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APPENDIX G

Feasibility Study

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1.0 FEASIBILITY STUDY COST ESTIMATE AND SCHEDULE.

The study will require eighteen to twenty four months to complete. There are three major groups of tasks to accomplish: design data collection, conceptual design, and preparing reports. The design data collection phase will include extensive survey and geology investigations, to establish locations, layouts, and physical properties of the various facilities and to make a comprehensive review of the existing systems. Conceptual design phase will start as soon as pertinent design data has been collected. Other tasks such as environmental studies and river hydraulics for bank stabilization will start at various times, 3 to 6 months into the study. Figure G-4 is a schedule showing the durations and approximate starting points for the various tasks. Approximately 65 percent of the work can be completed during the first twelve months. Estimated cost for the study is summarized in Table G-1 and G-2, and the projected expenditure is shown in Table G-3.

Table G-1. Feasibility Study Cost Estimate.

Design data collection	\$ 1,170,000
Conceptual design and construction cost estimate	\$ 1,110,000
Reports, reviews, and coordination	<u>\$ 350,000</u>
Sub-Total	\$ 2,630,000
15% for Unaccounted Items	<u>\$ 370,000</u>
Total for Feasibility Study <u>Note 1</u>	\$ 3,000,000

Note 1: \$ 2,000,000 for the first 12 months (FY 2000), and \$ 1,000,000 for the next twelve months (FY 2001).

2.0 PUEBLO INFORMATION AVAILABILITY.

Site visits were made by Reclamation and BIA to the major sites requiring repair, rehabilitation, and replacement. After the initial visits, BIA personnel provided additional information as requested by Reclamation.

The BIA Southern Pueblos Agency (SPA) and Laguna Pueblo Agency (LPA) performed additional site evaluation and provided additional data on deteriorated ditches that require rehabilitation. The data is based on the need and importance of the ditches, and includes their lengths and dimensions. SPA also provided approximate locations and lengths of ditches that require concrete lining or replacement with pipeline.

In Jemez and Zia Pueblos, the facilities needing rehabilitation were verified during field investigation. There was no site evaluation for water conservation measures. BIA Southern Pueblo Agency provided a list of ditches to be concrete lined.

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In the other six southern pueblos, the irrigation facilities are in relatively better condition than those in northern pueblos or in Acoma and Laguna Pueblos. Roughly one third of the irrigation facilities in these six pueblos are part of the Middle Rio Grande Conservancy District (District). A 1984 report by HKM Associates evaluated irrigation and drainage facilities (mostly those belonging to the District) in the six pueblos. BIA Southern Pueblo Agency provided a list of ditches, laterals, and sub-laterals to be concrete lined.

Laguna Pueblo did not include concrete lining of ditches for water conservation measures. Deficiencies of Acoma Pueblo irrigation facilities were verified during a site visit conducted by the Pueblo's representative. Water conservation measures are not included in the estimate for Acoma Pueblo.

Taos Pueblo has fairly complete information on its irrigation needs. Information for other northern Pueblos was provided by the BIA Northern Pueblos Agency (NPA) and the respective Pueblos. In general, more diversion structure rehabilitation is required in Pueblos served by NPA. There is also more need for ditches to be placed in pipeline.

3.0 COMPREHENSIVE REVIEW OF EXISTING FACILITIES.

A comprehensive review of the existing systems will be needed to develop conceptual designs and the estimated costs for rehabilitation of existing irrigation facilities.

There is presently little documentation of the structures, foundation, hydraulics, and operating data of the existing irrigation water distribution systems. Data collection will be required to identify requirements, such as: locations, alignment, ditch size and capacity, flow requirement, irrigated acreage, turnouts, flow measurement, and system operation. Structures and ditches to be rehabilitated or replaced, and highly permeable and waterlogged land areas will be identified.

Other information, such as location maps and local conditions, that will impact design and construction will be obtained.

3.1 Location Map(s) will show the following information:

- (1) Construction sites
- (2) County and Pueblo boundaries
- (3) Locations of potential construction and permanent access roads and sites for Government and Contractor's construction facilities.
- (4) Locations of borrow areas for construction materials and disposal areas for waste excavation.
- (5) Existing or potential areas or features having bearing on the design, construction, operation, or management of the project feature, such as: recreation areas, fish and wildlife areas, building areas, and areas of archeological, historical and mining or paleontological interest.

3.2 General description of local conditions:

- (1) Load restrictions and physical inadequacies of existing roads and an estimate

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of remedial improvements to accommodate construction hauling; and possible alternative means for delivering construction materials and equipment at the construction site.

- (2) Availability or accessibility of public facilities or utilities such as water supply, sewage disposal, telephone utility, fire protection services, and electrical power for construction.
- (3) Sources of materials such as riprap and concrete, gravel, bedding, and earth.
- (4) Existing site utility locations.
- (5) Existing underground structure locations.
- (6) Requirements for temporary construction access roads, permanent access and service roads, and relocation of existing roads.
- (7) Debris removal, and any special debris handling requirements.
- (8) Requirements for flows during construction and maximum length, time, and number of permitted interruptions - for operations of the irrigation ditches, and for flows in the creeks or rivers.

