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EXECUTIVE SUMMARY
SMITHS FORK IRRIGATION PROJECT
LEVEL II CONCEPTUAL DESIGN

WYOMING WATER DEVELOPMENT COMMISSION
IN COOPERATION WITH
THE SMITHS FORK IRRIGATION DISTRICT

ARIX CORPORATION
EXECUTIVE SUMMARY
SMITHS FORK IRRIGATION PROJECT
LEVEL II
CONCEPTUAL DESIGN
NOVEMBER 1990

Prepared for
WYOMING WATER DEVELOPMENT COMMISSION
HERSCHLER BUILDING, FOURTH FLOOR WEST WING
122 WEST 25TH STREET
CHEYENNE, WYOMING  82001

In cooperation with
SMITHS FORK IRRIGATION DISTRICT
P.O. BOX 101
COKEVILLE, WYOMING  83114

by
ARIX Corporation
877 North 8th West, Suite 8
Riverton, Wyoming  82501
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(i)
INTRODUCTION

The Smiths Fork Irrigation District is located in southwest Lincoln County near Cokeville, Wyoming as shown in Figure 1. The District has 17 operators and irrigates 4866 acres of hay and pasture. The water right of the District is about 70 cfs. The District's irrigation facilities consist of a river diversion and two main supply canals. The river diversion is located on the Smiths Fork, a tributary of the Bear River, 3.9 miles northeast of Cokeville. The canal system consists of the Covey Canal and the Mau Canal. The Covey Canal is 22.8 miles in length and irrigates 3482 acres. The canal parallels State Highway 232 for 5 miles from the diversion to Cokeville. The canal extends south of Cokeville for 18 miles on the east side of U.S. Highway 30. The Mau Canal is supplied by water released from the Covey Canal. The headgates for the Mau Canal are located at Spring Creek about one-half mile northeast of Cokeville. The Mau Canal is 8.6 miles in length and irrigates about 1384 acres. The Mau parallels the Covey and extends 8 miles south of Cokeville.

ARIX Corporation was commissioned in June 1990 to perform a Level II feasibility study for rehabilitation of the river diversion, Covey Canal and Mau Canal. The study consists of two phases. The Phase I Rehabilitation Plan was completed in August 1990. The Phase I study identifies repairs and improvements, sets priorities and provides cost estimates. The Phase II Conceptual Design was completed in November 1990. The Phase II study develops a conceptual design for the improvements, including plan drawings, subsurface investigation, detailed costs and an investigation of project economics.

STUDY PURPOSE AND SCOPE

The purpose of the Level II study is to evaluate the existing system, prepare a conceptual design and cost estimate for the improvements and investigate the economic feasibility of the project. The study will provide the basis for funding and final design of the rehabilitation improvements. The services provided by the study include the following:
Existing System Evaluation. The existing condition of the diversion, headworks, canal and appurtenant structures was evaluated to determine deficiencies in the physical condition and the operational function. The evaluation was based on an inspection of the facilities and discussions with the District.

Water Rights Investigation. The District water rights were investigated to determine the required capacities for the hydraulic structures.

Streamflow Analysis. The historic gaging records of the Smiths Fork were analyzed to determine the 100-year flood discharge, the 2-year low flow and mean monthly flows during the irrigating season.

Topographic Surveys. Topographic surveys were made at three locations where major hydraulic structures were planned.

River Mechanics Analysis. The river mechanics at the existing diversion site were evaluated to determine the potential for meander, bank erosion, and streambed erosion/siltation.

Rehabilitation Plan. Schematic plans and cost estimates were developed for 12 rehabilitation improvements. Five alternatives for the river diversion were evaluated.

Geotechnical Investigation. A subsurface investigation was conducted at the proposed diversion site. Three test pits were excavated. Soil samples were tested to determine classification and gradation. A recommendation was made regarding the diversion structure foundation.
Conceptual Plan. Conceptual plans and cost estimates were developed for the twelve rehabilitation improvements. The locations of the improvements are shown on 500 scale topographic mapping. Detailed plans and cross-sections were prepared for the hydraulic structures.

Permitting. The permits that will be required for the rehabilitation work were investigated.

Economic Analysis. The ability of the District to pay for the rehabilitation improvements was investigated. Alternatives for financing the improvements were evaluated. The economic impact of the loss of the diversion was determined. Annual operation and maintenance costs were estimated for the new hydraulic structures.

FINDINGS
1. The following deficiencies in the irrigation system were identified:

   • The existing diversion is not adequate to provide a dependable water supply to the canals. The diversion should be replaced with a new structure.

