customers on the Animas River during summer months, data contained in the 1996 FSFES was updated using photographs and logbooks of rafters for 1998 and 1999. The photographs and logbooks were provided by Reflections Photography–a company that photographs and records all passing rafts on the Animas River during the summer for the purposes of selling photographs to rafters.

For this analysis, log sheets were reviewed to determine the number of commercial rafts that floated on the Animas River during the summer of 1998 and 1999 (May through Labor Day). Then, a subsample of photographs were reviewed to determine the average number of passengers (excluding guides) in each raft. This number was multiplied by the number of commercial rafts to determine the number of annual rafting customers in 1999 (49,000 customers). The number of annual rafting customers in 1989, 1990, 1993, 1994 (taken from projections included in the 1996 FSFES), 1998, and 1991, were analyzed to develop an average *monthly* distribution of commercial rafting customers for the present annual level of use of 49,000 customers. The resulting average distribution is shown below in **Table 3.11-1**.

Table 3.11-1
Average Monthly Distribution of Commercial Rafting Customers on the Animas River

	May 16-31	June	July	August	Sept. 1-5	Total
Percent Distribution	3	26	44	26	1	**100**
Number Rafting Customers	1,470	12,740	21,560	12,740	490	**49,000**
Average Number of Customers per Day	98	425	695	411	98	

The number of lost floatable days (i.e., days when streamflow was less than 300 cfs) below the proposed Durango Pumping Plant site was determined for future conditions with and without the ALP Project. The analysis was conducted on a daily basis from May 15 through September 5 for water years 1929 through 1993. The number of lost floatable days was then used to estimate the number of lost rafting user-days using an average monthly distribution of commercial rafters at the 1999 level.

Reductions in the number of river miles available for rafting were based on historical usage data for 1993 and observations made during a 1994 study for the 1996 FSFES (Appendix G3, Volume 3). The study revealed that the number of river miles available for commercial rafting is directly related to streamflow rates (i.e., cfs) and take-out locations on the river (i.e., points along the river where rafters can safely end their trip and remove their rafts from the river). Specifically, as streamflow rates decrease, rafters are more likely to end their trips further upstream rather than downstream (thus, resulting in a reduction of available river miles). This progression upstream of take-out locations occurs because of the increased amount of time necessary to travel from one destination to another and the inability of rafts to pass through certain reaches of the river at reduced streamflow rates. To determine the reduction in number of available river miles resulting from the proposed project, four threshold streamflow rates and associated take-out locations were identified. The streamflow rates and takeout locations are discussed in Section 3.11.4.

3.11.2.1.2 Animas River Recreation - Private Use

According to the 1996 FSFES, there were an estimated 21,200 to 26,500 private whitewater user-days on the Animas River through Durango in 1994. Private whitewater user-days refer to the number of private rafters, kayakers, and canoeists on the Animas River per day. Projections for 1999 private whitewater user-days were developed using the 1996 FSFES data and information and estimates provided by local river recreationists. One such estimate suggested that private whitewater use has increased 10 to 15 percent each year since 1994 (pers. comm., Andy Corra and Mike Balster, Four Corners River Sports, 1999). Another estimate suggested that private use of the river has tripled since 1994 (pers. Comm., Kent Ford, Animas River Race Association, 1999). Using these estimates, private whitewater user-days were extrapolated to be between 42,600 and 79,500 in 1999.

A qualitative analysis of potential impacts on private user experiences was based on information gathered during interviews with local recreationists. Interview questions were related to preferred streamflows, reasons for such preferences, types of experiences at different levels of streamflow, and personal opinions about the project’s impact on river recreational experiences. This data indicated a large variation in flow preferences among private users, with preferences being dependent upon differences in user skill, specific activity and river gear, and location on the river. While floatable flows (i.e., the minimum stream flows necessary to float the river) for private rafters is essentially the same as for commercial rafters, floatable flows for private kayakers was not determined because of variations in preferences, and because of the insufficient number of interviews to determine an average perceived floatable flow for kayakers. Consequently, minimum floatable flow for private kayakers was not determined and no quantitative analysis of project impacts on private whitewater user-days has been attempted.

3.11.2.1.3 Animas River Recreation - Competitive/Organized Events

The only competitive/organized river-based event in the project area near Durango is the “Animas River Days”—occuring annually during the last week of June. Consequently, only this event is analyzed in detail. Average, historic river flows that occurred during the last week of June (i.e., without the project) were compared with average river flows during the same time period with the ALP Project.

3.11.2.1.4 Animas River Recreation - Stream Fishing

Stream fishing was not analyzed in the 1996 FSFES. Information was obtained for this analysis from CDOW (e.g., creel census data), the Southern Ute Indian Tribe, and interviews with local fly-fishing shops and fishing guide services. The fisheries resource analysis (presented in Section 3.6, Aquatic Resources), was used to determine project impacts on the trout fishery on the Animas River.

3.11.2.1.5 Animas River Recreation - Farmington, New Mexico

The Animas River near Farmington is not currently used extensively by whitewater recreationists with the exception of participating in events held during Riverfest, a water festival/competition held annually during Memorial Day holiday weekend. However, it is expected that future whitewater use in the area will increase. No user-day information is available for the Animas River near Farmington, and therefore, the analysis is restricted to a comparison of river flows for the with- and without-project conditions.

Monthly average, minimum, and maximum flows as well as streamflow duration tables were created to develop a general understanding of the potential changes in flow regime that could occur as a result of the project. In addition, a frequency analysis was conducted for daily flows for May 25 through May 31 for the period 1929 through 1993. This daily analysis provides an estimate of potential changes in the flow regime during Riverfest. For the purposes of this analysis, it was assumed that the last week of May represents the flow conditions for Memorial Day weekend.

3.11.2.1.6 Ridges Basin Recreation

Data on the current recreational uses in Ridges Basin were obtained from CDOW.

3.11.2.1.7 Project Area Reservoir Recreation

Data on existing project area reservoirs were obtained from Reclamation, Colorado State Parks Department, and the U.S. Forest Service (USFS). Ridgway Reservoir was selected to represent the proposed Ridges Basin reservoir in this analysis as it is comparable to the proposed Ridges Basin Reservoir (i.e., it is also a Reclamation facility, operated by the Colorado State Parks Division and is located on Colorado's Western slope near an urban area with an economy dependent upon tourist dollars). **Table 3.11-2** lists other features that make Ridgway Reservoir an appropriate representative reservoir for analyzing recreation impacts that could result from the proposed Ridges Basin Reservoir.

Table 3.11-2
Comparison of Existing Ridgway Reservoir Recreation Facilities and Possible Recreation Facilities at Ridges Basin Reservoir

	Ridges Basin Reservoir[a]	**Ridgway Reservoir[b]**
Surface Area	1,490 acres	1,065 acres
Elevation	6,870 feet	6,871 feet
Distance from Urban Area	3 miles from Durango	3 miles from Ridgway 12 miles from Ouray
User Capacity/Users at One Time	1,980	2,000
Annual User-Days[c]	218,400	201,901
Access	Two-lane county road	Two-lane highway
Type of Fishery	Coldwater	Coldwater
Boat Ramps	One, four-lane boat ramp	One, four-lane boat ramp
Camping Units	196	283
Picnic Units	37 individual sites and 1 group site	87 individual sites and 2 group sites

[a]Ridges Basin recreation facilities, user numbers, and annual recreation days were estimated by reducing the numbers provided in the 1996 FSFES by 33 percent due to a similar reduction in the reservoir surface area under Refined Alternative 4.
[b]Ridgway data were provided by Colorado State Parks (Ridgway and Denver offices); results of the 1997-98 Visitor Use Exit Survey (Ridgway State Park, 1998), and the 1998 Visitation Study Final Report (Colorado State Parks, 1998).
[c]User-days refer to the number of visitors during a 12-hour period.

The estimated number of recreation user-days (i.e., the number of visitors during a 12-hour period) for Ridges Basin Reservoir was derived by updating data presented in the 1996 FSFES using the 1990 population census. (The data presented in the 1996 FSFES was based on a study conducted in 1979.) Since the surface area of the proposed Ridges Basin Reservoir would be approximately one-third the size of the reservoir proposed in 1996, it has been assumed for the purposes of this analysis, that the estimated number of user days is one-third less than that of the larger reservoir proposed in 1996, or 218,400 recreation user-days. This estimation is supported by comparison with Ridgway Reservoir (a reservoir of similar size as that proposed for the Ridges Basin Reservoir), which reported 201,901 recreation user days in 1998.

3.11.2.1.8 San Juan River Recreation - Commercial and Private Whitewater Use

Because data related to the number of commercial and private whitewater rafting user-days on the San Juan River is not available, the analysis presented in this FSEIS was restricted to a comparison of river flows for the with and without project conditions. Based on information obtained from commercial river guides and private users of the San Juan River, floatable flows are estimated to be between 500 and 800 cfs or greater, depending on the size of the raft. Monthly average, minimum, and maximum flows as well as streamflow duration tables were created to develop a general understanding of the potential changes in flow regime that could occur as a result of the ALP Project. Hydrographs for typical wet, dry, and average years developed for Section 3.2 (Water Resources and Hydrology) were also reviewed. In addition, a frequency analysis was conducted for daily flows for April through October for the period 1929 through 1993. This daily analysis provides an estimate of potential changes in the frequency of specific daily flows such as the 500 cfs or 800 cfs flow rates.

3.11.2.1.9 Stream Fishing

Stream fishing on the Pine River, below Vallecito Reservoir, and the Florida River, below Lemon Reservoir, was assessed by reviewing analysis conducted for Section 3.6 (Aquatic Resources) to determine impacts on the quality of the trout fishery that could result from the proposed project.

3.11.2.2 Significance Criteria

Impacts to recreational resources resulting from the proposed project were considered significant if construction or operation of the project were to:

❑ Reduce commercial rafting user-days or floatable days on the Animas River by more than 10 percent per year;

❑ Substantially reduce the quality of the commercial or private boaters’ experience on the Animas River;

❑ Reduce the number of raftable days on the San Juan River by more than 5 percent;

❑ Result in the cancellation of organized river-based events due to alteration of streamflows;

❑ Reduce wildlife-related recreation in Ridges Basin that is not replaceable by similar forms of recreation within the project area;

❑ Substantially increase reservoir recreation opportunities in the project area;

- Substantially reduce angler satisfaction with their fishing efforts on the Animas River below the proposed Durango pumping plant site; or

- Result in declassification of the Gold Medal Water trout fishery designation.

3.11.3 Affected Environment

The sections below discuss existing river and reservoir-related recreation resources in the areas potentially affected by Refined Alternatives 4 and 6. The actions that may take place under the No Action Alternative are not fully known at this time, therefore it is not possible to completely define the affected environment of that alternative. However, many of the eventual actions that could occur as a result of the No Action Alternative would likely take place within the same geographic setting as that of Refined Alternative 4.

The Durango area provides a number of river-related recreational opportunities for both local users and visitors. The segment of the Animas River that extends through the city provides opportunity for whitewater boating (rafting, kayaking, canoeing), swimming and wading, and fishing.

For the purposes of this analysis, river-related recreational opportunities in the Farmington area are limited to those which take place on the Animas River (i.e., Riverfest).

River and reservoir-related recreation activities within the project area could be impacted by development of Refined Alternatives 4 or 6 including: Animas River recreation, Ridges Basin recreation, Lemon Reservoir recreation, San Juan River recreation, and area stream fishing.

3.11.3.1 Animas River Recreation

The section of the Animas River that runs directly through the City of Durango is unique for a southwestern urban river as it offers both quality whitewater opportunities (Class II - III rapids) and designated Gold Medal Waters for trophy trout fishing. River recreation on the Animas River near the City of Durango is an established component of Durango's tourism industry and an important form of recreation for many local users.

Four types of recreational activities which take place on the Animas River in the City of Durango are examined in this FSEIS:

- Commercial rafting (including the use of inflatable kayaks);

- Private whitewater use (rafting, kayaking, and canoeing);

- Organized/competitive events; and

- Stream fishing.

Wading and swimming, which can be considered other forms of private use, were not examined because specific data on these forms of recreation were not available. Similar Animas River recreational activities that occur 45 miles downstream of Durango, in the City of Farmington, New Mexico, were also considered.

3.11.3.1.1 Commercial Rafting

Most rivers in the southwest that offer commercial rafting opportunities are both heavily regulated and isolated in a wilderness or semi-wilderness setting. The Animas River is atypical as its commercial and private uses are not regulated (there are no required permits or limits on number of users), and it has a popular whitewater section that runs through an urban area.

For the commercial rafting customer, a river trip on the Animas River requires no skill, preparation, or commitment of resources, other than the cost of the trip, which averages $31.00. In addition, commercial customers do not have well-formed expectations about their river experience prior to departure (Arnould and Price 1993) The majority of commercial trips last from one to four hours, although full day trips are also offered, with an average of six to seven customers and one river guide in a raft per trip.

All commercial rafting trips for the affected reach of the Animas River originate at 32nd Street or other locations within the 3.5-mile segment upstream of the proposed pumping plant. Trips terminate at various locations downstream from the site of the proposed pumping plant or at the Santa Rita Park take-out, which is directly across the river from the proposed pumping plant site. Downstream take-outs include an access on Colorado Department of Transportation (CDOT) property (0.7 mile downstream of the proposed pumping plant site), at High Bridge (1.9 miles downstream of the proposed pumping plant site), Weaselskin Bridge (10.2 miles downstream of the proposed pumping plant site), or Bondad (16.7 miles downstream of the proposed pumping plant site).

The majority of commercial rafting occurs during the summer tourism season from the Memorial Day holiday weekend in late May through Labor Day in early September (user numbers closely correlate to use numbers on the Durango-Silverton Narrow Gauge Train (See 1996 FSFES, Appendix G, Volume 4). During the summer rafting season, annual commercial rafting user-days have increased from an estimated 7,200 in 1985, to 32,700 in 1994, and finally, to 49,000 in 1999. This increase reflects a general increase in the popularity of rafting in the western United States.

3.11.3.1.2 Private Whitewater Use

Private whitewater use of the Animas River occurs both upstream and downstream of the proposed Durango Pumping Plant site, including rafting various parts of the potentially affected section used by commercial rafters. However, most private use does not occur in the form of rafting. The majority of private users are kayakers (with a limited number of whitewater canoeists) who recreate on the river differently than rafters. For example, kayakers generally do not float long sections of the river, but tend to concentrate their activities on smaller sections of the river, such as specific rapids or “play holes,” where they can spend up to several hours in the same area.

Estimates of total annual private whitewater user-days have increased from an approximate range of 21,200 to 26,500 in 1994, to 42,600 to 79,500 in 1999. Even though the number of total annual private users is less than the number of total annual commercial users, private users account for more user-days of activity because of their repetitive use of the river throughout the recreation season. Private river use occurs throughout the year, although it is concentrated from April through September. Off-season use is more dependent upon weather conditions than river flow.

3.11.3.1.3 Competitive/Organized Events

Animas River Days, which often involves activities such as slalom races, kayak/canoe rodeos, and downriver races, is held annually during the last week of June. Events are held at the International

Whitewater Park located upstream from the proposed Durango pumping plant site and in the segement of the Animas River that extends through Durango, including that area which would be downstream of the proposed Durango pumping plant site. Based on personal observations and estimates from local participants and exhibitors at the 1999 Animas River Days, roughly 1,200 people, including 160 competitors, various concessionaires, and spectators, attended the event (pers. comm., Kent Ford, Animas River Race Association, 1999). These estimates are consistent with those presented in the 1996 FSFES for the same event.

While no other competitive events took place in 1999, events mentioned in the 1996 FSFES continue to be held periodically. In addition, the City of Durango Parks and Recreation Department continues to sponsor organized events such as rafting and kayaking activities for youth. The estimated number of participants and spectators at competitive and organized events as presented in the 1996 FSFES, totaling 5,000 recreation days per year, is considered representative of current participation.

3.11.3.1.4 Stream Fishing

Stream fishing on the section of the Animas River directly below the site of the proposed Durango pumping plant could be impacted by project development and operation. Anglers frequent this segment of the river to fish for trout—primarily rainbow trout, as well as brown, cutthroat, and brook trout. A 3.5-mile segment of the Animas River from Lightner Creek (above the proposed pumping plant site) to Purple Cliffs (downstream from the proposed pumping plant site) is one of only 14 waters in the State of Colorado designated as a Gold Medal Water by the Colorado State Wildlife Commission (so designated since 1997). This designation is awarded to waters that contain high quality aquatic habitat, a high percentage of trout 14 inches or longer, and the potential for catching trophy-sized trout. To retain the Gold Medal Water designation, CDOW manages this section of river using improved stocking techniques and by allowing only the use of artificial lures and flies, and a catch limit of two trout, with a minimum length of 16 inches.

Most fishing on the Animas River takes place from the banks, after the spring runoff. Fishing generally does not occur during the spring runoff in May and early June because flows are high and water is turbid. In general, anglers prefer low flows, around 300 cfs (pers. comm., Scott Meredith, Duranglers Flies and Supplies, 1999) because water is generally less turbid at lower flows, and wading to preferred fishing locations is both easier and safer. CDOW creel surveys indicate that there were approximately 2,200 angler-days (i.e., the fishing activity supported by a given waterway per day) between April and August in 1990, and 2,000 angler-days between July and September in 1997. Because creel data was only collected during part of the year, and during different months, average yearly angler-days was not calculated. In addition, it is suspected that many anglers were discouraged from coming to the area in 1997 because no trout were stocked in the Animas River due to hatchery shortages caused by whirling disease (pers. comm., Mike Japhet, CDOW, 1999). Another reason for the less-than-expected number of anglers during the creel survey in 1997 compared to 1990 is that the majority of days during 1997 experienced flows of over 1,000 cfs, and no days were within the preferred 300 cfs range. Fishing activities on the Animas River during the 1999 season were sporadic and lower than normal due to higher than average river flows, ranging from 1,000 to 2,000 cfs, throughout late spring and summer months (pers. comm., Scott Meredith, Duranglers Flies and Supplies, 1999).

Another popular fishing area on the Animas River starts at Purple Cliffs and ends at Weaselskin Bridge. Parts of this section of river are located on the Southern Ute Indian Reservation and, as indicated by permit sales to non-Tribal anglers, the popularity of fishing has steadily increased during the past several years, from 137 permits sold in 1993 to 826 in 1998.

Although angling on the section of the Animas that passes through the Southern Ute Indian Reservation may also be impacted by river flows, effects on the number of permits sold is difficult to determine as permits are sold reservation-wide, and can be used on other trout-stocked waters on the reservation such as the Pine, Upper San Juan, and Piedra Rivers. The number of angler-days on this section of the Animas River is not known; level of use, however, is governed by similar factors as fishing around Durango.

3.11.3.1.5 Animas River Recreation - Farmington, New Mexico

The Animas River runs through the City of Farmington, New Mexico, which is approximately 45 miles south of Durango. This section of the Animas River attracts fewer whitewater users and anglers because the river gradient is less steep, there are no major rapids, and water flows are less reliable during summer months because water is diverted for irrigation purposes. In addition, the water is too warm to support a coldwater fishery, except in the winter months, when fishing tends to be marginal.

One organized river-related event known as “Riverfest,” however, has been held for more than a decade during the Memorial Day holiday weekend at the Animas River Park in Farmington. The event is sponsored by River Reach Foundation, a volunteer organization, for the purposes of increasing community and visitor awareness and appreciation for Animas River recreational opportunities. Riverfest is considered an important event for both locals and tourists and includes live music and concessionaires , with an estimated 12,000 participants in 1999 (pers. comm., Marsha Goldstein, River Reach Foundation, 1999). Rafting trips on the Animas River are also offered during Riverfest. These trips are organized by River Reach Foundation in cooperation with San Juan College. In 1999, 1,240 individuals rafted down the river during the event.

While the Animas River through Farmington is not currently used extensively by whitewater recreationists due to the lack of major rapids, slower water, and greatly reduced flows during much of the summer season, plans for improving the hydraulics of the river have been formulated to make it more appealing to river recreationists. One plan includes building a structure at Willet Ditch Intake, a diversion dam adjacent to Animas Park, that would include a number of holes and waves to enhance boating opportunities and fish habitat (pers. comm., Dan Catron, River Reach Foundation, 1999). Construction of this project is nearing completion. Other future structures (e.g., smaller rapids, waves, or holes) are also being discussed, with an ultimate plan to build a whitewater park, similar to the one in Durango. Because of the basic hydrology of the river, whitewater recreational use in Farmington would always remain less attractive than what is currently in Durango; however, the plans to enhance whitewater opportunities in Farmington within the confines of existing historical flows are expected to result in greater private river use. (pers. comm., Marsha Goldstein, River Reach Foundation, 1999).

3.11.3.2 Ridges Basin Recreation

The proposed site for construction of Ridges Basin Reservoir encompasses roughly 1,500 acres of grasslands, with pinyon-juniper woodlands dominating the upper elevations and sagebrush and semidesert grass and shrub lands predominating as the elevation decreases. Recreational use in the Ridges Basin Reservoir area consists primarily of hunting and nature observation. Wildlife in the area include mule deer, elk, and golden eagles. It is estimated that the number of recreation user-days has not increased since the writing of the 1996 FSFES (pers. comm., C. Kloster, CDOW, 1999). In that document, it was estimated that there were 7,000 annual recreation user-days, based on 3,500 recreation user-days of hunting and 3,500 recreation user-days of nature observation.

3.11.3.3 Project Area Reservoir Recreation

The demand for recreational opportunities in Colorado is growing. While population in Colorado increased 14 percent between 1980 and 1990, visitation to Colorado State Parks increased 41 percent during that same period (Colorado Department of Parks and Recreation 1994). The 1986 State Comprehensive Outdoor Recreation Plan (SCORP) for Colorado and the 1991 SCORP for New Mexico identified a need for additional recreational opportunities including , picnicking and camping; and more %
lakes for water sports to name a few. The use of federal lakes nationwide is currently estimated at 900 %
million visits annually. This number is expected to increase by two percent per year, reaching nearly two billion visits by 2048 (National Recreation Lakes Study Commission 1999). Jones (1996) also found that the demand for public freshwater lakes and reservoirs for recreational uses is increasing and is especially high in areas where there are few natural lakes. Increasing growth and new road access to lakes has led to a rapid increase in recreational use of reservoirs for fishing, boating, swimming, camping, hiking, and sightseeing (National Recreation Lakes Study Commission 1999).

Within a 50-mile radius of Durango, there are five reservoirs available for recreational use. Estimated user-days in 1995 at the five sites listed below totaled 1,378,286.

- McPhee Reservoir covers 4,470 surface acres and is located eight miles north of the City of Cortez (approximately 45 miles northwest of Durango). Recreation is managed by the USFS and the Bureau of Land Management (BLM). Motorized boating, fishing (mainly rainbow trout and bass), and camping are the most participated forms of recreation, with motorized boating being the primary activity. Recreation facilities include 2 campgrounds with 155 campsites, including 19 recreational vehicle (RV) hookups; 4 picnic areas with 214 picnic tables and 2 tables; 2 boat launch ramps with a total of 10 boat launch lanes; and 1 marina with 26 boat slips and 49 mooring buoys. This reservoir is primarily used for fishing and water skiing. In 1995, 181,800 user-days were estimated.

- Jackson Gulch Reservoir (Mancos State Park) covers 216 surface acres and is located 34 miles west of Durango. Recreation is managed by Colorado Division of Parks and Outdoor Recreation. Fishing (mainly for rainbow trout), camping, and picnicking are the most participated forms of recreation, with fishing being the primary activity. Recreation facilities include 2 campgrounds with 33 camp sites; 2 picnic areas with 45 picnic tables, and 1 boat ramp with 1 lane. In 1995, 44,657 user-days were estimated.

- Navajo Reservoir covers 15,000 surface acres and is located approximately 35 miles southeast of Durango, crossing into New Mexico. Recreation is managed by New Mexico Division of Parks and Recreation and Colorado Division of Parks and Outdoor Recreation. Fishing, motorized boating, and camping are the most participated forms of recreation, with motorized boating being the primary activity. Recreation facilities are extensive and include 9 campgrounds with 305 campsites, including 72 RV hookups; 5 picnic areas with 261 picnic tables and 54 shelters; 5 boat launch ramps with a total of 11 boat lanes; and 3 marinas with 223 boat slips and 115 mooring buoys. In 1995, 644,259 user-days were estimated.

- Lemon Reservoir covers 620 surface acres and is located 14 miles northeast of Durango. Recreation is managed by the USFS. Camping, fishing (mainly for rainbow trout), and sightseeing are the most participated forms of recreation, with fishing being the primary activity. Recreation facilities are limited and include 1 campground with 14 campsites; 1 picnic area with 5 picnic tables; and 1 boat ramp with 1 lane. In 1995, 33,000 user-days were estimated.

- ❑ Vallecito Reservoir covers 2,720 acres and is located 18 miles northeast of Durango. While much of the area around the lake is privately owned, there are public recreation facilities that are managed by the USFS and Pine River Irrigation District. Camping, fishing (mainly for rainbow trout), and picnicking are the most participated forms of recreation, with fishing being the primary activity. There are 5 campgrounds with 116 campsites; 116 picnic tables; 3 boat ramps with 1 lane each; and 3 marinas with 224 mooring buoys and 58 mooring slips. In 1995, 474,570 user-days were estimated.

% 3.11.3.4 San Juan River Recreation - Commercial and Private Whitewater Use

The San Juan River is used on a large scale for whitewater rafting by commercial rafters and private and educational whitewater users (kayakers, canoeists, and rafters), primarily during the months of April through October, with the majority of trips occurring during the summer months. Rafting on the San Juan River is different from that on the Animas River for several reasons as described briefly below.

- ❑ Rafting trips on the San Juan are generally multi-day trips, lasting from two to seven days, while rafting trips on the Animas River rarely last more than a few hours.

- ❑ While the river experience on the Animas River primarily consists of fast moving water and rapids through an urban setting, a trip down the San Juan River consists of a meandering stream with few rapids through deep canyons and semi-wilderness and remote settings.

- ❑ The San Juan River can be considered a destination river. Many users travel over 100 miles just to take a trip on the San Juan River, and participate in no other form of recreation during their travels.

- ❑ Finally, while all of the commercial companies that regularly provide trips on the Animas River are operated out of Durango, the majority of commercial companies that offer trips on the San Juan River operate their businesses from locations away from the river, such as Moab, Utah (approximately 100 miles away) or from as far as Flagstaff, Arizona (over 200 miles away).

Recreation on the section of the San Juan River potentially affected by the project occurs 45 miles downstream of the confluence with the Animas River and begins at the town of Montezuma Creek, Utah, and extends downstream approximately 78 miles to the Clay Hills take-out at Lake Powell in the Glen Canyon National Recreation Area. This section of river is bordered on the north by BLM and National Park Service lands and bordered on the south by Navajo Nation lands. The intervening reach between the confluence and the town of Montezuma has limited access, is rarely floated by recreationists, and therefore is not examined in this impact analysis.

% The BLM limits the number of users on the San Juan River through imposing permits requirements for
% private users, and maintaining a cap on the number of people or boats allowed on the river each day. The number of permits issued by BLM has increased significantly since the early 1980s. According to the 1996 FSFES, rafting days increased by 76 percent between 1983 (27,950) and 1994 (49,266), with commercial rafting days increasing by over three times that for the same period, from 3,625 to 12,275. Current use of the San Juan River has become more stable, primarily because of the limits placed on users by BLM. **Table 3.11-3** shows the number of rafting days for commercial, private, and educational users from 1992 to 1998.

Table 3.11-3
Rafting User-Days on the San Juan River between Bluff and Clay Hills, Utah

Year	Commercial	Private	Educational	Total
1992	10,020	33,132	1,796	44,948
1993	11,622	33,678	1,652	46,952
1994	12,275	35,458	1,533	49,266
1995	11,470	32,991	1,688	46,149
1996	13,083	31,801	870	45,754
1997	14,198	40,631	1,522	56,351
1998	14,412	31,232	1,553	47,197

Source: BLM; San Juan Resource Area

While Table 3.11-3 shows that San Juan River use has been generally stable from 1992 through 1998, private commercial use was over 29 percent higher in 1997 than during 1996 and 1998. The reason for this increase is unclear, although it may be partially due to flow levels (BLM, San Juan Resource Area office). A possible explanation for the decline in rafting days in 1998 is that river permit holders were required to cancel their trips for a number of days during the river season as a result of reported fugitives in the area. This also caused other permit holders to voluntarily cancel their trips on other days.

While no official study has been conducted to determine the flow requirements of San Juan River users, discussions with a number of private and commercial users indicate that river rafting becomes difficult below flows of 800 cfs for large rafts (18 feet or longer). While the river is boatable at levels of approximately 500 to 800 cfs, the quality of the river experience decreases as users are required to spend more time on the boats during the trip to get downstream. This results in less time for users to engage in shore activities, such as hiking side canyons, swimming, and staying in camp, which are a primary part of the San Juan River trip experience. In addition, flows below 800 cfs result in the need to drag larger rafts through shallow areas and makes certain camp sites inaccessible. River users will tend to shift to smaller rafts (14 to 16 feet) when flows fall between 500 to 800 cfs. The former is considered the lowest level of floatable flows for all rafts.

3.11.3.5 Stream Fishing

The Pine River below Vallecito Reservoir and the Florida River below Lemon Reservoir offer quality trout fishing opportunities. While neither stream is stocked by CDOW, large trout are known to frequent both rivers. This is especially true for the Pine River, which has a comparable trout fishery to the Gold Medal Waters section of the Animas River (pers. comm., Mike Japhet, CDOW, 1999). However, the Pine River, as well as the Florida River, does not receive as much fishing pressure due to limited access. Both rivers extend through a large portion of privately owned land. Private property owners represent a large portion of the fishing pressure, and occasionally stock sections of the river that run through their lands. There have been a number of complaints by property owners in regard to low flows in winter months that seem to negatively impact the trout fishery (pers. comm., Mike Japhet, CDOW, 1999).

Both the Florida and Pine Rivers pass through the Southern Ute Indian Reservation. The tribe occasionally stocks the Pine River with trout and sells fishing permits to non-Indian anglers.

3.11.3.6 Other Area Recreation

The Durango area provides a number of recreational opportunities for both local users and visiting tourists. Much of the recreation centers on the area's scenic and historical resources. The City of Durango maintains 32 parks, comprising 48 acres that are used for picnicking, fishing, and group events. Also within city limits are eight trails that offer a variety of hiking and mountain biking activities, as well as some limited horseback riding. One such trail is the Animas River Trail that consists of a 4.5 mile hard-surfaced trail that is adjacent to the Animas River. Within one to five miles of Durango are a number of other trails, mostly on National Forest lands, that provide for additional hiking, mountain biking, nature observation, and horseback riding opportunities, as well as off-road vehicle use, and access to camping, hunting, and fishing areas.

The historic Durango & Silverton Narrow Gauge Railroad runs through the Animas River Canyon from downtown Durango to the historic mining town of Silverton, located at 11,000 feet among the San Juan Mountains, providing users an historic and scenic recreational experience. Mesa Verde National Park is located 36 miles west of Durango with over 200 ancient structures.

3.11.4 Environmental Consequences and Mitigation

The following sections discuss potential impacts to recreation resources from Refined Alternatives 4 and 6, and the No Action Alternative. In addition, mitigation measures are proposed to reduce or eliminate potential impacts to recreation.

3.11.4.1 Refined Alternative 4

Refined Alternative 4 Recreation Impact 1 - Less than Significant: Operation of the Durango Pumping Plant would reduce flows in the Animas River resulting in the annual, average reduction of commercial rafting by 6 floatable days and 2,183 commercial rafting user-days, and reduce the number of river miles available for rafting.

The projected reductions in commercial rafting by floatable days and rafting user-days under Refined Alternative 4 are shown in **Table 3.11-4**. The figures in the table assume a minimum floatable flow of 300 cfs for commercial rafters.

The average number of lost floatable days for commercial rafting is 6 days per year, which is about 6 percent of the 112 total number of floatable days in an average rafting season. The maximum number of lost floatable days for an entire commercial rafting season is 33 days and would occur with the project in operation under low flow conditions such as existed in 1946. The average number of lost commercial rafting user-days is 2,183 user-days per year, which is about 4.5 percent of the 49,000 total average user-days for the 1999 river season. The maximum number of lost rafting user-days projected is 13,713 and would occur with the project in operation under low flow conditions similar to those that existed in 1988. The maximum number of lost floatable days and lost rafting user-days occurred on different low-flow years because of the variation in the average monthly distribution of commercial rafting customers (see Table 3.11-1). Thus, while more floatable days would be lost under 1946 historical flow conditions than under 1988 flow conditions, more rafting user-days would be lost under 1988 flow conditions because a greater proportion of floatable days lost would occur during high-use periods, such as in July.

Table 3.11-4
Projected Losses in Commercial Rafting by Floatable Days and Rafting User-Days on the Animas River under Refined Alternative 4
(using historical flow conditions between 1929-93)

	May 16-31	June	July	August	Sept 1-5	Total
Floatable Days Available	15	30	31	31	5	112
Floatable Days Lost						
Average	0	0	1	4	2	6
Maximum	4	0	15	28	5	33
Minimum	0	0	0	0	0	0
Rafting User-Days Lost						
Average	8	0	374	1,644	157	2,183
Maximum	392	0	10,425	11,508	490	13,713
Minimum	0	0	0	0	0	0

The average and maximum impacts however, do not illustrate the variability of the annual impacts. For example, the impacts occur in only 37 out of the 65 years, or about 57 percent of the time. This variability is illustrated by the frequency distribution shown in **Figure 3.11-1**. For example, inspection of Figure 3.11-1 shows that 50 percent of the time the impact is 4 floatable days or less. The variability in the number of lost rafting user-days is illustrated in **Figure 3.11-2,** which shows that 50 percent of the time the impact is about 500 user-days or less. The river miles available for commercial rafting were also evaluated for the with and without project conditions as shown in **Table 3.11-5**. For example, the threshold flow necessary for rafting trips with the take-out location at High Bridge is 550 cfs. In general, when flows fall below the 550 cfs level, the take-out location is moved upstream to the CDOT property. The analysis shows that under without-Project conditions, the flows decrease below the threshold an average of 32 days per year. Also, the flows under the with-project conditions decrease to less than 550 cfs an average of 45 days per year. Therefore, the ALP Project operations would result in an increase on average of 13 days per year that flows would be less than 550 cfs, requiring that all commercial rafters take out at the CDOT property rather than downstream at High Bridge.

Mitigation for Refined Alternative 4 Recreation Impact 1 is discussed following Recreation Impact 4.

Refined Alternative 4 Recreation Impact 2 - Less than Significant: Operation of the Durango Pumping Plant would reduce flows in the Animas River resulting in impacts to private rafting that would be similar to impacts to commercial rafting, reduce the area of river used by private kayakers, and be considered aesthetically displeasing to some local users.

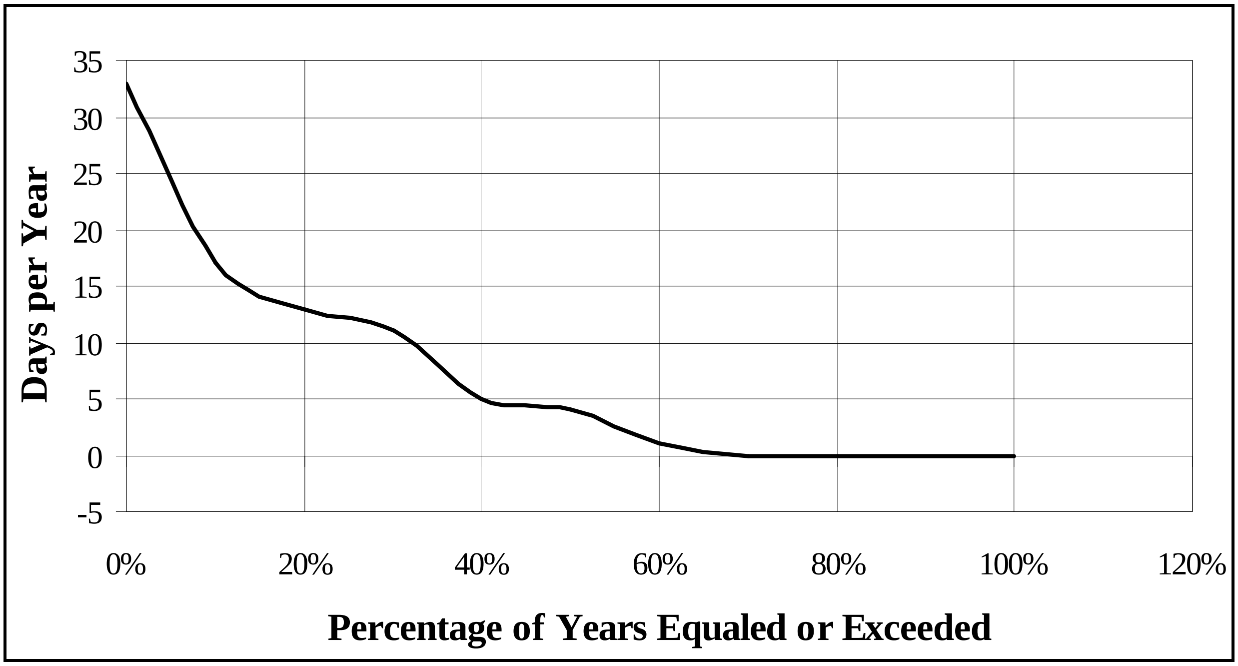


Figure 3.11-1 Number of Lost Floatable Days (below 300 cfs) on Animas River below Durango Pumping Plant

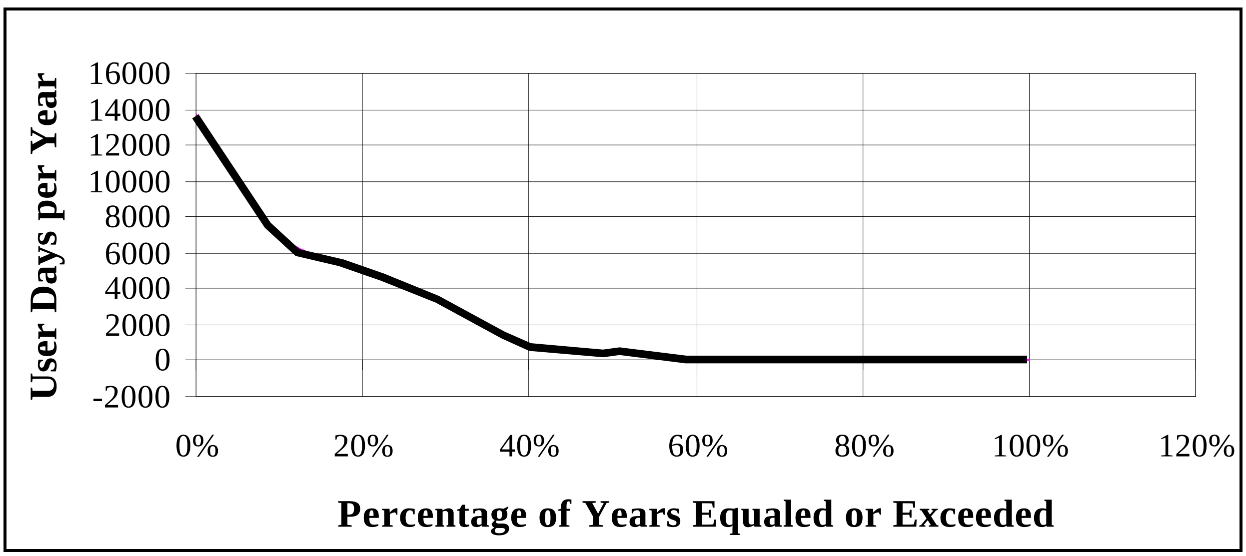


Figure 3.11-2 Number of Lost Commercial Rafting User-Days on Animas River below Durango Pumping Plant

%

Table 3.11-5
Average Number of Days with Reduced River Miles Available for Commercial Rafting or Take-Out Locations Downstream of 32nd Street under Refined Alternative 4
(Water Years 1929-1993)

Take-out	**Gateway Park**	**CDOT[a] Property**	**High Bridge**	**Weaselskin Bridge**
Miles from 32nd Street	3.6 miles	4.3 miles	5.4 miles	13.7 miles
Threshold Flow[b]	300 cfs	350 cfs	550 cfs	1,500 cfs
Without Project[c]				
May 16-31	0	0	0	3
June 1-30	0	0	1	6
July 1-31	2	3	8	23
August 1-31	6	9	19	30
September 1-5	2	3	4	5
Total	**10**	**15**	**32**	**67**
With Project				
May 16-31	0	0	0	4
June 1-30	0	0	2	8
July 1-31	3	6	14	25
August 1-31	10	17	25	30
September 1-5	4	4	4	5
Total	**17**	**27**	**45**	**72**
Impact Due to Project[d]				
May 16-31	0	0	0	1
June 1-30	0	0	1	2
July 1-31	1	3	6	2
August 1-31	4	8	6	2
September 1-5	2	1	0	0
Total	**7**	**12**	**13**	**7**

[a]Colorado Department of Transportation.
[b]Threshold flow is the value at which trips past the indicated take-out location cease.
[c]Lost user-days due to naturally occurring low streamflow conditions.
[d]Incremental increase in number of days above lost user-days for the with-project condition (baseline).

Effects on private rafters who utilize the river in the same fashion as commercial users, that is, float the potentially affected section of the Animas River (originating from upstream of the proposed pumping plant and terminating downstream of the pumping plant), would be impacted in a manner similar to that affecting commercial users in terms of the reduction of floatable days and the number of river miles available for rafting. The impact to the number of private rafting user-days would be similar to the impact to commercial rafting user-days, although the number of lost private rafting user-days have not been projected because the number and use patterns of private rafters has not been determined. However, since private rafters only make up a small portion of total private use, the number of lost private rafting user-days would be minimal.

Impact to floatable days and user-days for private kayakers (and canoeists) who make up the majority of private use would be different than impacts to both commercial and private rafters. Much of the private kayaker use occurs upstream from the proposed Durango Pumping Plant site, and would thus not be directly impacted by project construction (pers. comm., Andy Corra and Mike Balster, Four Corners River Sports, 1999).

In addition, private kayakers are not restricted to using the section of river that would be impacted. Kayakers who use areas below the proposed pumping plant site could move to upstream play holes when downstream river conditions were negatively impacted by low flows resulting from ALP Project operation. However, such displacement could contribute to overcrowding at upstream play holes. In addition, upstream play holes may be less accessible to some private users who choose downstream play holes because of location (e.g., the play hole is near a business, home, or particular put-in/take-out location). This is especially true for those kayakers who access the river on foot, carrying their kayaks to and from certain locations.

Private use is not expected to decrease as a result of Refined Alternative 4, although there may be some short-term impacts during project construction as users would avoid the area because of construction activities (pers. comm., Andy Corra and Mike Balster, Four Corners Sports, 1999).