3.3 Surface Data (Surveying and geology investigation):

- (1) Drawings showing the survey control to be used for construction. Original survey control points from construction of the existing facilities should be included, if available. Establish permanent survey control points as required. All survey work, including location and ground surface elevation of subsurface exploration, should be based on the permanent control. All surveys should be tied to the established coordinate system at the site.
- (2) Topographic mapping covering an area sufficient to accommodate all features associated with the borrow areas, disposal areas, and access roads, and structural features; this should be on a scale of 1 inch equals 50 feet with a contour interval of 1 foot. Areas with ditch rehabilitation will be shown on 1 inch equals 100 feet with contour interval of 1 foot. Other areas where no rehabilitation work is to be done will be shown on 1 inch equals 1,000 feet with contour interval of 5 feet. Show the coordinate system (state plan coordinates) and existing land survey corner monuments or special control points established for the topographic survey. Show all man made features in the included area. Plans and profiles of canals and pipelines to be rehabilitated.
- (3) Color photographs of all existing facilities or structures in the vicinity of the proposed designs and closeup views of any features which may affect designs.
- (4) Geology exploration. Review previous drill hole data and recommend locations of holes. Drill additional holes, as needed to determine foundation material. Geologic exploration along alignment of water conveyance channels, within footprint of proposed diversion structures, to determine foundation requirements. Conduct permeability tests and by visual observations to determine the need of water conservation measures, such as concrete lining of earthen ditches and lining of existing water storage ponds.
- (5) Water Conservation. Evaluate existing conditions and determine needs for water conservation.

3.4 Environmental Considerations:

- (1) Erosion and sediment control requirements, including sampling of sediment in

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- water courses for suspended and bottom sediment analysis.
- (2) List required permits from Regulatory Agencies.
- (3) Disposal of special excavation problem materials.

4.0 CONCEPTUAL DESIGN, QUANTITIES AND COST ESTIMATE

Alternative designs will be evaluated, along with hydraulics analysis and foundation investigation, to determine the most suitable and economical design.

- (1) Plan and profile drawings of canals and pipelines to be rehabilitated or replaced, including preliminary designs of system rehabilitation, such as improving conveyance efficiency.
- (2) Hydraulics study of existing conveyance system.
- (3) Conceptual designs and structural layouts for canal structures. Review alternative designs and determine the most suitable and economical structures.
- (4) Hydrologic studies for diversion structures in rivers. Preliminary designs for river bank protection for channel and structure stabilization.
- (5) Geology and geotechnical studies. Prepare geologic exploration program. Review and map drill hole data.
- (6) Determine locations for and designs of water conservation measures, such as concrete lining of earthen ditches and lining of existing water storage ponds.
- (7) Prepare quantity calculations and feasibility level cost estimates.

5.0 REPORTS

- (1) Feasibility design report will be prepared, to detail the irrigation systems' function and operations, and establish cost effective rehabilitations. Various projects will be prioritized, based on needs and economics. Design data collection and preliminary studies will be reviewed to establish and recommend criteria for final design.
- (2) Environmental study will be conducted and environmental assessment (EA), finding of no significant impact (FONSI) or environmental impact statement (EIS) report will be prepared.

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Table G-2. Details of Feasibility Study Cost Estimate.

Task	Estimated Cost
Design data collection	
Comprehensive review of existing irrigation system	270,000
Location maps	30,000
General description of local conditions	30,000
Surveying and geology investigation	690,000
Environmental considerations	50,000
Water conservation requirements	100,000
Sub-Total	\$ 1,170,000

Conceptual design and cost estimate

Plan and profile drawings of facilities to be rehabilitated	300,000
Review and perform hydraulic studies of conveyance systems	165,000
Conceptual designs for canal structures and diversion structures	360,000
Preliminary designs for rehabilitation of existing systems	165,000
Hydrologic studies for diversion structures in rivers. Preliminary designs for river bank protection	50,000
Geology and geotechnical studies. Geologic exploration program, review and map drill hole data.	30,000
Prepare quantity calculations and feasibility level cost estimates	40,000
Sub-Total	\$ 1,110,000

Reports, Reviews, and Coordination

Prepare environmental assessment (EA), finding of no significant impact (FONSI), or EIS	150,000
Prepare feasibility design report and documentation	100,000
Coordination between various agencies and work teams	100,000
Unaccounted work items	\$370,000
Sub-Total	\$ 720,000

Total cost = \$ 3,000,000

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Table G-3. Projected Cost

Task	Estimated Cost	
	FY 2000	FY 2001
Design Data Collection		
Comprehensive review of existing irrigation system	200,000	70,000
Location maps	30,000	0
General description of local conditions	30,000	0
Surveying and geology investigation	690,000	0
Environmental Considerations	30,000	20,000
Water conservation requirements	65,000	35,000
Sub-Totals	\$1,045,000	\$125,000
Conceptual Design and Cost Estimate		
Plan and profile drawings of facilities to be rehabilitated	200,000	100,000
Review and perform hydraulic studies of conveyance systems	100,000	65,000
Conceptual designs for canal structures and diversions.	200,000	160,000
Preliminary designs for rehabilitation of existing systems	100,000	65,000
Hydrologic studies for diversion structures in rivers. Preliminary designs for river bank protection	0	50,000
Geology and geotechnical studies.	30,000	0
Prepare quantity calculations and feasibility level cost estimates	0	40,000
Sub-Totals	\$630,000	\$480,000
Reports, Reviews, and Coordination		
Prepare environmental assessment (EA), finding of no significant impact (FONSI), or EIS	100,000	50,000
Prepare feasibility design report and documentation	25,000	75,000
Coordination between various agencies and work teams	50,000	50,000
Unaccounted work items	150,000	220,000
Sub-Totals	\$325,000	\$395,000
Total Estimated Expenditure in FY 2000 and 2001	\$2,000,000	\$1,000,000

