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Funding for WRDS and the creation of this electronic document was provided by the Wyoming Water Development Commission (http://wwdc.state.wy.us)
LITTLE SNAKE RIVER BASIN PLANNING STUDY
VOLUME II
EXECUTIVE SUMMARY
EVALUATION OF IRRIGATION DIVERSION DAMS
AND PRINCIPAL WATER SUPPLY DITCHES
PART A - DIVERSION DAMS

November 1992

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INTRODUCTION

The 1991 Wyoming Legislature authorized the Wyoming Water Development Commission (WWDC) to conduct a Level I, Little Snake River Basin Planning Study. The purposes of the study are to evaluate potential reservoir sites, (Task A), diversion dams and headgates, (Task B), inventory all irrigation diversions, inventory the two major canals, (Task C) and evaluate the Baggs water supply system, (Task D). This report presents the results of the evaluation of providing diversion dams and headworks to several of the canals in the basin.

In August 1991, the Level I, Phase I Little Snake River Basin Planning Study for, Tasks B and C (Diversions and Canals) report was completed in draft form by the Project Team and submitted to the WWDC and Project Sponsors. The objective of the Phase I Task B work was to evaluate the need to rehabilitate and combine irrigation diversion structures on Savery Creek and the Little Snake River. Work products presented in the Phase I report included the following items:

- An evaluation of the existing diversion facilities
- An evaluation of channel stability at each of the diversion sites
- An inventory of the diversion/conveyance facilities
- Reconnaissance level rehabilitation options
- Reconnaissance level rehabilitation cost estimates

As part of the Phase I investigation all of the diversion sites within the Conservancy District were inventoried. The inventory formed the basis upon which sites and combinations of sites were evaluated for the feasibility of constructing diversion dams. Twelve separate reconnaissance level diversion dam rehabilitation options were formulated and reconnaissance cost estimates were prepared for each. Some of the options considered did not appear to be economical so nine of these twelve rehabilitation plans were recommended for further study under Phase II. These nine sites included two on Savery Creek: at the Smith or the Cobb-Morgan Diversion, and seven on Little Snake River; at the
First Mesa (First Mesa or Snow Diversions); West Side; Baggs; Gibson-Blair; Trowel; and Heeley ditches. These nine alternate diversion locations are shown on Figure 1.

After discussions with the WWDC and Project Sponsors concerning the Phase I work the Project Team was authorized to proceed with Phase II Task B. The objectives of the Phase II Task B work were to:

* Expand selected diversion dam designs to conceptual level designs
* Identify permits, easements, environmental studies, and any mitigation necessary to construct the proposed structures
* Prepare total project cost estimates for the conceptual designs
* Perform an economic analysis to assist the state in determining a financing plan for any proposed rehabilitation design

The results of the Phase II Task B work were submitted in draft form to the WWDC and Project Sponsors in November 1991.

In February 1992, the WWDC and Project Sponsor requested that the Project Team refine the conceptual designs presented in the Phase II Task B report. The Little Snake River Conservancy District felt that the conceptual designs presented in the draft Level I Phase II report were not affordable. The request by the Sponsors has resulted in a Phase III to the Level I work. The objectives of the Phase III work are to:

* Size diversion dams using a set of design criteria which are less stringent than those of the Phase II designs.
* Estimate the water surface profiles behind the diversions for the refined designs.
* Estimate the materials and costs for constructing the revised designs at the West Side, First Mesa, Snow and Baggs sites.
* Evaluate diversion dam design options which use roller compacted concrete, gabions and pre-packaged concrete bags.
The Final Level I report contains selected information from all three phases of work. This summary presents the estimated costs for all of the proposed diversion dams using the criteria set forth in the Phase II report. These costs are shown in Table 1. The results of the refined conceptual designs and cost estimates for the four sites studied are also presented.

The overriding objective of the refined design work is to develop diversion dam designs that are more affordable to the project Sponsors. There are two possible avenues through which cost reductions from the original conceptual designs can be realized.

First, the design criteria can be changed. For example, the diversion dams can be downsized in elevation. A shorter diversion means less expense in theory, but it will not be able to deliver as much water during low flow periods. The trade off is obvious, this cost reduction avenue has sacrificed function for money. The elevations of the diversion dams vary slightly depending on the diversion rate criterion selected, however, the relatively small differences should not be considered significant, in terms of cost, at this level of design. Other site specific design considerations such as dam apron length, apron thickness, and apron elevation will have a larger impact on the cost of the structure than will the addition of a small quantity at the top of the dam. Many site specific considerations can not be considered until final design. For the revised conceptual designs presented herein, the estimated quantities are based on diversion dams that deliver 1/cfs per 70 acres.