Mitigation for Refined Alternative 4 Recreation Impact 2 is discussed following Recreation Impact 4.

Refined Alternative 4 Recreation Impact 3 - Less than Significant: Operation and presence of the Durango Pumping Plant would adversely affect the quality of the commercial rafting experience.

Commercial river companies float the potentially affected section of the Animas River, specifically the area of river adjacent to the proposed Durango Pumping Plant site and would be aware of changes in flows. Their customers however, would be aware of how extreme high or low flows impact their river experience, but would generally be unaware of the impacts that changes in flows brought by the proposed project would have on their river experience (except when project activities result in the cancellation of their river trip). The average commercial would be less sensitive to small and moderate fluctuation in river flows on their rafting experience. Consequently, impact to the quality of the commercial rafting experience for them would be less than significant.

Mitigation for Refined Alternative 4 Recreation Impact 3: No mitigation is proposed.

Refined Alternative 4 Recreation Impact 4 - Potentially Significant: Operation and presence of the Durango Pumping Plant would adversely affect the quality of the private boating experience for some local users.

The greatest impact resulting from project operation would be to local private rafters who repeatedly raft, kayak, or canoe the Animas River through Durango. This group possesses the experience necessary to recognize the changes in flows brought on by project operation and to make a judgement as to if, or how, these flows impact their river experience. While such alterations in flows would impact repeat private users' experience, the main adverse impact, is not based on impacts to river flow, except in low water years, but is based on an overall discontentment with the construction of the proposed project. This is a general concern within the private river community. Any project activity that impacts the "natural" flow of the Animas River, even if it would not significantly impact actual river use, would be deemed as undesirable by the Durango river user community (including private kayakers, rafters, and canoeists, as well as commercial river guides) and could negatively impact their river experience.

Mitigation For Refined Alternative 4 Recreation Impacts 1, 2, and 4: Pursue pumping regimes that reduce adverse flow effects on boating opportunities whenever possible, and take steps to improve public access to the river.

The mitigation measures provided in the 1980 FES and the 1996 FSFES are suggested for the current project. Such measures included altering the operation of Durango Pumping Plant at key times to avoid impacts. Other mitigation measures provided in the 1996 FSFES included implementing a program to acquire and improve public access on the Animas River. This could include creating additional put-in and take-out places. Finally, it was suggested in the 1980 FES that the river channel could be modified to provide higher quality of experience at lower flows. However, in this document, Reclamation's position is to not make modifications in the river itself, and this concept is removed from the environmental analysis.

Refined Alternative 4 Recreation Impact 5 - Less than Significant: Reduced flows as a result of operation of the Durango Pumping Plant could adversely affect competitive/organized events on the Animas River.

Animas River flows below the proposed Durango Pumping Plant site during the last week of June, when Animas River Days are typically held, would be reduced, on average, by 9 percent (Note: Under certain flow conditions no pumping would occur in June. See Section 3.2, Water Resources/Hydrology). Without the ALP Project, annual average river flows during the last week of June are 2,257 cfs. These flows are reduced by 212 cfs, on average, resulting in average flows of 2,045 cfs. All of the events held during Animas River Days could occur under the average with-project flows, with little impact to the quality of such events. Animas River flows at Farmington during the last week of May, when Riverfest is typically held, would be reduced, on average, by 10 percent. Without the ALP Project, annual average river flows during the last week of May at Farmington are 2,937 cfs. These flows are reduced with the ALP Project by 297 cfs, on average, resulting in average flows of 2,640 cfs. This reduction in average flows would not impact Animas River rafting during Riverfest. However, during extremely low-flow years, pumping associated with Refined Alternative 4 could result in Animas River flow conditions that could reduce the quality of special events or result in the cancellation of special events. It should be noted that extremely low flows could result in these cancellations under without project conditions.

Mitigation for Refined Alternative 4 Impact 5: Alteration or cessation of pumping from the Animas River during certain flow conditions during organized and competitive whitewater events, such as Animas River Days.

Refined Alternative 4 Recreation Impact 6 - Less than Significant: Operation of the Durango Pumping Plant could adversely affect stream fishing on the Animas River.

While the impact analysis in Section 3.6 (Aquatic Resources) states that decreases in water availability during some months, specifically October, as a result of ALP Project operation could adversely affect the trout fishery, the overall impact would not be significant. This means that the section of Animas River from the Lightner Creek confluence to Purple Cliffs would not lose its Gold Medal Waters designation. The reduction of Animas River flows may actually improve angler satisfaction as anglers generally prefer low flows.

Mitigation for Refined Alternative 4 Recreation Impact 6: Acquire public access at a minimum of two points on the Animas River between the High Bridge and Basin Creek.

The same mitigation as presented in Section 3.6 (Aquatic Resources) for potential adverse impacts to the trout fishery in the Animas River is suggested here. A stocking program would be developed for trout in the Animas River on the Southern Ute Reservation portion of the river that would insure a reliable source of rainbow trout and Snake River cutthroat trout to mitigate impacts to trout in the Animas River. Such a stocking program would supplement current stocking. Suggested fish stocking is addressed further in Section 3.6. In addition, Reclamation would provide funds to acquire and develop two fisherman access points on the Animas River. Costs for acquiring two access points is estimated to be no more than $500,000. These access points would also allow for the launching of rafts that would provide fishing access to otherwise inaccessible fishable waters. It is recommended that one access point be established near Purple Cliffs, located about one mile below the High Bridge, and another point about two miles further downstream. These access points would also allow for rafts to access the Animas River at much lower flows than could be floated upstream, since they would be located below an area that is very broad and has numerous large boulders. Successful navigation through this area requires streamflows in excess of 1,000 cfs, while the Animas River downstream of this area requires a minimum flow of about 500 cfs.

Refined Alternative 4 Recreation Impact 7 - Less than Significant: Construction of Ridges Basin Reservoir and associated recreation facilities would result in a reduction of current upland recreation in Ridges Basin.

As a result of inundation of Ridges Basin, up to a total of 7,000 user-days per year (3,500 hunting and 3,500 nature observation) would be displaced. Upland hunting opportunities within Ridges Basin would be reduced as a result of the construction of the reservoir, with further potential decreases in opportunities in the vicinity of the recreation facilities as new restrictions may be placed on hunting due to increased human use in the area. While some forms of wildlife may become less abundant due to human activity in the area (see Section 3.5, Wildlife Resources), other forms would increase, such as waterfowl and shore birds. This impact is considered less than significant due to other similar recreational opportunities within the ALP Project area.

Mitigation for Refined Alternative 4 Recreation Impact 7: No specific mitigation is proposed. The planned wildlife and wetland mitigation areas discussed in Sections 3.4 and 3.5 would provide new opportunities for hunting and other wildlife-oriented activities.

Refined Alternative 4 Recreation Impact 8 - Beneficial: Construction of Ridges Basin Reservoir and associated recreation facilities would result in a net gain of recreation user-days in the basin, and fill a perceived need for reservoir recreation in the area.

The completion of Ridges Basin Reservoir and associated recreation facilities would increase the number of reservoir recreation user-days to 218,400 per year, a 16 percent increase of reservoir recreation in the ALP Project area. The reservoir would also fill a perceived need, as defined in Section 3.11.3.2.2, for increased reservoir-based recreation opportunities.

It is likely that the Ridges Basin Reservoir would be visited by both local and non-local users, as is Ridgway Reservoir (Elling et al. 1998). Because the proposed Ridges Basin Reservoir is also located in an area with a number of popular tourist attractions where camping accommodations tend to be limited, especially during the summer months, the campground would likely be used as a "home base" for visitors who come to the area to see popular tourist attractions (e.g., Durango Silverton Narrow Gauge Train, San Juan Mountains, Mesa Verde). This is one reason why camping is the primary activity at Ridgway State Park (pers. comm., Jeff Riddle, Ridgway State Park, 1999), and would likely be the same for Ridges Basin.

Refined Alternative 4 Recreation Impact 9 - Less than Significant: Changes in San Juan River flows as a result of the ALP Project would slightly reduce floatable flows for all rafts near Bluff, Utah.

Table 3.11-6 shows the average percent of time that the San Juan River near Four Corners is below floatable flows for all rafts (500 cfs) without the ALP Project compared to the percent of time the river would be below floatable flows with the ALP Project. According to Table 3.11-6, the ALP Project would result in flows below floatable levels for an additional 0.7 percent to 2.0 percent of the time above conditions without the project, for an average of 1.0 percent of the time. Floatable flows would actually increase in August. Due to the low average reduction in floatable flows, this impact is considered less than significant.

Table 3.11-6
San Juan River Near Bluff, Utah

Month	Percent of Time Streamflow below Floatable Flows for All Rafts (500 cfs)			Percent of Time Streamflow below Floatable Flows for Large Rafts (800 cfs)		
	Without Project	With Project	Change	Without Project	With Project	Change
April	6.9%	8.9%	2.0%	26.6%	32.5%	5.9%
May	3.9%	4.7%	0.8%	10.0%	11.3%	1.3%
June	1.5%	2.2%	0.7%	4.4%	5.2%	0.8%
July	8.0%	9.3%	1.3%	31.0%	35.5%	4.5%
Aug	19.3%	18.5%	-0.8%	60.4%	64.7%	4.3%
Sept	23.0%	24.0%	1.0%	70.2%	71.5%	1.3%
Oct	16.8%	18.7%	1.9%	70.5%	75.6%	5.1%

Table 3.11-6 also indicates the average percent of time that the San Juan River would be below floatable flows for large rafts (800 cfs) with and without the ALP Project. As shown, Refined Alternative 4 would result in below floatable flows for larger rafts for an additional 0.8 percent to 5.9 percent of the time, for an average of 3.3 percent of the time compared to no-project conditions. While this impact is greater than that of the 500 cfs minimum flow requirements for all rafts on this area of the San Juan River, it is not as significant as it would not prevent users from rafting the San Juan River; however, it would require that they use smaller rafts.

Mitigation for Refined Alternative 4 Recreation Impact 9: No mitigation is proposed.

3.11.4.2 Refined Alternative 6

Refined Alternative 6 Recreation Impact 1 - Less than Significant: Disruption of Lemon Reservoir recreation activities as a result of construction and inundation of existing Lemon Reservoir shoreline recreation facilities would temporarily decrease recreation use of Lemon Reservoir.

Recreation facilities would be relocated to higher elevations as necessary. During construction activities associated with raising Lemon Dam and preparing the reservoir shoreline for raised water levels, current recreational uses of the reservoir may be displaced. In addition, recreation facilities located along the shoreline that would be inundated as a result of raising the reservoir surface level would be removed from use. Displacement would not likely affect all reservoir recreationists and would occur only during the period of construction; it is not considered a significant impact. It is assumed that recreational facilities inundated would be replaced or relocated to higher elevations and would be returned to use following filling of the reservoir. As such, this impact is considered less than significant.

Mitigation for Refined Alternative 6 Recreation Impact 1 - Recreation use of Lemon Reservoir would be accommodated as practicable during construction.

To the extent practicable, the use of Lemon Reservoir for recreation would be allowed during the period of construction through identifying certain areas of the reservoir and shoreline off-limits and maintaining access to others. Public safety would be a primary consideration when determining public access during construction.

Refined Alternative 6 Recreation Impact 2 - Less than Significant: Reductions in Animas River flows as a result of future City of Durango pumping could impact Animas River recreation.

Under Refined Alternative 6, it is assumed that the City of Durango would acquire additional water for the city water supply from the Animas River from the city's existing pumping plant near Santa Rita Park (formerly Gateway Park). This withdrawal would not reduce Animas River flows to the extent projected under Refined Alternative 4; nonetheless, the reduction in flows could result in reductions in commercial river use, private boater satisfaction, and stream fishing on the river. This impact would be less than significant.

Mitigation for Refined Alternative 6 Recreation Impact 2: No mitigation is proposed.

3.11.4.3 No Action Alternative

The following discussion regarding recreation impacts of the No Action Alternative was extracted from the 1996 FSFES.

<u>Reservoir Recreation</u>

Under the No Action Alternative, the ALP Project would not be constructed. Therefore, recreation would continue as discussed for the Affected Environment, with proportional increases as area population increases.

<u>Animas River Recreation</u>

In the No Action Alternative, while the ALP Project would not be constructed, demand for M&I water from the Animas River would continue; thus, there would be some impact on current river recreation and *streamflow conditions on the Animas River. In the No Action Alternative, river recreation is subject to impacts due to low naturally occurring streamflow conditions during the late summer. These natural losses are in the form of reduced user-days and river miles available for commercial rafting and provide the baseline for determining potential impacts for the various alternatives for ALP Project development.*

For the 60-year study period (water years 1930 through 1989), the average numbers of lost commercial rafting days (flows naturally drop below floatable flows) and user-days are 11 and 3,021, respectively (Bookman-Edmonston, 1995[a]). This represents an average annual loss in commercial user-days of about 9 percent attributed to naturally occurring low streamflow conditions. The monthly distributions of lost commercial rafting days and user-days during the commercial rafting season are presented in Table III-3. Projecting these dates into the future, a corresponding decline in commercial user-days would be expected due to the naturally occurring low streamflow conditions.

Table III-3.—Incremental increase[1] in average lost commercial rafting days and user-days on Animas River
Water years 1930-89

Period	May 27-31	June 1-30	July 1-31	Aug 1-31	Sept 1-5	Total
No Action Alternative (baseline condition)[2]						
Days below floatable flow	0	0	2	7	2	11
Lost user-days	0	0	930	2,009	82	3,021
1980 FES Plan[1]						
Lost rafting days	0	1	5	13	2	21
Lost user-days	0	79	2,054	3,870	86	6,089
1995 Proposed Plan Phase I, Stage A[1]						
Lost rafting days	0	0	1	3	1	5
Lost user-days	0	0	287	780	31	1,098
1995 Proposed Plan Phase I, Stage B[1]						
Lost rafting days	0	0	5	13	2	20
Lost user-days	0	49	2,186	3,688	83	6,005
1995 Proposed Plan Phase II[1]						
Lost rafting days	0	0	5	14	2	21
Lost user-days	0	49	2,209	3,827	85	6,170

[1] Incremental increase in number of days above lost user-days for the No Action Alternative (baseline condition).
[2] Lost user-days due to naturally low streamflow conditions.

River miles available to commercial rafting were also evaluated for the No Action Alternative. Table III-4 shows the average number of days within each month without sufficient streamflows to reach downstream take-out locations.

The number of lost private whitewater user-days has been evaluated in terms of ranges of floatable flow and maximum annual user-days. For the 60-year study period and assuming 26,500 annual user-days, the average number of lost private whitewater user-days ranges from 744 to 3,743, which is a 3- to 14-percent reduction compared to the maximum annual user-days. The monthly distribution of average lost private whitewater user-days for a maximum of 26,500 user-days is presented in table III-5.

Table III-4.—Incremental increase in average number of days with reduced river miles available for commercial rafting for take-out locations downstream of 32nd street Water years 1930-89

Take-out	*Gateway Park*	*CDOT[1] Property*	*High Bridge*	*Weaselskin Bridge*
Miles from 32nd Street	*3.6 miles*	*4.3 miles*	*5.4 miles*	*13.7 miles*
Threshold flow[2]	*300 cfs*	*350 cfs*	*550 cfs*	*1,500 cfs*
No Action Alternative (baseline condition)[3]				
May 27-31	*0*	*0*	*0*	*1*
June 1-30	*0*	*0*	*1*	*7*
July 1-31	*2*	*3*	*9*	*23*
August 1-31	*7*	*10*	*20*	*31*
September 1-5	*2*	*3*	*4*	*5*
1980 FES Plan[4]				
May 27-31	*0*	*0*	*0*	*0*
June 1-30	*1*	*1*	*2*	*4*
July 1-31	*5*	*7*	*9*	*3*
August 1-31	*13*	*15*	*9*	*0*
September 1-5	*2*	*2*	*1*	*0*
1995 Proposed Plan Phase I, Stage A[4]				
May 27-31	*0*	*0*	*0*	*0*
June 1-30	*0*	*1*	*0*	*1*
July 1-31	*1*	*1*	*2*	*1*
August 1-31	*3*	*4*	*2*	*0*
September 1-5	*1*	*0*	*0*	*0*
1995 Proposed Plan Phase I, Stage B[4]				
May 27-31	*0*	*0*	*0*	*0*
June 1-30	*0*	*1*	*2*	*5*
July 1-31	*5*	*8*	*10*	*3*
August 1-31	*13*	*15*	*9*	*0*
September 1-5	*2*	*1*	*1*	*0*
1995 Proposed Plan Phase II[4]				
May 27-31	*0*	*0*	*0*	*0*
June 1-30	*0*	*1*	*3*	*5*
July 1-31	*5*	*8*	*10*	*4*
August 1-31	*14*	*15*	*9*	*0*
September 1-5	*2*	*2*	*1*	*0*

Table III-4.—Incremental increase in average number of days with reduced river miles available for commercial rafting for take-out locations downstream of 32nd street Water years 1930-89

Take-out	*Gateway Park*	*CDOT[1] Property*	*High Bridge*	*Weaselskin Bridge*

[1] Colorado Department of Transportation.
[2] Threshold flow is the value at which trips past the indicated take-out location cease.
[3] Lost user-days due to naturally occurring low streamflow conditions.
[4] Incremental increase in number of days above lost user days for the No Action Alternative (baseline condition).

(Page III-87 - III-90)

<u>San Juan River</u>

Flows in the Animas and La Plata Rivers would continue to fluctuate as a result of agricultural and M&I diversions and other approved water uses or the natural variation in runoff during varying hydrologic periods.

However, the San Juan RIP, developed for federally listed native fish species, requires releases from Navajo Reservoir to mimic the natural hydrograph for a wide range of flow conditions during the 7-year research study. Consequently, it is anticipated that the future streamflows on the San Juan River will mimic the natural hydrograph. The existing streamflows on the San Juan River are not natural flows because of Navajo Reservoir operations and other depletions in the San Juan River Basin. This anticipated change in flow regime as a result of the San Juan RIP, irrespective of the ALP Project, will affect river recreation on the potentially affected reach of the San Juan River, described above.

The effect of the change in flows can be illustrated by comparing the historical flow regime (pre-Navajo Dam) with the present flow regime (current Navajo Dam operations). An analysis of historical and present flow regimes for the San Juan River measured at Bluff, Utah, has been conducted for representative wet, average, and dry years by the Service (1996). For wet years (1938 and 1949), the comparison shows the two hydrographs are essentially the same shape, but the historical flows are significantly higher in April, May, and June and slightly higher in March and July. For average years (1936 and 1945), the hydrograph shows the present peak flow is significantly less than the historical, but the crest of the present hydrograph extends over a greater period of time. Also, for average years, the historical flows compared to the present flows are higher in March through May but lower in June (1936). For dry years (1946 and 1951), the shape of the hydrograph and month in which the peak occurs are generally the same. However, the rising limb of the hydrograph in the spring historically began in March compared to the present beginning point in May. The historical flows in dry years are greater in April compared to the present flows. But the historical flows for dry years are less than the present flows in May and June. A comparison of these hydrographs is shown in the Hydrology Appendix included in the 1996 Biological Opinion (Attachment III).

The specific impacts on river recreation have not been determined, but the effects of returning the flows to the natural hydrograph would be varied. For example, average and dry years would experience increased flows for a greater period of time and potentially longer periods available to rafters compared to present conditions. Conversely, the peak flows for dry years would be reduced, potentially reducing the quality of the rafting experience. (Page III-94)

3.12 SOCIOECONOMICS

3.12.1 Introduction

This section addresses potential socioeconomic impacts that could result from actions associated with Refined Alternatives 4 and 6 and the No Action Alternative. Section 3.12.2 defines the Evaluation Methodology and significance criteria used for determining impacts, Section 3.12.3 describes the affected environment, and Section 3.12.4 identifies potential impacts and mitigation measures that would serve to reduce or eliminate anticipated impacts.

3.12.2 Evaluation Methodology

This section discusses the methodology used to determine potential impacts that could result from Refined Alternatives 4 and 6. Also discussed are specific criteria that were used to determine the significance of the impacts identified.

3.12.2.1 Methodology

The socioeconomic analysis presented in this section discusses potential direct, indirect, and induced impacts that could occur as a result of the project. The analysis utilized a computer-based modeling program called IMPLAN Professional (Version 2.0). Through the model, construction cost, operations, and revenue stream data are inputted to calculate indirect and induced effects; this then translates to gross revenues attributable to a particular Standard Industrial Classification (SIC) code. To measure these effects in terms of their significance, revenue generated as a result of the project was compared to the base value-added data resident within IMPLAN for each county that could be affected. All values are presented in 1999 dollars and all costs and revenues are considered to have occurred in 1999. IMPLAN modeling runs can be found in Technical Appendix 6, IMPLAN Analysis.

To determine the total value-added data for all industries on a per-county, basis Total Value Added data were used as a base case for measurement. The Total Value Added data were obtained from the Output, Value Added, and Employment report that is part of the IMPLAN data for each county. Total Value Added is a measurement of the value added to intermediate goods and services. It is equal to the total of employee compensation, proprietor income, other property income, and indirect business taxes. Total Value Added was chosen as the base case because it is an accurate measurement of wealth or benefit experienced in a county that is associated with all industries in the county economy. **Table 3.12-1** provides the base case valued-added data for the three counties.

Table 3.12-1
Base Case Value-Added Data for La Plata, Montezuma, and San Juan Counties

County	Total Value Added for All Industries (1999 Dollars)	Total Labor Force for All Industry Sector (1997 Data)
La Plata County	$1,170,994,000	23,978
Montezuma County	$441,667,900	11,137
San Juan County	$2,492,946,500	32,022

3.12.2.1.1 Structural Components

Construction, operation, and maintenance costs for each structural component were estimated. In order to run the IMPLAN models, each structural component was assigned an IMPLAN industry sector. The IMPLAN models were run on the assumption that all project construction, operations, and maintenance would be applied to a single-year event as an annual average cost. This simplification of the methodology was made because there is a high level of uncertainty and speculation regarding the temporal aspect of project construction, operation, and maintenance.

3.12.2.1.2 Non-Structural Component

The socioeconomic analysis conducted to determine impacts to La Plata and Montezuma counties considered the potential reduction of farm income, both in terms of direct loss of county revenues in general and to the agricultural sector in particular, that would result from transitioning from irrigated to dry land farming or placing the land into an approved conservation program. Information developed in the agricultural resources analysis was used to determine these effects.

3.12.2.1.3 Water End Uses

The analysis of potential impacts of non-binding water end uses under Refined Alternative 4 considered (1) the annual revenue stream generated by the sale of water from Ridges Basin Reservoir and (2) the socioeconomic benefits that would accrue to each county as a result of increased job and revenue resulting from development associated with the non-binding end uses of Colorado Ute Tribal water. The same end use development impacts would occur under Refined Alternative 6; however, the annual revenue stream generated by the sale of water under Refined Alternative 6 was not determined.

3.12.2.2 Significance Criteria

Impacts were considered significant if implementation of the project would result in a 10 percent or %
greater change in: %

- ❑ Direct, indirect, and induced gross sales revenues of a county;
- ❑ The number of jobs within a county;
- ❑ Revenue to the commercial rafting industry or would reduce the number of commercial rafting companies in La Plata County;
- ❑ Total county tourism receipts; or
- ❑ County agricultural crops sales.

3.12.3 Affected Environment

The sections below discuss the existing socioeconomic conditions in the areas potentially affected by Refined Alternatives 4 and 6. Because the actions that may eventually take place under the No Action Alternative are unknown, it is not possible to determine the specific affected environment for this alternative. However, many of the eventual actions that may occur as a result of the No Action Alternative would likely take place within the same area as that of Refined Alternative 4 and 6.

3.12.3.1 La Plata County, Colorado

3.12.3.1.1 Location and Area

Located in the southwestern part of Colorado, La Plata County is 1,081,616 acres in total area of which 17.8 percent is tribal reservation land (183,874 acres), 41.1 percent federal land (444,544 acres), and 41.1 percent private land (444,544 acres).

3.12.3.1.2 Population

The U.S. Census Bureau estimates the current population of La Plata County to be 40,413. During the 1990s, the annual population growth rate in La Plata County averaged 2.49 percent, about 2.5 times the national average of 1.01 percent over the same period. Between the years 1990 and 1998, La Plata County had the 17th fastest-growing population in Colorado and ranked 522nd in the nation for population growth.

Between 1993 and 1997, La Plata County grew by an annual average of three percent, with the most rapid growth rate occurring in Bayfield and unincorporated areas of the county. The town of Bayfield saw seven percent average annual growth during those years. The City of Durango grew by two percent annually. Durango is currently faced with several service and infrastructure issues, including accommodating visitor and residential growth within the city limits, improving traffic circulation, and providing water and sewer services in potential service areas outside of the city. Ignacio has had a moderate growth rate (two percent annually). With the advent of casino gambling on the Southern Ute Reservation and other expanding tribal enterprises, increased growth is anticipated (Region 9 Economic Development District, 1998). Current population estimates are Durango, 14,434; Bayfield, 1,950; and Ignacio, 965.

3.12.3.1.3 Tourism

Tourism in La Plata County centers on the area's natural environment. During the winter months, skiing at Purgatory Resort near Durango is a major attraction. Summertime is La Plata County's busiest season for tourism. Recreational activities include white-water rafting, kayaking, golf, fishing, hiking, rock climbing, and mountain biking. The Iron Horse Bicycle Classic is a popular summertime draw for mountain bikers. The Durango to Silverton Narrow Gauge Railroad is a major tourist attraction. Daily trips between the cities of Durango and Silverton allow tourists to view the beauty and history of southern Colorado. Thousands of tourists per year travel to Mesa Verde National Park to view cliff dwellings where 4,000 ancestral Puebloans lived between 600 A.D. to 1300 A.D. Additionally, historical interest associated with early mining communities draws numerous visitors.

3.12.3.1.4 Agriculture

The 1997 Census of Agriculture showed that in La Plata County, there were 580,135 acres of farmland countywide. About 22.9 percent of these farmlands are considered to have prime farmland soils. Of the 781 farms in 1997, 681 were involved in crop production. Principal crops grown are pasture, oats, grass hay, wheat, and alfalfa. In 1996, the agricultural sector employed 0.8 percent of the total workforce and payroll earnings for this sector were $5,696,000, representing about 1 percent of the county's total earnings, while employing about 4 percent of the workforce (USDA 1997).

3.12.3.1.5 Demographics

The most reliable data that describe the ethnic composition for the three counties are from the 1990 Census. La Plata and Montezuma Counties have fairly similar populations in terms of ethnic composition. Caucasians are by far the most populous group for the two counties, although Montezuma County has about 5 percent fewer Caucasians and about 5 percent more Native Americans than La Plata County. Caucasians are still the most populous group in San Juan County; however, Native Americans are a much greater proportion of the population than in the other two counties, reflecting the fact that a greater proportion of this county's land is composed of Indian reservation land.

3.12.3.1.6 Jobs and Income

Historically, La Plata County developed as a result of traditional western commodities such as minerals, cattle, and timber. The discovery and development of energy resources; the establishment of Fort Lewis College as a four-year college; the development of Purgatory Ski Area; the development of the Durango-Silverton narrow-gauge rail line as a visitor attraction; and the emergence of tourism and resort development have diversified La Plata County's economy. Direct base income from tourism was estimated at $122.5 million in 1996 (Region 9 Economic Development District 1998).

Durango is the county seat and largest city in La Plata County, with an estimated 1998 population of 14,434. The Durango area has major employers in education, medical services, government, groceries, and tourism (Colorado Department of Labor and Employment 1999). The top area employers include (in descending order by the number of employees) the Southern Ute Indian Tribe, the Mercy Medical Center, Fort Lewis College, 9-R School District, the federal government, and the Tammaron Sheraton Resort (City of Durango 1999).

In 1996, La Plata County had a per capita personal income of $22,012 and ranked twentieth in the state. The county per capita personal income was 85 percent of the state average of $25,470 and 91 percent of the national average of $24,169. Unemployment in La Plata County decreased from 6.3 percent in 1990 to 4.4 percent in 1996. The economy supports a low unemployment rate, although seasonal fluctuations are generally seen in the winter months.

3.12.3.1.7 Retail Sales

La Plata County has experienced strong retail sales, totaling more than $769 million in 1997. **Table 3.12-2** compares the sales amounts and proportions of the various retail sales sectors in 1997. Food stores (13 percent) and auto/service stations (12 percent) had the strongest sales, followed closely by services other than lodging (12 percent) and miscellaneous retail stores (11 percent).

The ratio of earnings to employment indicate which sectors are high earning sectors, on average, compared to those sectors that generate lower earnings. The service sector accounts for 36 percent of earnings and 34 percent of jobs. Wholesale/retail represents 24 percent of the county's employment and only 18 percent of the earnings, reflecting a relatively low-paying sector. Government sector jobs (12 percent) are fairly well-paying, but may be decreasing because of a downsizing trend in state and federal agencies (Colorado Information Services 1998). %

Table 3.12-2
Comparison of Retail Sales Sectors in La Plata County in 1997

Industry	Sales	Percent of Total
Agriculture, Forestry and Fisheries	$5,803,000	1
Mining	$4,059,000	1
Contract Construction	$46,542,000	6
Manufacturing	$16,654,000	2
Transportation and Public Utilities	$49,400,000	6
Wholesale Trade Retail Sales	$35,686,000	8
Retail, Building Materials and Farm Equipment	$60,686,000	8
Retail, General	$29,842,000	3.9
Retail, Food Stores	$98,716,000	13
Retail, Auto and Service Stations	$94,148,000	12
Retail, Apparel and Accessories Stores	$16,007,000	2
Retail, Home Furnishing Stores	$24,486,000	3
Retail, Eating and Drinking Places	$55,556,000	7
Retail, Miscellaneous Stores	$80,863,000	11
Finance, Insurance and Real Estate	$7,758,000	1
Hotels and Other Lodging Places	$49,549,000	6
Services Other than Lodging	$89,795,000	12
Other Industries	$3,991,000	0.52
Total Retail Sales	$769,613,000	100

Source: Region 9 Economic Development District 1998

The top nine commercial contributors to the county tax base are primarily associated with oil and natural gas production. In 1999, the total assessed value for all nonresidential establishments was $893,591,830 and $232,048,900 in residential taxes were collected (La Plata County Assessor's Office 1999).

3.12.3.2 Montezuma County, Colorado

3.12.3.2.1 Location and Area

Located in the southwestern part of Colorado, Montezuma County is 1,333,888 acres in area, of which 33 percent is Ute Mountain Ute Tribal land, 37 percent federal and state land, and 30 percent private land.

3.12.3.2.2 Population

During the 1990s, the average annual population growth rate in Montezuma County was 1.94 percent, almost twice the national average of 1.01 percent. Between the years 1990 and 1998, this county had the 22nd fastest growing population in Colorado and ranked 857th in the nation for population growth. The U.S. Census Bureau estimates the current population to be 22,456, which is almost double the 1970 population of 12,952. The growth rate has been moderately high for these years, but the county remains somewhat rural in character. Overall, population growth has been relatively stable from 1970 through

1999. Exceptions to this were in the year 1973 and the period between 1985 through 1989, when the growth rate was slower.

For the county as a whole, population increased about 3 percent annually between 1990 and 2000; however, slower growth is expected between 2000 and 2020, based on the assumption that the rate of immigration would decrease during those years and the national population growth rate is expected to slow somewhat.

3.12.3.2.3 Tourism

Tourism in Montezuma County revolves primarily around Native American heritage, particularly Hovenweep National Monument and Mesa Verde National Park, which draws approximately 700,000 visitors annually. Jackson Gulch Reservoir and McPhee Reservoir attract tourists interested in boating, fishing, hunting, and camping. These reservoirs are stocked yearly with trout. Deer and elk are also supported by the surrounding habitat. The Conquistador Golf Course and the Chicken Creek Cross Country Ski Trail also attract visitors. Tourism is expected to increase with the completion of the Native American Culture Park.

3.12.3.2.4 Agriculture

The 1997 Census of Agriculture showed that in Montezuma County, there were 935,000 acres of farmland countywide. About 22 percent of the land in the county would be considered prime farmland if an adequate and dependable supply of irrigation water were available. Of the 718 farms in 1997, 572 were irrigated (about 4.6 percent of total county land). Market value of production was $21,874,000. Crop production accounted for $12,913,000 and livestock $8,961,000. Agricultural products and services provided 11 percent (1,521) of the county's jobs and 1 percent ($1,972,000) of county earnings. Pasture, grass hay, wheat, dry beans, and alfalfa were the principal crops grown. Of the 333 principal farm operators in 1996, 291 were employed for 200 or more days off the farm (USDA 1997).

3.12.3.2.5 Jobs and Income

In 1996, Montezuma County had a per capita personal income of $17,546. This per capita personal income ranked 40th in the state and was 68 percent of the state average of $25,740 and 72 percent of the national average of $24,169. The 1990s have seen relatively high unemployment rates in Montezuma County. In 1997, the county had an average unemployment rate of 6.7 percent, slightly down from the 1996 rate of 6.9 percent. Statewide unemployment was 3.3 percent in the same year. Unemployment in Montezuma County decreased from 6.2 percent in 1996 to 4.1 percent in 1999 (U.S. Department of Labor Statistics 1999). Per capita income in the region increased from $10,176 in 1989 to $15,716 in 1996 (U.S. Census Bureau 1990b).

The service sector accounts for 31 percent of jobs and 25 percent of wages; retail represents 22 percent of the county's employment and only 17 percent of the earnings; both sectors are relatively low-paying. Government sector jobs account for 13 percent of total employment and are fairly well paid at an average of $23,011 per year, but may be decreasing because of a downsizing trend in state and federal agencies. The highest paid jobs are in the mining industry at an average wage of $42,400 per year, but account for only 1 percent of total employment and 2 percent of total income.

3.12.3.2.6 Retail Sales

Montezuma County, particularly Cortez, serves as a retail center for neighboring Dolores County as well as tribal populations (i.e., Ute Mountain Utes and Navajos). The strength of the Montezuma County economy is reflected in the steady growth of retail sales, totaling more than $343 million in 1997.

Table 3.12-3 compares the sales amounts and proportions of the various retail sales sectors in 1997. Automobile/service stations (17 percent) and food stores (15 percent) had the strongest sales, followed by miscellaneous retail stores (11 percent) and general retail (10 percent).

Table 3.12-3
Comparison of Retail Sales Sectors in Montezuma County (1997)

	Industry	**Sales**	**Percent of Total**
%	Agriculture, Forestry and Fisheries	$4,439,000	1.3
%	Mining	$5,139,000	1.5
%	Contract Construction	$11,590,000	3.4
%	Manufacturing	$13,730,000	4.0
%	Transportation and Public Utilities	$28,677,000	8.4
%	Wholesale Trade Retail Sales	$10,937,000	3.2
%	Retail, Building Materials and Farm Equipment	$23,730,000	6.9
	Retail, General	$34,996,000	10.2
%	Retail, Food Stores	$49,791,000	14.5
%	Retail, Auto and Service Stations	$58,317,000	17.0
%	Retail, Apparel and Accessories Stores	$1,684,000	0.5
%	Retail, Home Furnishing Stores	$8,223,000	2.4
%	Retail, Eating and Drinking Places	$17,964,000	5.2
%	Retail, Miscellaneous Stores	$36,203,000	10.5
%	Hotels and Other Lodging Places	$10,555,000	3.1
%	Services Other than Lodging	$25,287,000	7.4
	Other Industries	$2,084,000	0.6
	Total Retail Sales	**$343,256,000**	**100**

Many of the top 10 commercial county tax base contributors are associated with oil and gas production and power generation. In 1999, the total assessed value for all nonresidential establishments was $138,450,510; the total assessed value for residential property was $49,307,940; and the total tax base for the county was $187,758,450 (Montezuma County Assessor's Office 1999).

3.12.3.3 San Juan County, New Mexico

3.12.3.3.1 Location and Area

Located in the northwest corner of New Mexico, San Juan County has an area of 3,530,240 acres of which 56.1 percent is reservation land, 36 percent public land, and 7.9 percent private land. Of the total land in the county, 53.7 percent is considered agricultural, of which a large portion is on reservations.

3.12.3.3.2 Population

San Juan County has experienced moderate population growth between 1970 and 1999. Between 1986 and 1992, San Juan County's population did not grow, partly due to the national recession at that time. For the county as a whole, the population growth rate has been about 3 percent annually between 1990 and 2000.

3.12.3.3.3 Tourism

Tourism in San Juan County is most active during the summer months. Fishing, water skiing, sailing, boating, and parasailing are available on the San Juan River and on a number of lakes including Navajo Reservoir. Tourists can also ride mountain bikes, hike, backpack, ride horses, and hunt for deer, elk, waterfowl, game birds, and mountain lions. Historic sites include Aztec Ruins National Monument, Salmon Ruins, Aztec Museum, and Pioneer Village.

3.12.3.3.4 Agriculture

The 1997 agricultural census of San Juan County estimated there were approximately 660 farms in the county totaling about 1,857,223 acres of land, including crop production and range operations. About 85 percent of these farms were under 179 acres in size. Total cropland amounted to 84,000 acres of which 68,500 acres were irrigated and about 61,000 were harvested. Market value of agricultural crops sold amounted to $38,193,000. San Juan County ranks eighth in agricultural production among counties within New Mexico with a cash receipt from all farm commodities of $59,121,000 (New Mexico Economic Development Department 1997). Agriculture makes up about 0.1 percent of county gross % receipts. Mining and wholesale and retail trade and services are the predominant industries.

3.12.3.3.5 Jobs and Income

In 1997, San Juan County had an annual per capita personal income of $14,670 and an annual average wage of $24,195. San Juan County ranks 14th of 33 counties in per capita personal income and 4th in average wage. The county unemployment rate as of March 1998 was 8.65 percent. This rate, though high, has been falling steadily over the last several years. The 1997 Economic Census shows the top five industries provided 85 percent of the county's jobs. Approximately 32,022 people were employed.

The top 10 commercial contributors to the county tax base are all associated with mineral extraction and power production. Taxes collected for all nonresidential establishments (commercial, industrial, etc.) totaled $29,703,699 in 1999 (San Juan County Assessor's Office 1999). The residential taxes collected in 1999 totaled $11,422,626.

3.12.3.3.6 Retail Sales

San Juan County serves as the major retail hub for the neighboring counties in both New Mexico and Colorado. While largely dependent on the oil and gas sectors, San Juan County is developing a strong service base.

Table 3.12-4 shows the gross receipts of retail sales in 1996.

Table 3.12-4
Comparison of Retail Sales Sectors in San Juan County, New Mexico

Industry	Sales	Percent of Total
Agriculture	$2,217,000	1.0
Mining	$525,663,000	23.8
Construction	$249,819,000	11.3
Manufacturing	$94,341,000	4.2
Transportation, Communication, and Utilities	$101,593,000	4.6
Wholesale Trade	$446,578,000	20.0
Retail Trade	$783,113,000	35.0
Total Retail Sales	**$2,203,324,000**	**100**

3.12.3.4 Indian Reservations

Much of the land within La Plata, Montezuma, and San Juan Counties is comprised of Indian reservation lands. The following is a description of the Colorado Ute Tribes and Navajo Nation land in Colorado and New Mexico.

3.12.3.4.1 Ute Mountain Ute Indian Reservation

Currently, the homelands for the Ute Mountain Ute Tribe total more than 597,000 acres in southwestern Colorado, southeastern Utah, and northern New Mexico. The tribal lands lie on the Colorado Plateau, a high desert area with deep canyons carved through the mesas. Ute Mountain Ute Tribal Headquarters are in Towaoc, which lies southeast of Cortez in Montezuma County. Tribal enrollment in 1997 was 1,943, with the majority of the members living on the reservation in Towaoc (population 1,343 in 1998) and the White Mesa community (population 289 in 1998). The tribal census shows that 73 percent of the members are 34 years of age or younger. Most recent employment analyses indicate a potential resident employable population of 813 people, of whom 498 are employed, leaving a current unemployment rate of 39 percent.

The Colorado Ute Water Rights Settlement Act of 1988 mandated within the Dolores Project (McPhee Reservoir), brought drinking and irrigation water to the reservation and expanded farm and ranching capabilities. Other tribal resources include income from oil and gas wells and tribal enterprises that revolve around tourism including a gambling casino, an RV park, an archaeological park, and a pottery factory. The tribe employs over 900 people in its enterprises and is a major contributor to the regional economy.

3.12.3.4.2 Southern Ute Indian Reservation

The Southern Ute Reservation encompasses an area of more than 750,000 acres in La Plata and Archuleta Counties. Tribal headquarters are located adjacent to the town of Ignacio. The governing body is the Southern Ute Indian Tribal Council, which consists of a chairman and six council members. The tribal enrollment in 1997 was 1,330 with the majority of the members living on the reservation in La Plata County. The tribal census shows that 38 percent of the membership are under 20 years of age and 76 percent are under 40 years of age.

Natural resources on the reservation include extensive gas reserves, coal, timber, and water for agriculture. These resources provide the basis for the establishment of a diversified tribal economic base. Tribal energy resources in the form of natural gas have played the largest role in the reservation economy over the past decade (93 percent of tribal revenues in 1994 came from energy resource development).

The reservation's proximity to Durango and other tourist destinations in southwestern Colorado allows for tourism development. The reservation land includes the Navajo State Park, Lake Capote, and the Sky Ute Casino and Motel. The tribe sponsors casino gaming, cultural tours, fishing, hunting, and the Tribal Cultural Center and Museum. These enterprises play a role in diversifying the overall economy. The Southern Ute Tribe employs more than a thousand people and is a significant contributor to the regional economy.

3.12.3.4.3 Navajo Tribal Lands

The Navajo Nation comprises 26,897 square miles within the states of Arizona, New Mexico, and Utah, making it the largest Indian Reservation in the United States. While there are approximately 232,723 members of the Navajo Tribe, the population of the Navajo Nation is approximately 170,259, of which 163,555 are Native Americans. The Navajos have a high level of poverty with 49 percent having incomes below the poverty level, and high unemployment rates averaging from 42 percent (U.S. Census Bureau 1995) and 28 percent (Navajo Nation Division of Economic Development 1996).

3.12.4 Environmental Consequences and Mitigation

The following sections discuss potential socioeconomic impacts of Refined Alternatives 4 and 6. Impacts of the No Action Alternative are also discussed as presented in the 1996 FSFES. No mitigation measures are proposed for socioeconomic impacts; however, some socioeconomic impacts would be lessened with the implementation of mitigation proposed for recreation and agricultural resource impacts.

3.12.4.1 Refined Alternative 4

3.12.4.1.1 Structural Component

Refined Alternative 4 Socioeconomic Impact 1 - Less than Significant: Decreased commercial rafting on the Animas River would result in loss of revenue.