   • A flow measurement structure is required to accurately supply water from the Covey Canal to the Mau Canal.

   • The Mau Canal headgates are in poor condition and should be replaced.

   • The Mau Canal Sublette Siphon headgate and winter drain are in poor condition and should be replaced.


- Excessive seepage occurs at three locations in the Covey Canal. The seepage has caused major sloughing below the canal bank at two locations. The canal should be lined at these locations.

- Most of the 82 turnout headgates in the system are in poor condition. The existing structures do not provide a means of metering the discharge. The turnouts should be replaced with new structures capable of flow measurement.

- The existing flood relief structures for the Covey Canal are not adequate and should be replaced.

- Road crossings with double pipe culverts should be replaced with single pipes to minimize debris clogging.

2. The water right for the Covey Canal is 50 cubic feet per second (CFS), including supplemental acreage. The water right for the Mau Canal is 20 cfs, including supplemental acreage. Hydraulic structures for the canals should be designed for a capacity of 3 times the water right.

3. The river diversion should be designed to be protected from the 100-year flood discharge of 2258 cfs. The river diversion should be designed to divert the full water right of 70 cfs during the 2-year low flow discharge of 75 cfs. The mean monthly flow for May is 897 cfs; for June is 733 cfs; for July is 270 cfs; and for August is 109 cfs. On the average, the Smiths Fork supplies an adequate amount of water to enable diversion of the full water right throughout the irrigating season.
4. The river channel at the existing diversion site is relatively stable and is an appropriate location for the new diversion structure.

5. The subsurface investigation at the diversion site indicated the soil is composed of alluvial sands and gravels with cobbles up to 5 inches in diameter. Foundations should be supported on spread footings designed for an allowable bearing pressure of 5000 pounds per square foot. The footings should be placed 48 inches below the finished grade.

6. This study recommends the construction of 12 rehabilitation improvements to correct the existing deficiencies in the Smiths Fork Irrigation District. The rehabilitation improvements are summarized in Table 1. A summary of the project costs is shown in Table 2. The construction cost of the improvements is $790,000, the total project cost is $965,000.

7. Permits will be required as described below:

- The U.S. Army Corps of Engineers will not require a 404 permit for construction of the diversion structure.

- The U.S. Fish and Wildlife Service and the Wyoming Game and Fish Commission will review the final design of the diversion structure and will probably require a fish ladder and headgate screen to protect the endangered Utah Native Cutthroat.

- A permit from the State Engineer is not required for the diversion structure; however, a letter should be submitted by the District to the State Engineer describing the construction.
TABLE 1
SUMMARY OF RECOMMENDED IMPROVEMENTS
SMITHS FORK IRRIGATION DISTRICT

<table>
<thead>
<tr>
<th>PRIORITY</th>
<th>DESCRIPTION</th>
<th>COMMENTS</th>
<th>CONSTRUCTION COST</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Excessive erosion at turnout headgate north of Petersens - Replace existing constant head orifice. Provide new pipe extending to bottom of slope. Erosion protection at outlet.</td>
<td>Excessive erosion is undermining the canal bank. Continued erosion will cause failure of the canal bank.</td>
<td>$ 6,500</td>
</tr>
<tr>
<td>2.</td>
<td>Smiths Fork Diversion - New concrete diversion dam. Concrete sluice gate and headgates.</td>
<td>Required to ensure adequate diversion of water.</td>
<td>$150,000</td>
</tr>
<tr>
<td>3.</td>
<td>Mau Canal Headgates - New concrete headwall structure and headgates. New winter drain headgate. Concrete approach channel. Replace culvert under highway with 60&quot; x 46&quot; CMP arch.</td>
<td>Required to replace existing damaged headgates. New design will minimize operation problems during freezing conditions.</td>
<td>$ 31,000</td>
</tr>
<tr>
<td>4.</td>
<td>Spring Creek Flow Measurement - New 4' wide Parshall flume downstream of headgates.</td>
<td>Required to ensure adequate delivery of water to Mau users.</td>
<td>$ 6,100</td>
</tr>
<tr>
<td>5.</td>
<td>Canal Bank Sloughing - Replace canal sections with corrugated metal pipe. Repair erosion damage.</td>
<td>Required to prevent further damage to canal banks by excessive seepage.</td>
<td>$ 41,500</td>
</tr>
</tbody>
</table>
### TABLE 1 (continued)
#### SUMMARY OF RECOMMENDED IMPROVEMENTS
##### SMITHS FORK IRRIGATION DISTRICT