The second avenue for reducing costs is to design project elements with a smaller factor of safety. For example, instead of providing a riprap apron below a diversion dam to retard erosion of the stream bed, the riprap apron could be downsized or eliminated. The diversion will still divert water at the original design rate because the dam is the same size,
### Table 1

Summary of Conceptual and Revised Conceptual Diversion Dam Construction Cost Estimates and Total Project Cost Estimates

Little Snake River Basin Planning Study

<table>
<thead>
<tr>
<th>Diversion</th>
<th>CCT - CONSTRUCTION COST TOTAL</th>
<th>PCT - PROJECT COST TOTAL</th>
<th>Original Design Criteria</th>
<th>Revised Design Criteria</th>
<th>Original Design Criteria</th>
<th>Revised Design Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RCC Dam</td>
<td>RCC Gabion Dam</td>
<td>RCC Dam</td>
<td>RCC Gabion Dam</td>
<td>Sack-crete Dam</td>
<td>Sack-crete Dam</td>
</tr>
<tr>
<td>Smith</td>
<td>$720,000</td>
<td>$717,300</td>
<td>$807,000</td>
<td>$804,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dual Dam, Smith and Cobb-Morgan</td>
<td>$714,000</td>
<td>$719,300</td>
<td>$800,000</td>
<td>$806,200</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cobb-Morgan</td>
<td>$494,100</td>
<td>$487,800</td>
<td>$558,500</td>
<td>$551,800</td>
<td></td>
<td></td>
</tr>
<tr>
<td>First Mesa - Snow</td>
<td>$437,300</td>
<td>$433,700</td>
<td>$323,500</td>
<td>$299,500</td>
<td></td>
<td></td>
</tr>
<tr>
<td>First Mesa</td>
<td>$484,500</td>
<td>$480,000</td>
<td>$324,400</td>
<td>$299,500</td>
<td></td>
<td></td>
</tr>
<tr>
<td>West Side</td>
<td>$484,600</td>
<td>$480,000</td>
<td>$371,800</td>
<td>$344,500</td>
<td></td>
<td></td>
</tr>
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<td>Baggs</td>
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<td>$234,800</td>
<td>$168,500</td>
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<td></td>
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<tr>
<td>Gibson-Blair</td>
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<td>$392,200</td>
<td>$455,700</td>
<td>$446,400</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trowel</td>
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<td>$535,300</td>
<td>$618,900</td>
<td>$603,800</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heeley</td>
<td>$366,800</td>
<td>$363,700</td>
<td>$440,500</td>
<td>$437,100</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
but the risk of increasing maintenance costs or eventually loosening the structure has been increased. This cost reduction avenue has sacrificed reliability for money and maintenance.

Although altered design criteria have resulted in some conceptual design cost savings, only through the elimination of some project elements have the estimated construction costs been hopefully brought within the monetary range of the project Sponsors.

The design assumptions that were made as part of the original conceptual designs and the changes made as part of the refined designs are presented in the full report. The assumptions are important to understand and should be re-examined carefully at the next level of design. The following summarizes the steps that were taken to reduce the cost of the refined designs:

Cost Savings Resulting from Altered Design Criteria

1 - Out-of-bank flows are not controlled in the refined design, resulting in less expense for flood dike installation.

2 - Dam quantities are based on dams sized to deliver 1 cfs per 70 acres (slightly smaller than the 2 cfs per 70 dams).

Cost Savings Resulting from Altered Designs

1 - Downstream riprap in the river channel was eliminated.

2 - Upstream cutoff walls were eliminated.

3 - Sluice gate structures were eliminated in favor of a low flow notch.

4 - Diversion and dewatering costs were assumed to be considerably lower.

5 - Diversion dam foundation preparation costs were assumed to be considerably less.

6 - Alternative materials were considered such as gabion dams that are generally not considered as durable as more traditional concrete dams.
Sack-crete dams were considered as viable alternates because they require only manual labor, and they can be placed with little or no diversion and dewatering effort.
RECOMMENDATIONS

As a result of the work accomplished under the Phase I, II and III Investigation of Diversion Dams, the following recommendations are made:

1. Improved diversion dams can be provided at the following diversion dam sites:
   A. The Cobb-Morgan Diversion Dam
   B. The First Mesa - Snow Diversion Dam
   C. The West Side Diversion Dam
   D. The Baggs Diversion Dam
   E. The Gibson-Blair Diversion Dam
   F. The Heeley Diversion Dam

   The selection of sites and types of dam should be made by the individual canal companies. Additional field work including surveys, discharge gaging, and geotechnical investigations need to be conducted at the final design level. Also, design questions can be addressed at Level III without spending effort at a traditional Level II study.

2. If the choice of the type of dam is to use Roller Compacted Concrete or steel sheet piling as construction materials, their suitability should be investigated on a site by site basis. In general there is suitable aggregate for RCC along Savery Creek and the Little Snake River above Baggs, however, the surface geology changes considerably, from upstream to downstream and the local source of aggregate is questionable for those sites below Baggs. Also, the geology affects the suitability of sheet piling for dams and it is questionable that sheet piling would be viable on the upper portions of the river.

3. Additional field surveys should be performed at sites selected for final design. The river channel should be cross sectioned up and down stream from the present surveys to provide input for HEC-2 profile calculations. These calculations should be performed at the next level of design to confirm the dam site hydraulics determined in the Level I work. Also surveys should be extended out of the channel banks to better define the extent of flooding that will occur during events that leave the channel banks.

4. Requirements of a Section 404 permit from the COE will automatically involve several additional Federal agencies and require compliance with Federal environmental laws.
However, interpretation of the law that may give the COE jurisdiction over the proposed rehabilitation measures is variable, and thus the need for a Section 404 permit is as yet undetermined. If a Section 404 permit is not required, there will be no Federal involvement in the project. Several Wyoming and Colorado state statutes and rules have minimal permitting requirements which may apply to some of the proposed activities. Carbon County will require the purchase of a permit.