Commercial whitewater use on the Animas River for 1999 had a total direct economic impact of approximately $1,330,800 ($1,308,000 for commercial rafters and $22,800 for commercial users in inflatable kayaks). Using an economic multiplier of 1.64 for the region, the total direct and indirect impact of commercial rafting to the region was $2,182,512 for the 1999 commercial rafting season. Estimated county-wide direct base income from tourism receipts in 1999 dollars was $130,000,000.

Assuming commercial rafting contributes to tourism receipts, this represents approximately 1 percent of the tourism receipts. There would be an annual average of 2,183 lost user-days due to pumping from the Animas River associated with Ridges Basin Reservoir operation equating to $67,675, or a 4.5 percent reduction to commercial rafters and a .01 percent reduction to county tourism receipts.

While there were an estimated 42,640 to 65,940 private user days in 1999 and an estimated 5,000 participants and spectators for organized events, direct and indirect economic impacts cannot be determined at this time because information is not available on such factors as average yearly expenditures by private users for kayak equipment, supplies, shuttling costs and average expenditures by participants and spectators at the various organized events. These expenditures and the resulting direct, indirect, and induced revenues to the county are expected to be lower on a user-day basis than commercial rafting revenue and as such, limited anticipated reductions in private boater use levels would not likely be significant.

While fishing on the Animas River is a popular recreational activity that would be potentially impacted by project development, the economic impact has not been analyzed because there is insufficient information on the average number of users, average daily expenditures, and the like. While four main fishing guide services located in Durango currently take anglers on the Animas River, the Animas River is not considered a significant part of their business when compared to business on the San Juan River below Navajo Reservoir. On the Southern Ute Tribe section of the Animas River, 826 fishing permits sold to non-tribal members have brought income of $15,385 to the tribe.

Mitigation for Refined Alternative 4 Socioeconomic Impact 1: No mitigation is proposed.

Refined Alternative 4 Socioeconomic Impact 2 - Beneficial: Construction of Ridges Basin Reservoir would increase gross sales revenues and create jobs in La Plata County.

Total construction costs of Ridges Basin Dam, the Durango pumping plant, inlet conduit, pipeline relocations, roads, and mitigation (not including cultural resources and interest) are estimated at $202.8 million. Assuming an average annual cost of $33.63 million, expenditures during construction would provide an annual average gross direct, indirect, and induced increase in La Plata County revenue of $22.9 million during the 7-year construction period. Assuming that all the construction costs would be captured in La Plata County, this revenue would represent an approximately 1.96 percent increase over the projected 1999 county gross sales receipts of $1.2 billion. Additionally, it is estimated that 606 jobs would be created, representing a 2.5 percent increase to the current labor force. These jobs would be either directly related to construction itself or would be a result of additive monies flowing into the local economy creating new jobs resulting from the construction of Ridges Basin. **Table 3.12-5** shows the direct, indirect, and induced impacts.

Table 3.12-5
Economic Impacts for La Plata County Resulting from Construction of Structural Facilities for Ridges Basin Reservoir

Impact	Direct	Indirect	Induced	Total
Value Added (1999 Dollars)	$13,109,654	$ 4,372,041	$5,467,335	$22,949,030
Employment Impacts (Jobs)	348.16	127.1	131.0	606.23

Refined Alternative 4 Socioeconomic Impact 3 - Beneficial: Construction of the NNMP would increase gross sales revenue and create jobs in San Juan County, New Mexico.

Total construction costs of the NNMP are estimated at $24 million. Assuming an average annual cost of $12 million, expenditures during construction would provide an annual average gross direct, indirect and induced increase in San Juan County revenue of $9,865,863 during the 2-year construction period. Assuming that all the construction costs would be captured in San Juan County, this revenue would represent an approximate 0.04 percent increase over the projected 1999 county gross sales receipts of $2.493 billion. Additionally, it is estimated that 80.5 jobs would be created, representing a 0.25 percent increase to the current labor force. These jobs would be either directly related to construction itself or would be a result of additive monies flowing into the local economy creating new jobs. **Table 3.12-6** %
shows the direct, indirect, and induced impacts. **Table 3.12-7** indicates an estimated change in San Juan %
County's total value added per industry resulting from the construction of NNMP. It should be noted that %
all impacts referenced here are short term in nature. %

Table 3.12-6 %
Economic Impacts for La Plata County Resulting from Construction of the Navajo Nation Municipal Pipeline

	Direct	Indirect	Induced	Total
Value Added Impacts (1999 Dollars)	$6,919,074	$2,235,057	$711,733	$9,865,863
Employment Impacts (Jobs)	19.0	42.7	18.9	80.6

Table 3.12-7 %
Top 10 Industries Impacted in San Juan County from Construction of the Navajo Nation Municipal Pipeline

Industry	Total Value Added Impact (1999 Dollars)	Total Employment Impact
1. Pipelines, Except Natural Gas	$7,277,768	20.0
2. Maintenance and Repair, Other Facilities	$689,902	20.2
3. Electric Services	$347,054	1.1
4. Banking	$156,560	2.0
5. Wholesale Trade	$119,966	2.2
6. Real Estate	$100,514	0.9
7. Automobile Repair and Services	$94,185	2.7
8. Natural Gas and Crude Petroleum	$90,786	0.6
9. Owner Occupied Dwellings	$74,023	0
10. Miscellaneous Repair Shops	$59,494	2.0

Refined Alternative 4 Socioeconomic Impact 4 - Beneficial: Reservoir-based recreation would generate revenue in La Plata County.

The current recreational value of $15,000 related to hunting in the Ridges Basin would be replaced by the value associated with the reservoir. The annual recreation visitation associated with the reservoir has been estimated at 218,400 annual recreation days, with average daily expenditures estimated at $26.19[3] per visitor. The direct annual economic impact would be $5,720,000, showing a net increase to recreational value of $5,705,000. Assuming a multiplier of 1.64, the direct, indirect and induced benefits to the county would be $9,356,200.

3.12.4.1.2 Non-Structural Component

Refined Alternative 4 Socioeconomic Impact 5 - Less than Significant: Conversion of fee simple farmland to Indian Trust land would reduce tax revenue within La Plata and Montezuma Counties as these lands would be removed from tax roles.

Lands purchased and converted to Indian Trust would cease to generate tax revenue for the counties as these trust lands would be exempt from county taxes. Total annual losses to county revenues (using current values and mill levies) would be approximately $41,248 in La Plata County and $32,175 in Montezuma County under Refined Alternative 4. Currently, a compact is in place through which the Colorado Southern Ute Tribe provides a payment to the affected county equivalent to the tax revenue that the same land held in fee title would provide. A more detailed analysis of conversion of fee simple farmland to Indian trust lands is provided in Attachment D.

Mitigation for Refined Alternative 4 Socioeconomic Impact 5: Promote compacts between the Colorado Ute Tribes and the counties that would result in a Tribal payment to the counties for lands converted to Indian Trust in lieu of forgone tax revenue.

3.12.4.1.3 Non-Binding End Uses and Water Conveyance

Refined Alternative 4 Socioeconomic Impact 6 - Beneficial: Expenditures during the development of potential end uses and revenue generated during their operation would increase gross sales revenues and create jobs for the counties in which they are located.

Expenditures during construction of the non-binding end uses and conveyance systems would create jobs and generate revenue in the three counties in which they would be located. Operation of these end uses would also create jobs and generate revenue. Construction costs and estimated annual operating revenues are shown in **Table 3.12-8**. Potential job and revenue generation were not quantified for these non-binding end uses, but would be minimal in comparison to gross county sales receipts.

Refined Alternative 4 Socioeconomic Impact 7 - Beneficial: Sales of water developed by the project could generate revenue for the Colorado Ute Tribes.

Development of M&I water supplies for the Colorado Ute Tribes would enable the tribes to make use of the water through sales to generate revenue.

[3] Based on a survey of revenues generated from regional reservoir recreation.

Table 3.12-8
Estimated Construction Costs and Revenue Generation Resulting from Non-Binding End Uses

End Use	Estimated Construction Cost (1999 Dollars)	Estimated Annual Revenue Generation (1999 Dollars)
Ridges Basin Hotel	$19,872,000	$16,337,800
Ridges Basin Golf Course (includes one year of O&M)	$5,200,000	$1,226,500
Ridges Basin Casino	$3,680,000	$30,481,300
Mancos Canyon Hotel	$19,872,000	$13,037,800
Mancos Canyon Golf Course (includes one year of O&M)	$5,200,000	$858,900
La Plata Basin Hotel	$19,872,000	$10,896,200
La Plata Basin Golf Course (includes one year of O&M)	$5,200,000	$660,900
Dude Ranch	$2,268,000	$2,019,600
1,000 Megawatt Coal-Fired Power Plant, Ute Mountain Ute Indian Reservation	$900,000,000	$140,160,000
200 Megawatt Natural Gas-Fired Power Plant, Ute Mountain Ute Indian Reservation	$84,000,000	$31,536,000
Southern Ute Housing Developments (600 units)	$64,800,000	NA
Ute Mountain Ute Housing Development (400 units)	$43,200,000	NA

Refined Alternative 4 Socioeconomic Impact 8 - Beneficial: Increased availability of reliable water supplies and revenue generated from the sale of project water would allow for on-reservation development of potable water, new and/or improved housing, improved health and medical services, and other beneficial development.

The tribes would benefit from the project through available and reliable water supplies and income from the sale of water which would improve the living conditions and the health and welfare of tribal members as a result of having new and improved housing, job opportunities, and wage increases from development of water end uses.

3.12.4.2 Refined Alternative 6

3.12.4.2.1 Structural Components

Refined Alternative 6 Socioeconomic Impact 1 - Beneficial: Construction expenditures associated with raising Lemon Dam for additional M&I water would increase gross sales revenues and create jobs in La Plata County.

The estimated construction cost associated with raising Lemon Dam and Reservoir is $34.6 million. Assuming that construction would occur over a 2.5 year period, average annual construction expenditures would be $11.64 million. Project construction (2.5 years) would result in an annual total value added economic impact of $8,471,743 including direct, indirect and induced impacts (Table 3.12-9). This represents an 0.8 percent increase to the pre-construction value added for the county's total annual revenue of $1.17 billion and is considered to be less than significant. Project construction would result in the creation (annually throughout a 2.5-year period) of 224 new jobs, which represents a 1.0 percent increase to the 1997 total work force (23,978) and is considered to be less than significant.

%

Table 3.12-9 Economic Impacts for La Plata County for Construction of Structural Modifications to Lemon Reservoir				
	Direct	**Indirect**	**Induced**	**Total**
% Value Added Impacts (1999 Dollars)	$4,839,490	$1,613,960	$2,018,293	$8,471,743
% Employment Impacts (Jobs)	129	47	48	224

Refined Alternative 6 Socioeconomic Impact 2 - Beneficial: Construction of the NNMP would generate revenue and create jobs in San Juan County.

This impact is the same as Refined Alternative 4 Socioeconomic Impact 3 for Refined Alternative 4.

3.12.4.2.2 Non-Structural Component

Refined Alternative 6 Socioeconomic Impact 3 - Less than Significant: Purchase of irrigated agricultural production land to acquire adjudicated water rights and transfer those water rights to other uses would reduce county crop revenues and affect support and service industries.

As discussed in Section 3.10, Agriculture, 20,647 acres of irrigated land could be purchased in La Plata and Montezuma Counties. It was assumed that land purchased in the Animas and the Florida River Basins would remain in irrigated production, and would have no socioeconomic impacts, assuming they were purchased on a willing-buyer, willing-seller principal . The lands purchased on the Pine, Mancos, and La Plata River Basins and McElmo Creek Basin would have the irrigation water rights transferred to
% M&I uses, thus removing all irrigation from these particular lands. **Table 3.12-10** shows the estimated direct impacts to this lost or reduced value of crops sold per county.

%

Table 3.12-10 Estimated Changes in Agricultural Revenues by County					
	Acres Farmes		**Production Revenues**		
	Currently	**With Project**	**Currently**	**With Project**	**Percent Change**
La Plata County					
Total Land in Farms	580,135	575,135	$15,797,000	$14,560,024	(7.8)
Total Cropland	91,129	86,129	$4,948,000	$3,711,024	(7.4)
Irrigated Lands	71,855	61,070		($1,236,976)	(15.0)
Non-Irrigated Lands	19,274	25,059			30
Montezuma County					
Total Land in Farms	935,330	935,330	$21,874,000	$21,668,868	(1.6)
Total Cropland	102,915	102,915	$12,913,000	$12,707,868	(1.6)
Irrigated Lands	61,081	59,924		($205,132)	(1.9)
Non-Irrigated Lands	41,834	42,991			2.8

The total revenues for La Plata County was $1.2 billion. The reduced value of agricultural crop production in La Plata County would result in a reduction of $1,236,976 in total direct revenue to La Plata County ($1,336,836 of direct, indirect, and induced county revenue). This represents a 1.14 percent decrease in county revenue and is considered less than significant. This reduction would result in the a loss of 46.5 jobs, which represents a 0.19 percent decrease to the 1997 total labor force of 23,978 and is considered less than significant.

The reduced value of agricultural crop production in Montezuma County would result in a reduction of $189,240 direct, indirect and induced county revenue. This represents a 0.04 percent decrease in county revenue and is considered less than significant. This reduction would result in the loss of 6.6 jobs, which represents a 0.06 percent decrease to the 1997 total labor force of 11,137 and is considered less than significant.

Mitigation for Refined Alternative 6 Socioeconomic Impact 3: No mitigation is proposed.

Refined Alternative 6 Socioeconomic Impact 4 - Less than Significant: Conversion of fee simple farmland to Indian Trust land would reduce tax revenue within La Plata and Montezuma Counties as these lands would be removed from tax rolls.

Lands purchased and converted to Indian Trust would cease to generate tax revenue for the counties as these trust lands would be exempt from county taxes. Total annual losses to county revenues (using current values and mil levies) would be approximately $99,352 in La Plata County and $54,425 in Montezuma County under Refined Alternative 6. Currently, a compact is in place through which the Colorado Southern Ute Tribe provides a payment to the affected county equivalent to the tax revenue that the same land held in fee title would provide. A more detailed analysis of conversion of fee simple farmland to Indian trust land is included in Attachment D.

Mitigation for Refined Alternative 6 Socioeconomic Impact 4: Promote compacts between the Colorado Ute Tribes and the counties that would result in a Tribal payment to the counties for lands converted to Indian Trust in lieu of forgone tax revenue.

3.12.4.2.3 Water End Use and Delivery Systems

Refined Alternative 6 Socioeconomic Impact 5 - Beneficial: Expenditures during the development of potential end uses and revenue generated during their operation would increase gross sales revenues and create jobs for the counties in which they are located.

This impact would be the same as Refined Alternative 4 Socioeconomic Impact 6.

Refined Alternative 6 Socioeconomic Impact 5 - Beneficial: Sales of water developed by the project could generate revenue for the Colorado Ute Tribes.

This impact would be the same as Refined Alternative 4 Socioeconomic Impact 7. Note that Scenario 4 as discussed under Refined Alternative 4 Socioeconomic Impact 7 (Table 3.12-10) is based upon the construction cost of the structural components of Refined Alternative 4.

Refined Alternative 6 Socioeconomic Impact 6 - Beneficial: Increased availability of reliable water supplies and revenue generated from the sale of project water would allow for on-reservation development of potable water, new and/or improved housing, improved health and medical services, and other beneficial development.

This impact would be the same as Refined Alternative 4 Socioeconomic Impact 8.

3.12.4.3 No Action Alternative

The impacts identified below have been extracted from the 1996 FSFES.

3.12.4.3.1 Industry/Tourism

Under the No Action Alternative, it is anticipated that there would be no significant negative impacts to the study area in recreation and tourism. This portion of the economy would basically remain on the same course as was described in the Affected Environment discussion. (Page III-98)

3.12.4.3.2 Trade, Manufacturing and Mineral Resources

General.--No significant overall impacts are expected over the long-term to trade, manufacturing, or mineral resources, although some construction period benefits would not occur and Tribal enterprises could be affected (below). (Page III-107)

Tribal Mineral Resources.-One oil well and four gas wells that are non-producing and a high pressure gas line located on the southern Ute Indian Reservation would not be impacted by Southern Ute Reservoir. However, water necessary for future coal, gas, oil, and related energy development may not be available without the project.

3.12.4.3.3 Tribal Jobs and Income

General.-Assuming M&I water supplies for future growth would be developed through non-project means, a significant general impact could be the resulting loss of agriculture-related jobs and income, based on the discussion in the Agriculture section. (Page III-109)

Tribal.-The need to enhance the depressed social and economic conditions of the Ute Mountain Ute and Southern Ute Indian Reservations was addressed by congressional legislation. The 1988 Colorado Ute Indian Water Rights Settlement Act (Settlement Act) includes provisions that invoke the application of the Indian Self-Determination and Education Assistance Act in designing and constructing the project. Under current plans by both Ute Tribes, a tentative division of work has been reached for the construction of Phase I of the project. There are requirements in the self-determination act for using, to the greatest extent feasible, Indian people in opportunities for training and employment and preferences in the award of work to Indian-owned enterprises. Under the No-Action Alternative the congressional intent to assist the Ute Tribes in lowering unemployment would not be fulfilled.

An estimated 100 or more Tribal workers would not be employed as a result of not constructing the project, and current high unemployment rates would continue. In 1993, roughly 50 percent (477 people) of the southern Ute Indian Tribe labor force was unemployed, and about 30 percent (230 people) of the Ute Mountain Ute Tribal membership were seeking work. Project construction would be expected to reduce Tribal employment by between 5 and 10 percent.

The Ute Mountain Ute and Southern Ute Indian Tribes own and operate construction businesses. If the project is not constructed, potential revenue from construction could not be generated for the Tribes. Based on 1995 figures, an estimated 15 percent of the project construction employment would be unskilled labor. Gross income from unskilled labor wages is estimated to be $220,000 annually. Total *gross income potentially generated from project facility O&M employment wages could be about $405,000.*

3.12.4.3.4 Population

Under the No Action Alternative, the population in Durango would be 16,000 in the year 2020. The population of La Plata County, Colorado, would be approximately 65,000. In New Mexico, the population of Farmington in 2020 would be approximately 69,000. The population of San Juan County, New Mexico, would increase to approximately 126,000. These projections are not significantly changed by any of the alternative considered. (Page III-114)

3.13 LAND USE

3.13.1 Introduction

This section addresses potential impacts to land use that would result from actions associated with Refined Alternatives 4 and 6 and the No Action Alternative. Section 3.13.2 defines the Evaluation Methodology and significance criteria used for determining impacts, Section 3.13.3 describes the affected environment, and Section 3.13.4 identifies potential impacts and mitigation measures that would serve to reduce or eliminate anticipated impacts to land use.

The term “land use plans” as used herein includes all types of formally adopted documents for land use planning, zoning, and related regulatory requirements. Local general plans were included in the analysis, even though they are subject to future change. Proposed plans being actively pursued by officials of a potentially affected jurisdiction were also considered. The term “policies” includes formally adopted statements of land use policy as embodied in laws or regulations. It also includes proposals for action, such as the initiation of a planning process, or a formally adopted policy statement of the local, regional, or state executive branch, even if it has not yet been formally adopted by the appropriate legislative body.

This analysis is limited to non-agricultural land use issues and does not address other closely related issues, such as transportation, water supply and sewer systems, aesthetics and scenic vistas, and other issues identified as key concerns in local land use plans. These issues are addressed in other sections of Chapter 3 of this FSEIS.

Existing land use plans, policies, and controls could be affected in two local government jurisdictions, La Plata County and the City of Durango. Six key issues and concerns arise repeatedly in the specific county and city land use plans and policies, including:

- Preservation of the rural lifestyle and open space character of the region
- Provision of affordable housing and a variety of densities to accommodate the service sector of the local economy
- Development standards, densities, and related subdivision regulations
- Subdivision trends
- Commercial development trends
- Coordinated growth between La Plata County and the City of Durango

Opinions vary widely regarding the land use effects that would result from implementation of the project. There is particular concern with the extent to which water made available from Ridges Basin Dam and Reservoir could stimulate growth in La Plata County and the City of Durango. It is feared by some that this growth could adversely affect the rural lifestyle of the region, primarily by stimulating increased economic activity accompanied by more intense land development. Each of the six key local issues and concerns listed above addresses growth, either directly or indirectly. Therefore, the land use analysis in this section focuses on addressing issues associated with growth management and how project implementation could influence this process.

3.13.2 Evaluation Methodology

This section discusses the methodology used to determine potential impacts that could result from Refined Alternatives 4 and 6. Also discussed are specific criteria that were used to determine the significance of the impacts identified.

3.13.2.1 Methodology

The methods used to determine potential land use impacts focused on identifying land use planning conflicts and impacts that could cause controversy with respect to state, regional, or local land use planning contexts (40 CFR Part 1508.27(a)) and intensity (40 CFR Part 1508.27(b)(4)). Data collection included available federal, regional, state, and local land use plans for potentially affected areas. Collection and review of these plans was complemented with direct interviews with the planning officials having responsibility for implementation of these land use plans, policies, or controls. Interviews focused on identifying possible land use planning conflicts and impacts of greatest importance to the constituency of each potentially affected jurisdiction. Land use plans, policies, and controls established by these constituencies often reflect important quality-of-life issues.

The land use impacts analysis for the non-binding water use options is based on the water use scenario developed for the Colorado Ute Tribes. Table 5 of the report titled, “Animas-La Plata Project EIS Water Use Scenarios for Southern Ute and Ute Mountain Ute Indian Tribes” (Dornbusch 1999) identifies M&I, energy, livestock, and wildlife uses for water that could be delivered under the non-binding scenarios. It was assumed that construction of the conveyance facilities to deliver these waters and the development of the specific use (e.g., housing, industrial park, resort hotel, coal mine, and power plant) would not physically displace any existing residences or businesses.

It was also assumed that the Colorado Ute Tribes would put project water to use in ways that would not conflict with their respective land use planning policies. Land use effects, or environmental consequences, are therefore only identified as significant and adverse if they affect lands not owned by the Colorado Ute Tribes.

3.13.2.2 Significance Criteria

NEPA Section 1502.16 states that the environmental consequences section of an EIS should include discussions of possible conflicts between the proposed action and the objectives of federal, regional, state, local, and, in the case of a reservation, Indian tribal land use plans, policies, and controls for the area concerned. Conflicts with existing or proposed land use plans, policies, and controls or other related land use impacts were considered significant if construction, operation, or implementation of the project would result in one or more of the following:

- ❑ Direct displacement of residences or businesses
- ❑ Creation or inducement of incompatible adjacent or proximate land uses
- ❑ Increased new development and related growth in a manner inconsistent with existing land uses and land use plans
- ❑ Conflicts with adopted local, regional, state, or federal land use plans and policies;
- ❑ Conflicts with adopted zoning and proposed or approved development plans
- ❑ Access to previously inaccessible environmentally sensitive areas

3.13.3 Affected Environment

The sections below discuss existing land use resources in the areas potentially affected by Refined Alternatives 4 and 6. The actions that may take place under the No Action Alternative are not fully known at this time, and consequently, it is not possible to completely define the affected environment for that alternative. However, many of the eventual actions that may occur as a result of the No Action Alternative would likely take place within the same geographic setting as that of Refined Alternatives 4 and 6.

3.13.3.1 Structural Components

The potentially affected land use environment includes those areas where the physical presence or operation of structural components could cause direct conflicts with existing or proposed land use plans, policies, or controls. It also includes those areas where potentially significant impacts could occur from indirect changes in land use induced by the implementation of Refined Alternative 4. Structural components subject to land use analyses, therefore, include the Ridges Basin Dam and Reservoir and associated recreational facilities, the Durango Pumping Plant and inlet conduit, the NNMP, and Lemon Reservoir. Structural components for Refined Alternative 4 could affect land use in the following jurisdictions:

- # State of Colorado
- # La Plata County
- # West Durango Land Use Planning District
- # City of Durango
- # State of New Mexico
- # San Juan County
- # City of Farmington

3.13.3.1.1 State of Colorado

The Colorado Legislature has placed the majority of land use responsibility and control at the local level (county and municipal) of government. Additional legislation enables local governments and state agencies to perform a variety of functions that indirectly affect land use. All of the statutes, unless otherwise noted, are enabling legislation only, which means that they are tools for local governments to use at their prerogative in planning (i.e., they are not mandated or enforced).

Lands immediately north of Ridges Basin comprise part of the Bodo State Wildlife Area. They are owned by the State of Colorado and administered by the CDOW. The CDOW owns and manages property for wildlife. The management guidelines, regulations, and laws administered by the CDOW are written to (1) protect the wildlife resource and wildlife habitat, (2) allow wildlife-related public recreation, and (3) allow other non-wildlife recreation as long as it does not interfere with (1) and (2). Public non-wildlife-related recreation is normally allowed on these properties, but is often accompanied by restrictions such as seasonal or area closures and motorized and non-motorized vehicular restrictions.

3.13.3.1.2 La Plata County

Chapter 70 of the La Plata County Code establishes comprehensive planning maps (La Plata County Code Sec. 70-5). The County has adopted several reference maps and master plans. They are for comprehensive planning purposes and are used as advisory policy maps and master plans. These include a flood insurance study for La Plata County, wildfire hazard maps, geologic hazard maps, planning maps of the La Plata County Open Space Committee, the visual resource valuation map, and the individual component maps including sensitivity levels, public ownership, and wildlife habitat.

Several other land use plans and related classification maps have also been adopted within the County. These plans and maps were developed cooperatively by the La Plata County Planning Department and local planning groups that represent the North County, West Durango, Junction Creek, Animas Valley, Florida Road, Vallecito, Florida Mesa, and Bayfield planning districts. The Fort Lewis Mesa and Southeast La Plata planning districts have not developed advisory land use plans and maps. The northwest and northeast corners of La Plata County are not represented by local planning groups, maps, or plans, primarily because most of these lands are in the San Juan National Forest. Similarly, the City of Durango has its own comprehensive land use plan administered by the City of Durango Planning and Community Development Department.

3.13.3.1.3 West Durango Land Use Planning District

Development proposals within West Durango are currently considered on a case-by-case basis, utilizing the La Plata County Land Use System (LPLUS). West Durango lies in the west-central part of La Plata County. The edge of the City of Durango service area (near the intersection of Wildcat Canyon Road and State Highway 160) borders West Durango’s eastern edge, which follows the boundaries set by Bodo Wildlife Area, Ridges Basin, and the Southern Ute Indian Reservation. From the city service area, West Durango extends west on both sides of State Highway 160 and continues about two miles west of the entrance of the Durango West I subdivision. West Durango’s southern border continues about 1.2 miles west of Wildcat Canyon Road (CR 141), where it intersects one mile north of the entrance to the Trapper’s Crossing subdivision. The 1,400-acre Steward Ranch, located at the upper end of Lightner Creek, includes West Durango’s northern boundary that edges Colorado state-owned properties.

West Durango’s population is currently concentrated in several residential developments. These areas include Rafter J, Shenandoah, Trapper’s Crossing, and Durango West I and II. The Durango West I and II subdivisions were originally known as the Ismay Ranch. This site currently sustains approximately 695 residences and continues to grow. There are numerous private residences along Lightner Creek and an increasing number of homes along Wildcat Canyon Road. With the exception of a few home-businesses scattered throughout the district, there are few commercial properties in West Durango.

The Lake Durango Water Company is the major supplier of domestic water to this area, currently servicing about 766 units with the capacity to serve about 255 more units. Water is of key importance to

West Durango; its availability, or lack thereof, will determine much of the new development that occurs here.

The residential density and size restrictions and descriptions of the classifications are included in the West Durango Planning District Land Use Plan (West Durango Planning District 1997). Two goals of West Durango planning that have the potential to be affected by the project include: (1) encourage a diversity of housing, including "affordable" housing and more multi-family homes/development; and (2) encourage affordable housing development in areas that take advantage of central services.

3.13.3.1.4 City of Durango

The City of Durango planning area comprises a variety of existing land use types and development patterns (City of Durango 1997). These include agricultural uses surrounding the city, recreation and open space uses, low-density residential uses, and mid- and high-density residential uses as well as commercial and business uses which are primarily located in the downtown core and along primary roadways.

The land use element of the City Plan is directed toward:

- ❑ Preserving environmental and natural resources
- ❑ Ensuring that sufficient land is available for new development
- ❑ Preserving the existing areas of the city and its neighborhoods
- ❑ Indicating appropriate locations for future land uses

Table 3.13-1 presents the types and percentages of land uses in the city limits. Open space, agriculture, and vacant land comprise over 82 percent of city lands, which emphasizes the importance of the rural agricultural lifestyle in the region.

Key issues underlying the development of the Natural Environment Element of the Durango City Plan include ensuring public safety and balancing urban growth and environmental integrity. The city recognizes increasing pressures to develop environmentally constrained properties such as hillsides and floodplains by recommending appropriate design to minimize risks from natural hazards. These same pressures could result in the cumulative loss of open space and habitat values that give the community its environmental integrity. The specific goal, objective, and policy within the Natural Environment Element of the City Plan that could be affected by project implementation include:

- ❑ Goal 1: To maintain or improve the quality of Durango's natural resources.
- ❑ Objective 1.2: To adopt and implement cost-effective resource management strategies.
- ❑ Policy 1.2.3: To support growth and water resource management strategies that help maintain the aesthetic, recreational, and environmental value of the Animas River.

In addition, the Community Development Element of the City Plan includes a goal of maintaining and enhancing Durango's diverse, small town character by adopting a future land use map that provides guidance on land use decisions for public and private decision-makers; in addition, the City and La Plata County will review development proposals for conflict.

Table 3.13-1
Durango Planning Area Existing Land Uses

Land Use	Urbanized		Non-Urbanized		Total	
	Acres	Percent	Acres	Percent	Acres	Percent
Open Space	76	1.86	20,174	41.90	20,790	38.84
Parks	377	9.22	241	0.43	591	1.10
Agriculture	1	0.02	10,338	20.91	10,339	19.32
Single-Family Residential	987	24.15	4,167	8.43	5,154	9.63
Multi-Family Residential	97	2.37	27	0.05	124	0.23
Mobile Home	45	1.10	37	0.07	82	0.15
Motel/Hotel	53	1.30	35	0.07	88	0.16
Commercial	296	7.24	239	0.48	535	1.00
Industrial/Mining	140	3.43	157	0.32	297	0.55
Institutional	421	10.30	173	0.35	594	1.11
Utilities	18	0.44	62	0.13	80	0.15
Right-of-Way	722	17.67	765	1.55	1,487	2.78
Water	117	2.86	303	0.61	420	0.78
Vacant	737	18.03	12,209	24.69	12,946	24.19
Total	**4,087**	**100.00**	**49,440**	**100.00**	**53,528**	**100.00**

Source: City of Durango 1997

3.13.3.1.5 State of New Mexico

Land use planning and platting jurisdiction is provided to New Mexico municipalities in New Mexico state law. These statutes state that:

> *"A...Each municipality shall have planning and platting jurisdiction within its municipal boundary. Except as provided in subsection B of this section, the planning and platting jurisdiction of a municipality: (1) having a population of twenty-five thousand or more persons includes all territory within five miles of its boundary and not within the boundary of another municipality; or (2) having a population of less than twenty-five thousand persons includes all territory within three miles of its boundary and not within the boundary of another municipality." (N.M. Stat. Ann. § 3-19-5)(A)*

Subsection B sets planning and platting jurisdictional boundaries for municipalities with over 200,000 persons. Subsection C. states that:

> *"If territory not lying within the boundary of a municipality is within the planning and platting jurisdiction of more than one municipality, the planning and platting*

jurisdiction of each municipality shall terminate equidistant from the boundary of each municipality unless one municipality has a population of less than two hundred thousand five hundred persons and another municipality has a population of more than two thousand five hundred persons according to the most recent census. Then the planning and platting jurisdiction of the municipality having the greatest population extends to such territory." (N.M. Stat. Ann. § 3-19-5)(B).

The New Mexico statutes also include relevant subdivision regulations (N.M. Stat. Ann. § 3-19-6), platting of street lines by the planning commission (N.M. Stat. Ann. § 3-19-7), requirements for master plans by municipalities (N.M. Stat. Ann. § 3-19-9), and a statement of the legal status of master plans (N.M. Stat. Ann. § 3-19-11). These are particularly important if project diversions and those land use decisions depending on the delivery of project water have the potential to conflict with local master plans, policies, and controls, especially those adopted by Farmington, Aztec, or Bloomfield. In addition to statutes governing local land use planning, there is also a regional planning effort in northwest New Mexico.

The Northwest New Mexico Council of Governments (NWNMCOG) is a voluntary association of local units of government serving as the Regional Planning Organization (RPO) for the northwest corner of New Mexico, also known as State Planning and Development District I (Region I RPO). As such, it %
serves as one of seven state planning and development districts formed by state statute.

The Northwest New Mexico planning district spans over 15,000 square miles of highland plateau country and encompasses a population of nearly 200,000, about one-half of whom are members of one of four sovereign Native American nations:

- The Navajo Nation
- The Pueblo of Zuni
- The Pueblo of Acoma
- The Pueblo of Laguna

Most of the region's land base is composed of public lands (including federal Indian reservations), and approximately one-half of the region's population lives in non-municipal rural communities. The NWNMCOG serves as the state-appointed RPO for the coordination of transportation planning and project development in the northwest New Mexico District. The RPO also identified 23 roadway enhancements in its Regional Transportation Improvement Recommendations for the District 5 Portion of the Regional Planning Organization.

3.13.3.1.6 San Juan County

San Juan County does not have any established comprehensive land use planning or zoning laws or master plan. However, the county does have restrictive covenants for residential subdivisions on county lands outside city jurisdictional boundaries, consistent with its planning and platting jurisdiction and state subdivision regulations (N.M. Stat. Ann. § 3-19-6).

3.13.3.1.7 City of Farmington

The City of Farmington Comprehensive Plan, titled "Vision 2010," was adopted in July 1989 (City of Farmington 1989). Relevant goals, policies, and strategies address such issues as landscaping, view screening, sign standards, grading, drainage, erosion control, site and circulation and planning, adjacent land use compatibilities, floodplain development, proper planning of developing areas, and other local planning topics.

3.13.3.2 Non-Binding Water End Uses and Conveyance Systems

The representative affected environment includes land use planning districts in La Plata and Montezuma Counties that could receive water for housing or industrial development.

3.13.3.2.1 Florida Road Land Use Planning District

The Florida Road Land Use Planning District is characterized by mountainous forests, rugged terrain, narrow valley meadows, and the Florida River. These features, including risk of wildfire, landslides, soil erosion, flooding, and water availability, can constrain growth, which, according to district planners, should dictate the location and density of housing.

Several large ranches are considered as defining attributes of the district's rural and scenic character. Careful consideration is recommended to protect these meadows and open spaces while respecting the rights of property owners. District planners have identified the western end of the district, west of Edgemont Ranch, as the most suited for affordable housing because of its proximity to the City of Durango and relatively better road conditions.

Three primary types of commercial uses exist in the district, including the following:

- Small Cottage Businesses
- Neighborhood Commercial
- Home Occupations

The vision developed by the district residents is to maintain the natural aesthetics and beauty of the area, with man-made structures designed to enhance visual quality. Commercial development will be located in and adjacent to the presently established areas, with an emphasis on blending them with the scenic nature of the valley. Billboards, road improvements, and infrastructure should also be achieved with sensitivity to aesthetics and the environment.

3.13.3.2.2 Florida Mesa Land Use Planning District

Florida Mesa Land Use Planning District planners recognize the natural, scenic beauty of their district, which is integral to its attraction and property values. These planners also recognize that current subdivision practices are developing the mesa into smaller and smaller lots, gradually eroding the very qualities that attracted most residents. It is important to district planners that Florida Mesa’s future growth be directed to areas and development patterns that preserve the district’s rural character.

The residents of Florida Mesa envision a rural agricultural atmosphere with corridors and scattered islands of higher density and commercial/light industrial development. Riparian habitat along the Animas and Florida Rivers is highly valued. Nevertheless, the ease of the Minor Exempt Subdivision process is leading to a proliferation of three-acre lots throughout the district, resulting in a reduction in open space and agricultural character. The State of Colorado has an extensive set of subdivision regulations (Colo. Rev. Stat. § 30-28-133) that apply to counties. However, the definitions used as the context for those regulations (Colo. Rev. Stat. § 30-28-101(10)(b)) state that “The terms “subdivision” and “subdivided land” as defined in paragraph (a) of this subsection (10) shall not apply to any division of land which creates parcels of land each of which comprises thirty-five or more acres of land and none of which is intended for use by multiple owners." Because these regulations within Colorado state law do not require local subdivision approval for parcels of 35 acres or larger, property owners find it advantageous to sell land in 35-acre tracts. Buyers are interested in using the large lots for residential use and not for farming, thereby further reducing the rural character, according to district planners. Commercial uses are seen as having the potential to scatter throughout the district in the absence of zoning, thereby undermining the low density characteristics—and consequently the property values—of adjacent properties.

One land use goal and two related objectives identified in the Florida Mesa Land Use Planning District Land Use Plan (1998) associated with the issue of rural atmosphere protection have the potential to be affected by project implementation. These include a goal to protect the rural atmosphere of the district by maintaining a significant portion of the land as agricultural (farm and ranch) land with the objectives of (1) allowing productive farm and ranch land to stay in agricultural use as long as there are farmers and ranchers willing and able to run the farms and ranches; and (2) directing development to those portions of farms and ranches, which are less useful for agricultural purposes (due to conditions such as soil or slope unsuitability).

3.13.4 Environmental Consequences and Mitigation

The following sections discuss potential impacts to land use of Refined Alternative 4 and Alternative 6. No Action Alternative impacts are also included as presented in the 1996 FSFES. In addition, mitigation measures are proposed to reduce or eliminate potential impacts to land use.

3.13.4.1 Refined Alternative 4

3.13.4.1.1 Structural Component

Refined Alternative 4 Land Use Impact 1 - Significant: Increased recreation within Ridges Basin could increase violations of CDOW restrictions within Bodo State Wildlife Area and could reduce the rural quality of the surrounding area.

Recreational facilities associated with Ridges Basin Reservoir would increase the number of recreational visitors to the lands surrounding the reservoir. The increased intensity of these uses could increase motorized vehicle use in surrounding areas, littering, domestic animal releases, disorderly conduct, and other activities. These activities have the potential to violate prohibitions on such activities set forth by the CDOW.

Much of the Large Lot Residential and Agriculture/Rural Residential development towards the western end of Ridges Basin is unfenced and presently affords local residents an open, rural lifestyle and also maintains open access to environmentally sensitive areas. Increases in the number of visitors to the area would likely increase use of local roads and lands for passive recreational purposes (e.g., bird watching, hiking, photography, hunting and off-road vehicle use). The increased intensity of these uses, as well as supporting infrastructure and potential commercial establishment development, could threaten the quality of the environmental values associated with the rural character of the area, the aesthetics and visual resources, general lack of noise, and remoteness of the area.

Construction and operation of the Ridges Basin Dam and Reservoir would not directly displace any residences or businesses. It would not have significant adverse impacts to any land use elements important for community character and would not directly conflict with adopted zoning or proposed or approved development plans. It would not conflict with adopted federal or regional land use plans or policies.

Project implementation would not conflict with the City of Durango's goal of maintaining or improving the quality of Durango's natural resources. Project implementation also meets city goals to adopt and implement cost-effective resource management strategies. Similarly, mitigation measures throughout this FSEIS fulfill the city policy to support growth and water resource management strategies that help maintain aesthetic, recreational, and environmental values of the Animas River.

Mitigation for Refined Alternative 4 Land Use Impact 1: Carefully plan reservoir-associated development and restrict access to surrounding roads and property through gating and local transportation planning to limit access to surrounding lands.

During construction planning for Ridges Basin Dam and Reservoir, the responsible recreation management entity will cooperate with CDOW to develop access, circulation, and use patterns that minimize the opportunities for unauthorized motorized vehicle use, access to wildlife-sensitive lands, littering, and other activities that could upset wildlife management goals in the Bodo State Wildlife Area. Chapter 5 of this FSEIS includes specific commitments to reduce impacts of recreation to wildlife around Ridges Basin.

The responsible recreation management entity would design, locate, and construct recreation facilities so that they blend with the surrounding natural environment. These facilities would be located near the reservoir and specifically situated to minimize their visibility from surrounding residential properties. Clearing and grading for structures and parking lots would be minimized, and trees preserved in all instances where their presence allows them to block views of the structures from surrounding residential areas. Efforts would be made by the development/management entity to integrate West Durango's concerns regarding land use incompatibilities associated with recreational land development and use.

Vehicular access to Ridges Basin Reservoir would be limited to two entrances, one at the northwest end of the reservoir, entering from State Highway 141 about 6.5 miles west of the City of Durango, slightly west of the intersection of Highway 141 and State Highway 125, and from CR 211 from the east (i.e., from Durango).

Boat ramp and marina facilities, fisherman access points, picnic units, and campsites could be situated near the reservoir shore or at a distance that attenuates and reduces recreational noise to reasonably tolerable levels for nearby residents. The northern, western, and southwestern reservoir boundaries would have approximately 15 miles of fence to keep livestock from entering the Ridges Basin Reservoir area and to restrict uncontrolled access to the reservoir.

3.13.4.1.2 Non-Binding End Uses and Water Conveyance

Refined Alternative 4 Land Use Impact 2 - Less than Significant: Land use impacts could result from the inability of one or more of the cities to which water would be made available to implement orderly growth consistent with their respective general plans.

It is reasonably foreseeable that the City of Farmington would use project deliveries to accommodate planned growth in the area lying generally between the cities of Farmington, Aztec, and Bloomfield, New Mexico (Sullivan 1999). Adverse land use impacts could result from the inability of one or more of these cities to implement orderly growth consistent with their respective general plans. However, the provision of project water in and of itself would not directly cause adverse land use impacts. Growth might be accelerated if project water were made available, but this acceleration would need to be manifested as developments that conflicted with local plans. Such conflicts would result from the local planning process, but would not result from the provision of project water.

Mitigation for Refined Alternative 4 Land Use Impact 2: No mitigation is proposed.

Refined Alternative 4 Land Use Impact 3 - Less than Significant: Development associated with M&I growth under the non-binding scenario could create conflicts with rural atmosphere goals and objectives of the Animas Valley, Florida Mesa, West Durango Land Use Planning Districts, and other areas in which development may occur.

Water deliveries for housing or other developments could slightly degrade the rural atmosphere by increasing growth and development and, therefore, reducing the land area used for agriculture. Although the non-binding water use scenarios project that housing units could be developed in the Animas Valley and Florida Mesa Land Use Planning Districts, subsequent La Plata County Planning Commission approvals would be needed before the units could be built. Developers of units on non-tribal lands would need to submit development proposals to the La Plata County Planning Department. These proposals will be subject to review and compliance with the goals and objectives of the Animas Valley and Florida Mesa Land Use Planning Districts. If the La Plata County Planning Department, working in cooperation with either of those districts, determines that the development could substantially degrade the rural atmosphere, they would recommend development proposal revisions. For example, objective number 2 for achieving the goal of protecting the rural atmosphere of the Florida Mesa Land Use Planning District seeks to direct development to those portions of farms and ranches that are less useful for agricultural purposes, because of conditions such as limited soil productivity or slopes unsuitable for farming.