<table>
<thead>
<tr>
<th>PRIORITY</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.</td>
<td>Canal Seepage at Rock Cut - Replace canal with corrugated metal pipe.</td>
</tr>
<tr>
<td>7.</td>
<td>Big Hill Canal Relief Structure - 10' wide concrete cut off wall spillway. Rip-rap erosion protection at outlet.</td>
</tr>
<tr>
<td>8.</td>
<td>Turnout Headgates and Flow Measurement. Replace 44 structures on the Covey and 38 on the Mau.</td>
</tr>
<tr>
<td>9.</td>
<td>Flood Bypass Structures - Spillway with concrete cutoff wall and rip-rap erosion protection at Horse Creek, north of Petersen's residence and at Bartek Draw</td>
</tr>
<tr>
<td>10.</td>
<td>Winter Drain Headgate at Bruner Creek - Install 60&quot; headgate salvaged from diversion structure and new concrete headwall</td>
</tr>
<tr>
<td>PRIORITY</td>
<td>DESCRIPTION</td>
</tr>
<tr>
<td>----------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>11.</td>
<td>Mau Canal Sublette Siphon - New concrete headwall for siphon and winter drain headgates. New headgate and C.M.P. outlet for winter drain.</td>
</tr>
<tr>
<td>12.</td>
<td>Road Crossings at Popes - New 60&quot; CMP to replace 54&quot; pipes. Remove 48&quot; CMP at power line.</td>
</tr>
</tbody>
</table>

**SUBTOTAL**  
$623,000
## TABLE 2
Summary of Total Project Cost
Smiths Fork Irrigation Improvements

<table>
<thead>
<tr>
<th>Item</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preparation of Final Designs and Specifications</td>
<td>$100,000</td>
</tr>
<tr>
<td>Permitting and Mitigation</td>
<td>$50,000</td>
</tr>
<tr>
<td>Legal Fees</td>
<td>$25,000</td>
</tr>
<tr>
<td>Acquisition of Access and Rights-of-Way</td>
<td>$0</td>
</tr>
<tr>
<td>Construction Cost Subtotal from Table 1</td>
<td>$623,000</td>
</tr>
<tr>
<td>Engineering Costs (10%)</td>
<td>$63,000</td>
</tr>
<tr>
<td>Subtotal</td>
<td>$686,000</td>
</tr>
<tr>
<td>Contingency (15%)</td>
<td>$104,000</td>
</tr>
<tr>
<td>Construction Cost total</td>
<td>$790,000</td>
</tr>
<tr>
<td>TOTAL PROJECT COST</td>
<td>$965,000</td>
</tr>
</tbody>
</table>
A license will be required by the Wyoming Highway Department for replacement of the culvert in State Highway 232.

A permit will be required from the Wyoming Department of Environmental Quality and from Lincoln County to quarry the rip-rap for the diversion structure.

8. The economic analysis indicated the following conclusions:

- The negative economic impact to Lincoln county that would be caused by the loss of the diversion is $2,800,000.

- The operation and maintenance costs for the structures proposed as part of the rehabilitation improvements is $4,230. These costs will not impact the current operating budget of the District.

- The rehabilitation improvements will result in an increase in the amount of water available to the District. This benefit is not included in the economic analysis since the amount of the water increase is not supported by adequate data.

- The net return per acre per year is used as measure of the ability to pay for the rehabilitation improvements. The net return based on 5-year average crop prices and costs is estimated at $-7.47 per acre per year. Improved management practices will increase the net return to $14.44 per acre per year.

- A financing plan based on a 50 percent grant from the Wyoming Water Development Commission and a 50 percent loan at 4 percent annual interest for 50 years will result in an end user assessment of $5.23 per acre per year.
RECOMMENDATIONS
This study recommends the construction of all 12 rehabilitation improvements with a construction cost of $790,000 and a total project cost of $965,000. The improvements are designed to:

1) Correct existing deficiencies which threaten property loss or loss of canal structures. These improvements include repair of the canal sloughing, repair of the turnout headgate erosion, the Big Hill Canal relief structure, and the flood bypass structures.

2) Provide for adequate supply and conservation of water resources. These improvements include the Smiths Fork Diversion, flow measurement at Spring Creek, canal lining at the rock cut, and new turnout headgates throughout the system.

3) Increase operation efficiency and reduce maintenance costs. These improvements include the Mau Canal headgates, the road crossings and the Mau Canal Sublette Siphon.