GOSHEN IRRIGATION DISTRICT
REHABILITATION PROJECT
LEVEL II
FINAL REPORT

EXECUTIVE SUMMARY

PREPARED FOR:

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and

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EXECUTIVE SUMMARY

Authorization and Purpose

In the Fall of 1990, the Wyoming Water Development Commission (WWDC) received an application to fund a feasibility study to identify deficiencies in facilities owned and operated by the Goshen Irrigation District (GID). Specifically, these facilities included a pumping station, two tunnels and four siphons. On June 5, 1991 Lidstone & Anderson, Inc. (LA) entered into a contract with the WWDC to provide professional services related to the Level II-Goshen Irrigation District Rehabilitation Project. As stated in the contract, the purpose of the Level II project is threefold: (1) inventory and evaluate the potential bottlenecks in the main irrigation delivery system, specifically consisting of the two tunnels and four siphons; (2) evaluate and design an efficient pumping station on the Laramie River; and (3) identify and describe those rehabilitation measures necessary to increase capacity and ensure a more efficient operation of the water supply system. The scope of services for the project consists of two separate tasks: Task A which involves the evaluation of the Laramie River Pump Station, and Task B which entails the evaluation of the siphons and tunnels. This report documents the results of the work associated with the completion of Task A.

Project Location and Summary of Existing Problems

The Goshen Irrigation District (GID) is located in Goshen County, Wyoming. The primary source of irrigation water is obtained from the North Platte River via the Fort Laramie Canal. Approximately 52,484 acres of land in Wyoming and an additional 53,000 acres of land in Nebraska are served by the water conveyed in the canal. In addition to the water diverted from the North Platte River, a supplemental supply (100 cfs) from the Laramie River has been earmarked for the GID and is presently diverted by a pump station located 4 miles west of Fort Laramie. The general location map for the project is presented on Figure 1.
Figure 1  General Location Map
The GID was formed in November of 1926 following the construction of the project by the U.S. Bureau of Reclamation. Presently, the primary conveyance system consists of approximately 85 miles of the Fort Laramie Canal in Wyoming, two tunnels, four siphons, appurtenant structures, lateral canals and pipelines. Of particular interest to this report is the pump station along the Laramie River. The existing pump station consists of a CrisaFulli 24-inch centrifugal pump driven by a 200-horsepower electric motor. This pump station became operational following the abandonment of a diversion canal from the Laramie River to the Fort Laramie Canal located approximately 0.5 miles upstream. Recent studies funded by the WWDC concluded that the existing pump station is operationally inefficient and incurs high power and maintenance costs. Furthermore, the existing pump station is capable of diverting less than half of the 100 cfs supplemental supply. In general, these factors have led to limited use of the pumping facility.

In recent years, the GID has been unable to provide the full irrigation requirements of its users. The problems stem from the reduced runoff and below average snowfall within the watershed of the North Platte River. To partially alleviate these shortfalls, construction of a more reliable and efficient pumping station on the Laramie River appeared warranted. Aside from the engineering aspects associated with the implementation and design of a new pumping station, several other pertinent considerations were evaluated during the completion of this study. These considerations included:

1. requirements of the downstream senior appropriators on the Laramie River;
2. institutional constraints associated with the agreement with the Basin Electric Power Cooperative, State Engineers Office, U.S. Bureau of Reclamation and conditions imposed by the North Platte Decree, especially with respect to the recent claim filed on the tributaries to the North Platte River;
3. flow availability of the Laramie River with respect to meeting the supplemental supply (100 cfs) requirements of the GID while taking into account senior water appropriators and releases mandated by the Basin Electric Agreement; and
4. environmental concerns and permitting associated with the installation of the pumping station.
Overview of Level II Investigation

Following the project scoping meeting, an extensive field investigation was conducted to inventory and evaluate the existing system as well as determine the stability of the river channel near the point of diversion. Additional work involved an appraisal of the water right issues, quantification of available flow in the Laramie River, and evaluation of the potential impacts associated with institutional constraints. Several rehabilitation alternatives were developed including the preparation of preliminary cost estimates. A recommended alternative was selected and conceptual design information and cost estimates prepared. Permits necessary for construction of the recommended alternative were also identified. Finally, an economic analysis was completed to assist the State of Wyoming in the development of a fair and equitable financing plan for the project improvements.