Mitigation for Refined Alternative 4 Land Use Impact 3: No mitigation is proposed.

3.13.4.2 Refined Alternative 6

3.13.4.2.1 Structural Components

Refined Alternative 6 Land Use Impact 1 - Less than Significant: Raising Lemon Reservoir would inundate shoreline facilities, which would be incompatible with their current uses.

Raising Lemon Dam and Reservoir 11.5 vertical feet would inundate current shoreline recreational and %
other lands, which could be incompatible with their current uses. It is likely that, in most cases, these facilities could be relocated along the new reservoir shoreline. As such, this impact is considered to be less than significant.

Mitigation for Refined Alternative 6 Land Use Impact 1: No mitigation is proposed.

3.13.4.2.2 Non-Binding Water End Uses and Conveyance Systems

Refined Alternative 6 Land Use Impact 2 - Less Than Significant: Land use impacts could result from the inability of one or more of the cities to which water would be made available to implement orderly growth consistent with their respective general plans.

Same as Refined Alternative 4 Land Use Impact 2.

Mitigation for Refined Alternative 6 Land Use Impact 2: No mitigation is proposed.

Refined Alternative 6 Land Use Impact 3 - Less than Significant: Development that could be associated with M&I growth under the non-binding scenario could create conflicts with rural atmosphere goals and objectives of the Animas Valley, Florida Mesa Land Use Planning Districts, and other areas in which development could occur.

Same as Refined Alternative 4 Land Use Impact 3.

Mitigation for Refined Alternative 6 Land Use Impact 3: No mitigation is proposed.

3.13.4.3 No Action Alternative

There was no discussion of land use impacts in the 1996 FSFES.

3.14 HAZARDOUS MATERIALS

3.14.1 Introduction

This section addresses potential impacts associated with hazardous materials that would result from actions associated with Refined Alternatives 4 and 6 and the No Action Alternative. Section 3.14.2 defines the Evaluation Methodology and significance criteria used for determining impacts, Section 3.14.3 describes the affected environment, and Section 3.14.4 identifies potential impacts and mitigation measures that would serve to reduce or eliminate anticipated impacts from hazardous materials.

The hazardous material of greatest public concern in relation to the project is radioactive waste resulting from historical uranium processing that may be found in soil and groundwater, which could be disturbed by the project and pose a health hazard in the project area.

Heavy metals that are present in various concentrations in the Animas, La Plata, and San Juan Rivers, after being leached from mines, mine tailings, and other areas disturbed by mining, are not included in this section, but are discussed in Section 3.3, Water Quality. In addition, it was assumed that the potential reduction in irrigated cropping resulting from the non-structural component of both Refined Alternatives 4 and 6 would not affect hazardous waste or increase use and potential exposure to hazardous materials. Consequently, this component was not analyzed.

3.14.2 Methodology

This section discusses the methodology used to determine potential impacts that could result from Refined Alternatives 4 and 6. Also discussed are specific criteria that were used to determine the significance of the impacts identified.

3.14.2.1 Evaluation Methodology

The analysis included a search of public EPA documents for information on disposal sites of radioactive wastes and of other hazardous wastes, and contacts with county health departments regarding other known hazardous waste disposal sites. The available information was examined to assess the relevant areas of concern on the proposed project.

The potential for the project construction and operation to cause or aggravate pollution from such materials was addressed by examining information about the locations of such wastes within the project area and determining the physical and hydraulic connection between project construction and operation and such wastes.

3.14.2.2 Significance Criteria

The criteria used to determine the significance of impacts were whether the project would create or disturb hazardous materials that could cause a health risk to project workers, the general public, or the environment.

3.14.3 Affected Environment

The sections below discuss existing hazardous materials conditions in the areas potentially affected by Refined Alternatives 4 and 6. The actions that may take place under the No Action Alternative are not fully known at this time, and consequently it is not possible to completely define the affected environment of that alternative. However, many of the actions that could occur as a result of the No Action Alternative would likely take place within the same geographic setting as that of Refined Alternative 4.

3.14.3.1 Structural Components of Refined Alternative 4

3.14.3.1.1 Durango Pumping Plant and Ridges Basin Inlet Conduit

The proposed Durango Pumping Plant site is located along the west bank of the Animas River, on a topographic bench near the Bodo Industrial Park, immediately south of Durango. The site is just west of U.S. Highway 550/160. The immediate area was the site of a former uranium processing operation, known to have disposed hazardous waste on two separate parcels. The resulting waste generated by these activities consists of mine tailings and soils contaminated with treatment plant wastes, and contamination of localized groundwater. The pumping plant would be located on a 46-acre tract of land where raffinate settlement ponds were used to clarify uranium mill tailings water. Low levels of cadmium and selenium were also detected in sampling programs, with concentrations slightly above EPA standards. This site is designated as a Category II site, meaning that it would require groundwater remediation prior to future use.

The Durango processing site was remediated under the Uranium Mill Tailings Radiation Control Act (UMTRCA). Radioactive solids left from milling operations were removed by the Department of Energy (DOE) and Colorado Department of Health (CDH) under a Uranium Mill Tailings Remedial Action (UMTRA) Project completed in 1990. The site was then revegetated and currently contains a healthy stand of vegetation. Groundwater beneath the pumping plant has not been remediated and contains concentrations of several inorganic and radiologic contaminants. DOE is authorized under UMTRCA to clean up the groundwater, but clean-up has not been scheduled or funded. DOE determined that the groundwater could not be used or allowed to enter public or surface water supplies through development until its site characterization study is complete.

Because of uncertainties concerning any remaining contamination at the site, the DOE has restricted the use of the site under a Restricted Use Plan and a 50-year renewable easement contract with the property owner, currently, the Animas La Plata Water Conservancy District. This effectively precluded development of the site for commercial or residential purposes. However, a Hydrogeochemical Site Characterization performed by Reclamation dated November 1990, was reviewed by the Nuclear

Regulatory Commission, DOE and CDH who determined that Reclamation could proceed with construction prior to further site studies by Reclamation.

3.14.3.1.2 Ridges Basin Dam and Reservoir

Radioactive solids are contained in an UMTRA containment cell located about 0.25 mile outside the northeast arm of the proposed Ridges Basin Reservoir. This containment cell was installed as part of the remedial action for the Durango processing site described above.

3.14.3.1.3 Navajo Nation Municipal Pipeline

Part of the approximately 29-mile long pipeline, which would lie mostly within the existing pipeline alignment between Farmington and Shiprock, New Mexico, would be constructed a few miles from a radioactive material waste site at Shiprock. The site, known as the Shiprock UMTRA Project Site, is located on the southeast edge of Shiprock, along the south side of the San Juan River on an elevated terrace about 50 feet above the river. This site was contaminated with residues from former uranium milling and processing operations. The contaminated soil was stabilized in a 72-acre disposal cell in the same location as the former milling operation. However, contaminated groundwater remains in the river terrace alluvium and the upper Mancos shale beneath the site and in the floodplain alluvium along the river. The maximum concentration limits are exceeded for radium 226, radium 228, cadmium, selenium, net gross alpha, and uranium (DOE 1993). This site is designated as a Category II site meaning that it would require groundwater remediation prior to future use.

3.14.3.2 Structural Components of Refined Alternative 6

3.14.3.2.1 Increased Capacity of Lemon Reservoir

No known hazardous waste sites have been identified in the areas that would be affected during the construction or operation of a raised Lemon Dam and Reservoir.

3.14.3.2.2 Navajo Nation Municipal Pipeline

The affected environment associated with the NNMP would be the same as that described above for Refined Alternative 4.

3.14.3.3 Non-Binding End Uses and Conveyance Systems

The Southern Ute Indian Tribe’s non-binding options that could involve concerns about hazardous materials and waste include the construction and operation of the coal mine and coal-fired power plant in the La Plata River Basin, and the construction of water distribution pipelines in the La Plata River Basin and the pipelines east of Ridges Basin. The La Plata River Basin is essentially an agricultural area surrounded by open land. The coal mine and power plant would be developed at the eastern edge of the basin, several miles from residential development. The distribution pipelines would branch through the La Plata River Basin community and farming areas and the more developed corridor east of the Animas River. East of Ridges Basin, the pipe distribution system location would involve several miles of the Animas River bottom and several miles along U.S. Highway 160 from the river to the Loma Linda area.

The Ute Mountain Ute Tribe’s non-binding options that could involve concerns about hazardous materials and waste impacts include the construction and operation of the gas-fired power plant in the San Juan River Basin and pipeline construction in the southern Mancos River Basin. The potential power plant would be located north of an existing coal and gas development area along the San Juan River, at the base of the bench land in the undeveloped southern part of the Ute Mountain Ute Reservation. The distribution pipeline would run from the west side of the La Plata River Basin along the Grass Valley Road corridor on its way to the Mancos River Valley, across remote bench land and canyon land.

Other than the radioactive waste disposal cell in Ridges Basin, described above, no hazardous waste sites have been reported in the areas identified for non-binding facilities. Handling and disposal of hazardous wastes involved with construction of power plants and other facilities would be governed by construction contract provisions designed to ensure proper handling and disposal.

3.14.4 Environmental Consequences and Mitigation

The following sections discuss potential impacts to hazardous materials of Refined Alternatives 4 and 6. In addition, mitigation measures are proposed to reduce or eliminate potential impacts to hazardous materials.

3.14.4.1 Refined Alternative 4

3.14.4.1.1 Structural Component Impacts

Refined Alternative 4 Hazardous Materials Impact 1 - Significant: Construction of the Durango Pumping Plant could expose contaminated materials.

There is a potential for the exposure of soil and water contaminated by hazardous waste during pumping plant construction. The release of contaminated water to the Animas River could pose a health hazard to people and the environment. The excavation and redeposition of contaminated soil could expose construction workers to radioactivity and result in contaminated soil being left at the surface of spoil areas when construction is complete.

The construction of the Durango Pumping Plant and its intake channel would involve massive excavations at the UMTRA remediation site. Soils excavated for the pumping plant foundation and inlet channel would be distributed and contoured on the site. If the excavation were to encounter soils that still contain contamination, they would be segregated and stockpiled separately, and then disposed of at a suitable disposal site.

The foundation excavation could also encounter contaminated groundwater and allow it to discharge into the foundation excavations. Water pumped from the excavations for dewatering, which under other circumstances might be desilted and released to the river, would need to be monitored for contamination and, if contamination were identified, be run through a treatment process prior to release from the site.

Mitigation for Refined Alternative 4 Hazardous Materials Impact 1: The Durango Pumping Plant would be designed to minimize the disturbance of contaminated materials; procedures will be
developed for radiological monitoring of excavated soils and groundwater encountered; and %
remedial procedures will be planned in advance to counteract the potential for human exposure %
and for the prevention of contaminated groundwater release from the construction site. The %
construction contractor would be required to implement a construction safety plan. %

A requirement of the pumping plant design would be to prevent contaminated groundwater from entering the pumping plant and impacting water quality in Ridges Basin Reservoir. The design of the pumping plant, intake channel, and intake structure would employ construction materials and design techniques that would result in an installation that eliminates the infiltration of groundwater. The pumping plant foundation and understory walls could be designed to provide the necessary shielding against any remaining hazard from groundwater or soil contamination at the site, as well as to prevent infiltration of groundwater. A principal requirement of the construction program would be safe handling of soil and water contamination encountered during construction, to prevent adverse impacts to public health and the environment. A set of minimum construction requirements have been developed.

The human exposure to contaminated soils and the potential for release of contaminated groundwater from the site would be mitigated by measures that include the following:

❏ Reviewing remediation reports and current monitoring data to understand existing subsurface conditions with respect to radioactive materials;

❏ Obtaining preconstruction soil and water samples at the pumping plant and intake channel site for laboratory testing of radioactive constituents;

❏ Developing a Site Safety and Health Management Plan including radiation protection for workers and the public;

❏ Developing construction plans to deal with the potentially hazardous conditions of excavated soils and groundwater;

❏ Using analytical data to design a treatment system for the contaminated water from the de-watering activities during construction; and

❏ Providing a treatment system, if needed, to decontaminate water pumped from excavations before discharge to the river, under permit conditions required by the Colorado Discharge Permit System (CDPS).

During the design phase of the project, the additional subsurface testing performed for the project, and the resulting pumping plant design and construction management plan, would be presented to EPA and state regulatory agencies for approval.

Refined Alternative 4 Hazardous Materials Impact 2 - Potentially Significant: Hazardous materials used for the construction of the Durango Pumping Plant and Ridges Basin Dam could cause stream pollution.

Various hazardous materials ranging from paints to industrial solvents would be used in the construction of project features. If carelessly disposed of, their containers or application tools could introduce contaminants into the Animas River or Basin Creek. Typically, modern construction specifications contain handling and disposal procedures to prevent such contamination. Consequently this is a potentially significant impact under unauthorized procedures.

Mitigation for Refined Alternative 4 Hazardous Materials Impact 2: Ensure that construction contractors adhere to all federal and state requirements pertaining to the management and handling of hazardous materials, mixed waste, and radioactive waste.

Specific requirements for handling hazardous materials and disposal of containers and contaminated materials and scrap would be written into construction specifications. Contractors will be required to dispose of such materials in approved disposal areas.

Refined Alternative 4 Hazardous Materials Impact 3 - Less than Significant: Activities associated with Ridges Basin Reservoir could involve a risk of construction worker or public exposure to hazardous waste at the radioactive waste disposal cell in Ridges Basin.

The designs and specifications for construction of Ridges Basin Dam and Reservoir would not have construction activity at the disposal cell. However, with construction activity there could be a slight risk of unauthorized entry onto and disturbance of the disposal site. The DOE Remedial Action Plan, which addressed the potential for seepage from the disposal site, groundwater movement, and seismic stability, concluded that the proposed reservoir would not impact the disposal cell (1996 FSFES).

Mitigation for Refined Alternative 4 Hazardous Materials Impact 3: Identify through signage and avoid the disposal site during construction activities.

Construction specifications for Ridges Basin Dam and Reservoir, the Ridges Basin Inlet Conduit, road relocation, and related work would prohibit contractors from disturbing the disposal cell. The disposal cell would be liberally signed to make the public aware of its presence and any personal hazards that it presents.

Refined Alternative 4 Hazardous Materials Impact 4 - Less than Significant: Construction of the NNMP could affect the zone of contaminated groundwater from the Shiprock UMTRA Disposal site.

The Shiprock UMTRA Disposal Site would not be affected by construction of the NNMP because it would be constructed on the opposite side of the San Juan River from the site, and the relatively shallow (6' to 8' deep) pipeline trench excavation would not likely affect the zone of contaminated groundwater on the south side of the San Juan River.

Mitigation for Refined Alternative 4 Hazardous Materials Impact 4: No mitigation is proposed.

Refined Alternative 4 Hazardous Materials Impact 5 – Potentially Significant: Hazardous Materials located in Bodo Canyon UMTRA Disposal Site impacting Ridges Basin Reservoir.

The Bodo Canyon UMTRA Disposal Site was designed and constructed to store excavated mill tailings and soils from the former Uranium Mill Site along the Animas River. The site has been under the care of the DOE's Long-term Surveillance and Maintenance Program. If the Disposal Site has had or has a future release of contaminated water, the possibility exists for contamination of the reservoir planned for Ridges Basin.

Mitigation for Refined Alternative 4 Hazardous Materials Impact 5: Conduct joint Reclamation/DOE confirmation of the Disposal Site integrity and institute verification monitoring.

Reclamation will confer with DOE and their Long-Term Surveillance and Maintenance Program to understand the current operational scheme and parameters for the Bodo Canyon disposal cell. As well, Reclamation will reactivate sampling and monitoring of wells DH-228 and DH-229 for indicator parameters including but not limited to molybdenum, selenium, and uranium.

% ***3.14.4.1.2 Non-Binding Water End Use Impacts***

% **Refined Alternative 4 Hazardous Materials Impact 6 - Less than Significant: Hazardous waste or materials could be encountered during construction of the non-binding end uses and conveyance structures.**

It is possible that the locations of pipelines or other facilities related to the non-binding uses could encounter previously discarded hazardous wastes at random locations. However, such occurrences would become known during preconstruction surveys and appropriate action taken for their removal or neutralization. In general, the locations of end use developments and related conveyance pipelines would be sufficiently flexible so that any sites with significant hazardous waste contamination could be avoided. Consequently impacts on or from hazardous wastes from the construction of these project components are expected to be less than significant.

% **Mitigation for Refined Alternative 4 Hazardous Materials Impact 6: Require preconstruction surveys and adherence to hazardous material standards relating to construction.**

Prior to construction of any future water end-use facilities, examination for the existence of hazardous wastes would be included in site surveys for preparation of designs and specifications. If hazardous wastes are found, site surveys and sampling would be conducted to determine the hazardous waste history of the site, and appropriate containment and/or cleanup would be arranged.

3.14.4.2 Refined Alternative 6

3.14.4.2.1 Structural Components

Refined Alternative 6 Hazardous Materials Impact 1 - Less than Significant: Hazardous materials used during construction activities associated with raising Lemon Dam could cause stream pollution.

Various hazardous materials including fuel for construction vehicles and equipment would be used during construction for raising Lemon Reservoir Dam. If carelessly handled or disposed of, the materials could introduce contaminants into the Florida River. Typical modern construction specifications contain handling and disposal procedures to prevent such contamination. However, this remains a potential impact under unauthorized procedures.

Mitigation for Refined Alternative 6 Hazardous Materials Impact 1: Commit to developing a hazardous material management program for the purpose of this project.

Specific requirements for handling hazardous materials and disposal of containers and contaminated materials and scrap would be written into construction specifications. Contractors will be required to dispose of such materials in approved disposal areas.

Refined Alternative 6 Hazardous Materials Impact 2 - Less than Significant: Construction of the NNMP could affect the zone of contaminated groundwater from the Shiprock UMTRA Disposal Site.

Same as Refined Alternative 4 Hazardous Materials Impact 4.

Mitigation for Refined Alternative 6 Hazardous Materials Impact 2: No mitigation is proposed.

3.14.4.2.2 Non-Binding Water End Uses and Conveyance

Refined Alternative 6 Hazardous Materials Impact 3 - Less than Significant: Hazardous materials could be encountered during construction of the non-binding end uses and conveyance systems.

Same as Refined Alternative 4 Hazardous Materials Impact 5.

Mitigation for Refined Alternative 6 Hazardous Materials Impact 3: Areas should be inspected for hazardous materials and avoided when possible during siting of end use facilities and conveyance systems. These avoidance activities are included in construction costs.

Prior to construction of any future water end-use facilities, examination for the existence of hazardous wastes would be included in site surveys for preparation of designs and specifications. If hazardous wastes are found, site surveys and sampling would be conducted to determine the hazardous waste history of the site, and appropriate containment and/or cleanup would be arranged.

3.14.4.3 No Action Alternative

No impacts were identified in the 1996 FSFES.

3.15 TRANSPORTATION

3.15.1 Introduction

This section addresses potential impacts to transportation that would result from actions associated with Refined Alternatives 4 and 6 and the No Action Alternative. Section 3.15.2 defines the Evaluation Methodology and significance criteria used for determining impacts, Section 3.15.3 describes the affected environment, and Section 3.15.4 identifies potential impacts and mitigation measures that would serve to reduce or eliminate potentially significant impacts to transportation.

Public comments and concerns have been expressed regarding the effect of construction-related activities on traffic and the physical condition of local roads. One primary concern is that construction could overload certain roads and intersection capacities, resulting in additional delays at key intersections over the short term. A similar concern has been expressed regarding the long-term effects of recreation visitation traffic and especially the effect of increased volumes of visitors on key intersections that could be used to access Ridges Basin Reservoir. Another concern is that more frequent and heavier vehicular traffic generated by project construction would increase the wear on paved highways and secondary roads beyond normal usage. These issues are addressed in this analysis.

3.15.2 Methodology

This section discusses the methodology used to determine potential impacts that could result from construction of the structural elements of Refined Alternatives 4 and 6. Also discussed are potential impacts to transportation that could result from operation and maintenance activities associated with recreational use of the proposed Ridges Basin Reservoir. Finally, specific criteria used to determine the significance of the impacts are identified.

Nonstructural components are not analyzed in this section. Under each of the alternatives, nonstructural components would involve changes in irrigation patterns on agricultural land in various agricultural areas. The resulting changes in cropping patterns or land use would have only minor effects on road and highway traffic circulation and physical conditions. Such changes would be within the expected, normal variation in traffic generated by conventional agricultural production, harvest, and related operational practices. Safety issues related to construction activities along roads are addressed in Section 3.18, Public Health and Safety.

3.15.2.1 Construction Impacts Evaluation

This analysis focuses on the additional traffic associated with construction of the structural components of Refined Alternatives 4 and 6, and includes effects on local traffic circulation and potential impacts to roadway physical conditions primarily in the Durango, Colorado area. Construction-related impacts to traffic conditions were evaluated for the effects that both construction worker commute traffic and materials and equipment haul trucks could have on potentially affected roadways. **Table 3.15-1** summarizes the assumptions that guided this analysis.

For Refined Alternative 4, traffic caused by construction workers commuting to the construction sites (at 2003 levels) was added to the morning (7:00 to 8:00 a.m.) and afternoon (4:30 to 5:30 p.m.) peak periods at two intersections to arrive at an estimate of the construction-related trips that would be experienced on local roads. Because it was assumed that most of the construction workers would be drawn from the available labor pool in Durango and nearby communities, the analysis focused on the intersection of U.S. Highway 550 (U.S. 550) and U.S. Highway 160 (U.S. 160) and West Frontage Road and the intersection of West Frontage Road and CR 211.

The additional trips that would be made by these workers during peak commute traffic hours were projected for the entire seven-year construction schedule. Truck trips to haul construction equipment, materials, pipe, and concrete were assumed to be scheduled to avoid peak commute traffic. It was also assumed that earth materials required for construction of Ridges Basin Dam would be obtained on-site and would not be hauled across public access roads. By using these assumptions, which concentrate workers in vehicles at 1.75 workers per vehicle and assign all trips directly within the peak commute hour, the analysis presents a reasonable estimate of the “worst-case” impacts that construction traffic could have on the two intersections listed above. These construction traffic volumes were then compared to traffic volumes expected to occur under future conditions with the ALP Project to determine the percentage increase in construction traffic.

3.15.2.2 Recreation Operation and Maintenance Impacts Evaluation

In response to concerns regarding recreation-related traffic for Refined Alternative 4, recreation visitation at Ridges Basin Reservoir was evaluated based on an estimated 218,400 annual user-days in 2020. It was assumed that 60 percent (131,040) of these visitors would visit Ridges Basin Reservoir in June, July, and August. Another 20 percent (43,680) would visit in May and September; another 15 percent (32,760) would visit in March, April, and October; and the remaining 5 percent (10,920) would visit in November, December, January, and February.

Weekend and weekday visitation was estimated and converted to the number of weekend and weekday vehicles that would use CR 141 to access Ridges Basin Reservoir. These trips were compared with the 2020 average daily traffic (ADT) volume for CR 141 to arrive at a percentage of traffic that would be added to the 2020 CR 141 ADT. Impacts on CR 211 from recreation visitation were not estimated, because there are no published 2020 ADT values for CR 211.

Table 3.15-1
Assumptions Used in Identifying Construction-Related Traffic Impacts Associated with the Structural Components of Refined Alternative 4

Construction Schedule	Construction time frame is April 1 through October 31, recognizing some activities could occur during the winter months.
	Time frames for construction activities generally correspond to the construction sequence schedule in Figure 2-2; some activities occur earlier or later than shown on the schedule to take advantage of the first available April to October construction time frame.
	Workers and truck-hauling are done 20 days per month for each month in the construction activities' time frames.
	Construction begins at the start of the construction season after funding has been authorized.
Construction Employees and Access Routes Used	9 gas pipeline relocation employees, all of whom access the site from the eastern (Durango) end of CR 211.
	80 dam construction employees; 80 percent of workers for dam construction (both time frames = 64 workers) come from eastern (Durango) end of CR 211. The other 20 percent of dam workers (16 workers) enter from west side (SR 140 and CR 141).
	35 pumping plant construction employees, all of whom access the site from the eastern (Durango) end of CR 211.
	35 inlet conduit construction employees, all of whom access the site from the eastern (Durango) end of CR 211.
	15 CR 211 relocation employees, all of whom access the site from the eastern (Durango) end of CR 211.
	15 minimal recreational facilities construction employees, all of whom access the site from the eastern (Durango) end of CR 211.
	15 electrical transmission line relocation employees, all of whom access the site from the eastern (Durango) end of CR 211.
	15 final structural component completion employees, all of whom access the site from the eastern (Durango) end of CR 211.
	1.75 workers per commute vehicle to and from each construction site; one extra contingency trip is added for every 20 worker trips. Assumes one a.m. and one p.m. commute/worker.
Construction Truckloads	Truckloads for construction traffic (all equipment and materials other than concrete) are hauled at equal intervals over the number of months needed to complete each particular construction activity.
	Earth materials required for dam construction would be obtained on-site and would not be hauled over public roads.
	Truck trips will be scheduled to avoid peak hour.
	Number of truckloads estimated based on materials volumes, equipment sizes, pipe sizes, and volume of concrete needed for each construction activity.

3.15.2.3 Significance Criteria

Project impacts on traffic were considered significant if they would cause the following:

% ❑ Increases in ADT or peak-hour traffic volumes of greater than 15 percent.

% ❑ Degraded physical conditions of roadways as a direct result of heavy truck traffic attributable to
% project construction.

3.15.3 Affected Environment

This section discusses the federal highways, state routes, and county roads in the project area that could potentially be affected by the development and operation of Refined Alternatives 4 and 6. Federal and state highways within the project area are shown on Map 1-1. These highways, as well as other relevant roadways within the project area are discussed in the following sections. The actions that may take place under the No Action Alternative are not fully known at this time, and consequently it is not possible to completely define the affected environment for that alternative. However, many of the eventual actions that may occur as a result of the No Action Alternative would likely take place within the same geographic setting as that of Refined Alternative 4.

3.15.3.1 Federal Highways

The major highways in the project area are U.S. 550 and U.S. 160. U.S. 550 is a principal arterial highway that runs in a north-south direction through the City of Durango, southwest towards Farmington, then west to Shiprock. U.S. 160, also a principal arterial highway, runs in an east-west direction, intersects U.S. 550 from the east, proceeds north along the U.S. 550/160 corridor for about 4.5 miles south of Durango, then branches off to the west on the southwest side of downtown Durango. This 4.5-mile U.S. 550/160 corridor is the only highway segment in Colorado where two major primary highways share the same traffic lane corridor. Each of these highways is a major thoroughfare for commercial, residential, and tourism traffic.

U.S. 550 and U.S. 160 are principal arterials, which are typically designed to carry traffic through at relatively high speeds. However, because of the high regional growth rate, local traffic and circulation patterns, and other complex transportation engineering issues, congestion and delays have been occurring with increasing frequency along the U.S. 550/160 corridor. The CDOT is conducting a study of traffic growth and improvement alternatives for U.S. 160 and U.S. 550. These key arterials have limited potential for additional capacity in their current alignments.

3.15.3.2 State Routes

State Routes (SR) 140 and 172 are part of the minor arterial system. SR 140 travels northeast/southwest from points south of Red Mesa, west of Ridges Basin. It travels through the towns of Breen and Hesperus before intersecting with U.S. 160 about 12 miles west of Durango. It intersects the western end of CR 141, which provides access to the western end of CR 211 that can be used to access the west end of Ridges Basin. SR 140 also provides eastbound access from U.S. 160 to CR 125. CR 125 can be used to access CR 141 and CR 211 from the west, again providing access to the west end of Ridges Basin. SR 172 travels north and west from Ignacio to its intersection with U.S. 160, about 3 miles east of the intersection of U.S. 160 and U.S. 550. It could serve as an access route for contractors and labor coming from Ignacio and the surrounding communities.

3.15.3.3 County Roads

The rural local road system, in comparison to collectors and arterial systems, provides access to land adjacent to the collector network and serves travel over relatively short distances. The local road system includes all rural roads not classified as principal arterial, minor arterial, or collector roads. Five La Plata County roads could be affected in the short term (seven year construction time frame) by % construction, hauling, labor force commuting, and equipment movement. These include CR 125, CR 141 (i.e., Wildcat Canyon Road), CR 211, CR 212, and CR 213 (i.e., La Posta Road) and are described below.

3.15.3.3.1 County Road 125

The potentially affected segment of CR 125 travels southeast about 3.5 miles from its western intersection with SR 140 to its eastern intersection with Wildcat Canyon Road. CR 125 is a paved two-lane road in good condition.

3.15.3.3.2 County Road 141

CR 141 (Wildcat Canyon Road) intersects U.S. 160 about two miles west of Durango and extends southwest through Wildcat Canyon for about 4.5 miles, where it intersects the western end of CR 211. CR 141 continues southwest for about 3.8 miles, then turns sharply west for about 3.5 miles, where it intersects SR 140. CR 141 is a paved two-lane road in good condition. The Draft County Traffic Study proposes $1.7 million in major roadway alignment improvements and $15,600 in minor safety improvements (La Plata County 1999a).

3.15.3.3.3 County Road 211

The eastern terminus of CR 211 begins near the south end of Durango. It intersects with the northern end of West Frontage Road and proceeds west into Ridges Basin. CR 211 has one gravel paved lane in each direction, with a total of about 22 feet of running surface. It is in marginal condition, with some “washboarding” and edge raveling evident along its route into Ridges Basin (Hamilton Engineers 1997). It travels west and slightly south adjacent to the current Bodo State Wildlife Area and through Ridges Basin for about seven miles, where its western end intersects with CR 141 (i.e., Wildcat Canyon Road).

As discussed in Chapter 2, portions of the existing CR 211 roadway would be inundated as a result of operation of Ridges Basin Dam and Reservoir and would need to be relocated to an alignment above the future high water level. Two routes have been investigated. Each route would begin at CR 211 on the west side of the crest of Bodo Draw and proceed west approximately 1.3 miles along the low hills north of the proposed reservoir. One alternative would turn north and then west to where it connected with CR 141. The other alternative would continue west, cross the electric transmission line and continue up the north side of the hill to its junction with existing CR 211 west of the future high water level.

3.15.3.3.4 County Road 212

CR 212 intersects CR 211 about 1.8 miles west of the intersection of CR 211 and U.S. 550/160. It extends northwest for about one mile, then turns northeast for another mile, terminating near the radio towers on Smelter Mountain. CR 212 also merges with an unimproved ridge road that trends southwest, running along the north side of Ridges Basin. CR 212 is a two-lane gravel road in fair to good condition.

3.15.3.3.5 County Road 213

CR 213 (i.e., La Posta Road) extends north-south and parallel to the Animas River south of Durango. It is located on the west side of the river. CR 213 is a two-lane improved road in fair to good condition.

3.15.4 Environmental Consequences and Mitigation

The following sections discuss potential impacts to transportation of Refined Alternatives 4 and 6. In addition, mitigation measures are proposed to reduce or eliminate potential impacts to transportation.

3.15.4.1 Refined Alternative 4

Refined Alternative 4 Transportation Impact 1 - Significant: Increased delays at the intersection of West Frontage Road and CR 211 could result from construction worker peak hour commute trips during the construction of the structural components.

The estimated number of additional trips generated by workers during construction of the structural components could cause substantial delays at the intersection of West Frontage Road and CR 211. **Table 3.15-2** indicates the number of additional trips estimated for the morning and afternoon peak hours from the addition of construction workers for the particular construction activities and corresponding months.

As shown in Table 3.15-2, construction of the structural components of Refined Alternative 4 has the potential to cause significant impacts to traffic at the intersection of West Frontage Road and CR 211. Increased worker trips during month 9 through month 66 could increase morning peak traffic from 17 to 316 percent of the existing volume. During this same period, the afternoon peak traffic volume could increase from 4 to 78 percent of the existing volume.

Mitigation for Refined Alternative 4 Transportation Impacts 1 and 2 is discussed following Transportation Impact 2 below.

Refined Alternative 4 Transportation Impact 2 - Significant: Increased delays at the intersection of U.S. 550/160 and West Frontage Road could result from construction worker peak hour commute trips.

The estimated number of additional trips generated by construction workers during project construction could cause substantial delays at the intersection of U.S. 550/160 and West Frontage Road. **Table 3.15-3** indicates the number of additional trips estimated for the peak traffic hours. Increased worker trips during months 9 to 66 could increase morning peak traffic from 1.6 to 30.2 percent of existing traffic volume. Afternoon peak traffic could increase from 0.7 to 13.2 percent of the existing volume.

Mitigation for Refined Alternative 4 Transportation Impacts 1 and 2: Conduct a transportation survey and implement methods to reduce construction impacts.

Delays at the intersection of CR 211 and West Frontage Road and U.S. 550 and West Frontage Road could be reduced by minimizing or avoiding the use of these intersections during morning and afternoon peak traffic periods. Labor contractors could be required to assemble workers at a remote collection point at the start of every work day and transport them to the construction sites by bus. If busing is not feasible for all workers, early morning shifts could be implemented to begin before or after the morning peak hour commute by no less than one-half hour. This offset timing would be used to avoid the peak hour traffic. Similar measures could be taken to avoid or minimize construction worker use of the afternoon peak traffic period for their return commutes. Implementation of one or more of these measures would reduce this impact to a less than significant level.

Table 3.15-2
Estimated Additional Ridges Basin Facilities Construction Peak Hour Commute Trips at the Intersection of West Frontage Road and County Road 211

Construction Period (Months)	Construction Activities	Added a.m. Worker Trips[a]	Percent of a.m. Peak[b]	Added pm. Worker Trips[a]	Percent of p.m. Peak[c]	Significant Impact[d]
9 to 21	Gas Pipeline Relocation	5.1	17.7	5.1	4.2	Yes (a.m. only)
21 to 27	Gas Pipeline Relocation, Ridges Basin Dam Construction	41.7	143.8	41.7	33.9	Yes
27 to 30	Ridges Basin Dam Construction	36.6	122.1	36.6	29.7	Yes
30 to 38	Ridges Basin Dam, Durango Pumping Plant Construction	30.1	99	30.1	24	Yes
38 to 48	Ridges Basin Dam. Durango Pumping Plant, Inlet Conduit Construction	76.6	264	76.6	62.3	Yes
48 to 50	Ridges Basin Dam, Durango Pumping Plant, Inlet Conduit Construction., Electric Transmission Line and CR 211 Relocation	93.7	323.2	93.7	76.2	Yes
50 to 62	Ridges Basin Dam, Durango Pumping Plant, Electric Transmission Line and CR 211 Relocation	73.7	254.2	73.7	59.9	Yes
62 to 66	Electric Transmission Line and CR 211 Relocation, Durango Pumping Plant Construction	37.1	128.1	37.1	30.2	Yes

[a]Assumes all workers access construction sites from east side of CR 211 and use the intersection of U.S. 550/160 and West Frontage Road.
[b]Assumes a.m. peak volume of 29 vehicles based on Figure 11 of Hamilton report.
cAssumes p.m. peak volume of 123 vehicles based on Figure 11 of Hamilton report.
[d]Based on 15 percent or greater increase over peak volume.

Table 3.15-3
Estimated Additional Ridges Basin Facilities Construction Peak Hour Commute Trips at the Intersection of U.S. 550/160 and West Frontage Road

Construction Period (Months)	Construction Activities	Added a.m. Worker Trips[a]	Percent of p.m. Peak[b]	Added p.m. Worker Trips[a]	Percent of p.m. Peak[c]	Significant Impact[d]
9 to 21	Gas Pipeline Relocation	5.1	1.7	5.1	0.8	No
21 to 27	Gas Pipeline Relocation, Ridges Basin Dam Construction	41.7	13.8	41.7	6.1	No
27 to 30	Ridges Basin Dam Construction	36.6	12.1	36.6	5.4	No
30 to 38	Ridges Basin Dam, Durango Pumping Plant, Inlet Conduit Construction	56.6	18.7	56.6	8.3	Yes (a.m. only)
38 to 48	Ridges Basin Dam, Durango Pumping Plant, Inlet Conduit Construction	76.6	25.4	76.6	11.2	Yes (a.m. only)
48 to 50	Ridges Basin Dam, Durango Pumping Plant, Inlet Conduit Construction, Electric Transmission Line, and CR 211 Relocation	93.7	31	93.7	13.8	Yes (a.m. only)
50 to 62	Ridges Basin Dam, Durango Pumping Plant, Electric Transmission Line and CR 211 Relocation	73.7	24.4	73.7	10.8	Yes (a.m. only)
62 to 66	Electric Transmission Line and CR Relocation, Durango Pumping Plant Construction	37.1	12.8	37.1	5.5	No

[a]Assumes all workers access construction sites from east side of CR 211 use the intersection of U.S. 550/160 and West Frontage Road.
[b]Assumes a.m. peak volume of 302 vehicles based on Figure 12 in Hamilton report.
[c]Assumes p.m. peak volume of 681 vehicles based on Figure 12 in Hamilton report.
[d]Based on 15 percent or greater increase over peak volume..

Refined Alternative 4 Transportation Impact 3 - Significant: Physical degradation of CR 211 could occur as a result of construction vehicle traffic associated with construction of the structural components.

Additional truck traffic on CR 211 from truckloads hauled to the ALP Project construction sites could cause substantial physical degradation of CR 211. (Earth materials required for the construction of Ridges Basin Dam would be obtained onsite and would not be hauled across public roads.) This impact is considered significant.

Mitigation for Refined Alternative 4 Transportation Impact 3: Require that construction contractors maintain CR 211 roadway, shoulder, drainage, and roadside to standards adequate to avoid noticeable degradation.

During construction of the structural components of Refined Alternative 4, Reclamation would ensure that construction contractors maintain CR 211 in accordance with the following guidelines:

- ❑ The traveled roadway would be maintained to provide for a moderate degree of user comfort and convenience and to protect the county’s investment and resource values. Surfacing, where present, would be replaced to the depth required for blade maintenance and to prevent wear of the base course. Dust would be abated using water trucks making regular passes as needed to suppress dust. A dust and surface palliative would likely be applied and maintained.

- ❑ Road drainage would be maintained as necessary to keep drainage facilities functional and to prevent unacceptable environmental damage (i.e., rill and sheet erosion and mass failure).

- ❑ Roadway slides and slumps would be repaired or removed to provide passage by prudent drivers in standard passenger cars and to allow unimpeded travel by construction truck traffic.

- ❑ Roadside litter would be cleaned in accordance with road management objectives. Hazards would be abated as needed with minimal environmental damage.

Implementation of these measures on an ongoing basis during construction would reduce this impact to a less than significant level.

Refined Alternative 4 Transportation Impact 4 - Less than Significant: During construction of the structural components, truck traffic used for hauling construction equipment, building materials, machinery, pipe, concrete, and other supplies would slightly increase traffic at the intersection of West Frontage Road and CR 211.

The average number of truck trips through the intersection of West Frontage Road and CR 211 would range from zero to four trips per day. These estimates assume that truck trips would be scheduled to avoid morning and afternoon peak hour traffic and would be hauled at roughly equal intervals over the construction time frame for the particular construction activity they support.

Because these truck trips would be scheduled at equal intervals and at off-peak traffic hours, they represent a less-than-significant impact to traffic flow. This volume of truck traffic is well within the normal variability of truck traffic now experienced on nearby potentially affected roadways.

Mitigation for Refined Alternative 4 Transportation Impact 4: No mitigation is proposed.

Refined Alternative 4 Transportation Impact 5 - Less than Significant: During construction of the structural components, low numbers of heavy truck trips on U.S. 550/160 and West Frontage Road in relation to existing truck traffic could slightly degrade roadway physical conditions.

Because the volume of truck traffic would be well within the normal variability of truck traffic now experienced on nearby potentially affected roadways, physical degradation to U.S. 550/160 and West Frontage Road would not be substantial in relation to normal physical degradation caused by existing truck traffic. This impact is considered less than significant because only a minor level of degradation in the physical conditions of these roadways could be attributable directly to increased truck trips needed for construction of the structural components of Refined Alternative 4.

Mitigation for Refined Alternative 4 Transportation Impact 5: No mitigation is proposed.

Refined Alternative 4 Transportation Impact 6 - Less than Significant: Construction workers accessing Ridges Basin from the west using SR 140 and CR 141 (Wildcat Canyon Road) would slightly increase the number of average daily trips on these roadways.

About 16 workers are estimated to access Ridges Basin from the western end of CR 211. Most of these workers would access the site using Wildcat Canyon Road (CR 141) from SR 140 or U.S. 160. Based on the assumption that there would be, on average, 1.75 workers per worker commute vehicle, this amounts to the addition of approximately 18 to 20 daily trips to these roadways. The ADT volume of CR 141 in 2005 is estimated at about 4,370 (La Plata County 1999a). Eighteen additional trips, therefore, represent an addition of less than 1 percent of projected traffic on CR 141 and are a less than significant impact.

Mitigation for Refined Alternative 4 Transportation Impact 6: No mitigation is proposed.

Refined Alternative 4 Transportation Impact 7 - Significant: Recreation visitation traffic associated with construction of the structural components could exceed the capacity of CR 141 and other access roads.

Recreation visitation impacts were evaluated for 2020 visitation of approximately 218,400 user-days. Eighty percent of visitors in January, February, March, and April were assumed to visit on the weekend. Sixty percent of visitors in May and September were assumed to visit on the weekend. Fifty percent of visitors in June, July, and August were assumed to visit on the weekend. The remaining visitors were assumed to visit Ridges Basin on weekdays. **Table 3.15-4** presents estimated recreation visitation for traffic impacts analysis.

As indicated on Table 3.15-4, weekend additions of vehicles to CR 141 in March, April, and October associated with visitor trips to Ridges Basin recreation areas could exceed the 2020 CR 141 ADT by roughly 29 percent. Weekend visitation in May and September could exceed 2020 CR 141 ADT by 59 percent and by 117 percent from June through August. Similarly, weekday visitation from May through September could exceed the 2020 CR 141 ADT from 15 to 29 percent. Although these estimates are rough approximations, they indicate the potential for extraordinarily high recreation visitation and, at this level of analysis, are considered potentially significant impacts.

Furthermore, the recreation visitation traffic volumes identified to occur on CR 141 represent less than half of the recreation visitation traffic volumes estimated to occur on CR 211. Regardless of how these visitation numbers are respectively assigned to CR 141 and CR 211, each of these roads will need to handle traffic volumes that would stress the 2020 CR 141 ADT as now envisioned in the Draft County Traffic Study (La Plata County 1999a).

Mitigation for Refined Alternative 4 Transportation Impact 7: Reclamation would require recreation developers to conduct a traffic engineering impacts analysis study and mitigate facility impacts according to state and county standards.

Table 3.15-4
2020 Recreation Visitation Impacts on Wildcat Canyon Road (CR 141)

Month	No. of Visitors	Weekend Visitors	Weekend Vehicles[a]	Weekday Visitors	Weekday Vehicles[a]	Weekend Addition to CR 141 ADT[a]	Weekday Addition to CR 141 ADT[a]	Weekend Pct of CR 141 2020 ADT	Weekday Pct of CR 141 2020 ADT	Significant Impact[a]
January	2,730	2,184	874	546	218	349	87	7%	2%	No
February	2,730	2,184	874	546	218	349	87	7%	2%	No
March	10,920	8,736	3,494	2,184	874	1,398	349	29%	7%	Yes (weekend only)
April	10,920	8,736	3,494	2,184	874	1,398	349	29%	7%	Yes (weekend only)
May	21,840	17,472	6,989	4,368	1,747	2,796	699	59%	15%	Yes
June	43,680	34,944	13,978	8,736	3,494	5,591	1,398	117%	29%	Yes
July	43,680	34,944	13,978	8,736	3,494	5,591	1,398	117%	29%	Yes
August	43,680	34,944	13,978	8,736	3,494	5,591	1,398	117%	29%	Yes
September	21,840	17,472	6,989	4,368	1,747	2,796	699	59%	15%	Yes
October	10,920	8,736	3,494	2,184	874	1,398	349	29%	7%	Yes (weekend only)
November	2,730	2,184	874	546	218	349	87	7%	2%	No
December	2,730	2,184	874	546	218	349	87	7%	2%	No

ADT on CR 141 is assumed to be 4,760 in 202 based on La Plata County's 1999 Draft County Traffic Study.
[a] Assumes 2.5 visitors per vehicle. Assumes vehicle traffice to Ridges Basin recreation facilities would use CR 141.
[b]Significant impacts determined based on a 15 percent or greater increase.

Third-party recreational developers should be required to fund a comprehensive traffic and transportation engineering and impacts analysis. The analysis should characterize "existing traffic conditions" when recreational development is planned for implementation, identify increased levels of traffic attributable to recreational visitation to be developed at Ridges Basin, and mitigate for impacts to area roadways. Implementation of the appropriate traffic and transportation studies and fulfillment of mitigation obligations negotiated after their completion are expected to reduce this impact to a less than significant level.

Refined Alternative 4 Transportation Impact 8 - Less than Significant: Construction of the NNMP would increase traffic on area roadways.

The construction the NNMP could cause temporary delays in vehicular traffic as a result of construction activities along U.S. 550. The Federal Highway Administration and New Mexico Division of Motor Transportation regularly allow maintenance, repair, and replacement of pipelines along highway rights-of-way. Installation of water conveyance pipelines along the U.S. 550 corridor would be conducted according to well-established practices administered by these agencies with jurisdiction over transportation facilities. This impact is less than significant because such installations would be conducted according to established procedures.

Mitigation for Refined Alternative 4 Transportation Impact 8: No mitigation is proposed.

Refined Alternative 4 Transportation Impact 9 - Less than Significant: Construction of the water end uses and conveyance systems would increase traffic volumes on roadways used for accessing end use areas and conveyance pipeline rights-of-way.

The construction of residential communities, resorts, a coal mine, and power plants could all cause temporary increases in vehicular traffic on SR 140, SR 172, CR 125, CR 141, and CR 213 as a result of the commuting of construction workers and hauling of construction materials. However, because of the relatively low number of workers that are expected to use each of these roads to access construction sites, the increased construction worker commute traffic is not expected to cause delays in local traffic.

Much of the distribution system pipeline construction would be along paved and unpaved roads, existing rights-of-way, or existing developed travel or transmission corridors. The CDOT and La Plata County Road and Bridge Department regularly allow maintenance, repair, and replacement of pipelines along easements and rights-of-way. Installation of water conveyance pipelines along these developed corridors would be conducted according to well-established staging and traffic control practices administered by these and other agencies with jurisdiction over roadways and other transportation facilities. This impact is less than significant because such installations would be completed according to established procedures.

Mitigation for Refined Alternative 4 Transportation Impact 9: No mitigation is proposed.

3.15.4.2 Refined Alternative 6

3.15.4.2.1 Structural Components

Refined Alternative 6 Transportation Impact 1 - Significant: Construction activities associated with raising Lemon Dam and Reservoir would increase traffic on local roadways.

Construction activities necessary for raising Lemon Reservoir Dam and preparing the shoreline would require additional vehicle trips associated with worker commutes. Truck trips to haul equipment and materials over public roads to increase the height of the dam would also be required. Although the specific routes and volumes of trips have not been determined, these activities could have a potential short-term significant impact to the affected roadways and intersections in terms of LOS.

Mitigation for Refined Alternative 6 Transportation Impact 1: Develop a transportation plan that would include methods to reduce peak period construction traffic.

Delays at affected intersections could be reduced by minimizing or avoiding the use of these intersections during morning and afternoon peak traffic periods. Labor contractors could be required to assemble workers at a remote collection point at the start of every work day and transport them to the construction sites by bus. If busing is not feasible for all workers, early morning shifts could be implemented to begin before or after the morning peak hour commute by no less than one-half hour. This offset timing would be used to avoid the peak hour traffic. Similar measures could be taken to avoid or minimize construction worker use of the afternoon peak traffic period for their return commutes. Implementation of one or more of these measures would reduce this impact to a less than significant level.

Refined Alternative 6 Transportation Impact 2 - Less than Significant: Physical degradation of roadways used for materials and equipment hauling could occur during the construction activities associated with raising Lemon Dam and Reservoir.

Heavy load haul trips associated with raising Lemon Dam and Reservoir could increase physical degradation rates on roadways used for accessing construction sites. This degradation would not be expected to occur to significant levels as relatively limited hauling would be likely to occur.

Mitigation for Refined Alternative 6 Transportation Impact 2: No mitigation is proposed.

Refined Alternative 6 Transportation Impact 3 - Less than Significant: Construction of the NNMP would increase traffic volumes on area roadways.

Same as Refined Alternative 4 Transportation Impact 8.

Mitigation for Refined Alternative 6 Transportation Impact 3: No mitigation is proposed.

Refined Alternative 6 Transportation Impact 4 - Construction of the water end uses and conveyance systems would increase traffic volumes on roadways used for accessing end use areas and conveyance pipeline alignments.

Same as Refined Alternative 4 Transportation Impact 9.

Mitigation for Refined Alternative 6 Transportation Impact 4: No mitigation is proposed.

3.15.4.3 No Action Alternative

The No Action Alternative impacts were not discussed in the 1996 FSFES.

3.16 AIR QUALITY

3.16.1 Introduction

This section addresses potential impacts on air quality that could result from actions associated with Refined Alternatives 4 and 6 and the No Action Alternative. Section 3.16.2 defines the Evaluation Methodology and significance criteria used for determining impacts, Section 3.16.3 describes the affected environment, Section 3.16.4 identifies potential impacts and discusses the mitigation measures that would serve to reduce or eliminate potential impacts.

3.16.2 Methodology

This section discusses the methodology used to determine potential impacts that could result from Refined Alternative 4, Refined Alternative 6, and the No Action Alternative. Also discussed are specific criteria that were used to determine the significance of the impacts identified.

3.16.2.1 Evaluation Methodology

For evaluation of the air quality impacts, the estimates of expected emissions from the construction and operation of the proposed project components and their effects on local and regional air quality were evaluated against federal and local requirements for protecting public health. It was assumed that construction contractors would be required to maintain compliance with all applicable requirements for control of particulate and gaseous emissions.

3.16.2.2 Significance Criteria

Air emissions are regulated under the Federal Clean Air Act (CAA). The primary purpose of the CAA is to protect and enhance the quality of the nation's air resources. The CAA provides National Ambient Air Quality Standards (NAAQS) and New Source Performance Standards (NSPS), a permitting process to prevent significant deterioration of air quality, visibility limitations for national parks and wilderness areas, and limits on emissions of hazardous substances. The EPA has established NAAQS, codified in 40 CFR Part 50, for several pollutants, including carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), ozone (O_3), lead (Pb), and particulate matter smaller than 10 microns in diameter (PM_{10}). These standards are expressed as pollutant concentration limits and are set at levels intended to protect public health.

The following criteria were used to determine the significance of the emissions from project construction and operation. For the proposed project, an air quality impact would be considered significant if one of the following were to occur as a result of any of the project's components:

- ❑ Construction or operation emissions resulting in a short- or long-term violation of any ambient air quality standard;
- ❑ Construction or operation releases of harmful quantities of hazardous pollutants; or
- ❑ Construction or operation would interfere with any local air quality management planning efforts to attain and maintain standards.

3.16.3 Affected Environment

The section below discuss existing air quality resources in the areas potentially affected by Refined Alternatives 4 and 6. The actions that may take place under the No Action Alternative are not fully known at this time, and consequently it is not possible to completely define the affected environment of that alternative. However, many of the eventual actions that could occur as a result of the No Action Alternative would likely take place within the same geographic setting as that of Refined Alternatives 4 and 6. The affected environment for the project air quality analysis includes both climate and the existing ambient air quality within the impact area of influence.

3.16.3.1 Climate

Climate is a composite of the long-term average weather patterns of a given area. Weather affects air quality through its impact on the dispersion of pollutants emitted into the atmosphere. In some cases, weather conditions can also affect the amount of pollutants emitted, such as fugitive dust particles blown airborne from exposed soils. The most important meteorological parameters affecting air quality are wind speed and wind direction. Wind speed and direction determine where pollutants are transported and the rate of dilution in the atmosphere. Temperature and precipitation also affect air quality through their effects on emissions, pollutant transport, atmospheric removal mechanisms, and atmospheric chemistry.

The project area (southwestern Colorado and northwestern New Mexico) has a semiarid continental climate, with four well-defined seasons. Climate and meteorological conditions are influenced by the altitude of the area (approximately 4,950 above sea level at Shiprock, New Mexico, to 6,900 feet at Ridges Basin near Durango, Colorado). Summers are typically warm and dry, with high temperatures averaging 89 degrees Fahrenheit (°F) and winter low temperatures of 7°F. In southwestern Colorado, the average annual precipitation ranges from under 10 inches at the southwest corner of Montezuma County (at Four Corners) to over 35 inches at the northwest corner of La Plata County. The project area in New Mexico lies in a precipitation zone that receives under 12 inches per year. The average annual snowfall is in the range of 6 to 80 inches, with greater snowfall occurring at higher elevations. Durango's temperature ranges from a mean monthly low of 14.4°F to a mean monthly high of 83.1°F. Farmington's corresponding temperature range is from 19.0°F to 93.2°F. Cortez' corresponding temperature range is from 12.0°F to 88.3°F.

Wind speed and directional data were obtained from Mesa Verde National Park (Mesa Verde), approximately 25 miles west of Durango, and the Four Corners Regional Airport at Farmington. At Mesa Verde the wind blows in all directions, with wind from the north and north-northeast predominating at about 25 percent of the time. The rest of the wind is distributed among the other directions, from 3 to 8 percent each. An east wind, from the direction of Ridges Basin, occurs about 5 percent of the time, and an east-southeast wind occurs from 5 to 7 percent of the time. Winds are generally light (i.e., less than 9 miles per hour). At Farmington, the wind blows mainly in two opposite directions; from the east and east-northeast about 36 percent of the time and from the opposite direction (west and west-southwest) about 28 percent of the time. The rest of the wind is divided among other directions with none over 4 percent of the time.

3.16.3.2 Local Ambient Air Quality

Ambient air quality is characterized by the atmospheric concentrations of "criteria pollutants": NO_2, SO_2, O_3, CO, PM_{10}, and Pb. NAAQS have been promulgated for these criteria pollutants and are intended to protect public health, with a margin of safety. For the purposes of air quality management, geographic areas of the country are classified as "attainment" or "non-attainment" with NAAQS. The areas most immediately affected by the construction of the structural components of Refined Alternative 4 and 6 are Durango and adjacent area, and the San Juan River corridor from Farmington to Shiprock, New Mexico. The effects of the potential non-binding components of both action alternatives would range further west of the Durango Area, and include Mesa Verde. The potential sites of the coal mine and the coal-fired power plant are about 19 miles equidistant from Durango, Farmington, and Mesa Verde. The potential site of the gas-fired power plant is about 19 miles south of Mesa Verde, 40 miles southwest of Durango, and 14 miles northwest of Farmington.

The project area in Colorado is in the Western Slope Air Quality Region, which consists of nearly the entire western half of the state. Within this region, La Plata and Montezuma Counties are attainment areas for all air quality standards, as are most of the counties in this region. Several counties within Colorado are currently designated non-attainment areas for various criteria pollutants, and have developed specific air pollution control programs for individual pollutants. San Miguel County, which includes the community of Telluride, is the nearest non-attainment county to the project area. Although coal-fired power plants are located in the four corners area, the dispersion of gases from their stack emissions produce no recordable violations of federal standards for SO_2 or nitrogen oxides (NO_x) in Colorado.

Occasional occurrences of high winds cause dust storms resulting from pick-up of dust from wind-blown soils, gravel roads, construction projects and other sources, some from outside the area. Durango has experienced such conditions twice in the past three years to the degree that concentrations of PM_{10} have exceeded the ambient standard for PM_{10} of 150 micrograms per cubic meter. The State of Colorado is setting up a monitoring station for $PM_{2.5}$ at Durango in response to EPA requirements. The station will sample the ambient air for three years, after which a determination will be made whether the area meets Federal standards for $PM_{2.5}$.

Mesa Verde has experienced a slight decline in air quality and visibility since the late 1960s. This condition is influenced by pollutants originating within San Juan County, New Mexico, Apache County, Arizona, which contain coal-fired powerplants, and to a lesser extent by emissions from Montezuma and La Plata Counties. Visibility is the only air quality-related value known to be impacted; current levels of pollution are high enough to produce haze and obscure important vistas at the park. Mesa Verde has been designated as a Class I area for preservation or enhancement of visual qualities by EPA, as discussed below in Section 3.16.3.3, Regional Ambient Air Quality.

San Juan County is an attainment area for all air quality standards. Isolated exceedances have occurred in past years, and the mining of coal in the San Juan River Basin between Farmington and Shiprock causes occasional localized dust emissions. An emissions inventory in the county showed that the county leads the State of New Mexico in emissions from permitted stationary sources, primarily from oil and gas extraction and electric, gas, and sanitary services. (New Mexico 1997) Two coal-fired powerplants are situated between Farmington and Shiprock.

3.16.3.3 Regional Ambient Air Quality

The project area is on the Colorado Plateau, a high, semi-arid tableland encompassing southeastern Utah, northern Arizona, northwest New Mexico, and western Colorado. Air quality in this area is of national concern because it contains various national parks, national monuments, and wilderness areas. They include Mesa Verde, the Weminuche Wilderness Area and Black Canyon National Park in southwestern Colorado, the Grand Canyon and Petrified Forest National Parks in northern Arizona, and Canyonlands, Bryce Canyon, and Zion National Parks in southern Utah. The air quality of the plateau has experienced a decline over natural conditions. This decline has been accompanied by a noticeable reduction in the average visibility of distant landscapes, because the gasses and extremely fine particulates affecting human health also affect the transmissivity of light. The Grand Canyon, about 280 miles southwest of the La Plata Basin, has experienced a particularly marked decline in visibility since the late 1960s.

Concerned over the deteriorating visibility, Congress designated the parks and other areas cited above as Class I areas whose air quality needed protection and, if possible, improvement. EPA also formed the Grand Canyon Visual Transport Commission (GCVTC) to investigate the nature of the air quality degradation at the Grand Canyon and elsewhere on the Colorado Plateau, and to make recommendations for its control. The resulting analysis indicated that a decline in air quality occurred on the Colorado Plateau between the 1940s and the 1970s as the result of man-made development and other activities on the plateau and adjoining regions from which airborne pollutants drift in. The major sources of pollution were concluded to be vehicle emissions, road dust, utility emissions, and airborne pollution from Mexico. It was also concluded that, whereas the air pollution appeared to hold steady in the 1980s and early 1990s, future population and economic growth that will occur in the region pose a potential threat to air quality on the plateau.

The GCVTC's final report contained a variety of recommendations, including strategies for emissions control, more detailed modeling, and the establishment of a regional coordinating entity to implement the recommendations and provide continuing oversight. (GCVTC 1996)

In 1999, based on the GCVTC report and knowledge developed elsewhere, EPA issued its final Regional Haze Regulations, which set forth the obligation of the states to closely monitor their air quality, and where appropriate to develop programs to control emissions and protect the air quality at Class 1 areas (EPA 1999b). EPA also approved the recommendations in the 1996 GCVTC report, and the governors of the western states formed the Western Regional Air Partnership (WRAP) to provide a unified effort at addressing the requirements of the EPA Regional Haze Regulations (WRAP 1999). The required air quality programs and oversight provided by EPA may lead to the establishment of numeric area limits on emissions, but in any event will subject any proposals for new stationary emission sources to analysis with respect to their potential contribution to regional haze.

3.16.4 Environmental Consequences and Mitigation

The following sections discuss potential air quality impacts and mitigation for Refined Alternative 4 and 6. In addition, mitigation measures are proposed to reduce or eliminate potential impacts to air quality.

3.16.4.1 Refined Alternative 4

3.16.4.1.1 Structural Component Impacts

Refined Alternative 4 Air Quality Impact 1 - Significant: Fugitive dust and exhaust emissions from the construction of the Durango Pumping Plant, Ridges Basin Inlet Conduit, Ridges Basin Dam, and the NNMP could cause or contribute to temporary exceedances of an NAAQS or affect the health of nearby sensitive persons.

Fugitive dust would be emitted during excavation and related earthwork during construction of structural components. As discussed in Section 3.8, Geology and Soils, fugitive dust emissions (of which PM_{10} is a component) would occur during ground-disturbing activities. In addition, air entrainment of any heavy metals or toxic substances contained in the soils disturbed during pumping plant foundation excavation could pose health threats to those exposed.

The construction schedule presented in Chapter 2 provides for the concurrent construction of the Ridges Basin Dam, Durango Pumping Plant, Ridges Basin Inlet Conduit, and the NNMP. Under normal weather conditions, the dust and other emissions caused by these projects would be localized in the immediate areas. However, under infrequent conditions of high wind, the dust could become additive for brief periods. Exhaust emissions from construction equipment and fugitive dust emissions from construction activities were estimated for each of the four components, using emissions factors from the Fifth Edition of AP-42, EPA's Compilation of Air Pollutant Emission Factors (EPA 1995). These unit values were used to estimate the peak construction emissions. **Table 3.16-1** presents the combined emissions for Ridges Basin Dam, the Durango Pumping Plant, and the Ridges Basin Inlet Conduit, which are close together. **Table 3.16-2** presents the emissions for the NNMP. Most of these emissions are from equipment travel over unpaved roads or direct disturbance of the soil by excavation, transport, grading, and compacting. Application of standard dust suppression techniques (e.g., soil stabilization or watering of trench stockpiles) would reduce daily PM_{10} emissions.

Table 3.16-1
Summary of Total Daily Construction Emissions
from Construction of Ridges Basin Dam, Durango Pumping Plant, and Ridges Basin Inlet Conduit

Emission Source Category	Daily Emissions (pounds/day)				
	CO	Reactive Organic Gases	NO_x	SO_2	PM_{10}
Equipment Exhaust	1,286	269	2,945	262	272
Construction Dust	NA	NA	NA	NA	1,382
Total	**1,286**	**269**	**2,495**	**262**	**1,654**

Table 3.16-2
Summary of Total Daily Construction Emissions
from Construction of Navajo Nation Municipal Pipeline

Emission Source Category	Daily Emissions (pounds/day)				
	CO	Reactive Organic Gases	NO_x	SO_2	PM_{10}
Equipment Exhaust	99	25	256	22	26
Construction Dust	NA	NA	NA	NA	154
Total	**99**	**25**	**256**	**22**	**180**

The short-term impacts of these emissions were assessed by applying the EPA's SCREEN 3 model to the emission estimates. The model was run in area source mode with the dam, pumping station, and inlet conduit areas being combined. The municipal pipeline area was treated separately, given its relatively extreme distance from the other three areas. The model was run for a series of meteorological conditions (i.e., wind speeds and stability classes). Modeling results were compared with the NAAQS for which short-term standards exist, i.e., PM_{10} (24-hour), CO (1-hour and 8-hour), and SO_2 (3-hour and 24-hour). The results of the model indicate that no exceedances of the NAAQS for either CO or SO_2 are likely to occur. For PM_{10} both construction dust and equipment exhaust emissions were included. The modeling did not include the effects of potential avoidance measures to minimize short-term construction dust and long-term wind erosion. The results of the model run for PM_{10} show that the federal 24-hour PM_{10} standard would be exceeded from construction activities. This occurrence of emissions in excess of the standard could be characterized as being temporary and localized in extent. Based on the significance criteria and results of the model, estimated exceedances of the federal 24-hour PM_{10} standard are considered significant.

Mitigation for Refined Alternative 4 Air Quality Impact 1: Implement measures to control fugitive dust and exhaust emissions from the construction activities.

Dust from operation of construction equipment would be controlled by water spraying of haul roads and storage piles. Chemical stabilization of overburden storage piles is effective when water evaporation is a problem. Dust from dam foundation stripping and embankment material excavation would be controlled by pre-wetting the material to be handled. Dust from haul roads and materials processing operations would be controlled by water spraying of haul roads and storage piles. Dust emissions from the Durango Pumping Plant foundation excavation would be controlled by watering and other measures designed to minimize the disturbance of contaminated soils, as described in Section 3.14, Hazardous Materials. Contractors would be required to seed landscaped areas within a certain period of time after final grading. Personal breathing devices would be provided to workers exposed to excessive amounts of dust.

Refined Alternative 4 Air Quality Impact 2 - Less than Significant: Windblown dust from Ridges Basin Reservoir when the water level is drawn down could create fugitive dust emissions.

Lower reservoir levels would expose previously inundated soil whose surface lacks a vegetative cover and whose soil surface has been rearranged by the action of water. This condition could foster wind erosion of fine particles and entrainment of fugitive particulates to the atmosphere.

The area of exposed reservoir bottom and the duration of the exposure would depend on the modes of water delivery from the proposed project. There could be reservoir releases in response to late summer/early fall project demands, instream flow releases for fisheries, or for other purposes. The drawdown could persist through much of the fall and winter seasons or until sufficient water is available in the Animas River to refill the reservoir. Hydrologic modeling developed for Ridges Basin Reservoir estimates that reservoir elevation would not decline more than about 9.5 feet or increase more than about 10 feet in any one month. However, there are times when reservoir elevations could drop up to 50 feet over a nine-month period.

Mitigation for Refined Alternative 4 Air Quality Impact 2: No mitigation is proposed.

3.16.4.1.2 Non-Binding Water End Use and Conveyance Impacts

Refined Alternative 4 Air Quality Impact 3 - Less than Significant: Fugitive dust and exhaust emissions would occur from the development of a coal mine and construction of two power plants.

Mine development—including removal of overburden to expose the coal seam, coal removal, and stockpiling for initial use—and construction of the electrical power station would have air impacts resulting from fugitive dust entrained by construction equipment and gaseous emissions from engine exhausts. Construction of the electrical power plants would have temporary air quality impacts that would be similar to those described for the structural components above.

Construction of the pipe distribution systems to provide water for the coal mine, power plant, resort, and community housing developments would be constructed in a conventional manner, which would produce a very localized and limited potential for blowing dust and emissions from construction equipment. The water treatment plants that would be constructed along the pipelines would involve construction on a scale of a multi-family dwelling unit in terms of potential for fugitive dust emissions and other emissions, and would result in a less than significant impact.

Mitigation for Refined Alternative 4 Air Quality Impact 3: Require that the end user follow environmental regulations and develop BMPs for reducing fugitive dust emissions. Costs are to be covered by the end user of water.

Mitigation techniques to control fugitive dust include water sprinkling of haul roads, work areas, and stockpiles that are prone to producing wind-blown dust, operating practices that minimize the area of exposed soil subject to producing dust, and revegetation of spoil areas under a waste disposal area reclamation program. A combination of these measures would be used to control emissions from the mining operation.

Refined Alternative 4 Air Quality Impact 4 - Significant: Dust and stack emissions would occur from operation of a coal-fired power plant, coal mine, and gas-fired power plant.

The operation of the potential coal mine and power plants could add to the concentrations of fine particulates in the Four Corners area and the overall Colorado Plateau area. This could result in further degradation of the air quality and visibility at Mesa Verde and other Class I areas designated by Congress.

Fugitive dust or particulate matter would be released during operation of the coal mine. Fugitive dust would also likely be generated while coal was conveyed. During generation of electrical power, coal would be fed from the mine to boiler stokers more or less directly by conveyor without the need for over-the-road transport. During and after combustion of the coal, other emissions would be generated, including those from power plant ash ponds.

The major pollutants of concern from the combustion of bituminous and subbituminous coal are PM, SOx, and NO_x. Some unburned combustibles, including CO and numerous organic compounds such as products of incomplete combustion (PICs) which often include benzene, alkalenes, aldehydes, dibenzo-p-dioxins, and polychlorinated dibenzofurans.

During operation using natural gas as fuel, the principal emission would be NO_x. Small quantities of CO, and SO_2 can be expected in significantly lower volume than from coal-fired combustion. Typically, NO_x would be limited by emission permit to 0.20 to 0.30 pounds per million (ppm) British Thermal Unit (Btu) of heat input. Reasonably Available Control Technology (RACT) requirements for gas turbines provide the regulatory framework for assuring that emissions are controlled within permitted limits.

Mitigation for Refined Alternative 4 Air Quality Impact 4: The future end users of water could develop and implement environmental quality plans that would require emissions control technologies.

A wide variety of technologies are available to control combustion emissions. PM would be controlled by one or a combination of devices, such as electrostatic precipitator, fabric filter, cyclone collector or side stream separator. The collected PM and bottom ash must be handled and disposed in a manner that does not result in re-entrainment to the atmosphere. SO_2 is commonly controlled successfully using a wet scrubber or flue gas desulfurization devices. NO_x can be controlled during combustion and after by selective catalytic reduction. By controlling these pollutants, PICs are also controlled. Control technology efficiencies range from 80 to 95+ percent for wet scrubbers and more that 95 percent for PM separation. By arranging controls in trains, sequential separation of pollutants may reach 98 percent efficiency.

Specific new source performance standards for electric utility steam generating units also must be met. NSPS apply to certain steam generating units (40 CFR 60, Subpart D et seq.) and gas turbines (40 CFR 60, Subpart GG).

However, the power plant permitting process would limit the emissions to concentrations calculated to avoid air quality degradation in the project area. The potential for impacts to air quality at Mesa Verde and on the Colorado Plateau in general would also need to be considered when setting emission limits for these plants. Generating units must employ RACT. Depending upon location—an attainment area or non-attainment area for a particular pollutant or pollutants—certain permitted levels are allowed. More stringent limitations are imposed in non-attainment areas. For example, after controls are employed, typical emission levels permitted for PM would be a reduction of 15 to 25 percent. Typical permitted levels for SO_2 emissions range from 1.2 to 1.9 ppm Btu of heat input and up to 5.0 ppm Btu of heat input if the stack is at a certain height. NO_x is typically permitted at 0.40 to 0.50 ppm Btu of heat input.

Utilities which own or plan to own fossil fuel-fired generation facilities, or which purchase power from such plants, must be aware of the acid rain regulations regulating the amount of sulfur dioxide which can be produced by such plants. The law provides for pollution “allowances” for such facilities beginning in 1995 (for some) and 2000. Unless a facility has adequate allowances, the amount of power that is generated could be restricted. Many notification, recordkeeping, and reporting requirements associated with the procedures are defined in the federal regulations, which assist with the monitoring of emissions from power plant operation.

3.16.4.2 Refined Alternative 6

3.16.4.2.1 Structural Component Impacts

Refined Alternative 6 Air Quality Impact 1 - Significant: Fugitive dust and exhaust emissions from the enlargement of Lemon Dam and construction of the NNMP could cause or contribute to temporary exceedance of an NAAQS or affect the health of nearby sensitive persons.

Fugitive dust would be emitted during excavation and related earthwork during the construction in similar ways to those described for Refined Alternative 4. Exhaust emissions from construction equipment along with fugitive PM_{10} emissions from associated activities for both project components were estimated using the Fifth Edition of EPA AP-42 document (EPA 1995). These emissions factors were used to estimate the peak construction emissions for the Lemon Dam renovation shown below in **Table 3.16-3**. The emissions for the NNMP were previously shown in Table 3.16-2. Most of these emissions are from vehicular and equipment travel over unpaved roads or the direct disturbance of the soil.

Table 3.16-3
Summary of Total Daily Construction Emissions
From Enlargement of Lemon Dam

Emission Source Category	Daily Emissions (pounds/day)				
	CO	Reactive Organic Gases	NO_x	SO_2	PM_{10}
Equipment Exhaust	258	65	694	65	65
Construction Dust	NA	NA	NA	NA	409
Total	**258**	**65**	**694**	**65**	**474**

The short-term impacts of the emissions for the Lemon Dam enlargement and the NNMP were assessed using the SCREEN 3 model. Modeling results were compared with the NAAQS for which short-term standards exist [i.e., PM_{10} (24-hour), CO (1-hour and 8-hour), and SO_2 (3-hour and 24-hour)]. The results of the model indicate that no exceedances of the NAAQS for either CO or SO_2 are likely to occur.

For PM_{10} both construction dust and equipment exhaust emissions were included, and the modeling did not include the effects of potential avoidance measures to reduce fugitive dust. The results of the model run for PM_{10} show that the federal 24-hour PM_{10} standard would be exceeded from construction activities. This occurrence of emissions in excess of the standard could be characterized as being temporary and localized in extent. Based on the significance criteria and results of the model, estimated exceedances of the federal 24-hour PM_{10} standard are considered significant.

Mitigation for Refined Alternative 6 Air Quality Impact 1: Implement measures to control fugitive dust and exhaust emissions from construction activities.

The control measures would be the same as those described above under Refined Alternative 4 Air Quality Impact 1.

3.16.4.2.2 Non-Structural Component Impacts

Refined Alternative 6 Air Quality Impact 2 - Potentially Significant: Fugitive dust emissions could occur as a result of irrigation water being taken off of the land under the non-structural component.

No construction activities are anticipated in connection with the non-structural component. However, the discontinuation of irrigation on tracts of agricultural land could result in a short-term fugitive dust hazard until vegetative cover is re-established.

Mitigation for Refined Alternative 6 Air Quality Impact 2: Require that cover-crop requirements be developed for agricultural lands taken out of production.

A coordinated agricultural land management program could be developed that would include wind erosion control measures through the use of cover-crop requirements to avoid excessive soil exposure.

3.16.4.2.3 Non-Binding End Use and Conveyance Impacts

Refined Alternative 6 Air Quality Impact 3 - Less than Significant: Fugitive dust and exhaust emissions would occur from the potential development of a coal mine and construction of two power plants. %

Mine development and the construction of two electrical power plants would have the same air impacts as described above under Refined Alternative 4 Air Quality Impact 4.

Mitigation for Refined Alternative 6 Air Quality Impact 3: Require that the end user follow environmental regulations and develop BMPs for reducing fugitive dust emissions.

Mitigation techniques to control fugitive dust would be the same as those proposed for Refined Alternative 4 Air Quality Impact 4.

Refined Alternative 6 Air Quality Impact 4 - Significant: Dust and stack emissions would occur from operation of a coal-fired power plant, coal mine, and gas-fired power plant.

Potential dust from operation of the power plants and coal mine would be identical to those described above for Refined Alternative 4 Air Quality Impact 4.

Mitigation for Refined Alternative 6 Air Quality Impact 4: The future end users of water could develop and implement environmental quality plans that would require emissions control technologies.

The technologies available to control emissions are the same as those described above for Refined Alternative 4 Air Quality Impact 4.

3.16.4.3 No Action Alternative

No air quality impacts were identified in the 1996 FSFES.

3.17 NOISE

3.17.1 Introduction

This section addresses potential noise impacts that would result from actions associated with Refined Alternatives 4 and 6 and the No Action Alternative. Section 3.17.2 defines the Evaluation Methodology and significance criteria used for determining impacts, Section 3.17.3 describes the affected environment, and Section 3.17.4 identifies potential impacts and mitigation measures that would serve to reduce or eliminate anticipated noise impacts.

This section evaluates the potential noise effects on receptors other than the project work force. It was assumed that the federal Occupational Safety and Health Act (OSHA), which regulates sound levels in the work place, would be complied with during construction and operation of project facilities. The non-structural components of the alternatives have been eliminated from the analysis of potential noise impacts because no construction would be required and any changes to agricultural production would not be expected to increase noise levels.

3.17.2 Methodology

This section discusses the methodology used to determine potential impacts that could result from Refined Alternative 4 and Refined Alternative 6. Also discussed are specific criteria that were used to determine the significance of the impacts identified.

3.17.2.1 Evaluation Methodology

For evaluation of noise impacts, projected noise levels produced during construction and operation were compared to acceptable levels for adjacent area levels under federal and local standards. Manufacturer's data on noise emissions and potential means of construction noise abatement were obtained. Distances from noise sources to the nearest sensitive receptors were determined.

Noise restrictions in the cities of Durango and Farmington municipal codes were obtained for evaluation of the noise intensities expected from construction equipment in or adjacent to these cities, and in other residential areas. The guidelines published by the Federal Highway Administration for traffic and heavy construction equipment were also considered for the other areas.

Exceptions to this approach occurred in the cases of dynamite blasting and wildlife sensitivity, where the approaches were based on public perceptions of disturbance to the public and wildlife, and local ordinances where available. Time-of-day relationships were also considered.

3.17.2.2 Significance Criteria

The significance criteria used to determine noise impacts were whether the following effects would be caused by the construction or operation of project facilities:

❏ Noise generated in exceedence of established noise ordinances or criteria;

❏ Substantial increases in noise levels over the existing noise levels in an area; or

❏ Noise that would be disturbing or injurious to wildlife.

Noise intensity is measured in decibels. The hearing of humans is more sensitive to sounds in the middle range of frequencies than at the extremes. To account for this, a weighted scale, the "A" scale, has been devised to measure the intensity of noise as perceived by the human ear. Sounds measured in decibels with an "A" weighted range of sound are expressed using the notation dB(A). On this scale, zero represents the threshold of human hearing and 180 dB(A) represents irreversible hearing loss. The daytime range generally experienced by people tends to range from 30 dB(A) to 90 dB(A), with the upper value represented by heavy truck traffic at a distance of 50 feet. To the human ear, each 10 dB(A) increase seems twice as loud.

The municipal codes of Durango and Farmington limit the sound intensity from stationary sources by municipal zone, as shown on **Table 3.17-1**. The limitations cited are as measured 25 feet from the property line of the property on which the noise source is located.

Table 3.17-1
Permissible Noise Intensities from Stationary Sources in Durango and Farmington
(Measured in Decibels 25 Feet from Property Line)

City Zoning District	Durango		Farmington	
	7 a.m. to 7 p.m. dB(A)	7 p.m. to 7 a.m. dB(A)	7 a.m. to 7 p.m. dB(A)	7 a.m. to 7 p.m. dB(A)
Residential	55	50	60	50
Commercial	60	55	65	55
Industrial	80	75	75	75

Under a special provisions of Durango's noise code, a construction project is allowed the maximum permissible noise intensity set for an industrial zone during the period of construction. There are also provisions for obtaining permits for exceedence of the noise restrictions under specific conditions, if the restriction would pose a hardship on the contractor. The conditions would spell out the times of day when such exceedences would be permitted.

Both Durango and Farmington also restrict the noise level from various types of vehicles. Durango has a limit of 88 dB(A) for vehicles with gross weight greater than 10,000 pounds and 80 dB(A) of other vehicles. Farmington has limits which vary with vehicle speed, under which the limit for a vehicle engaged in interstate commerce weighing over 8,000 pounds would be 86 dB(A) at or below 35 miles per hour, and 90 dB(A) at higher speeds with certain daytime exemptions for construction equipment.

The Federal Highway Administration's Noise Abatement Criteria illustrate noise criteria established for a broader geographic scope. These criteria are expressed in terms of an L_{10} value for outdoor noise, which is the level exceeded only 10 percent of the time in the noisiest hour of the day. The L_{10} criteria values of significance are 60 dB(A) for areas where serenity and quiet serve an important public need and must be preserved, 70 dB(A) in areas of active public use ranging from recreation areas to residences, and schools, and 75 dB(A) for developed lands not included in the categories above.

The sensitivity of wildlife to noise is well understood, but documentation and quantification of disturbance from terrestrial sources (as opposed to aircraft) are apparently limited. Certain sources will be drawn upon in the analysis.

3.17.3 Affected Environment

The sections below identify existing characteristics and noise levels in the areas potentially affected by noise generated during construction and operation of the structural components of Refined Alternatives 4 and 6. The actions that may take place under the No Action Alternative are not fully known at this time, and consequently it is not possible to completely define the affected environment of that alternative. However, many of the eventual actions that could occur as a result of the No Action Alternative would likely take place within the same geographic setting as that of Refined Alternative 4.

3.17.3.1 Structural Components of Refined Alternative 4

3.17.3.1.1 Durango Pumping Plant and Ridges Basin Inlet Conduit

The proposed Durango Pumping Plant site is located along the west bank of the Animas River, on a topographic bench near the Bodo Industrial Park, approximately 1.6 miles south of the center of Durango. The site is just west of U.S. 550/160. Access to the plant site would be from CR 211 immediately north of the Centennial Mall. Santa Rita Park (formerly Gateway Park) is on the opposite side of the river from the proposed plant site. Existing noise sources consist primarily of traffic on U.S. 550/160, typically producing a noise intensity of 75 to 80 dB(A) with heavy traffic, and frontage and connecting roads serving civic and commercial development in the Animas River Valley in the vicinity of the pumping plant site.

3.17.3.1.2 Ridges Basin Dam and Reservoir

Ridges Basin and the Basin Creek corridor east of the proposed dam site can be characterized as open space. Public access is available along unpaved CR 211 through Ridges Basin and from an unpaved road through the dam site which runs partly along Basin Creek and connects Ridges Basin with the Animas River Valley. Existing noise levels within the basin are limited to sources associated with limited vehicle travel on CR 211 and natural sources.

Carbon Mountain, which forms part of the northern rim of Ridges Basin, has known golden eagle nests on its face in Ridges Basin. Golden eagles initiate mating and nesting in the winter and end in the spring or early summer.

3.17.3.1.3 Navajo Nation Municipal Pipeline

The area along the proposed NNMP alignment is sparsely populated with scattered housing. Most of the alignment crosses agricultural or grazing lands. Within the City of Farmington, the alignment follows the existing pipeline alignment and is within close proximity to residences. Once the alignment crosses the San Juan River at Farmington and onto Navajo Nation lands, only a few scattered residences are located within close proximity to the alignment. The largest concentration of residential homes in immediate proximity to the alignment is located between the two crossings of the Hogback Canal and U.S. 550 just east of Shiprock. In this area, numerous single-family homes are located along U.S. 550 and the Hogback Canal. Noise levels along the alignment can be characterized as low and are associated with rural residential generation and adjacent roadway traffic.

3.17.3.2 Structural Components of Refined Alternative 6

3.17.3.2.1 Lemon Dam and Reservoir

Lemon Dam is an existing 215-foot high earth and rockfill dam on the Florida River approximately 14 miles northeast of Durango. The reservoir extends approximately 3.3 miles upstream from the dam along the Florida River Valley, and has an average width of about 0.35 miles along most of that distance. The forested slopes of the valley are steep with development limited to a few locations on the east side. A road runs through the valley along the east side of the reservoir. The floor of the river valley upstream and downstream of the reservoir has scattered private residences. Noise levels in this area are generally low and associated with low-level traffic on area roadways and natural sources.

3.17.3.2.2 Navajo Nation Municipal Pipeline

The location and existing characteristics of the NNMP would be the same as described above under Refined Alternative 4.

3.17.3.3 Non-Binding End Uses and Conveyance Systems

As described in Chapter 2, future water end uses and the water conveyance systems to supply them could be developed in areas west of Ridges Basin, the Animas River bottom, and Florida Mesa east of the Animas River.

The Southern Ute Indian Tribe's non-binding options that could involve concerns about noise impacts include the construction and operation of the coal mine and coal-fired power plant in the La Plata River Basin, and the construction of water distribution pipelines in the La Plata River Basin and the pipelines east of Ridges Basin. The La Plata River Basin is essentially an agricultural area surrounded by open land. The coal mine and power plant would be developed at the eastern edge of the basin, several miles from residential development. The distribution pipelines would branch through the La Plata River Basin community and farming areas and the more developed corridor east of the Animas River. East of Ridges Basin, the pipe distribution system location would involve several miles of the Animas River bottom and several miles along U.S. 160 from the river to the Loma Linda area.

The Ute Mountain Ute Tribe's non-binding options that could involve concerns about noise impacts include the construction and operation of the gas-fired power plant in the San Juan River Basin and pipeline construction in the southern Mancos River Basin. The potential power plant would be located north of an existing coal and gas development area along the San Juan River, at the base of the bench land in the undeveloped southern part of the Ute Mountain Ute Reservation. The distribution pipeline would run from the west side of the La Plata River Basin along the Grass Valley Road corridor on its way to the Mancos River Valley, across remote bench land and canyon land. Noise levels in each of these areas are generally low and associated with natural sources, infrequent human activity, and low-level traffic volumes on transecting roadways.

3.17.4 Environmental Consequences and Mitigation

The following sections discuss potential noise impacts of Refined Alternatives 4 and 6. In addition, mitigation measures are proposed to reduce or eliminate potential noise impacts.

3.17.4.1 Refined Alternative 4

Refined Alternative 4 Noise Impact 1 - Significant: Noise generated during construction of the Durango Pumping Plant and Ridges Basin Inlet Conduit could disturb nearby residents and other sensitive receptors.

Excavation and other earthwork for the pumping plant and its intake channel would be performed by numerous large pieces of equipment, among which the largest would be bulldozers and off-road haul units of various kinds. The sound levels emitted by typical heavy construction machinery that would be used for construction of the Durango Pumping Plant are shown on **Table 3.17-2**.

Table 3.17-2
Typical Construction Equipment Noise Intensities

Equipment	Horsepower	Range of Noise at 50 Feet in dB(A)	Nominal Noise at 50 feet in dB(A)
Backhoe	250	71-93	85
Bulldozer	300	72-96	86
Loader	400	71-96	82
Grader	200	73-95	85
Crane	180	75-95	80
Dump Truck	235	70-92	85
Bottom Dump, Semi-Trailer	260	70-92	85

The noise intensities cited are measured 50 feet from the machines. The noise intensity from equipment typically declines by 6 dB(A) for each doubling of distance from the source. Based on this relationship, the equipment noise intensities in Table 3.17-2 would decrease by 12 decibels at a distance of 200 feet from the equipment, which would generally be within the setback of the construction activity from the areas used by the public, with the exception cited below. Consequently, the offsite intensity of noise from construction equipment, other than pile drivers, would be less than the maximum set by the city code, and would not be substantially greater than the levels along U.S. 160/550. The exception would occur along the bank of the Animas River where persons on the river would at times pass construction equipment at a distance of 50 feet or less.