Inventory and Assessment of the Existing Pumping Facility

The existing pumping facility includes a CrisaFulli Model CP24CH pump unit which incorporates a 24-inch diameter discharge line and a closed impeller. The pump driver consists of a Reliance electric motor (200 horsepower) rated at 460 volts, 228 amps and 1,780 rpm. At the existing location, an average lift of 12 feet is required to divert the water from the Laramie River to the Canal. Based on pump curves provided by Crisafulli Pump Company, the capacity of the existing facility is estimated to be 35 cfs; efficiency ranges from 20% to 25%.

No permanent sump or intake structure presently exists for the pumping facility. Basically, the pump is mounted on a wood frame and lowered into a sump consisting of an excavated hole adjacent to the river bank. The depth of the existing sump varies from 5 to 6 feet. No screens or trash racks are present to prevent damage to the impeller caused by floating debris, channel bed saltation, or a heavy sediment load. The water level near the sump is controlled by backwater created by an irrigation diversion dam, located approximately 700 feet downstream, in the vicinity of the headgate for the Fort Laramie Ditch.

Typically, the existing pumping facility has been operated for durations of two to three weeks during the late irrigation season. Operation expenses largely consist of the cost
of electricity to operate the pump. Energy costs associated with operation of the pumping facility have been excessive. This can be directly related to the inefficiency of the pumping system coupled with an excessively high demand charge per month of operation. For example, in 1990 the GID diverted approximately 648 acre-feet from the Laramie River during twelve days in August and one day in September. Due to the monthly demand charge levied by Wyrulec, the cost to divert the water was approximately $4,656 or $7.18 per acre-foot. Within the last year, Wyrulec has revised their rate structure and significantly reduced the monthly demand charge. Under the present rate structure, the cost to divert 648 acre-feet would be $3950 or $6.10 per acre-foot. As pumping is increased during the month, the cost per acre-foot will be significantly reduced. The estimated cost to pump for a 30-day period in one month is estimated to be $2.20 per acre-foot utilizing the present rate structure. Considering the efficiency of the existing CrisaFulli pump, it is anticipated that a more efficient pump unit would result in an additional 50% to 60% reduction in monthly energy costs. The life of the system is estimated to be an additional 10 to 15 years.

**Summary of Alternative Evaluation**

The range of considered alternatives varied from the "no action" alternative to the construction of a new pump station. Included within the construction of a new pump station were various options that considered diesel motor versus electric motor drives and single pump installations versus dual pump installations. The alternatives evaluated during this study included the following:

1. No action,
2. Abandon the existing facility,
3. Improve the existing facility,
4. Construct a new pump station: 100 cfs capacity,
5. Construct a new pump station: 68 cfs capacity,
6. Construct a new pump station: 34 cfs capacity,
7. Improve the existing facility and construct a new pump station with 68 cfs capacity (Alternatives #3 and #5),

8. Improve the existing facility and construct a new pump station with 34 cfs capacity (Alternatives #3 and #6), and

9. Install an alluvial well field.

Several criteria were utilized to evaluate the considered alternatives listed above. These criteria included the impact of water rights and abandonment proceedings, flow availability, capability to fulfill the late season irrigation requirements, legal implications of institutional constraints imposed by the Basin Electric Agreement, and estimated costs.

To assist in the selection of the recommended alternative or combination of alternatives, a decision matrix was developed. Alternative 5 (Construct a New Pump Station with a Capacity of 68 cfs) receiving the highest rating during the evaluation process. Associated with the selection of Alternative 5 is the potential abandonment of 32 cfs of the supplemental supply. It should be noted, however, the availability of diverting the full supplemental supply requirement (100 cfs) on a continuous basis is limited; the potential for diverting flows less than or equal to 68 cfs is considerably higher. Furthermore, the diversion of 68 cfs is considerably more than the 35 cfs presently diverted by the existing system. Although legal implications are minimized with a diversion of 35 cfs or less, the diversion of 68 cfs meets the stipulation in the Basin Electric Agreement. Additional coordination between the GID and Basin Electric Power Cooperative will be necessary to better define the limitation associated with releasing all flows less than 30 cfs to the mouth of the Laramie River. Finally, the cost to implement Alternative 5 appears to provide the most diversion capability with the least expense.