The sound intensity emitted by a pile driver depends on its pile driving mechanism (i.e., drop hammer vs. vibratory ram), type and length of pile, and length of pile above ground as it is driven. The type and configuration of piles that would be used for the intake structure are not yet known. However, sound-proofing devices are available for pile driving equipment. Consequently, it is anticipated that pile driving could be performed without creating a disturbance to the public.

Although construction noise would attenuate with distance from the construction area, the noise of heavy equipment working would probably be discernible in the general area of the pumping plant site. During the day, the noise would typically combine with noise from traffic and other sources, outside and inside. However, at night when the ambient noise level tends to drop, the same construction noise would be more noticeable. While this is reflected in Durango's noise ordinance, the operation of construction equipment at night, particularly a pile driver, may nevertheless create objectionable noise. Thus, night operation could be an impact, depending on the contractor’s proposed methods and sequencing of excavation and other earthwork.

Mitigation for Refined Alternative 4 Noise Impact 1: Pumping plant construction contractor would be required to adhere to Durango’s noise ordinance, and be restricted from operating heavy equipment during the nighttime hours.

The construction contracts would contain provisions requiring the contractors to conform to the City of Durango’s noise ordinance, and to obtain the necessary permits for unavoidable exceedances of the noise limitation. Signs would be placed along the west side of the Animas River warning boaters of construction activity along the west shoreline. Provisions governing nighttime construction would be included in the construction specifications.

Refined Alternative 4 Noise Impact 2 - Significant: Noise from dynamite blasting for pipeline trenching and foundation excavation could exceed local noise standards and disturb nearby residents and other sensitive receptors.

Blasting would likely be necessary during foundation preparation for the dam and pumping plant, the reservoir intake conduit, and the NNMP. The sudden noise of dynamite blasts could disturb the public in the vicinity of the construction sites.

Mitigation for Refined Alternative 4 Noise Impact 2: Blasting notification would be provided to residents and pre-blast alarms would be sounded.

Prior to blasting, nearby residents and commercial establishments would be notified by mail of expected blasting dates and times. Similar notification would also be posted in the surrounding area. Immediately in advance of blasting, the construction contractor would be required to sound a signal announcing the blast. Construction contractors will follow the construction safety plan which will provide for these measures.

Refined Alternative 4 Noise Impact 3 - Potentially Significant: Operation of the Durango Pumping Plant could generate noise levels that exceed local standards and disturb recreationists at Santa Rita Park (formerly Gateway Park) and on the Animas River.

Operation of motors and hydraulic machinery in the Durango Pumping Plant could produce noise on the plant operating floor loud enough to impede conversation between operators. Standard hearing protection would provide suitable protection. The actual intensity would depend on the configuration of the pumping units. However, the low elevation of the pumping plant with respect to the surrounding terrain would have a dampening effect on operational sound emission.

Noise generated during operation of the Durango Pumping would be reduced to minimal levels within the site boundary. It is expected that pumping plant noise would be subordinate to other noise sources in the areas adjacent to the pumping plant site (including the noise of flowing water in the river and traffic on nearby roadways), and would not substantially contribute to increased noise levels in the area. However, due to the presence of Santa Rita Park and use of the river as a place of relative solitude, it is recognized that even a slight increase in noise could be considered adverse by park and river users. As such, this impact is considered potentially significant.

Mitigation for Refined Alternative 4 Noise Impact 3: Noise reduction would be provided in the form of sound insulation within the pumping plant and vegetative screening designed as part of site landscaping.

Specifically placed vegetation between the pumping plant building and the exterior of the pumping plant site would increase the buffer zone effect of pumping plant setback on the site. Pumping plant design could also include structural elements that insulate noise generation.

Refined Alternative 4 Noise Impact 4 - Significant: Noise generated by the construction of Ridges Basin Dam, the relocation of CR 211, gas pipeline relocation, and the construction of a recreation area could disturb golden eagle nesting on Carbon Mountain.

Noise from construction of the dam, road relocation, utility and pipeline relocations, and recreation facilities occurring during the winter and spring has the potential to disturb nesting and reproduction of the golden eagles that nest on Carbon Mountain. Responses to noise vary among animals, and in the case of certain bird species can cause reproductive losses as birds are flushed from their nests, and eggs are broken and young are exposed to injury and predators. Also, animals rely on hearing to avoid predators, obtain food, and communicate, and the auditory systems of some are acute and sensitive to physical damage from chronic noise. Noise from blasting and heavy earth-hauling units would potentially cause the greatest impact, and the degree of impact would depend on its proximity of the activity to Carbon Mountain.

Mitigation for Refined Alternative 4 Noise Impact 4: Construction activities could be scheduled to avoid or minimize high noise level activities in the vicinity of the golden eagle nesting area during the nesting season. The nesting area would be off limits to the construction work force and visitors.

Refined Alternative 4 Noise Impact 5 - Significant: Noise generated by recreational activities associated with public recreation in Ridges Basin Reservoir and the potential adjacent recreation area could disturb golden eagle nesting on Carbon Mountain.

Eagles are sensitive to noise and human activities during the nesting period. Noise from traffic, motor boats, and jet skis would potentially cause the greatest impact. The degree of impact from any activity would depend on its proximity to Carbon Mountain.

Mitigation for Refined Alternative 4 Noise Impact 5: Incorporate in a recreation development/ management plan the requirement to prohibit watercraft that generate high noise levels, and include signing to advise people of eagle nesting sensitivity to human presence and noise.

Recommendations of the Service regarding location of recreation facilities, the type and horsepower of watercraft, and other aspects of public visitation would be incorporated into the recreation operation
% plan.

Refined Alternative 4 Noise Impact 6 - Potentially Significant: Construction of the end uses and conveyance systems identified under the non-binding scenario could generate noise that could disturb nearby sensitive receptors.

Construction of the facilities that would be associated with the end uses of project water, as well as the water conveyance systems, would require site preparation that would generate noise to the surrounding areas. Because of the relatively remote locations of the potential mine and power plants, and the noise attenuation with distance, construction noise would not likely have a significant impact. However, due to the unknown final locations and potential for additional sensitive receptors at the time when development could ultimately take place, this impact is considered potentially significant.

Mitigation for Refined Alternative 4 Noise Impact 6: Require that end use developers incorporate methods to minimize noise disturbances.

3.17.4.2 Refined Alternative 6

Refined Alternative 6 Noise Impact 1 - Less Than Significant: Noise generated during the enlargement of Lemon Dam could disturb nearby residents and other sensitive receptors.

Noise producing construction activities during the enlargement of Lemon Dam would include foundation excavation adjacent to the dam, excavation of embankment material downstream of the dam and/or upstream of the reservoir, the addition of embankment material to the downstream face of the dam, and the enlargement of the spillway at the west abutment of the dam. Hauling of embankment materials from borrow areas to the dam would be performed with highway haul units, operated on the canyon road for distances of up to five miles upstream and downstream of the dam. Highway bulk haul trucks have a nominal noise intensity of 85 dB(A) at a distance of 50 feet. This would exceed the FHWA's noise abatement criteria when embankment material is hauled, and thus could expose residents to increased noise levels during construction. Although construction noise would attenuate with distance from the construction area, the noise of heavy equipment working would be discernible in the general area of the dam.

Mitigation for Refined Alternative 6 Noise Impact 1: Construction work at the dam should be restricted from operating heavy equipment during the nighttime hours if such operation could pose a public nuisance. Speed limits would be set on road haul units to control traffic noise in the canyon.

Refined Alternative 6 Noise Impact 2 - Significant: Noise from dynamite blasting for pipeline trenching and spillway enlargement could exceed local noise standards and disturb nearby residents and other sensitive receptors.

This potential impact during construction of the NNMP would be similar to Noise Impact 2 under Refined Alternative 4. Enlargement of the Lemon Dam spillway could include controlled blasting for foundation enlargement.

Mitigation for Refined Alternative 6 Noise Impact 2: Blasting notification would be provided to residents and pre-blast alarms would be sounded.

This mitigation would be the same as that described under Mitigation for Refined Alternative 4 Noise Impact 2.

Refined Alternative 6 Noise Impact 3 - Significant: Construction work at Lemon Dam could disturb nesting of bald eagles and osprey at Lemon Reservoir.

Noise from the enlargement of the dam and spillway, and the haul of embankment materials to the dam, has the potential to disturb nesting and reproduction of raptors and other birds that nest adjacent to Lemon Reservoir in a manner similar to that described in Refined Alternative 4 Noise Impact 4.

Mitigation for Refined Alternative 6 Noise Impact 3: Construction work at Lemon Dam could be scheduled to avoid or minimize high noise level activities in the vicinity of nesting areas during the nesting season. The nesting areas would be off limits to the construction work force and visitors.

Refined Alternative 6 Noise Impact 4 - Potentially Significant: Construction of the end uses and conveyance systems identified under the non-binding scenario could generate noise that could disturb nearby sensitive receptors.

This impact would be the same as that described above for Refined Alternative 4 Noise Impact 4.

Mitigation for Refined Alternative 6 Noise Impact 4: Require that end use developers incorporate methods to minimize noise disturbances.

Same mitigation as that described for Refined Alternative 4 Noise Impact 6.

3.17.4.3 No Action Alternative

There was no discussion of noise impacts for the No Action Alternative in the 1996 FSFES.

3.18 PUBLIC HEALTH AND SAFETY

3.18.1 Introduction

This section addresses potential impacts to public health and safety that would result from actions associated with Refined Alternatives 4 and 6 and the No Action Alternative. Section 3.18.2 defines the Evaluation Methodology and significance criteria used for determining impacts, Section 3.18.3 describes the affected environment, and Section 3.18.4 identifies potential impacts and mitigation measures that would serve to reduce or eliminate anticipated impacts to public health and safety.

Public safety aspects are primarily associated with public entry into construction areas, trespass at project facilities, and safety of construction workers. Public health aspects are associated mainly with the possibility of liquid or gaseous emissions from construction areas and exposure to construction workers. The transfer of water rights under the non-structural component is not expected to result in any direct public health and safety impacts. As such, the non-structural component is not addressed further in this section.

3.18.2 Methodology

This section discusses the methodology used to determine potential impacts that could result from Refined Alternative 4 and Refined Alternative 6. Also discussed are specific criteria that were used to determine the significance of the impacts identified.

3.18.2.1 Evaluation Methodology

For evaluation of the public health and safety aspects, the typical hazards associated with the types of construction associated with the proposed project were identified and evaluated as to their potential on the proposed project.

3.18.2.2 Significance Criteria

Health and safety hazards were considered significant if they could create substantial risk of harm or injury to project workers or the general public.

3.18.3 Affected Environment

The sections below discuss existing public uses in the areas potentially affected by Refined Alternative 4 and Refined Alternative 6. The actions that may take place under the No Action Alternative are not fully known, and consequently, it is not possible to completely define the affected environment for that alternative. However, many of the eventual actions that may occur as a result of the No Action Alternative would likely take place within the same geographic setting as that of Refined Alternative 4.

3.18.3.1 Structural Components of Refined Alternative 4

3.18.3.1.1 Durango Pumping Plant and Ridges Basin Inlet Conduit

The proposed Durango Pumping Plant site is along the west bank of the Animas River, about 1.6 miles south of the center of Durango. The pumping plant site is a former Uranium Mill Tailings Remedial Action site where contaminated surficial materials have been removed. Because elevated levels of groundwater contamination are possible, water encountered during construction at the site will be monitored regularly. The river is used for recreational uses such as kayaking, rafting, and fishing.

The proposed alignment of the Ridges Basin Inlet Conduit begins at the Durango Pumping Plant site and extends generally southwest to Ridges Basin, essentially parallel to CR 211. A buried natural gas pipeline is located within the CR 211 corridor.

3.18.3.1.2 Ridges Basin Dam and Reservoir

The proposed dam site is removed from areas of heavy public use, but includes various unpaved roads used by the public. The reservoir site occupies much of the floor of Ridges Basin, which is an undeveloped area traversed by CR 211. Borrow and haul of dam embankment materials would extend from the influence of dam construction into the center of Ridges Basin and approximately two miles downstream from the dam site along Basin Creek.

3.18.3.1.3 Navajo Nation Municipal Pipeline

The area along the alignment of the NNMP is sparsely populated with scattered housing. The majority of the alignment crosses agricultural or grazing lands. Within the City of Farmington the alignment follows the existing pipeline alignment and is within close proximity to residences. Once the alignment crosses the San Juan River at Farmington and onto Navajo Nation lands, only a few scattered residences are located within close proximity to the alignment. The alignment crosses the Fruitland Irrigation Canal four times and the final crossing is just east of the Nenahnezad Indian School. The alignment then again cross the San Juan River near the Hogback at Highway 550 and then runs north of the San Juan River, crossing the Hogback Canal and Highway 550 twice before ending at the Cortez storage tank just north of Shiprock. The largest concentration of residential homes in immediate proximity to the alignment is located between the two crossings of the Hogback Canal and Highway 550 just east of Shiprock. In this area numerous single-family homes are located along Highway 550 and the Hogback Canal.

Numerous natural gas pipelines are located along the entire length of the alignment. The alignment would cross four primary natural gas lines and several other smaller gas pipelines. The lines also run adjacent to some of the gas pipelines. On the eastern crossing of the San Juan River, there is also a major gas pipeline crossing the San Juan immediately downstream. No heavily used public access areas are located along the alignment of the pipeline.

3.18.3.2 Structural Components of Refined Alternative 6

3.18.3.2.1 Lemon Dam and Reservoir

Lemon Dam is an existing 215-foot high earth and rockfill dam on the Florida River approximately 14 miles northeast of Durango. The reservoir extends approximately 3.3 miles upstream from the dam along the Florida River Valley, and has an average width of about 0.35 miles along most of that distance. The forested slopes of the valley are steep with development limited to a few locations on the east side. The floor of the river valley upstream and downstream of the reservoir has scattered private residences. The single road running through the valley passes along the east side of Lemon Reservoir. The borrow areas from which embankment material would be obtained could be as far as five miles downstream of the dam and two miles upstream of the upper end of the reservoir.

3.18.3.2.2 Navajo Nation Municipal Pipeline

The affected environment for construction of the NNMP would be the same as described in Section 3.18.3.1., Structural Components of Refined Alternative 4.

3.18.3.3 Non-Binding End Uses and Conveyance Systems for Refined Alternative 4

As described in Chapter 2, coal mining, power generation, residential, and resort developments could be developed in the La Plata and Mancos River valleys west of Ridges Basin. A potential coal mine and coal-fired power plant could be developed on Southern Ute Reservation land in La Plata County in the southeast corner of the La Plata Valley, north of the county line and east of Highway 140. Water would also be served to coal mine development in the vicinity of the power plant. A potential housing development could be developed on Ute Mountain Reservation land in the southwest corner of the La Plata River Basin. Further west along the Mancos River south of Mesa Verde National Park, a destination resort could be developed.

The branching system of water lines from Ridges Basin Reservoir to these development sites would be constructed within the La Plata River Basin, and one line would extend 6 miles into New Mexico along Highway 170.

The gas-fired power plant that could be developed in the San Juan River Valley would lie at the northern edge of an area containing scattered gas and coal production and handling facilities north of the river.

East of Ridges Basin, the distribution pipeline to the Florida Mesa would extend across the Animas River and then eastward along part of the Highway 160 corridor to Bayfield. The potential residential development would include reservation lands south of the community of Loma Linda. The Animas River corridor downstream of the Ridges Basin Dam site would also be included in the affected environment by a branch pipeline running south along the river.

3.18.3.4 Non-Binding End Uses and Conveyance Systems for Refined Alternative 6

The M&I water end uses under Refined Alternative 6 would be the same as described in the previous subsection; however, the conveyance corridors would differ, reflecting the different sources of water in Refined Alternative 6. As shown in Chapter 2, the following corridors would apply to the potential end uses. The housing on the Florida Mesa would be supplied from Lemon Dam with a pipeline running partly through the Florida River valley and partly due south along CR 234. The pipeline to serve the Animas River area housing and industrial park would lie along the same route as under Refined Alternative 4 but the water would be pumped from the Animas River. The hotel complex in Ridges Basin would be served through a pipeline running from the Animas River up the Basin Creek corridor into Ridges Basin. The housing developments, hotel complex, and dude ranch in the La Plata River Basin would be supplied with water from the La Plata River system through a pipe system contained entirely in the La Plata River Basin. The gas-fired power plant in the San Juan River Basin and the coal mine and coal-fired power plant in the La Plata River Basin would all be served with water pumped from the San Juan River near Fruitland, New Mexico, through a single pipeline whose northern extension runs up the La Plata River corridor for part of its length.

3.18.4 Environmental Consequences and Mitigation

The following sections discuss potential impacts to public health and safety of Refined Alternatives 4 and 6. In addition, mitigation measures are proposed to reduce or eliminate potential impacts to public health and safety.

3.18.4.1 Refined Alternative 4

Refined Alternative 4 Public Health and Safety Impact 1 - Significant: Public entry into construction areas could cause exposure to construction accidents.

The proposed Durango Pumping Plant site would have a high public visibility, and construction activity would extend into the Animas River for the intake structure. The potential hazards the project could pose to the public would be inadvertent entry by kayakers and boaters into a hazardous construction zone, and members of the public driving onto the construction site or onto haul roads and being exposed to the hazards of moving construction equipment or unfinished earthwork. Construction workers are exposed to many hazards on heavy construction work. In addition, construction in enclosed buildings such as pumping plants can cause exposure to fumes from paints, solvents, and other hazardous substances used in interior construction. The potential for spills or disposal of hazardous substances posing a risk to the general public is insignificant. Because the site is a former UMTRA site, elevated levels of contamination may be encountered.

The construction activity at the dam site is far removed from easy access by the public, but could be an attraction. The potential hazards stem primarily from members of the public driving onto the construction site or onto haul roads and exposing themselves to the hazards of moving construction equipment or ungraded earthwork. This would occur at the relocation of part of CR 211 in Ridges Basin, where the ends of the new section of road would be connected to the existing road. Clearing activity in the reservoir basin would be performed by a small, mobile crew, and would not pose a significant public hazard. Construction of the Ridges Basin Inlet Conduit and NNMP would present hazards similar to those.

Mitigation for Refined Alternative 4 Public Health and Safety Impact 1: Reclamation will ensure that public access to structural component construction areas will be controlled by signage and by fencing around construction areas.

Refined Alternative 4 Public Health and Safety Impact 2 - Significant: Materials and equipment transport could create hazards to the public on local roadways and delay emergency vehicles.

Members of the public crossing or driving on haul roads in use by heavy hauling equipment could cause or become involved in collisions with moving equipment. In areas where construction may occur along roadways, drivers could neglect to use proper caution in the vicinity of construction activities, and endanger themselves and construction workers.

Mitigation for Refined Alternative 4 Public Health and Safety Impact 2: Reclamation will ensure that contractors will be required to configure haul routes and access roads to prevent or discourage public vehicular entry, including placement of signs warning against entry.

Refined Alternative 4 Public Health and Safety Impact 3 - Less than Significant: Construction activities and relocation of gas pipelines would create a gas pipeline puncture hazard.

Construction at crossings of gas pipelines and gas pipeline relocation would pose a public health and worker safety risk because of explosion hazard posed by a punctured gas line. However, such an accident would be unlikely due to coordination with gas companies prior to and during construction.

Mitigation for Refined Alternative 4 Public Health and Safety Impact 3: Reclamation will ensure that potentially affected gas companies are contacted prior to construction; crossings of gas pipelines, and pipelines will be precisely located and appropriately marked in the field and on the specifications.

Under procedures similar to those used by water, gas, and electric utilities to mark the locations of their lines in advance of excavation by builders and developers in municipal settings, the utilities will be requested to mark locations in advance of the construction of the structural components of Refined Alternative 4.

Refined Alternative 4 Public Health and Safety Impact 4 - Significant: Construction activities associated with end uses and conveyance systems under the non-binding scenario would create potential for injury.

The construction activities associated with the end uses of project water and conveyance systems identified as part of the non-binding end use scenario would create a similar impact potential as that discussed under Refined Alternative 4 Public Health and Safety Impacts 1 through 3, above.

Mitigation for Refined Alternative 4 Public Health and Safety Impact 4: Reclamation will require that developers ensure that public access to end use and delivery system construction areas is controlled by signage and by fencing around construction areas.

Refined Alternative 4 Public Health and Safety Impact 5 - Potentially Significant: Increased coal bed methane gas seepage that may occur as a result of developing Ridges Basin Dam and Reservoir could create increased risk of injury to workers or the public.

Coal bed methane gas emissions from the ground occur in the general area of the proposed dam site, emissions have been observed at points along Basin Creek downstream of the dam site, and gas has been detected in adjacent soils. Although the coal-bearing Fruitland Formation would not be excavated with the size of dam in this alternative, it is possible that the excavation and unwatering of the dam foundation trench, and/or drilling of grout holes in the bottom of the trench, could cause a release of methane gas from underlying formations into the trench. This could affect construction workers or visitors in the trench prior to the refill of the trench with dam embankment material. Methane gas could also seep into the outlet works tunnel during construction, affecting tunnel construction crews working underground. On a longer-term basis, it is also possible that the excavations for the dam and outlet works may affect the rate of gas discharge along Basin Creek downstream of the dam.

Mitigation for Refined Alternative 4 Public Health and Safety Impact 5: Investigate for the potential of gas release due to man-made intrusions, monitor excavations for the presence of gas, and employ safety measures as needed.

Prior to construction, the potential for gas emissions would be investigated, including a study of emissions from abandoned exploration wells and the Gates Coal Mine. As the foundation trench and the outlet works tunnel are excavated, they would be monitored for the presence of coal bed methane gas, and if the gas is detected in concentrations that exceed safety standards for construction, appropriate measures would be taken to protect workmen in the foundation trench and in the outlet works tunnel. The gas emissions along Basin Creek would be monitored during construction, and if construction were to increase point source emissions to the degree of posing a public health hazard in the immediate vicinity, a public advisory would be posted.

Refined Alternative 4 Public Health and Safety Impact 6 - Significant: During operation of the project, trespass onto properties containing project facilities or entrance into Basin Creek could expose the public to increased risk of injury.

Access to potentially dangerous components would be restricted through signage and fencing or other physical barriers; however, it is possible that trespass would still occur. Access to project facilities with inherent dangers would create a safety risk to these trespassers. The primary interface between the operation of the pumping plant and the public would be at the entrance to the intake channel along the Animas River, although a proposed screen across the intake channel would prevent boaters from entering the channel.

Operational hazards would also exist as a result of unanticipated reservoir discharge releases into Basin Creek and rapidly rising water levels. The presence of people in these areas at such time could result in harm or drownings.

Mitigation for Refined Alternative 4 Public Health and Safety Impact 6: Reclamation would control public access to operation areas that would pose a threat to public safety.

Refined Alternative 4 Public Health and Safety Impact 7 - Less than Significant: Recreational opportunities afforded to the public in Ridges Basin Reservoir and nearby campground and picnic areas would result in injuries typically associated with these activities.

The use of Ridges Basin Reservoir and surrounding areas for recreational purposes would create a range of conventional hazards associated with boating, swimming, fishing, and other water- and land-based recreation activities. The potential development of a campground in the vicinity of the reservoir would create the conventional hazards involved with campground use, including vehicular circulation within the recreation area. This impact is considered to be less than significant as the risk associated with these activities would be typical of the risks associated with general recreation.

Mitigation for Refined Alternative 4 Public Health and Safety Impact 7: Reclamation will ensure that recreation area planning and final design of facilities and reservoir access points will be developed to promote safety and use of accident management techniques.

Refined Alternative 4 Public Health and Safety Impact 8 - Less than Significant: Non-binding end uses could result in increased risk of injury.

The construction of certain end uses identified under the non-binding component could increase risk of injury. The coal mine and power plants envisioned would be in relatively isolated areas from which the public could be excluded, reducing public safety hazards. Common practice for such facilities is to have clearly marked gates at access points, and fences where needed to prohibit incoming traffic at unpaved roads or trails. Depending on the management policy regarding visitors, the entrances are signed to discourage public entry, or public entry is controlled on the premises.

Community and resort development would be carried out with standard safety provisions and no uncommon or atypical risks would be expected to exist.

Mitigation for Refined Alternative 4 Public Health and Safety Impact 8: No mitigation is proposed.

3.18.4.2 Refined Alternative 6

Refined Alternative 6 Public Health and Safety Impact 1 - Significant: Public entry into construction areas could cause exposure to construction accidents.

The proposed enlargement of Lemon Dam would have a high public visibility, and the haul of embankment material would occur along the canyon road. The potential hazards the project could pose to the public would be from members of the public driving onto the construction site, entering borrow areas, or coming into conflict with trucks hauling embankment material along CR 243. Construction workers would also be exposed to hazards on heavy construction work. In addition, work on spillway gates and control systems could cause exposure to fumes from paint, solvents, and other hazardous substances. The potential for spills or disposal of hazardous substances posing a risk to the general public is insignificant.

The construction activities along the right-of-way of the NNMP would be an attraction to the public visitation by automobile or on foot, carrying the risk of exposure to the hazards of moving construction equipment, open trenches, and temporary spoil piles.

Mitigation for Refined Alternative 6 Public Health and Safety Impact 1. Reclamation will ensure that public access to structural component construction areas would be controlled by signage and by fencing around construction areas.

Refined Alternative 6 Public Health and Safety Impact 2 - Significant: Materials and equipment transport could create hazards to the public on local roadways and delay emergency vehicles.

This impact would be similar to Refined Alternative 4 Public Health and Safety Impact 2 described above.

Mitigation for Refined Alternative 6 Public Health and Safety Impact 2: Reclamation will ensure that contractors configure haul routes and access roads to prevent or discourage public vehicular entry, including placement of signs warning against entry.

Refined Alternative 6 Public Health and Safety Impact 3 - Significant: Construction activities associated with end uses and conveyance systems under the non-binding scenario would create potential for injury.

This impact would be similar to Refined Alternative 4 Public Health and Safety Impact 4 described above.

Mitigation for Refined Alternative 6 Public Health and Safety Impact 3: Reclamation will require that developers ensure that public access to end use and delivery system construction areas is controlled by signage and by fencing around construction areas.

Refined Alternative 6 Public Health and Safety Impact 4 - Less than Significant: Non-binding end uses could result in increased risk of injury.

This impact would be similar to Refined Alternative 4 Public Health and Safety Impact 8 described above.

Mitigation for Refined Alternative 6 Public Health and Safety Impact 4: No mitigation is proposed.

3.18.4.3 No Action Alternative

There was no discussion of public health and safety in the 1996 FSFES.

3.19 PUBLIC SERVICES AND UTILITIES

3.19.1 Introduction

This section addresses potential impacts to public services and utilities that would result from actions associated with Refined Alternatives 4 and 6 and the No Action Alternative. Section 3.19.2 defines the Evaluation Methodology and significance criteria used for determining impacts, Section 3.19.3 describes the affected environment, and Section 3.19.4 identifies potential impacts and mitigation measures that would serve to reduce or eliminate anticipated impacts to public services and utilities.

The public services and utilities addressed in this section include natural gas, electrical power, and water utilities; police and fire protection; and emergency medical services. The non-structural component of Refined Alternatives 4 and 6 would have minimal direct impacts on public services and has been eliminated from further analysis in this section.

3.19.2 Methodology

This section discusses the methodology used to determine potential impacts that could result from Refined Alternatives 4 and 6. Also discussed are specific criteria that were used to determine the significance of the impacts identified.

3.19.2.1 Evaluation Methodology

For the proposed structural facilities, data collection and analysis focused on the best available information. Existing reports, internal agency documents, and public records of service levels and facility locations were used for describing the potentially affected public services and utilities environment. Interviews with city and county staff provided insight regarding potential environmental consequences. Physical impacts, service level requirements, and utilities demands of Ridges Basin Dam and Reservoir and the Durango Pumping Plant were estimated based on preliminary 1991 design specifications developed by Reclamation, and on a technical memorandum by the Navajo Tribal Utility Authority (NTUA) (Navajo Nation 1998). %

To determine impacts of potential end uses and distribution systems, data collection included review of existing reports, internal agency documents, public records of service levels and facility locations, and interviews with city and county staff from the relevant jurisdictions.

3.19.2.2 Significance Criteria

Significance criteria were formulated for the project components, as follows. Impacts were considered significant if they could adversely affect:

- ❑ The ability of utility providers (electric, natural gas, water, and wastewater) to maintain current levels of service to their customers in the area;
- ❑ The ability of solid waste disposal facilities to absorb additional waste streams without substantially altering their ability to meet current life expectancy projections; or
- ❑ The ability of fire and police protection agencies to maintain current levels of service to current and future area residents.

3.19.3 Affected Environment

The sections below discuss existing public services resources in the areas potentially affected by Refined Alternatives 4 and 6. The actions that may take place under the No Action Alternative are not fully known, and consequently, it is not possible to completely define the affected environment for that alternative. However, many of the eventual actions that may occur as a result of the No Action Alternative would likely take place within the same geographic setting as that of Refined Alternative 4.

A summary review of existing public services and utilities is provided below for areas potentially affected by construction or operation of the structural components and non-binding end uses. The services and utilities are relevant to both the structural and the non-binding end use components of the two action alternatives. Transportation and circulation issues, including road relocations, are addressed in Section 3.16, Transportation.

3.19.3.1 Fire Protection

Ridges Basin and adjacent areas are served by the Animas Fire Protection District, a completely volunteer district. The fire station is located in Bodo Industrial Park, approximately six miles (by roadway) from Ridges Basin.

3.19.3.2 Police/Sheriff Protection

The project area's law enforcement needs are served by both state and local agencies. The Colorado State Patrol has a regional office in Durango. The La Plata County Sheriff's office patrols the rural portions of the county, including the Ridges Basin area. The City of Durango Police Department has responsibility for police protection for areas within the city limits. The Southern Ute Indian Tribe has law enforcement personnel in Ignacio who serve the reservation, and the Ute Mountain Ute Tribe has law enforcement personnel in Towaoc. State Patrol and county law enforcement officers also serve both reservations.

3.19.3.3 Emergency Medical Services

Emergency medical services are provided cooperatively by the La Plata County Sheriff's Department and private ambulance services. The Sheriff's Department acts as a central dispatch point for "911" emergency calls. Existing ambulance services are dispatched as needed based on the type of medical services needed, location of the emergency, and response time needed. Air ambulance services are available from base points at the Durango-La Plata Airport, Farmington Airport, Durango, Dove Creek, Cortez, and Pagosa Springs.

3.19.3.4 Electric Utility Service

The Ridges Basin Dam and Reservoir area is located within the service area of the La Plata Electric Association, Inc. (La Plata Electric), a rural electric cooperative under the Rural Electrification Administration System. La Plata Electric buys all its power from Tri-State Generation and Transmission Association, Inc. (Tri-State) A 115-kilovolt (kV) power line runs generally east/west along CR 211 from the northeast end of Bodo Industrial Park to the northeastern section of the Ridges Basin area and a series of power lines run along the northern ridge of Ridges Basin. An electrical substation is also located near north of the basin, adjacent to CR 211.

3.19.3.5 Natural Gas Service

Greeley Gas Company provides natural gas service to the City of Durango, and for much of La Plata County. There are still some areas, because of their rural nature, that do not receive natural gas service.

Four buried natural gas transmission lines run through Ridges Basin, within the proposed reservoir area. Numerous natural gas pipelines are located along the entire length of the NNMP alignment. The alignment would cross four primary natural gas lines and several other smaller gas pipelines. The proposed alignment also runs generally parallel to segments of these gas pipelines. A major gas pipeline crosses the San Juan River immediately downstream of one of the proposed NNMP crossings.

3.19.3.6 Domestic (Potable) Water Service

The City of Durango diverts culinary water from the Florida River immediately downstream of Lemon Dam and pipes it to a reservoir immediately east of the city. During the high demand periods of the summer, additional water is pumped from the Animas River from a pumping plant located at the northern end of Santa Rita Park to the city's reservoir.

The Lake Durango Water Company currently supplies domestic water to the major subdivisions in the Ridges Basin area with the anticipation of expansion (West Durango Planning District 1997). Individual wells are also used in some parts of the West Durango Land Use Planning District (District). The majority of the District is included in a Water Critical Area as defined by the State of Colorado. The Water Critical Area designation affects well permits and water use restrictions. Some residents use cisterns as primary or reserve water supplies (West Durango Planning District 1997). Most rural users elsewhere rely on private wells or, if they have undependable or poor quality well water, haul their drinking water.

In New Mexico, the NTUA provides water to more than 10,000 people and to commercial, industrial and institutional connections in a 700-square mile area of the San Juan River Basin. Included are connections serving seven Chapters of the Navajo Nation which are (from east to west) the Upper Fruitland, San %

Juan, Nenahnezad, Hogback, Shiprock, Cudei, and Beclaibito Chapters. Water for these areas is obtained by pumping from the San Juan River near Shiprock, pumping from the Hogback Canal System east of Highway 666, and by means of a 28.7-mile pipeline from the City of Farmington to storage tanks west of Shiprock. The pipeline conveys treated water purchased from the City of Farmington under a 30-year contract beginning in 1968, with a 10-year renewal option.

3.19.3.7 Wastewater Service

The City of Durango provides sewer service in the vicinity of the proposed Durango Pumping Plant.

Sewage and wastewater facilities have not been developed in the Ridges Basin area. Residents of this area use septic tank systems to dispose of their waste. Several local contractors service the area's septic tanks.

3.19.3.8 Solid Waste Disposal

Many La Plata County residents contract with private haulers to pick up and dispose of household trash. The County offers two convenience centers, operated by Waste Management of the Four Corners, where residents can take their household trash for disposal (La Plata County 1999b). A privately owned landfill was opened in 1997 near Ignacio, Colorado, which includes the La Plata Recycling Center and Depository. Citizens have the option of choosing use of the landfill as an alternative to private trash pickup, or the use of County Convenience Centers (La Plata County 1999b). Recycling is available to county residents at the Bayfield and Marvel Convenience Centers. Paper, aluminum, tin, and glass are accepted for recycling. Old automotive batteries and used motor oil are also accepted for disposal at the Bayfield Center. The County also offers a yard waste collection site at the Bayfield Convenience Center where property owners can dispose of dry brown yard wastes free of charge. The yard waste collection site is open from about May through September of each year (La Plata County 1999b).

3.19.4 Environmental Consequences and Mitigation

The following sections discuss potential impacts to public services and utilities of Refined Alternatives 4 and 6. In addition, mitigation measures are proposed to reduce or eliminate potential impacts to public services and utilities.

3.19.4.1 Refined Alternative 4

3.19.4.1.1 Structural Components Impacts

Refined Alternative 4 Public Services and Utilities Impact 1 - Less than Significant: Project construction could require additional demands for fire, police, or emergency medical services.

Construction of the Durango Pumping Plant, Ridges Basin Inlet Conduit, Ridges Basin Dam and Reservoir, and NNMP could result in increased demands for fire protection, police protection, or emergency medical services. Construction of the proposed pumping plant and pipeline would add activity and traffic to the general area immediately south of Durango. However, the number and location of construction workers do not exceed the range of protective and emergency response demands presently made within La Plata and San Juan Counties during the tourist season, when visitation is high. Construction contractors would be required to take conventional precautions to fence hazardous areas under construction (e.g., buildings, trenches, materials stockpiles, etc.) and otherwise discourage and limit access through the use of physical barriers and "No Trespassing" postings consistent with standard construction safety management practices.

Mitigation for Refined Alternative 4 Public Services and Utilities Impact 1: Ensure that construction contractors adequately secure and patrol their work sites and coordinate with city or county law enforcement agencies.

Refined Alternative 4 Public Services and Utilities Impact 2 - Less than Significant: Project construction could reduce the level of solid waste disposal capacity.

Construction of the Durango Pumping Plant, Ridges Basin Inlet Conduit, and the NNMP would generate small volumes of solid waste. Normal construction waste, litter, and excess building materials would be generated at a rate similar to that of other similar-sized industrial or commercial construction projects. No major demolition waste would be generated. Excavated rock and earth materials would be used on site or wasted on site and they blended with area surroundings.

Existing landfill capacity would not be substantially affected. Reclamation and its contractors would require all construction activities to include strict prohibitions on litter. All waste disposal activities would use an adequate number and capacity of trash bins, dumpsters, and other appropriate containers situated and used to completely eliminate the possibility of adverse nuisance impacts associated with litter on scenic hillsides, along the Animas or San Juan River corridors, or within Ridges Basin.

Mitigation for Refined Alternative 4 Public Services and Utilities Impact 2: No mitigation is proposed.

Refined Alternative 4 Public Services and Utilities Impact 3 - Less than Significant: Relocation of natural gas and electrical transmission facilities could affect services provided by these utilities.

Three gas pipelines lie within the dam foundation area of the proposed Ridges Basin Reservoir. They are owned by the Northwest Pipeline Corporation and the Mid-American Pipeline Company. The three pipelines would need to be relocated around the dam site and reservoir inundation area. Construction of Ridges Basin Dam and Reservoir would also require the relocation of a 3,000-foot segment of Tri-State's 115-kV electric line (eight towers), and some Mountain Bell phone lines. The transmission line would be relocated north of the reservoir. A service and permanent power supply would be necessary to the dam site.

The Western Area Power Administration (WAPA) has indicated that transmission facilities to the dam could be provided by WAPA or a commercial utility. Construction of the Durango Pumping Plant, inlet conduit, and Ridges Basin Dam and Reservoir would not substantially degrade electric service, because Reclamation would cooperate with Tri-State and the La Plata Electric Association to ensure continued electric service during power line relocation and extension of service to the dam, which would occur late in construction. Northwest Gas Corporation would construct a tie-in and meter station for relocating the tap into the Greeley Gas local distribution pipeline, ensuring no interruption in natural gas service. It is not anticipated that any gas or electrical transmission facilities would need to be relocated or taken out of service during construction of the NNMP.

Mitigation for Refined Alternative 4 Public Services and Utilities Impact 3: No mitigation is proposed.

Refined Alternative 4 Public Services and Utilities Impact 4 - Less than Significant: The crossing of natural gas and electrical transmission facilities during construction of the NNMP could temporarily affect these services.

Mitigation for Refined Alternative 4 Public Services and Utilities Impact 4: Ensure that during construction activities the locations of existing buried utilities will be marked and a notification system will be developed.

Refined Alternative 4 Public Services and Utilities Impact 5 - Less than Significant: Operation of the project's structural components would require increased utility services.

The Durango Pumping Plant would require service from local culinary water and sanitary sewer systems, but would not impose substantial demands on their respective service loads beyond existing demands for similar small industrial facility construction demands. The power to operate the Durango Pumping Plant would be provided by WAPA. A City of Durango sewer line is close to the pumping plant.

The operation of water-based recreation facilities and a campground at the proposed reservoir would require extension of potable water, electricity, waste removal, and telephone services into the area of Ridges Basin north of the proposed reservoir. Sanitary sewer systems would also need to be installed for recreation development. It is anticipated that these requirements could be met by expansion of existing systems and no significant impacts to these systems would be expected.

Mitigation for Refined Alternative 4 Public Services and Utilities Impact 5: No mitigation is proposed.

3.19.4.1.2 Non-Binding End Uses and Distribution Systems

Refined Alternative 4 Public Services and Utilities Impact 6 - Less than Significant: Construction of end uses and distribution systems could disrupt local utility services.

The water distribution system construction would involve conventional pipe trenching, laying, and backfilling activities. Numerous buried utility pipelines and cables would be crossed. The utility crossings would be made according to the procedures required by the system owners, and no substantial service disruptions would be expected.

Mitigation for Refined Alternative 4 Public Services and Utilities Impact 6: No mitigation is proposed.

Refined Alternative 4 Public Services and Utilities Impact 7 - Less than Significant: Development associated with water end uses would place additional demands on local public services and utilities.

Development of new housing units on the Florida Mesa, in the Animas River Basin, and elsewhere as described in Chapter 2, would require extensions of water, electrical, and residential gas systems. The increased population would require expansion of tribal or other local police and fire protection services. These increased patrols would need to be obtained by either reducing the patrol areas or times of the existing forces, or adding staff to provide the needed level of police and crime prevention services. Delayed police and fire services could delay emergency medical services. The operation of a pumping plant and other facilities associated with water delivery would require pumping power from the area's power grid. It is anticipated that additional local tax revenue associated with this development could adequately provide funding for these additional service requirements.

Mitigation for Refined Alternative 4 Public Services and Utilities Impact 7: No mitigation is proposed.

Refined Alternative 4 Public Services and Utilities Impact 8 - Beneficial: The project could provide conveyance capacity for M&I water to Durango and surrounding communities.

The City of Durango would have the option of using the Durango Pumping Plant to divert Animas River water under its current or future water rights. The pumping plant would be constructed with an unfinished bay in which the city could install its own pump to divert water from the river for conveyance to its water system. The city would also have the option of connecting a water line to the outlet of Ridges Basin Dam, which would serve the same purpose as the additional pump. This conveyance potential is considered a beneficial impact to communities that utilize the facilities. Additional communities could also be able to access water made available as a result of the ALP Project through purchasing project water from the Colorado Ute Tribes or through access to project water supplied to other ALP Project beneficiaries.

3.19.4.2 Refined Alternative 6

3.19.4.2.1 Structural Components

Refined Alternative 6 Public Services and Utilities Impact 1 - Less than Significant: Project construction could require additional demands for fire, police, or emergency medical services.

Enlargement of Lemon Dam and construction of the NNMP could result in increased demands for public services as described above under Refined Alternative 4 Impact 1. However, additional requirements associated with Lemon Reservoir under Refined Alternative 6 would be less than those necessary for Ridges Basin Dam and Related facilities under Refined Alternative 4.

Mitigation for Refined Alternative 6 Public Services and Utilities Impact 1: Ensure that construction contractors adequately secure and patrol their work sites and coordinate with city or county law enforcement agencies.

Refined Alternative 6 Public Services and Utilities Impact 2 - Less than Significant: Project construction could reduce the level of solid waste disposal capacity.

Enlargement of Lemon Dam and construction of the NNMP could result in increased solid waste disposal needs in a similar manner as described above under Refined Alternative 4 Impact 2.

Mitigation for Refined Alternative 6 Public Services and Utilities Impact 2: No mitigation is proposed.

Refined Alternative 6 Public Services and Utilities Impact 3 - Less than Significant: The crossing of natural gas and electrical transmission facilities during construction of the NNMP could temporarily affect these services.

There is a risk of accidental disturbance of a utility line which could result in a temporary shutdown.

Mitigation for Refined Alternative 6 Public Services and Utilities Impact 3: Ensure that during construction activities the locations of existing buried utilities will be marked and a notification system will be developed.

3.19.4.2.2 Non-Binding End Use and Distribution Systems

Refined Alternative 6 Public Services and Utilities Impact 4 - Less than Significant: Construction of end uses and distribution systems could disrupt local utility services.

The impact of this alternative would be similar to Refined Alternative 4 Public Services and Utilities Impact 6.

Mitigation for Refined Alternative 6 Public Services and Utilities Impact 4: No mitigation is proposed.

Refined Alternative 6 Public Services and Utilities Impact 5 - Less than Significant: Development associated with water end uses would place additional demands on local public services and utilities.

The impact of this alternative would be similar to that of Refined Alternative 4 Public Services and Utilities Impact 7.

Mitigation for Refined Alternative 6 Public Services and Utilities Impact 5: No mitigation is proposed.

Refined Alternative 6 Public Services and Utilities Impact 6 - Beneficial: The project could provide conveyance capacity for M&I water to Durango and surrounding communities.

Because of the use of the enlarged Lemon Reservoir for production of part of the project water supply, water from Lemon Dam could be conveyed to the city's proposed Horse Gulch Reservoir from the Florida River corridor.

3.19.4.3 No Action Alternative

No discussion of public services and utilities impacts from the ALP Project are anticipated under the No Action Alternative.

3.20 VISUAL RESOURCES

3.20.1 Introduction

This section addresses potential impacts to visual resources that would result from actions associated with Refined Alternatives 4 and 6, and the No Action Alternative. Section 3.20.2 defines the Evaluation Methodology and significance criteria used for determining impacts, Section 3.20.3 describes the affected environment, and Section 3.20.4 identifies potential impacts and mitigation measures that would serve to reduce or eliminate anticipated impacts to visual resources.

Some of the most attractive features of southwestern Colorado are the spectacular scenic vistas formed by mountains and river valleys. Land use plans developed in La Plata County and the City of Durango repeatedly mention the importance of conserving these features and their associated aesthetic qualities because of their critical importance in enhancing the quality of life in the region. The Natural Environment Element of the City Comprehensive Plan (City of Durango 1997) recognizes the key issue of preserving access to vistas of natural areas. The City of Durango seeks to maintain attractive natural vistas for many years by protecting hillsides and ridgelines overlooking the community from inappropriate development.

The City of Farmington's Comprehensive Plan (City of Farmington 1989) identifies some key issues, such as maintaining visual aesthetics through maintenance of open space, parks, and the quality of the riverine resources, including the San Juan River. Farmington's Riverine Plan (City of Farmington 1990) seeks to preserve and enhance the San Juan River corridor through habitat restoration and long-range plans for riverfront park development.

3.20.2 Methodology

This section discusses the methodology used to determine potential impacts that could result from Refined Alternatives 4 and 6. Also discussed are specific criteria that were used to determine the significance of the impacts identified.

3.20.2.1 Evaluation Methodology

Local land use plans and policies were reviewed and used as a basis for evaluating aesthetic and visual impacts. Data collection goals focused on obtaining the most current federal, state, regional, and local policies and plans related to visual resources and aesthetics. Interviews with federal and local planning officials were used to confirm the relative importance of aesthetics and scenic vistas in areas that could be potentially affected by project structural components. Relevant professional literature was reviewed to help frame the importance of aesthetic qualities associated with river flows, Ridges Basin, the pipeline conduit to the Animas River, and the San Juan River between Farmington and Shiprock. The Animas River corridor through the City of Durango, and the proposed Durango Pumping Plant site were visited and photographed from Santa Rita Park and nearby points.

The nature and severity of the impacts to view corridors and scenic resources depend on the amount of visual contrast in those corridors and the potential for "scarring" of visible terrain. The amount of contrast between the existing landscape and project features or construction disturbance is determined by characterizing the potentially affected environment for the basic elements of form, line, color, and texture. Sensitivity levels are a measure of people's concern for all of these criteria, which comprise the scenic quality of landscapes. Sensitivity levels are affected by visibility to people who live in the area, travel through on developed roads and trails, use public picnic and visitor areas, and recreate along streams. These factors were considered in order to determine the perceived effects of visible activities, project facilities, and changes in landscape.

3.20.2.2 Significance Criteria

The criteria for this evaluation were based on the application of local standards and professional judgement regarding human scenic and aesthetic values. According to NEPA regulations (40 CFR Part 1508.27), significance involves consideration of both "context" and "intensity."

A reduction in mountainous, rural, and open space aesthetics, scenic vistas, and surrounding visual resources would represent significant environmental consequences. Environmental consequences were, therefore, identified as significant if they:

- Impact a highly visible scenic vista;
- Damage or substantially alter scenic resources (e.g., trees, rock outcrops, historic buildings) along a scenic corridor;
- Block, disrupt, or reduce public viewing opportunities;
- Conflict with locally adopted aesthetic/scenic/visual plans and policies; or
- Violate visual quality objectives adopted by federal, regional, or state government agencies.

Short-term activities associated with construction were not considered significant. However, visible scarring of landscape that would require greater than three years to naturally restore was considered significant.

3.20.3 Affected Environment

This section discusses existing visual resources in the areas potentially affected by Refined Alternatives 4 and 6. The actions that may take place under the No Action Alternative are not fully known at this time, and consequently it is not possible to completely define the affected environment for that alternative. However, many of the eventual actions that may occur as a result of the No Action Alternative would likely take place within the same geographic setting as that of Refined Alternatives 4 and 6.

In general, the rugged mountainous terrain characterizing southwestern Colorado provides a variety of scenic mountain vistas, natural rivers and other scenic view corridors, and an aesthetically pleasing panoramic rural atmosphere. All of these features are extremely valuable to residents of and visitors to the City of Durango, La Plata County, and the surrounding communities. Aesthetics, scenic resources, and the visual quality of the region are integral to defining the high quality of life for year-round residents. Similarly, they also attract thousands of recreational visitors; hence they are economically valuable for maintaining tourism and recreational revenue.

The following sections discuss the affected environment in the specific areas of proposed structural components and then describe the general visual characteristics of areas east and southwest of Ridges Basin for visual changes potentially caused by the non-structural and non-binding components.

3.20.3.1 Durango Pumping Plant and Ridges Basin Inlet Conduit

The proposed Durango Pumping Plant site is along the west bank of the Animas River, on a topographic bench near the Bodo Industrial Park, immediately south of Durango. The site is west of U.S. 550/160, and directly across the river from the southern end of Santa Rita Park.

The hillsides overlooking the Animas River are characterized by pinon-juniper woodland and scrub/shrub-juniper vegetation. Visual variety is created by rock outcrops, which can comprise from 5 to over 50 percent of the area seen from the Animas River corridor. Views from the river to the lower one-third to one-half of the east-facing hillsides are screened by riparian vegetation. The potentially affected visual environment is, therefore, the upper one-half to two-thirds of the hillsides (i.e., those visible to river recreationists and Santa Rita Park visitors).

3.20.3.2 Ridges Basin Dam and Reservoir

Carbon Mountain is the dominant feature of the area with its steep face and strong contrast of color, texture, and form. The existing viewshed includes meadow, pasture, and rangeland within Ridges Basin with a few scattered farm buildings and fences. CR 211 is located within the basin and a number of transmission lines can be seen on the basin's northern ridge.

Ridges Basin Reservoir would be visible on approximately 1.5 miles of U.S. 160 from about 5.5 miles northwest of the reservoir and from Wildcat Canyon Road for about 1.5 miles. The dam site would be briefly visible from U.S. 550 from a distance of about four miles. The dam and reservoir would be visible as small, distant background elements from CR 219, located about 3 miles southeast of the dam site.

3.20.3.3 Navajo Nation Municipal Pipeline

The approximately 29-mile long pipeline, which would lie mostly within the existing pipeline alignment, would traverse various types of terrain including two crossings of the San Juan River. For its first approximately 17.5 miles, from Farmington to the area north of Morgan Lake, the pipeline would run through a 75-150-foot-wide river corridor. The first crossing of the San Juan River is located where the existing underground pipeline is situated. The view of the river is somewhat obstructed from nearby roadways; however, some residential areas overlook the river. Downstream views along the river include a mixture of light industrial, commercial, and residential. The pipeline would cross the Fruitland and Hogback Canals.

The second crossing of the San Juan River is located near the Hogback Ridge and is visible from U.S. 550. The crossing would follow the existing crossing alignment. Downstream of the second crossing to Shiprock, the pipeline traverses a mixture of agricultural and residential areas and follows the alignment of the Hogback Canal for the majority of the distance.

3.20.3.4 Lemon Dam and Reservoir

Lemon Dam is an existing 215-foot high earth and rockfill dam in the Florida River Valley. The dam occupies a valley having a bottom width of about 0.35 mile and relatively steep, densely forested slopes. The reservoir extends approximately 3.3 miles upstream from the dam. Development in the vicinity consists of scattered residences on the valley floor upstream and downstream of the reservoir, and a campground on the east side of the reservoir. County Road 243, the only road running through the valley, passes along the east side of Lemon Reservoir.

3.20.3.5 Areas West of Ridges Basin

The La Plata River Basin in Colorado contains scattered tracts of irrigated land among areas of grassland, sagebrush, and pinyon-juniper woodland. The La Plata River and a few of its tributaries are dominant features, and contain bottomland vegetation including cottonwood trees. As the river enters New Mexico and runs south to the San Juan River, the river valley becomes narrower, with irrigated agriculture lying close to the river in a the corridor bordered by sage brush scrub vegetation away from the river.

The Mancos River valley in the vicinity of Mancos, Colorado, contains an agricultural area based on water diverted from the Mancos River, surrounded by hilly intermountain woodland consisting of pinyon pine and juniper with an understory of big sagebrush and other shrubs. As the Mancos River proceeds downstream, the river corridor itself is bordered by salt desert shrub.

In areas west of Ridges Basin, much of the land not located within river basins is typical of high desert terrain. Southwest sloping mesa tops are sparely vegetated with sage and rabbit brush or pinyon pine/juniper cover. Development in the area is widely scattered with open spaces and low volume two-lane roadways common throughout the area.

3.20.3.6 Areas East of Ridges Basin

Areas east of Ridges Basin which are relevant to the non-structural components or the non-binding end uses and conveyance corridors consist of the Animas, Florida, and Pine River Basins. The Animas River downstream of Durango is contained in a relatively narrow valley with hillsides rising from each side. The valley floor is dominated by transportation routes, including U.S. 160 and 550 and local county roads. East of the Animas River along U.S. 160 lies the Florida Mesa, a relatively flat grassland area containing irrigated cropland, and bisected by the Florida River and various smaller streams. The area has numerous irrigation canals carrying water from the Florida River and other streams. Further to the east, the Pine River valley also has a grassland setting with irrigated cropland and canals supplying water from the Vallecito Reservoir.

3.20.4 Environmental Consequences and Mitigation

The following sections discuss potential impacts to visual resources of Refined Alternatives 4 and 6. No Action Alternative impacts are also included as presented in the 1996 FSFES. In addition, mitigation measures are proposed to reduce or eliminate potential impacts to visual resources.

3.20.4.1 Refined Alternative 4

3.20.4.1.1 Structural Component

Refined Alternative 4 Visual Impact 1 - Significant: The construction and the presence of the Durango Pumping Plant and reservoir inlet conduit adjacent to the Animas River would detract from the scenic quality of the area and could be in conflict with City of Durango visual quality objectives.

The Durango Pumping Plant would be located on the west side of the Animas River and would be visible to river-based recreationists and land-based recreationists in Santa Rita Park and on the paved bike path which passes through Santa Rita Park and from U.S. 550/160 south of Durango. Construction activities associated with the pumping plant and inlet conduit would also be visible from these areas. Although there are similar existing man-made structures in the area, these visible features and activities would detract from the viewshed within this area resulting in a significant impact. Additionally, construction activities associated with the inlet conduit could conflict with the City of Durango's goal of maintaining Durango's views of natural hillsides and mountains with the objective of limiting development on hillsides overlooking the city so that views of natural hillsides are maintained.

Mitigation for Refined Alternative 4 Visual Impact 1: As part of construction design, the pumping plant would be blended into the natural land form to the extent practicable and the site will be adequately revegetated.

Pumping plant construction would be blended as much as reasonably possible into the natural land form. The form, color, and lines used for the plant would complement natural forms, colors, and lines occurring on the west side of the Animas River. Design elements would blend with the surrounding vegetation and river terrace topography and colors to create a very similar view as afforded by local land forms. Revegetation would use native species, including container stock as necessary, to accelerate the time needed to shield the plant from view. Blended form, color, and vegetative design elements would limit views of the plant and related equipment, parking, and maintenance facilities. Effective blending, done in cooperation with the City of Durango, would reduce this impact.

Refined Alternative 4 Visual Impact 2 - Significant: The construction and presence of Ridges Basin Dam and other physical components would alter the existing visual characteristics of the area and could detract from the future visual quality of the area.

During construction, heavy equipment use, the associated increased human activity, and clearing and grading operations would temporarily diminish the rural aesthetics and visual quality of the mountainous terrain. Relocations of electric, gas, and telephone lines could result in highly visible linear landscape scarring across Ridges Basin. Trenching, backfilling, and related disturbances often take decades to revegetate to near-natural conditions and are often maintained in a low-growing grass/weed cover appearance to facilitate convenient maintenance and repair access. This is considered a significant impact because it has the potential to cause long-term visual degradation in Ridges Basin.

Mitigation for Refined Alternative 4 Visual Impact 2: Design, as practical, non-intrusive structures to the extent practicable and restore disturbed areas.

Reclamation would employ the services of a qualified landscape architect to develop and supervise implementation of a landscaping plan that specifically focuses on minimizing visual impacts of project structural components. The plan would include regrading and revegetation of any borrow, staging, or parking areas used for project construction. The plan would include design elements that enhance local contours, create visual barriers and berms, and otherwise use natural vegetation to conceal Project structural components. If these elements cannot be fully concealed from view, careful planning would be used to ensure that they are concealed from key recreational observation points. The color, line, and form of structural components and surrounding landscaping would blend to the maximum reasonable extent to retain needed functions. %

All areas cleared and graded for construction of any project structural components would be revegetated as soon as possible to realize long-term vegetative success. Fertilizer and water trucks and other portable methods of irrigation would be used as reasonable to accelerate and enhance revegetation success, especially in visually sensitive areas.

Refined Alternative 4 Visual Impact 3 - Less than Significant: Ridges Basin Reservoir would substantially alter the existing visual characteristics of the area.

The presence of Ridges Basin Reservoir would substantially alter the visual characteristics of the area. Once filled, the reservoir would become the dominant element in the basin. This analysis does not attempt to characterize this change in setting as adverse or beneficial. However, it is reasonable to anticipate that the reservoir would create increased use of the area, in part due to the visual aspects of the reservoir. Increased visitation to the area, which would maintain a relatively high scenic quality, would allow for the appreciation of the visual qualities of the area by more people than currently experience the area.

Operational characteristics of the reservoir could detract from the visual quality. Substantially increased reservoir releases in response to late summer/early fall instream flow releases would result in the exposure of barren shoreline, effectively creating temporary “bathtub rings” around Ridges Basin Reservoir. These rings could persist through much of the fall and winter seasons or until adequate runoff could refill the reservoir, which would correlate with low visitation rates.

Mitigation for Refined Alternative 4 Visual Impact 3: No mitigation is proposed.

Refined Alternative 4 Visual Impact 4 - Less than Significant: Construction activities and the physical presence of above-ground facilities associated with the NNMP would alter the existing visual characteristics of the area.

Grading and trenching for construction of the NNMP would not be expected to result in significant visual impacts since the alignment follows the existing pipeline for most of its length. Any required pumping plant or turnouts would replace existing structures, so no new visual impacts would result. During construction, there would be some temporary visual impacts, especially from the second crossing at U.S. 550 at Hogback; however, these impacts are not expected to be significant.

Mitigation for Refined Alternative 4 Visual Impact 4: No mitigation is proposed.

3.20.4.1.2 Non-Binding End Uses and Conveyance Corridors Impacts

Refined Alternative 4 Visual Impact 5 - Potentially Significant: Development of project water end uses could detract from the scenic quality of the areas in which these facilities would be located.

The development of a coal mine, coal-fired power plant, or gas-fired power plant and other identified end use facilities could substantially degrade the visual quality and rural aesthetics in areas where they would be constructed. Without careful planning, these facilities could become dominant forms on the landscape. This impact is considered potentially significant because depending on final planning, the visual character of high-quality visual areas could be substantially reduced.

Mitigation for Refined Alternative 4 Visual Impact 5: Design of end use facilities could plan for permanent structures to be blended harmoniously with surrounding landscape, and could plan for revegetation of conveyance corridors after pipeline construction.

Various measures could be taken to minimize the visual impact of the potential coal mine and power plant developments. The coal mining operation could be laid out to provide as much of a topographic or vegetative screen as possible between the mining operation and adjacent areas. Spoil areas could be contoured to blend as much as possible with natural land forms, and then revegetated. The coal- and gas-fired power plants could be minimized by positioning the plant to achieve maximum natural screening from adjacent developed areas. Finally, transmission lines could be routed to minimize visual impact from developed areas. Pipeline routes could be graded to blend with the natural topography and allowed to revegetate naturally where feasible. On sloping terrain the graded corridor could be reseeded to protect against soil erosion until natural vegetation becomes re-established.

3.20.4.2 Refined Alternative 6

3.20.4.2.1 Structural Component

Refined Alternative 6 Visual Impact 1 - Less than Significant: Construction activities and ground disturbance associated with the enlargement of Lemon Dam and its spillway would temporarily detract from the scenic quality of the Florida Valley.

Excavation of the foundation zone at the downstream toe of the dam would result in removal of vegetation and stockpiling of excavated materials in a construction area immediately downstream of the dam. Excavation of embankment material from borrow areas upstream of the reservoir or downstream of the dam would involve clearing of vegetation and excavation of silt and gravel. These activities would detract from the scenic attractiveness of the valley; however, they would be short-term and therefore are considered less than significant.

Mitigation for Refined Alternative 6 Visual Impact 1: Contour and revegetate disturbed areas.

Under a site grading and revegetation plan, the construction area would be shaped and revegetated to blend harmoniously with the surrounding topography and vegetation. After a few years of regrowth, the area would regain its pre-construction scenic characteristics.

Refined Alternative 6 Visual Impact 2 - Less than Significant: Construction activities and physical presence of above-ground facilities associated with the NNMP would substantially alter the existing visual characteristics of the area.

This impact would be the same as that for Refined Alternative 4 Visual Impact 4.

Mitigation for Refined Alternative 6 Visual Impact 2: No mitigation is proposed.

3.20.4.2.2 Non-Structural Component

Refined Alternative 6 Visual Impact 3 - Less than Significant: Change of cropping patterns and vegetative cover on the lands that would be acquired under the non-structural component could detract from the visual quality of the areas in which they are located.

The scenic attractiveness of the affected agricultural areas stems largely from the mosaic of green fields bordered on undeveloped land with natural vegetation. The purchase of tracts of lands up to several thousand acres in size and converting them to dryland cropping or removing them from agriculture would reduce this scenic quality. The degree of scenic degradation to any area would depend on various factors, such as the location of the acreage in relation to other lands, whether the land would be taken out of production, and the type of cover crop or other vegetation planted.

Mitigation for Refined Alternative 6 Impact 3: No mitigation is proposed.

3.20.4.2.3 Non-Binding End Uses and Conveyance Corridors

Refined Alternative 6 Visual Impact 4 - Potentially Significant: Development of project water end uses could detract from the scenic quality of the areas in which these facilities would be located.

Same as Refined Alternative 4 Visual Impact 5.

Mitigation for Refined Alternative 6 Visual Impact 4: Design of end use facilities could plan for permanent structures to be blended harmoniously with surrounding landscape, and could plan for revegetation of conveyance corridors after pipeline construction.

Same as mitigation for Refined Alternative 4 Visual Impact 5.

3.20.4.3 No Action Alternative

There was no discussion of visual resources impacts in the 1996 FSFES.

3.21 SUMMARY OF IMPACTS FOR REFINED ALTERNATIVE 4 AND REFINED ALTERNATIVE 6

Table 3.21-1 summarizes the impacts and mitigation measures identified in the preceding sections. The table also indicates the significance of each adverse impact without mitigation and with mitigation.

Table 3.21-1
Summary of Impacts for Refined Alternative 4 and Refined Alternative 6

Impact	Significance	Mitigation	Significance with Mitigation
WATER RESOURCES/HYDROLOGY			
Refined Alternative 4 Hydrology Impact 1 Depletions resulting from operation of Refined Alternative 4 would alter flows in the Animas River between the Durango Pumping Plant and the confluence of the San Juan River.	LS	Bypass flows included in plan.	LS
Refined Alternative 4 Hydrology Impact 2 Impacts to existing flow are anticipated in the San Juan River as a result of project operation that would reduce water supply for future Indian trust water uses.	S	Develop an operation plan for the Durango Pumping Plant to schedule pumping from the Animas River in a manner that limits the effects of reduced water supplies in the San Juan River to the extent practicable.	PS
Refined Alternative 4 Hydrology Impact 3 Project return flow from non-binding uses would increase flows in the La Plata River in New Mexico in an area that is now water-short. Unless these return flows are protected or the depletion of them replaced, downstream depletion would increase above 57,100 afy with subsequent impact to endangered fish flows.	PS	Pursue a method to protect non-binding components return flow waters in the La Plata River drainage as a water supply for endangered fish.	PS
Refined Alternative 4 Hydrology Impact 4 Increased flow in the lower Mancos River due to return flow from non-binding uses in Mancos Canyon.	B	NA	NA
Refined Alternative 4 Hydrology Impact 5 Ridges Basin Reservoir would add a permanent pool of water in the San Juan River Basin.	B	NA	NA
Refined Alternative 4 Hydrology Impact 6 The water level in Navajo Reservoir would be lowered slightly by operation of Refined Alternative 4.	LS	No mitigation is proposed.	LS

LS = Less than Significant PS = Potentially Significant S = Significant B = Beneficial NA = Not Applicable

Table 3.21-1 (continued)
Summary of Impacts for Refined Alternative 4 and Refined Alternative 6

Impact	Significance	Mitigation	Significance with Mitigation
Refined Alternative 6 Hydrology Impact 1 Depletions resulting from operation of Refined Alternative 6 would alter flows in the Animas River between the Durango Pumping Plant and the confluence of the San Juan River.	LS	No mitigation is proposed.	LS
Refined Alternative 6 Hydrology Impact 2 Impacts to existing flow are anticipated in the San Juan River that would reduce water supply for future Indian trust water uses.	PS	Pursue the purchase of additional irrigated land upstream of Navajo reservoir, convert the depletion to M&I use and deliver to Navajo Reservoir as required to fulfill future ITA uses.	PS
Refined Alternative 6 Hydrology Impact 3 Operation of Refined Alternative 6 would change the flows in the La Plata River drainage primarily by increasing flows from the Colorado/New Mexico state line to the confluence with the San Juan River as a result of the introduction of return flow from San Juan River diversions.	LS	No mitigation is proposed.	LS
Refined Alternative 6 Hydrology Impact 4 Flows in the Mancos River would change primarily in timing as a result of operation of Refined Alternative 6.	LS	No mitigation is proposed.	LS
Refined Alternative 6 Hydrology Impact 5 The water level in Navajo Reservoir would be lowered slightly by operation of Refined Alternative 6.	LS	No mitigation is proposed.	LS
Refined Alternative 6 Hydrology Impact 6 Transfer of water rights from irrigation to instream flow enhancement and downstream M&I use on the Pine River under Refined Alternative 6 could have enhancing hydrology effects on the Pine River.	B	NA	NA
% ***Refined Alternative 6 Hydrology Impact 7*** Irrigated land purchased in the Montezuma Valley Irrigation Company service area for which the depletion is transferred to M&I use would slightly modify the timing of flows in McElmo Creek and upper Dolores River.	LS	No mitigation is proposed.	LS

LS = Less than Significant   PS = Potentially Significant   S = Significant   B = Beneficial   NA = Not Applicable

Table 3.21-1 (continued)
Summary of Impacts for Refined Alternative 4 and Refined Alternative 6

Impact	Significance	Mitigation	Significance with Mitigation
WATER QUALITY			
Refined Alternative 4 Water Quality Impact 1 Construction of the proposed Durango Pumping Plant and new gas pipelines, associated with the relocation and realignment of gas pipelines in Ridges Basin, could result in temporary increases in suspended sediment loads in the Animas River.	PS	Implement a program to reduce, minimize or eliminate temporary, short-term increases in suspended sediment loading or other water quality constituents, potentially caused by project construction, through the incorporation of permits, Best Management Practices (BMPs), and sediment control structures.	LS
Refined Alternative 4 Water Quality Impact 2 Construction of the NNMP could temporarily increase suspended sediment loads in the San Juan River.	PS		LS
Refined Alternative 4 Water Quality Impact 3 Construction of the Ridges Basin Dam and outlet structure could temporarily increase sediment loads in Basin Creek.	PS		LS
Refined Alternative 4 Water Quality Impact 4 Filling Ridges Basin Reservoir, and operational releases from the reservoir would alter the concentration of water quality parameters in both the reservoir and the receiving streams (i.e., the Animas, La Plata and Mancos Rivers).	LS	Potential impacts to water quality associated with the filling of Ridges Basin could be mitigated through development and implementation of a water quality monitoring program in the Animas River from the Durango Pumping Plant to the confluence with the San Juan River. Such a program would be developed to monitor compliance with the water quality standards and criteria of the Southern Ute Indian Tribe and states of Colorado and New Mexico. Also see mitigation for Refined Alternative 4 Aquatic Resources Impact 3, in Section 3.6.4.1 of the Aquatic Resources section.	LS
Refined Alternative 4 Water Quality Impact 5 Refined Alternative 4 would contribute to the present increase in concentration of trace metals in the San Juan River between Farmington, New Mexico and Mexican Hat (near Bluff), Utah.	LS	No mitigation is proposed.	LS

LS = Less than Significant PS = Potentially Significant S = Significant B = Beneficial NA = Not Applicable

Table 3.21-1 (continued)
Summary of Impacts for Refined Alternative 4 and Refined Alternative 6

Impact	Significance	Mitigation	Significance with Mitigation
Refined Alternative 4 Water Quality Impact 6 Erosion and sediment discharge during construction of end use water conveyance pipelines could increase suspended sediment loads in the Animas, La Plata, and Mancos Rivers.	PS	Develop and implement a program to reduce, minimize or eliminate the temporary, short-term increases in suspended sediment loading that potentially may occur during project construction through the incorporation of BMPs and sediment control devices.	LS
Refined Alternative 6 Water Quality Impact 1 Enlargement of Lemon Reservoir and use of stored Florida River water would contribute to changes in concentrations of water quality parameters in the Florida and Animas River Basins.	LS	No mitigation is proposed.	LS
Refined Alternative 6 Water Quality Impact 2 Retirement of land in the Pine River Basin and downstream use of water would improve water quality parameters in Pine River.	B	No mitigation is proposed.	NA
Refined Alternative 6 Water Quality Impact 3 Retirement of land in the La Plata and Mancos River Basins and use of water would contribute to changes in water quality parameters.	LS	No mitigation is proposed.	LS
Refined Alternative 6 Water Quality Impact 4 Operation of Navajo Dam to deliver project water would contribute to changes in water quality parameters.	LS	No mitigation is proposed.	LS
Refined Alternative 6 Water Quality Impact 5 M&I return flows from new housing, industrial, and recreation developments in the Florida Mesa, Animas River Basin, Red Mesa, La Plata River Basin and the Mancos River Basin would contribute to changes in concentrations of water quality parameters.	LS	No mitigation is proposed.	LS

LS = Less than Significant PS = Potentially Significant S = Significant B = Beneficial NA = Not Applicable

Table 3.21-1 (continued)
Summary of Impacts for Refined Alternative 4 and Refined Alternative 6

Impact	Significance	Mitigation	Significance with Mitigation
VEGETATION			
Refined Alternative 4 Vegetation Impact 1 Approximately 1,500 acres of upland vegetation would be permanently lost by the construction of Ridges Basin Reservoir and Dam.	S	Replacement and protection of approximately 1,645 acres of upland vegetation lost from the construction of Ridges Basin Dam and Reservoir, the Durango Pumping Plant, the relocation of CR211, recreation and associated facilities, and new O&M access roads by acquiring compensatory lands and on-site creation, restoration, or enhancement of riparian/wetlands impacted by the relocation of CR211.	LS
Refined Alternative 4 Vegetation Impact 2 Construction of Durango Pumping Plant, the relocation of County Road 211, construction of new recreation facilities, and construction of access and maintenance roads would permanently impact approximately 158 acres of upland vegetation.	S		LS
Refined Alternative 4 Vegetation Impact 3 Construction of Ridges Basin Reservoir and Dam would permanently inundate or fill 121 acres of wetlands/riparian vegetation cover.	S	The loss of 134 acres wetland/riparian habitat would be compensated at a mitigation ratio to replace or exceed the habitat value of wetland/riparian habitat lost.	LS
Refined Alternative 4 Vegetation Impact 4 Construction and initial operation of Ridges Basin Reservoir would destroy approximately 13 acres of wetland/riparian vegetation within Basin Creek downstream of the proposed dam.	S		LS
Refined Alternative 4 Vegetation Impact 5 Approximately 30 acres of upland and 1 acre of riparian/wetlands associated with the construction of the Ridges Basin inlet conduit, and approximately 85 acres of upland vegetation associated with the relocation of gas pipelines, would be temporarily impacted.	PS	Reclamation would limit the ground disturbance to the smallest feasible areas, and would implement BMPs, along with planting or re-seeding using native plant species to assist in the reestablishment of native vegetation.	LS
Refined Alternative 4 Vegetation Impact 6 Reduced flow conditions in the Animas River may result in minor impacts to cottonwood recruitment near the confluence with the San Juan River.	LS	Bypass flows and operation of the Durango Pumping Plan to meet endangered fish needs should reduce this potential problem.	LS

LS = Less than Significant PS = Potentially Significant S = Significant B = Beneficial NA = Not Applicable

Table 3.21-1 (continued) Summary of Impacts for Refined Alternative 4 and Refined Alternative 6			
Impact	**Significance**	**Mitigation**	**Significance with Mitigation**
Refined Alternative 4 Vegetation Impact 7 Construction of the NNMP could result in short-term disturbance to native upland vegetation and riparian wetlands.	LS	No mitigation is proposed.	LS
Refined Alternative 4 Vegetation Impact 8 Construction of water conveyance pipelines could result in the loss of between 20 and 300 acres of wetland and riparian vegetation.	S	To avoid or minimize construction impacts to wetland and riparian vegetation located within the potential corridor alignments of the non-binding water conveyance pipelines, the construction zone would be the minimal needed to meet project objectives. If avoidance is not possible, a riparian/wetland mitigation and monitoring plan would be developed to compensate for the loss of vegetation cover.	LS
Refined Alternative 6 Vegetation Impact 1 Raising Lemon Reservoir and Dam would result in the permanent loss of approximately 60 acres of upland vegetation.	LS	No mitigation is proposed.	LS
Refined Alternative 6 Vegetation Impact 2 Construction of the NNMP could result in short-term disturbance to native upland vegetation and riparian wetlands.	LS	No mitigation is proposed.	LS
Refined Alternative 6 Vegetation Impact 3 Acquisition of water rights and cessation of water conveyance and irrigation in the Pine, La Plata, and Mancos River Basins, and McElmo Creek Basin could result in the conversion of over 1,200 acres of wetland and riparian vegetation to upland vegetation cover.	S	Pursue a program of maintaining existing wetlands and wetland values by avoiding impacts and by replacing wetland losses that cannot be avoided. 600 - 900 acres of wetland losses not avoided would be compensated at a mitigation ratio to replace or exceed the habitat value of wetland riparian habitat lost.	LS
Refined Alternative 6 Vegetation Impact 4 Construction of water conveyance pipelines could result in the loss of between 20 and 300 acres of wetland and riparian vegetation at the crossings of creeks, drainage channels, canals, and floodplains.	S	To avoid or minimize construction impacts to wetland and riparian vegetation located within the potential corridor alignments of the non-binding water conveyance pipelines, the construction zone would be the minimal needed to meet project objectives. If avoidance is not possible, a riparian/wetland mitigation and monitoring plan would be developed to compensate for the loss of habitat value.	LS

LS = Less than Significant PS = Potentially Significant S = Significant B = Beneficial NA = Not Applicable

Table 3.21-1 (continued)
Summary of Impacts for Refined Alternative 4 and Refined Alternative 6

Impact	Significance	Mitigation	Significance with Mitigation
WILDLIFE			
Refined Alternative 4 Wildlife Impact 1 Inundation of Ridges Basin and other direct and indirect habitat losses would result in the loss of approximately 2,700-2,900 acres of wildlife habitat used by a variety of wildlife species, most notably big-game animals, principally mule deer and elk.	S	The direct and indirect loss of approximately 2,700-2,900 acres of wildlife habitat would be mitigated by the purchase, enhancement, and management of approximately 2,700-2,900 acres of suitable land.	LS
Refined Alternative 4 Wildlife Impact 2 Construction of the gas pipeline relocation corridor, road relocation, and recreation area development associated with Refined Alternative 4 would have a temporary adverse effect on mule deer, elk and possibly elk calving areas.	S	Construction specifications would include noise, traffic, and human use restrictions to minimize disturbance to wildlife near the construction zone of Ridges Basin. The Carbon Mountain gas pipeline route, which could significantly impact golden eagle nesting, would not be considered.	LS
Refined Alternative 4 Wildlife Impact 3 Once constructed, the long-term effects of the use of the relocated road and recreation areas would reduce use of the area by elk and deer during the summer period and although the areas would continue to be used as winter range, increased use of the area by humans would disrupt deer and elk habitat utilization and behavior.	S	Recreational facilities and the new alignment for CR 211 would be sited or restricted in a way to minimize the disruption of deer and elk habitat utilization and behavior. In addition, the operation of those facilities would be managed through a plan that would support the minimization or elimination of those conflicts/impacts.	LS
Refined Alternative 4 Wildlife Impact 4 Construction of the Ridges Basin Dam, pumping plant, inlet conduit line, new road alignment for CR 211, reservoir access roads, relocation of transmission lines, and recreation facilities could impact nesting golden eagles.	S	Reclamation and raptor specialists from the Service and CDOW would collaborate on road realignment and construction activity at Ridges Basin Dam to identify and implement measures minimizing effects on existing golden eagles and their nests on Carbon Mountain. All reasonable means to preclude human activity on Carbon Mountain should be pursued. All powerlines would be designed raptor-proof.	LS

LS = Less than Significant PS = Potentially Significant S = Significant B = Beneficial NA = Not Applicable

Table 3.21-1 (continued)
Summary of Impacts for Refined Alternative 4 and Refined Alternative 6

Impact	Significance	Mitigation	Significance with Mitigation
Refined Alternative 4 Wildlife Impact 5 Development of Ridges Basin Reservoir and associated recreation area would increase use in the general area, which could disturb nesting golden eagles on Carbon Mountain.	S	A 0.25 mile buffer around the existing golden eagle nests would be identified and all reasonable measures should be pursued to preclude human activity on Carbon Mountain between December 1 through July 15, the nesting period of golden eagles.	LS
Refined Alternative 4 Wildlife Impact 6 Construction of the NNMP could result in the displacement of wildlife along the alignment.	LS	No mitigation is proposed.	LS
Refined Alternative 4 Wildlife Impact 7 Construction of water conveyance pipelines would result in the loss of 20 to 300 acres of wetland and riparian wildlife habitat. Construction activities, noise, and human intrusion could result in short-term disturbance to wildlife security.	S	Construction zones would be the minimal needed to meet project objectives. If avoidance is not possible, riparian/wetland habitat mitigation and a monitoring plan would be developed to compensate for the loss of habitat value.	LS
Refined Alternative 6 Wildlife Impact 1 Raising Lemon Reservoir Dam, which would inundate 60 acres of ponderosa pine and other wildlife habitat, could result in short-term construction disturbance to sensitive wildlife, and longer-term wildlife conflicts due to access road relocation around the reservoir.	PS	Prior to construction, field surveys would be conducted to identify sensitive wildlife receptors within the construction influence zone. A wildlife protection plan would be developed for construction and relocation of existing reservoir facilities, structures, and access roads.	LS
Refined Alternative 6 Wildlife Impact 2 Construction of the NNMP could result in the displacement of wildlife along the alignment.	LS	No mitigation is proposed.	LS
Refined Alternative 6 Wildlife Impact 3 Acquisition of water rights, converting irrigation water to M&I uses, and cessation of irrigation in the Pine River, La Plata River, Mancos River, Dolores River, and McElmo River basins would result in the conversion of over 600 acres of wetland and riparian wildlife habitat to upland habitat.	S	Attempts to avoid impacts up to 600 of the 1,200 acres of wetlands would be made by maintaining portions of the wetlands' water supply. The remaining 600 or more acres would be mitigated through a program of land acquisition and wetland development.	PS

LS = Less than Significant PS = Potentially Significant S = Significant B = Beneficial NA = Not Applicable

Table 3.21-1 (continued)
Summary of Impacts for Refined Alternative 4 and Refined Alternative 6

Impact	Significance	Mitigation	Significance with Mitigation
Refined Alternative 6 Wildlife Impact 4 Construction of water conveyance pipelines would result in the loss of 20 to 300 acres of wetland and riparian wildlife habitat. Construction activities, noise, and human intrusion could result in short-term disturbance to wildlife security.	S	Construction zones would be the minimal needed to meet project objectives. If avoidance is not possible, riparian/wetland habitat mitigation and a monitoring plan would be developed to compensate for the loss of habitat value.	LS
AQUATIC RESOURCES			
Refined Alternative 4 Aquatic Resources Impact 1 Decreases in aquatic habitat due to chronic flow depletions could adversely affect the carrying capacity for trout in the Animas River.	PS	Establish three seasonal bypass flows past the Durango Pumping Plant. Implement a stocking program for trout in the Animas River to compensate/replace loss of usable habitat due to flow depletions.	LS
Refined Alternative 4 Aquatic Resources Impact 2 High summer water temperatures and reduced oxygen in dry water years may adversely affect trout in Ridges Basin reservoir.	LS	If feasible, the reservoir inlet conduit could be extended to allow water to enter the reservoir below the thermocline to minimize fishery impact during dry years.	LS
Refined Alternative 4 Aquatic Resources Impact 3 The introduction of trace elements into Ridges Basin Reservoir from the Animas River could lead to the bioaccumulation of these elements into the food chain.	PS	The reservoir basin would be cleared of all vegetation with stems (trunks) greater than 2" in diameter. Only trout would be stocked in the reservoir. A monitoring program would be initiated at Ridges Basin to assess the significance of bioaccumulation of trace elements within the reservoir and associated fish and wildlife.	PS
Refined Alternative 4 Aquatic Resources Impact 4 Reductions in Animas River flow would reduce physical habitat affecting the carrying capacity of the Animas River to support native fish.	PS	Reclamation would continue to monitor the native fish populations in the Animas River and would evaluate several methods of compensating for impacts. This could include further modifying pumping operations, providing fish passage around barriers, reducing fish entrainment in irrigation diversions, and possibly protecting introduced flow in the La Plata River and/or protecting important native fish habitat by obtaining conservation easements.	PS

LS = Less than Significant PS = Potentially Significant S = Significant B = Beneficial NA = Not Applicable

Table 3.21-1 (continued)
Summary of Impacts for Refined Alternative 4 and Refined Alternative 6

Impact	Significance	Mitigation	Significance with Mitigation
Refined Alternative 4 Aquatic Resources Impact 5 Stocked fingerling trout and native fish fry and fingerlings could be entrained or impinged on intake screens at the Ridges Basin Pumping Plant.	PS	Reclamation would review and adopt established guidelines for screening diversion facilities to minimize fish entrainment and impingement at the Ridges Basin Pumping Plant. Best Available Technology would be adopted at the time of construction.	LS
Refined Alternative 4 Aquatic Resources Impact 6 Stocked fingerling trout and native fish fry and fingerlings could be stranded downstream of the Durango Pumping Plant if pumping rates are not staged.	PS	Reclamation would operate the Durango Pumping Plant in a manner to minimize the downstream stranding of fish in the Animas River.	LS
Refined Alternative 4 Aquatic Resources Impact 7 Populations of native fish in the Animas and San Juan Rivers and endangered fish in the San Juan River could be reduced by the competitive interaction with non-native fish species escaping from Ridges Basin Reservoir.	PS	Reclamation would either screen or implement other physical structures to prevent live fish from being released from Ridges Basin Reservoir.	LS
Refined Alternative 4 Aquatic Resources Impact 8 Construction of the NNMP could impact fisheries at stream crossings.	LS	Construction of San Juan River crossings could be scheduled to take place during a season when impacts to downstream native and/or endangered fish would be minimized.	LS
Refined Alternative 6 Aquatic Resource Impact 1 During construction, raising of Lemon Reservoir Dam could increase erosion and cause short-term increases in water turbidity in the reservoir and downstream into the Florida River.	LS	No mitigation is proposed.	LS
Refined Alternative 6 Aquatic Resource Impact 2 Reduced flow in the La Plata River above the Colorado/New Mexico state line as a result of conversion of water from irrigation to M&I use could reduce the habitat for native fish.	PS	Reclamation would pursue the establishment of compensatory mitigation to ensure increased flow in the La Plata River during summer months.	PS
% ***Refined Alternative 6 Aquatic Resource Impact 3*** Conversion of irrigation water to M&I uses in the Pine River Basin would increase the flow in the river.	B	No mitigation is proposed.	NA

LS = Less than Significant PS = Potentially Significant S = Significant B = Beneficial NA = Not Applicable

Table 3.21-1 (continued)
Summary of Impacts for Refined Alternative 4 and Refined Alternative 6

Impact	Significance	Mitigation	Significance with Mitigation
SPECIAL STATUS SPECIES			
Refined Alternative 4 Special Status Species Impact 1 Flow alterations in the Animas River and within irrigation ditches may alter riparian vegetation composition and abundance, and affect bald eagle perch or roost sites.	LS	Incorporate bypass flows into ALP Project operations to reduce the possibility of impacts to cottonwood recruitment.	LS
Refined Alternative 4 Special Status Species Impact 2 Implementation of Refined Alternative 4 could potentially affect the food base of bald eagles.	S	Develop and implement a monitoring program of the potential bioaccumulation of trace metals in bald eagle food sources in conjunction with the Service, CDOW, NMDGF, and the Colorado Ute Tribes.	PS
Refined Alternative 4 Special Status Species Impact 3 Construction of the NNMP could impact southwestern willow flycatcher nesting habitat at two crossings of the San Juan River.	PS	Schedule construction of pipeline crossings to avoid construction during periods when the southwestern willow flycatcher is present.	LS
Refined Alternative 4 Special Status Species Impact 4 The operation of the ALP Project without offsetting measures could adversely affect the Colorado pikeminnow and razorback sucker in the San Juan River.	S	Reclamation would operate Navajo Reservoir and the Durango Pumping Plant to mimic the natural hydrograph of the San Juan River for the benefit of the Colorado pikeminnow and razorback sucker.	LS
Refined Alternative 4 Special Status Species Impact 5 Survival and recovery of endangered fish in the San Juan River could be jeopardized by competitive interaction with nonnative fish released from Ridges Basin Reservoir to the Animas River.	PS	The reservoir outlet system would be designed and operated to eliminate survival of predatory or competitive fish from escaping the reservoir.	LS
Refined Alternative 6 Special Status Species Impact 1 Raising Lemon Reservoir Dam could result in short-term construction-related disturbance to bald eagle roosting, nesting, and feeding behavior.	PS	Prior to construction, field surveys would be conducted to identify raptor use sites within the construction influence zone. A wildlife protection plan would be developed that would incorporate procedures and recommendations for the control of noise and human disturbance. Construction may be required under the ESA concerning bald eagle impacts.	LS