Conceptual Design and Cost Estimates

Based on the alternative recommendation, conceptual design details and cost estimates were generated for the construction of a new pump station capable of diverting 68 cfs from the Laramie River. The capital construction cost associated with the implementation of Alternative 5 includes the following items.
two axial flow pumps (34 cfs each);
• two electric motors, one 50-horsepower and one 75 horsepower;
• two variable speed motor drives;
• installation of the sump and intake structure including screen grates, bell strainers, outlet pipe, fencing, and pump installation;
• construction of the housing for the pumping facility; and
• installation of bank protection measures.

For the new pump station, the total cost of the project components and final cost estimate are presented in Table 1.

Economic Analysis

With construction of the new pump station, the cost to divert water is approximately $1.01 per acre-foot based on two months of pumping at a rate of 68 cfs. This compares with net benefits attributable to the project of $22.90 per acre-foot of water. The cost associated with the proposed project represents an increase of $0.16 per acre in the annual assessment levied by the GID. Including the annual operation and maintenance costs associated with operating the pumping facility for two months, the assessment increases by $0.26 per acre.

Conclusions and Recommendations

The conclusions and recommendations generated during the completion of this Level II study are provided below.

1. This project should proceed to Level III with rehabilitation of the pump station consisting of:

   • installation of a dual pump facility with the capacity to divert 68 cfs; the pump system should be driven by two electric motors with variable speed units; and
TABLE 1. FINAL COST ESTIMATE AND REPAYMENT PLAN

<table>
<thead>
<tr>
<th>ITEM</th>
<th>COST</th>
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<tbody>
<tr>
<td>Pumps and Drivers</td>
<td>$74,800</td>
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<tr>
<td>Sump and Intake Facility</td>
<td>$98,500</td>
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<tr>
<td>Bank Protection</td>
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<td><strong>COST OF PROJECT COMPONENTS</strong></td>
<td><strong>$178,550</strong></td>
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<td>Engineering Costs (10%)</td>
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<tr>
<td>Subtotal</td>
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<td>Contingency (15%)</td>
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<td><strong>TOTAL CONSTRUCTION</strong></td>
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<tr>
<td>Final Plans and Specs</td>
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<tr>
<td>Permitting and Mitigation</td>
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<tr>
<td>Legal Fees</td>
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<tr>
<td>Access and Right-of-Way</td>
<td>$ 1,000</td>
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<td><strong>TOTAL PROJECT COST</strong></td>
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<tr>
<td>50% Loan</td>
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<tr>
<td>Repayment Factor (25 yrs @ 4%)</td>
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<tr>
<td><strong>ANNUAL PAYMENT</strong></td>
<td><strong>$ 8,176</strong></td>
</tr>
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</table>
placement of bank protection measures in the vicinity of the pumping facility.

2. With construction of the proposed pumping facility, the cost to divert the water is estimated to be $1.01 per acre-foot compared with potential benefits received of $22.90 per acre-foot.

3. Costs associated with construction of the proposed project are estimated to increase the annual assessment from $18.76 to $18.92 per acre.

4. Maintenance of the downstream diversion dam is not warranted at this time; however, future floods may dictate the need to place remedial bank protection measures upstream of the diversion dam. The potential for sedimentation and the subsequent overbank flows will be reduced if a small notch is placed in the diversion dam. It is recognized that this type of remedial activity will require coordination and the approval of the water users diverting water into the Fort Laramie Ditch.

5. Additional coordination with Basin Electric Power Cooperative is required to clarify the minimum release of 30 cfs at the point of diversion for the pumping station. The analysis in this study presumed a flow available without consideration of this minimum release.