LS = Less than Significant   PS = Potentially Significant   S = Significant   B = Beneficial   NA = Not Applicable

Table 3.21-1 (continued) Summary of Impacts for Refined Alternative 4 and Refined Alternative 6			
Impact	**Significance**	**Mitigation**	**Significance with Mitigation**
Refined Alternative 6 Special Status Species Impact 2 Construction of the NNMP could impact southwestern willow flycatcher nesting habitat at two crossings of the San Juan River.	PS	Schedule construction of pipeline crossings to avoid construction during periods when the willow flycatcher is present.	LS
Refined Alternative 6 Special Status Species Impact 3 Acquisition of water rights resulting in the abandonment and dewatering of irrigation canals and altering existing hydrology within the Pine, La Plata River, Mancos, and McElmo River Basins may adversely affect southwestern willow flycatcher habitat near surface waters.	PS	Enhancing, restoring, and protecting suitable near-site wetlands would compensate the loss of wetland/riparian habitat along abandoned irrigation ditches.	PS
GEOLOGY AND SOILS			
Refined Alternative 4 Geology Impact 1 Seismic events within the project area would have the potential to damage project facilities.	LS	Reduce or eliminate the potential for damage to project facilities through specific dam design specifications to withstand maximum credible earthquake.	LS
Refined Alternative 4 Geology Impact 2 Rapid filling and discharges from Ridges Basin Reservoir could cause reservoir-induced seismicity.	LS	Provide a controlled water rate program for filling the Ridges Basin Reservoir to offset the potential of induced seismic impacts.	LS
Refined Alternative 4 Geology Impact 3 Wave action and drawdown runoff from the exposed Ridges Basin Reservoir shoreline could create landslides and slumping potential.	LS	Develop and implement a facilities operations program that includes monitoring the reservoir shoreline and slopes for landslide and slumping; and provide for public notification and control of public access in areas where high landslide and slumping potential exists.	LS
Refined Alternative 4 Geology Impact 4 Dewatering for construction of Ridges Basin Dam and filling of the reservoir could increase the natural seepage and surface release of coal-bed methane gas.	PS	Monitor methane seepage during construction and facility operations and implement a process plan to manage dam site methane releases during construction.	PS

LS = Less than Significant PS = Potentially Significant S = Significant B = Beneficial NA = Not Applicable

Table 3.21-1 (continued)
Summary of Impacts for Refined Alternative 4 and Refined Alternative 6

Impact	Significance	Mitigation	Significance with Mitigation
Refined Alternative 4 Geology Impact 5 The presence of existing man-made intrusions into areas within Ridges Basin could release methane and hydrogen sulfide gas and could impair integrity of the dam.	LS	Investigate for the potential of gas release due to man-made intrusions, and monitor excavations for the presence of gas, and employ safety measures as needed.	LS
Refined Alternative 4 Soils Impact 1 Ground disturbance during construction of structural and non-binding components would expose soils to potential increases in wind and water erosion and increase risk of slope instability.	S	Implement measures contained within erosion control guidelines and BMPs to reduce impacts from construction of structural and non-binding components.	LS
Refined Alternative 4 Soils Impact 2 Wave action and rapid reservoir surface elevation changes could cause sedimentation and erosion along the reservoir shoreline.	LS	Implement a program in which reservoir filling and drawdown would be controlled at rates sufficient to reduce significant erosion and sedimentation impacts.	LS
Refined Alternative 6 Geology Impact 1 Seismic events within the project area would have the potential to damage project facilities.	LS	No mitigation is proposed.	LS
Refined Alternative 6 Geology Impact 2 Wave action and drawdown runoff from the new shoreline of Lemon Reservoir would create new landslide and slumping potential including that from existing landslides.	LS	Develop and implement a facilities operation program that includes monitoring the reservoir shoreline and slopes for landslide and slumping; and provide for public notification and control of public access in areas where high landslide and slumping potential exists.	LS
Refined Alternative 6 Soils Impact 1 Ground disturbance during construction of the structural and non-structural components would expose soils to potential increases in wind and water erosion and increase risk of slope instability.	LS	Implement measures contained within erosion control guidelines and BMPs to reduce impacts from construction of structural and non-binding components.	LS
Refined Alternative 6 Soils Impact 2 Wave action on Lemon Reservoir shoreline could cause sedimentation and erosion.	LS	No mitigation is proposed.	LS

LS = Less than Significant PS = Potentially Significant S = Significant B = Beneficial NA = Not Applicable

Table 3.21-1 (continued)
Summary of Impacts for Refined Alternative 4 and Refined Alternative 6

Impact	Significance	Mitigation	Significance with Mitigation
Refined Alternative 6 Soils Impact 3 Increased wind and water erosion could occur as a result of removing or reducing irrigation from currently irrigated lands.	LS	Develop procedures to require implementation of an erosion protection program for acquired lands.	LS
Refined Alternative 6 Soils Impact 4 Increased erosion and slumping potential could occur along the Pine River due to increased flows.	LS	No mitigation is proposed.	LS
CULTURAL RESOURCES			
Refined Alternative 4 Cultural Impact 1 Historic properties would be adversely affected. Construction activities associated with the structural components and inundation of Ridges Basin could disturb or destroy cultural resources eligible for inclusion in the NRHP.	S	Implement the historic/archaeological treatment measures and publication of results pursuant to the Programmatic Agreement.	S (although issues would be resolved through proper treatment)
Refined Alternative 4 Cultural Impact 2 Operations and recreation activities associated with Ridges Basin Reservoir would create potential for disturbance of cultural resources eligible for inclusion in the NRHP.	S	Implement the historic/archaeological treatment measures and publication of results pursuant to the Programmatic Agreement.	S (although issues would be resolved through proper treatment)
Refined Alternative 4 Cultural Impact 3 Historic properties would be affected. Construction disturbance associated with the potential end uses and conveyance systems would create potential for disturbance and increased public access to cultural resources eligible for inclusion in the NRHP.	PS	Implement the historic/archaeological treatment measures and publication of results pursuant to the Programmatic Agreement.	PS (although issues would be resolved through proper treatment)
Refined Alternative 4 Cultural Impact 4 Activities described in Refined Alternative 4 Cultural Impacts 1-3 could result in adverse impacts to exposed human remains and sacred sites.	S	Follow mitigation measures in accordance with NAGPRA and Executive Order 13007.	S (although issues would be resolved through proper treatment)

LS = Less than Significant   PS = Potentially Significant   S = Significant   B = Beneficial   NA = Not Applicable

Table 3.21-1 (continued) Summary of Impacts for Refined Alternative 4 and Refined Alternative 6			
Impact	**Significance**	**Mitigation**	**Significance with Mitigation**
Refined Alternative 4 Paleontologic Impact 1 Construction activities associated with the structural components and inundation of Ridges Basin could disturb or destroy fossils of scientific significance in Late Cretaceous and Early Cenozoic age.	PS	Field survey areas prior to construction disturbance and construction monitoring if deemed appropriate.	LS
Refined Alternative 4 Paleontologic Impact 2 Operation and recreation activities that would be associated with Ridges Basin Reservoir would create potential for disturbance of important paleontologic resources within Ridges Basin.	PS	Conduct periodic shoreline monitoring as part of the facilities operations plan.	LS
Refined Alternative 4 Paleontologic Impact 3 Increased discovery could add to scientific database and knowledge.	B	No mitigation is necessary.	NA
Refined Alternative 4 Paleontologic Impact 4 Construction disturbance associated with the potential end uses and conveyance systems would create potential for disturbance to important paleontologic resources.	LS	Field survey areas prior to construction disturbance, and construction monitoring if deemed appropriate.	LS
Refined Alternative 6 Cultural Impact 1 Historic properties could be affected. Construction activities associated with the structural components and inundation of additional shoreline surrounding Lemon Reservoir could disturb or destroy cultural resources eligible for inclusion in the NRHP.	S	Same as mitigation for Refined Alternative 4 Cultural Impacts 1-3.	S (although issues would be resolved through proper treatment)
Refined Alternative 6 Cultural Impact 2 Historic properties could be affected. Operation and activities at relocated recreation areas at an enlarged Lemon Reservoir would create potential for disturbance and increased public access to cultural resources eligible for inclusion in the NRHP.	PS	Same as mitigation for Refined Alternative 4 Cultural Impacts 1-3.	PS (although issues would be resolved through proper treatment)

LS = Less than Significant PS = Potentially Significant S = Significant B = Beneficial NA = Not Applicable

Table 3.21-1 (continued) Summary of Impacts for Refined Alternative 4 and Refined Alternative 6			
Impact	**Significance**	**Mitigation**	**Significance with Mitigation**
Refined Alternative 6 Cultural Impact 3 Historic properties could be affected. Construction disturbance associated with the potential end uses and conveyance systems would create potential for disturbance and increased public access to identified and unidentified cultural resources with known or unknown eligibility for inclusion in the NRHP.	S	Same as mitigation for Refined Alternative 4 Cultural Impacts 1-3.	S (although issues would be resolved through proper treatment)
Refined Alternative 6 Cultural Impact 4 Construction and operation activities described in Refined Alternative 6 Cultural Impacts 1-3 could result in adverse impacts to exposed human remains and sacred sites.	S	Follow mitigation measures in accordance with NAGPRA and Executive Order 13007.	S (although issues would be resolved through proper treatment)
Refined Alternative 6 Cultural Impact 5 Historic properties might be affected. Eliminating agricultural irrigation from certain lands could alter farming practices in these areas and change the potential for cultural resource disturbance within these agricultural areas.	PS	Commit to the historic/archaeological treatment measures and publication of results pursuant to a Programmatic Agreement.	PS (although issues would be resolved through proper treatment)
Refined Alternative 6 Paleontologic Impact 1 Disturbance of paleontologic resources could occur during construction activities associated with raising Lemon Reservoir, the NNMP and development of non-binding end uses and conveyance systems.	LS	Field survey areas prior to construction disturbance and construction monitoring if deemed appropriate.	LS
Refined Alternative 6 Paleontologic Impact 2 Eliminating agricultural irrigation from certain lands could alter farming practices in these areas and change the potential for paleontologic resources disturbance.	LS	No mitigation is proposed.	LS
Refined Alternative 6 Paleontologic Impact 3 Increased discovery could add to scientific database and knowledge.	B	NA	NA

LS = Less than Significant PS = Potentially Significant S = Significant B = Beneficial NA = Not Applicable

Table 3.21-1 (continued)
Summary of Impacts for Refined Alternative 4 and Refined Alternative 6

Impact	Significance	Mitigation	Significance with Mitigation
AGRICULTURE			
Refined Alternative 4 Agriculture Impact 1 Construction and operation of structural components would eliminate the agricultural productivity potential of lands within Ridges Basin.	LS	No mitigation is proposed. The lands would be permanently lost to agriculture during construction and filling of the reservoir.	LS
Refined Alternative 4 Agriculture Impact 2 Construction and operation of the pipeline could eliminate agricultural production along the NNMP right-of-way.	LS	Schedule construction during periods of non-production.	LS
Refined Alternative 4 Agriculture Impact 3 Construction of Colorado Ute Tribe and non-Colorado Ute Tribe water end uses and conveyance facilities could temporarily and permanently reduce crop production, pasture, and rangeland within La Plata, Montezuma and San Juan Counties.	LS	Schedule construction during periods of non-production, or restore farmland to original condition.	LS
Refined Alternative 6 Agriculture Impact 1 Raising Lemon Dam by 10 feet would eliminate 45.06 acres of non-irrigated pasture and 11.04 acres of irrigated pasture from the north end of Lemon Reservoir.	LS	There is no mitigation for this loss in terms of production foregone. However, a plan would be developed to compensate the landowner for the property loss.	LS
Refined Alternative 6 Agriculture Impact 2 Construction and operation of the pipeline could eliminate agricultural production along the NNMP right-of-way.	LS	Schedule construction activities during periods of non-production.	LS
Refined Alternative 6 Agriculture Impact 3 Purchase of irrigated farmland on any irrigation ditch could cause disruption of historic irrigation practices to remaining appropriators.	PS	Develop Land Acquisition and Mitigation Plan.	PS
Refined Alternative 6 Agriculture Impact 4 Purchase of irrigated lands and transfer of the irrigation water off the land to M&I purposes would decrease agricultural productivity in La Plata and Montezuma Counties.	LS	Develop procedures for taking lands out of production.	LS

LS = Less than Significant   PS = Potentially Significant   S = Significant   B = Beneficial   NA = Not Applicable

Table 3.21-1 (continued)
Summary of Impacts for Refined Alternative 4 and Refined Alternative 6

Impact	Significance	Mitigation	Significance with Mitigation
Refined Alternative 6 Agriculture Impact 5 Construction of Colorado Ute Tribe and non-Colorado Ute Tribe water end uses and conveyance facilities could temporarily and permanently reduce crop production, pasture, and rangeland within La Plata, Montezuma and San Juan Counties.	LS	Schedule construction during periods of non-production, or restore farmland to original condition.	LS
RECREATION			
Refined Alternative 4 Recreation Impact 1 Operation of the Durango Pumping Plant would reduce flows in the Animas River resulting in the annual, average reduction of commercial rafting by 6 floatable days and 2,183 commercial rafting user-days, and reduce the number of river miles available for rafting.	LS	Mitigation For Refined Alternative 4 Recreation Impacts 1, 2, and 4: Pursue pumping regimes that reduce adverse flow effects on boating opportunities whenever possible; and take steps to improve public access to the river. Mitigation For Refined Alternative 4 Recreation Impact 3: No mitigation is proposed.	LS
Refined Alternative 4 Recreation Impact 2 Operation of the Durango Pumping Plant would reduce flows in the Animas River resulting in impacts to private rafting that would be similar to impacts to commercial rafting, reduce the area of river used by private kayakers, and be considered aesthetically displeasing to some local users.	LS		
Refined Alternative 4 Recreation Impact 3 Operation and presence of the Durango Pumping Plant would adversely affect the quality of the commercial rafting experience.	LS		LS
Refined Alternative 4 Recreation Impact 4 Operation and presence of the Durango Pumping Plant would adversely affect the quality of the private boating experience for some local users.	PS		
Refined Alternative 4 Recreation Impact 5 Reduced flows as a result of operation of the Durango Pumping Plant could adversely affect competitive/ organized events on the Animas River.	LS	Alteration or cessation of pumping from the Animas River during certain flow conditions during organized and competitive whitewater events, such as Animas River Days.	LS

LS = Less than Significant   PS = Potentially Significant   S = Significant   B = Beneficial   NA = Not Applicable

Table 3.21-1 (continued)
Summary of Impacts for Refined Alternative 4 and Refined Alternative 6

Impact	Significance	Mitigation	Significance with Mitigation
Refined Alternative 4 Recreation Impact 6 Operation of the Durango Pumping Plant could adversely affect stream fishing on the Animas River.	LS	Acquire public access at a minimum of two points on the Animas River between the High Bridge and Basin Creek.	LS
Refined Alternative 4 Recreation Impact 7 Construction of Ridges Basin Reservoir and associated recreation facilities would result in a reduction of current upland recreation in Ridges Basin.	LS	No specific mitigation is proposed. The planned wildlife and wetland mitigation areas discussed in Sections 3.4 and 3.5 would provide new opportunities for hunting and other wildlife-oriented activities.	LS
Refined Alternative 4 Recreation Impact 8 Construction of Ridges Basin Reservoir and associated recreation facilities would result in a net gain of recreation user-days in the basin, and fill a perceived need for reservoir recreation in the area.	B	NA	NA
Refined Alternative 4 Recreation Impact 9 Changes in San Juan River flows as a result of the ALP Project would slightly reduce floatable flows for all rafts near Bluff, Utah.	LS	No mitigation is proposed.	LS
Refined Alternative 6 Recreation Impact 1 Disruption of Lemon Reservoir recreation activities as a result of construction and inundation of existing Lemon Reservoir shoreline recreation facilities would temporarily decrease recreation use of Lemon Reservoir.	LS	Recreation use of Lemon Reservoir would be accommodated as practicable during construction.	LS
Refined Alternative 6 Recreation Impact 2 Reductions in Animas River flows as a result of future City of Durango pumping could impact Animas River recreation.	LS	No mitigation is proposed.	LS
SOCIOECONOMICS			
Refined Alternative 4 Socioeconomic Impact 1 Decreased commercial rafting on the Animas River would result in loss of revenue.	LS	No mitigation is proposed.	LS

LS = Less than Significant   PS = Potentially Significant   S = Significant   B = Beneficial   NA = Not Applicable

Table 3.21-1 (continued) Summary of Impacts for Refined Alternative 4 and Refined Alternative 6			
Impact	**Significance**	**Mitigation**	**Significance with Mitigation**
Refined Alternative 4 Socioeconomic Impact 2 Construction of Ridges Basin Reservoir would increase gross sales revenues and create jobs in La Plata County.	B	NA	NA
Refined Alternative 4 Socioeconomic Impact 3 Construction of the NNMP would increase gross sales revenue and create jobs in San Juan County, New Mexico.	B	NA	NA
Refined Alternative 4 Socioeconomic Impact 4 Reservoir-based recreation would generate revenue in La Plata County.	B	NA	NA
Refined Alternative 4 Socioeconomic Impact 5 Conversion of fee simple farmland to Indian Trust land would reduce tax revenue within La Plata and Montezuma counties as these lands would be removed from tax rolls.	LS	Promote compacts between the Colorado Ute Tribes and the counties that would result in a Tribal payment to the counties for lands converted to Indian Trust in lieu of forgone tax revenue.	LS
Refined Alternative 4 Socioeconomic Impact 6 Expenditures during the development of potential end uses and revenue generated during their operation would increase gross sales revenues and create jobs for the counties in which they are located.	B	NA	NA
Refined Alternative 4 Socioeconomic Impact 7 Sales of water developed by the project could generate revenue for the Colorado Ute Tribes.	B	NA	NA
Refined Alternative 4 Socioeconomic Impact 8 Increased availability of reliable water supplies and revenue generated from the sale of project water would allow for on-reservation development of potable water, new and/or improved housing, improved health and medical services, and other beneficial development.	B	NA	NA

LS = Less than Significant   PS = Potentially Significant   S = Significant   B = Beneficial   NA = Not Applicable

Table 3.21-1 (continued) Summary of Impacts for Refined Alternative 4 and Refined Alternative 6			
Impact	**Significance**	**Mitigation**	**Significance with Mitigation**
Refined Alternative 6 Socioeconomic Impact 1 Construction expenditures associated with raising Lemon Dam for additional M&I water would increase gross sales revenues and create jobs in La Plata County.	B	NA	NA
Refined Alternative 6 Socioeconomic Impact 2 Construction of the NNMP would generate revenue and create jobs in San Juan County.	B	NA	NA
Refined Alternative 6 Socioeconomic Impact 3 Purchase of irrigated agricultural production land to acquire adjudicated water rights and transfer those water rights to other uses would reduce county crop revenues and affect support and service industries.	B	NA	NA
Refined Alternative 6 Socioeconomic Impact 4 Conversion of fee simple farmland to Indian Trust land would reduce tax revenue within La Plata and Montezuma Counties as these lands would be removed from tax rolls.	LS	Promote compacts between the Colorado Ute Tribes and the counties that would result in a Tribal payment to the counties for lands converted to Indian Trust in lieu of forgone tax revenue.	LS
Refined Alternative 6 Socioeconomic Impact 5 Expenditures during the development of potential end uses and revenue generated during their operation would increase gross sales revenues and create jobs for the counties in which they are located.	B	NA	NA
Refined Alternative 6 Socioeconomic Impact 6 Sales of water developed by the project could generate revenue for the Colorado Ute Tribes.	B	NA	NA
Refined Alternative 6 Socioeconomic Impact 7 Increased availability of reliable water supplies and revenue generated from the sale of project water would allow for on-reservation development of potable water, new and/or improved housing, improved health and medical services, and other beneficial development.	B	NA	NA

LS = Less than Significant PS = Potentially Significant S = Significant B = Beneficial NA = Not Applicable

Table 3.21-1 (continued) Summary of Impacts for Refined Alternative 4 and Refined Alternative 6			
Impact	**Significance**	**Mitigation**	**Significance with Mitigation**
LAND USE			
Refined Alternative 4 Land Use Impact 1 Increased recreation within Ridges Basin could increase violations of CDOW restrictions within Bodo State Wildlife Area and could reduce the rural quality of the surrounding area.	S	Carefully plan reservoir-associated development and restrict access to surrounding roads and property through gating and local transportation planning to limit access to surrounding lands.	LS
Refined Alternative 4 Land Use Impact 2 Land use impacts could result from the inability of one or more of the cities to which water would be made available to implement orderly growth consistent with their respective general plans.	LS	No mitigation is proposed.	LS
Refined Alternative 4 Land Use Impact 3 Development associated with M&I growth under the non-binding scenario could create conflicts with rural atmosphere goals and objectives of the Animas Valley, Florida Mesa, West Durango Land Use Planning Districts and other areas in which development may occur.	LS	No mitigation is proposed.	LS
Refined Alternative 6 Land Use Impact 1 Raising Lemon Reservoir would inundate shoreline facilities which would be incompatible with their current uses.	LS	No mitigation is proposed.	LS
Refined Alternative 6 Land Use Impact 2 Land use impacts could result from the inability of one or more of the cities to which water would be made available to implement orderly growth consistent with their respective general plans.	LS	No mitigation is proposed.	LS
Refined Alternative 6 Land Use Impact 3 Development that could be associated with M&I growth under the non-binding scenario could create conflicts with rural atmosphere goals and objectives of the Animas Valley, Florida Mesa Land Use Planning Districts, and other areas in which development could occur.	LS	No mitigation is proposed.	LS

LS = Less than Significant PS = Potentially Significant S = Significant B = Beneficial NA = Not Applicable

Table 3.21-1 (continued)
Summary of Impacts for Refined Alternative 4 and Refined Alternative 6

Impact	Significance	Mitigation	Significance with Mitigation
HAZARDOUS MATERIALS			
Refined Alternative 4 Hazardous Materials Impact 1 Construction of the Durango Pumping Plant could expose contaminated materials.	S	The Durango Pumping Plant would be designed to minimize the disturbance of contaminated materials; procedures will be developed for radiological monitoring of excavated soils and groundwater encountered; and remedial procedures will be planned in advance to counteract the potential for human exposure and for the prevention of contaminated groundwater release from the construction site. The construction contractor would be required to implement a construction safety plan.	LS
Refined Alternative 4 Hazardous Materials Impact 2 Hazardous materials used for the construction of the Durango Pumping Plant and Ridges Basin Dam could cause stream pollution.	PS	Ensure that construction contractors adhere to all federal and state requirements pertaining to the management and handling of hazardous materials, mixed waste, and radioactive waste.	LS
Refined Alternative 4 Hazardous Materials Impact 3 Activities associated with Ridges Basin Reservoir could involve a risk of construction worker or public exposure to hazardous waste at the radioactive waste disposal cell in Ridges Basin.	LS	Identify through signage and avoid the disposal site during construction activities.	LS
Refined Alternative 4 Hazardous Materials Impact 4 Construction of the NNMP could affect the zone of contaminated groundwater from the Shiprock UMTRA disposal site.	LS	No mitigation is proposed.	LS
Refined Alternative 4 Hazardous Materials Impact 5 Hazardous Materials located in Bodo Canyon UMTRA Disposal Site impacting Ridges Basin Reservoir.	PS	Conduct joint Reclamation/DOE confirmation of the Disposal Site integrity and institute verification monitoring.	PS
Refined Alternative 4 Hazardous Materials Impact 6 Hazardous waste or materials could be encountered during construction of the non-binding end uses and conveyance structures.	LS	Require preconstruction surveys and adherence to hazardous material standards relating to construction.	LS

LS = Less than Significant PS = Potentially Significant S = Significant B = Beneficial NA = Not Applicable

Table 3.21-1 (continued)
Summary of Impacts for Refined Alternative 4 and Refined Alternative 6

Impact	Significance	Mitigation	Significance with Mitigation
Refined Alternative 6 Hazardous Materials Impact 1 Hazardous materials used during construction activities associated with raising Lemon Reservoir Dam could cause stream pollution.	LS	Commit to developing a hazardous material management program for the purpose of this project.	LS
Refined Alternative 6 Hazardous Materials Impact 2 Construction of the NNMP could affect the zone of contaminated groundwater from the Shiprock UMTRA disposal site.	LS	No mitigation is proposed.	LS
Refined Alternative 6 Hazardous Materials Impact 3 Hazardous materials could be encountered during construction of the non-binding end uses and conveyance systems.	LS	Areas should be inspected for hazardous materials and avoided when possible during siting of end use facilities and conveyance systems. These avoidance activities are included in construction costs.	LS
TRANSPORTATION			
Refined Alternative 4 Transportation Impact 1 Increased delays at the intersection of West Frontage Road and County Road 211 could result from construction worker peak hour commute trips during the construction of the structural components.	S	Conduct a transportation survey and implement methods to reduce construction impacts.	LS
Refined Alternative 4 Transportation Impact 2 Increased delays at the intersection of U.S. 550/160 and West Frontage Road could result from construction worker peak hour commute trips.	S		LS
% ***Refined Alternative 4 Transportation Impact 3*** Physical degradation of CR 211 could occur as a result of construction vehicle traffic associated with construction of the structural components.	S	Require that construction contractors maintain CR 211 roadway, shoulder, drainage, and roadside to standards adequate to avoid noticeable degradation.	LS

LS = Less than Significant PS = Potentially Significant S = Significant B = Beneficial NA = Not Applicable

Table 3.21-1 (continued)
Summary of Impacts for Refined Alternative 4 and Refined Alternative 6

Impact	Significance	Mitigation	Significance with Mitigation
Refined Alternative 4 Transportation Impact 4 During construction of the structural components, truck traffic used for hauling construction equipment, building materials, machinery, pipe, concrete, and other supplies would slightly increase traffic at the intersection of West Frontage Road and CR 211.	LS	No mitigation is proposed.	LS
Refined Alternative 4 Transportation Impact 5 During construction of the structural components, low numbers of heavy truck trips on U.S. 550/160 and West Frontage Road in relation to existing truck traffic could slightly degrade roadway physical conditions.	LS	No mitigation is proposed.	LS
Refined Alternative 4 Transportation Impact 6 Construction workers accessing Ridges Basin from the west using SR 140 and CR 141 (Wildcat Canyon Road) would slightly increase the number of average daily trips on these roadways.	LS	No mitigation is proposed.	LS
Refined Alternative 4 Transportation Impact 7 Recreation visitation traffic associated with construction of the structural components could exceed the capacity of CR 141 and other access roads.	S	Reclamation would require recreation developers to conduct a traffic engineering impacts analysis study and mitigate facility impacts according to State and County standards.	LS
Refined Alternative 4 Transportation Impact 8 Construction of the NNMP would increase traffic on area roadways.	LS	No mitigation is proposed.	LS
Refined Alternative 4 Transportation Impact 9 Construction of the water end uses and conveyance systems would increase traffic volumes on roadways used for accessing end use areas and conveyance pipeline rights-of-way.	LS	No mitigation is proposed.	LS
Refined Alternative 6 Transportation Impact 1 Construction associated with raising Lemon Dam and Reservoir would increase traffic on local roadways.	S	Develop a transportation plan that would include methods to reduce peak period construction traffic.	LS

LS = Less than Significant PS = Potentially Significant S = Significant B = Beneficial NA = Not Applicable

Table 3.21-1 (continued) Summary of Impacts for Refined Alternative 4 and Refined Alternative 6			
Impact	**Significance**	**Mitigation**	**Significance with Mitigation**
Refined Alternative 6 Transportation Impact 2 Physical degradation of roadways used for materials and equipment hauling could occur during the construction activities associated with raising Lemon Dam and Reservoir.	LS	No mitigation is proposed.	LS
Refined Alternative 6 Transportation Impact 3 Construction of the NNMP would increase traffic volumes on area roadways.	LS	No mitigation is proposed.	LS
Refined Alternative 6 Transportation Impact 4 Construction of the water end uses and conveyance systems would increase traffic volumes on roadways used for accessing end use areas and conveyance pipeline alignments.	LS	No mitigation is proposed.	LS
AIR QUALITY			
Refined Alternative 4 Air Quality Impact 1 Fugitive dust and exhaust emissions from the construction of the Durango Pumping Plant, Ridges Basin Inlet Conduit, Ridges Basin Dam, and the NNMP could cause or contribute to temporary exceedences of an NAAQS or affect the health of nearby sensitive persons.	S	Implement measures to control fugitive dust and exhaust emissions from the construction activities.	LS
Refined Alternative 4 Air Quality Impact 2 Windblown dust from Ridges Basin Reservoir when the water level is drawn down could create fugitive dust emissions.	LS	No mitigation proposed.	LS
Refined Alternative 4 Air Quality Impact 3 Fugitive dust and exhaust emissions would occur from the development of a coal mine and construction of two power plants.	LS	Require that the end user follow environmental regulations and develop BMPs for reducing fugitive dust emissions. Costs are to be covered by the end user of water.	LS
Refined Alternative 4 Air Quality Impact 4 Dust and stack emissions would occur from operation of a coal-fired power plant and coal mine and a gas-fired power plant.	S	The future end users of water could develop and implement environmental quality plans that would require emissions control technologies.	PS

LS = Less than Significant PS = Potentially Significant S = Significant B = Beneficial NA = Not Applicable

Table 3.21-1 (continued)
Summary of Impacts for Refined Alternative 4 and Refined Alternative 6

Impact	Significance	Mitigation	Significance with Mitigation
Refined Alternative 6 Air Quality Impact 1 Fugitive dust and exhaust emissions from the enlargement of Lemon Dam and construction of the NNMP could cause or contribute to temporary exceedence of an NAAQS or affect the health of nearby sensitive persons.	S	Implement measures to control fugitive dust and exhaust emissions from construction activities.	LS
Refined Alternative 6 Air Quality Impact 2 Fugitive dust emissions could occur as a result of irrigation water being taken off of the land under the non-structural component.	PS	Require that cover-crop requirements be developed for agricultural lands taken out of production.	LS
Refined Alternative 6 Air Quality Impact 3 Fugitive dust and exhaust emissions would occur from the potential development of a coal mine and construction of two power plants.	LS	Require that the end user follow environmental regulations and develop BMPs for reducing fugitive dust emissions.	LS
Refined Alternative 6 Air Quality Impact 4 Dust and stack emissions would occur from operation of a coal-fired power plant, coal mine, and gas-fired power plant.	S	The future end users of water could develop and implement environmental quality plans that would require emissions control technologies.	PS
NOISE			
Refined Alternative 4 Noise Impact 1 Noise generated during construction of the Durango Pumping Plant and Ridges Basin Inlet Conduit could disturb nearby residents and other sensitive receptors.	S	Pumping plant construction contractor would be required to adhere to Durango's noise ordinance, and be restricted from operating heavy equipment during the nighttime hours.	LS
Refined Alternative 4 Noise Impact 2 Noise from dynamite blasting for pipeline trenching and foundation excavation could exceed local noise standards and disturb nearby residents and other sensitive receptors.	S	Blasting notification would be provided to residents and pre-blast alarms would be sounded.	LS
Refined Alternative 4 Noise Impact 3 Operation of the Durango Pumping Plant could generate noise levels that exceed local standards and disturb recreationists at Santa Rita Park (formerly Gateway Park) and on the Animas River.	PS	Noise reduction would be provided in the form of sound insulation within the pumping plant and vegetative screening designed as part of site landscaping.	LS

LS = Less than Significant PS = Potentially Significant S = Significant B = Beneficial NA = Not Applicable

Table 3.21-1 (continued)
Summary of Impacts for Refined Alternative 4 and Refined Alternative 6

Impact	Significance	Mitigation	Significance with Mitigation
Refined Alternative 4 Noise Impact 4 Noise generated by the construction of Ridges Basin Dam, the relocation of CR 211, gas pipeline relocation, and the construction of a recreation area could disturb golden eagle nesting on Carbon Mountain.	S	Construction activities could be scheduled to avoid or minimize high noise level activities in the vicinity of the golden eagle nesting area during the nesting season. The nesting area would be off limits to the construction work force and visitors.	PS
Refined Alternative 4 Noise Impact 5 Noise generated by recreational activities associated with public recreation in Ridges Basin Reservoir and the potential adjacent recreation area could disturb golden eagle nesting on Carbon Mountain.	S	Incorporate in a recreation development/ management plan the requirement to prohibit watercraft that generate high noise levels, and include signing to advise people of eagle nesting sensitivity to human presence and noise.	PS
Refined Alternative 4 Noise Impact 6 Construction of the end uses and conveyance systems identified under the non-binding scenario could generate noise that could disturb nearby sensitive receptors.	PS	Require that end use developers incorporate methods to minimize noise disturbances.	LS
Refined Alternative 6 Noise Impact 1 Noise generated during the enlargement of Lemon Dam could disturb nearby residents and other sensitive receptors.	LS	Construction work at the dam should be restricted from operating heavy equipment during the nighttime hours if such operation could pose a public nuisance. Speed limits would be set on road haul units to control traffic noise in the canyon.	LS
Refined Alternative 6 Noise Impact 2 Noise from dynamite blasting for pipeline trenching and spillway enlargement could exceed local noise standards and disturb nearby residents and other sensitive receptors.	S	Blasting notification would be provided to residents and pre-blast alarms would be sounded.	PS
Refined Alternative 6 Noise Impact 3 Construction work at Lemon Dam could disturb raptors, including bald eagles, at Lemon Reservoir.	S	Construction work at Lemon Dam could be scheduled to avoid or minimize high noise level activities in the vicinity of bald eagle and osprey areas.	PS
Refined Alternative 6 Noise Impact 4 Construction of the end uses and conveyance systems identified under the non-binding scenario could generate noise that could disturb nearby sensitive receptors.	PS	Require that end use developers incorporate methods to minimize noise disturbances.	LS

LS = Less than Significant PS = Potentially Significant S = Significant B = Beneficial NA = Not Applicable

Table 3.21-1 (continued)
Summary of Impacts for Refined Alternative 4 and Refined Alternative 6

Impact	Significance	Mitigation	Significance with Mitigation
PUBLIC HEALTH AND SAFETY			
Refined Alternative 4 Public Health and Safety Impact 1 Public entry into construction areas could cause exposure to construction accidents.	S	Reclamation will ensure that public access to structural component construction areas will be controlled by signage and by fencing around construction areas.	LS
Refined Alternative 4 Public Health and Safety Impact 2 Materials and equipment transport could create hazards to the public on local roadways and delay emergency vehicles.	S	Reclamation will ensure that contractors will be required to configure haul routes and access roads to prevent or discourage public vehicular entry, including placement of signs warning against entry.	LS
Refined Alternative 4 Public Health and Safety Impact 3 Construction activities and relocation of gas pipelines would create a gas pipeline puncture hazard.	LS	Reclamation will ensure that potentially affected gas companies are contacted prior to construction; crossings of gas pipelines will be precisely located and appropriately marked in the field and on the specifications.	LS
Refined Alternative 4 Public Health and Safety Impact 4 Construction activities associated with end uses and conveyance systems under the non-binding scenario would create potential for injury.	S	Reclamation will require that developers ensure that public access to end use and delivery system construction areas is controlled by signage and by fencing around construction areas.	LS
Refined Alternative 4 Public Health and Safety Impact 5 Increased coal bed methane gas seepage that may occur as a result of developing Ridges Basin Dam and Reservoir could create increased risk of injury to workers or the public.	PS	Investigate for the potential of gas release due to man made intrusions, monitor excavations for the presence of gas, and employ safety measures as needed.	PS
Refined Alternative 4 Public Health and Safety Impact 6 During operation of the project, trespass onto properties containing project facilities or entrance into Basin Creek could expose the public to increased risk of injury.	S	Reclamation will ensure that public access to structural component construction areas would be controlled by signage and by fencing around construction areas.	LS
Refined Alternative 4 Public Health and Safety Impact 7 Recreational opportunities afforded to the public in Ridges Basin Reservoir and nearby campground and picnic areas would result in injuries typically associated with these activities.	LS	Reclamation will ensure that recreation area planning and final design of facilities and reservoir access points will be developed to promote safety and accident management techniques.	LS

LS = Less than Significant PS = Potentially Significant S = Significant B = Beneficial NA = Not Applicable

Table 3.21-1 (continued)
Summary of Impacts for Refined Alternative 4 and Refined Alternative 6

Impact	Significance	Mitigation	Significance with Mitigation
Refined Alternative 4 Public Health and Safety Impact 8 Non-binding end uses could result in increased risk of injury.	LS	No mitigation is proposed.	LS
Refined Alternative 6 Public Health and Safety Impact 1 Public entry into construction areas could cause exposure to construction accidents.	S	Reclamation will ensure that public access to structural component construction areas would be controlled by signage and by fencing around construction areas.	LS
Refined Alternative 6 Public Health and Safety Impact 2 Materials and equipment transport could create hazards to the public on local roadways and delay emergency vehicles.	S	Reclamation will ensure that contractors would be required to configure haul routes and access roads to prevent or discourage public vehicular entry, including placement of signs warning against entry.	LS
Refined Alternative 6 Public Health and Safety Impact 3 Construction activities associated with end uses and conveyance systems under the non-binding scenario would create potential for injury.	S	Reclamation will require that developers ensure that public access to end use and delivery system construction areas is controlled by signage and by fencing around construction areas.	LS
Refined Alternative 6 Public Health and Safety Impact 4 Non-binding end uses could result in increased risk of injury.	LS	No mitigation is proposed.	LS
PUBLIC SERVICES AND UTILITIES			
Refined Alternative 4 Public Services and Utilities Impact 1 Project construction could require additional demands for fire, police, or emergency medical services.	LS	Ensure that construction contractors adequately secure and patrol their work sites and coordinate with city or county law enforcement agencies.	LS
Refined Alternative 4 Public Services and Utilities Impact 2 Project construction could reduce the level of solid waste disposal capacity.	LS	No mitigation is proposed.	LS
Refined Alternative 4 Public Services and Utilities Impact 3 Relocation of natural gas and electrical transmission facilities could affect services provided by these utilities.	LS	No mitigation is proposed.	LS

LS = Less than Significant PS = Potentially Significant S = Significant B = Beneficial NA = Not Applicable

Table 3.21-1 (continued)
Summary of Impacts for Refined Alternative 4 and Refined Alternative 6

Impact	Significance	Mitigation	Significance with Mitigation
Refined Alternative 4 Public Services and Utilities Impact 4 The crossing of natural gas and electrical transmission facilities during construction of the NNMP could temporarily affect these services.	LS	Ensure that during construction activities the locations of existing buried utilities will be marked and notification system will be developed.	LS
Refined Alternative 4 Public Services and Utilities Impact 5 Operation of the project's structural components would require increased utility services.	LS	No mitigation is proposed.	LS
Refined Alternative 4 Public Services and Utilities Impact 6 Construction of end uses and distribution systems could disrupt local utility services.	LS	No mitigation is proposed.	LS
Refined Alternative 4 Public Services and Utilities Impact 7 Development associated with water end uses would place additional demands on local public services and utilities.	LS	No mitigation is proposed.	LS
Refined Alternative 4 Public Services and Utilities Impact 8 The project could provide conveyance capacity for M&I water to Durango and surrounding communities.	B	NA	NA
Refined Alternative 6 Public Services and Utilities Impact 1 Project construction could require additional demands for fire, police, or emergency medical services.	LS	Ensure that construction contractors adequately secure and patrol their work sites and coordinate with city or County law enforcement agencies.	LS
Refined Alternative 6 Public Services and Utilities Impact 2 Project construction could reduce the level of solid waste disposal capacity.	LS	No mitigation is proposed.	LS
Refined Alternative 6 Public Services and Utilities Impact 3 The crossing of natural gas and electrical transmission facilities during construction of the NNMP could temporarily affect these services.	LS	Ensure that during construction activities the locations of existing buried utilities will be marked and a notification system will be developed.	LS
Refined Alternative 6 Public Services and Utilities Impact 4 Construction of end uses and distribution systems could disrupt local utility services.	LS	No mitigation is proposed.	LS

LS = Less than Significant   PS = Potentially Significant   S = Significant   B = Beneficial   NA = Not Applicable

Table 3.21-1 (continued)
Summary of Impacts for Refined Alternative 4 and Refined Alternative 6

Impact	Significance	Mitigation	Significance with Mitigation
Refined Alternative 6 Public Services and Utilities Impact 5 Development associated with water end uses would place additional demands on local public services and utilities.	LS	No mitigation is proposed.	LS
Refined Alternative 6 Public Services and Utilities Impact 6 The project could provide conveyance capacity for M&I water to Durango and surrounding communities.	B	NA	NA
VISUAL RESOURCES			
Refined Alternative 4 Visual Impact 1 The construction and the presence of the Durango Pumping Plant and reservoir inlet conduit adjacent to the Animas River would detract from the scenic quality of the area and could be in conflict with City of Durango visual quality objectives.	S	As part of construction design, the pumping plant would be blended into the natural land form to the extent practicable and the site will be adequately revegetated.	PS
Refined Alternative 4 Visual Impact 2 The construction and presence of Ridges Basin Dam and other physical components would alter the existing visual characteristics of the area and could detract from the future visual quality of the area.	S	Design, as practical, non-intrusive structures to the extent practicable and restore disturbed areas.	PS
Refined Alternative 4 Visual Impact 3 Ridges Basin Reservoir would substantially alter the existing visual characteristics of the area.	LS	No mitigation is proposed.	LS
Refined Alternative 4 Visual Impact 4 Construction activities and the physical presence of above-ground facilities associated with the NNMP would alter the existing visual characteristics of the area.	LS	No mitigation is proposed.	LS
Refined Alternative 4 Visual Impact 5 Development of project water end uses could detract from the scenic quality of the areas in which these facilities would be located.	PS	Design of end use facilities could plan for permanent structures to be blended harmoniously with surrounding landscape and could plan for revegetation of conveyance corridors after pipeline construction.	PS

LS = Less than Significant PS = Potentially Significant S = Significant B = Beneficial NA = Not Applicable