EXECUTIVE SUMMARY

GOSHEN HOLE AND GOSHEN MUTUAL IRRIGATION CANAL COMPANIES

Upper Portion
Goshen Hole Ditch

Goshen Mutual Ditch

SUBMITTED TO:

WYOMING WATER DEVELOPMENT COMMISSION

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EXECUTIVE SUMMARY

GOSHEN HOLE AND GOSHEN MUTUAL CANAL COMPANIES IMPROVEMENTS PROJECT LEVEL II

SUBMITTED TO:

Wyoming Water Development Commission
Herschler Building, 4th Floor
122 West 25th Street
Cheyenne, WY 82002

SUBMITTED BY:

Lidstone & Anderson, Inc.
760 Whalers Way, Suite B200
Fort Collins, CO 80525
(LA Project No. WYWDC13)

January 26, 1999
EXECUTIVE SUMMARY

Authorization and Purpose

On June 12, 1998 Lidstone & Anderson, Inc. (LA) entered into a contract with the Wyoming Water Development Commission (WWDC) to provide professional services related to the Goshen Hole and Goshen Mutual Irrigation Canal Companies Improvements Project. LA was retained to conduct a feasibility study (Level II investigation) of structural or management measures associated with both of the canal companies to: (a) improve operation and management of the irrigation delivery system, (b) reduce maintenance, and (c) rehabilitate the structures associated with the supply ditches, main canals and laterals. This work was completed in two phases; Phase I involved the identification and evaluation of alternative improvements while Phase II pertained to the preparation of conceptual designs and costs estimates associated with the rehabilitation measures or improvements selected for implementation. The Phase I results were documented in a Rehabilitation Plan submitted to the WWDC and the Canal Companies on August 24, 1998. A final report summarizing the results of tasks associated with the Phase II work effort was submitted to the WWDC on October 27, 1998.

History of the Project

As indicated on Figure 1, the Goshen Hole Irrigation Canal Company is located in Goshen County with irrigated lands situated in the vicinity of Yoder, Wyoming. The source of irrigation water is obtained from Horse Creek via the Goshen Hole Ditch. The water diverted from Horse Creek is stored in Springer Reservoir (Goshen Hole Reservoir) and released into irrigation facilities that serve in excess of 2,500 acres of land.

The original supply of irrigation water for the Goshen Hole Irrigation Canal Company consists of direct flow from Horse Creek under Permit #4695E (priority 6-7-1930) and storage in Springer Reservoir under Permits #349R (priority date 11-5-1902) and #4425R (priority date 6-7-1930). A secondary supply of irrigation water is available to the irrigators under Permit #30154 (priority 1-20-1989). Based on a direct flow appropriation of 1 cfs per 70 acres, the canal company can legally divert 35.7 cfs of direct flow at the headgate on Horse Creek when in priority. The storage rights for Springer Reservoir total approximately 4,961 acre-feet.

The assessment for the Goshen Hole Irrigation Canal Company is $7.00 per acre. This assessment provides for an operating budget of approximately $18,000. Seven landowners divert water from the delivery system.

The Goshen Mutual Irrigation Company is also located in Goshen County with irrigated lands situated west and southwest of Yoder, Wyoming (please refer to Figure 1). The source of irrigation water is obtained from Horse Creek via the Bump-Sullivan Ditch (Goshen Ditch). The water diverted from Horse Creek is stored in Bump-Sullivan Reservoir (Goshen Reservoir) and released into irrigation facilities that serve approximately 640 acres of irrigated land.
Figure 1. Location Map
The original supply of irrigation water for the Goshen Mutual Irrigation Canal Company consists of direct flow from Horse Creek under Permits #3961E (priority 5-22-1911), #10653 (priority 5-22-1911) and #4434E (priority 3-16-1925) and storage in Bump-Sullivan Reservoir under Permits #2140R (priority 5-22-1911), 2716R (priority 7-16-1914) and 3517R (priority 1-08-1919). When in priority and based on an appropriation of 1 cfs per 70 acres, the canal company can legally divert 9.2 cfs (associated with irrigation of approximately 640 acres) of direct flow at the headgate on Horse Creek. The storage rights total approximately 1,928 acre-feet.

The present assessment for the Goshen Mutual Irrigation Canal Company is $10.00 per acre. This assessment provides for an operating budget of approximately $6,500 which is allocated primarily for payment of the ditch rider and a sinking fund for major repairs. Not more than five landowners divert water from this delivery system.

Summary of Existing Problems

**Goshen Hole Irrigation Canal Company.** Rehabilitation of the existing diversion dam and headgate structure occurred in 1953. The original structure was constructed much earlier. Presently, the structure is experiencing minor deterioration associated with the concrete walls, but remains functional. The capability to accurately measure flow diverted from the creek does not presently exist; however, conversations with Gary Mehling indicate that accurate flow measurement may not be required. Due to minor displacement of the diversion structure, placement and removal of stoplogs is difficult.

Seepage from the main canal is a problem presently experienced by the Canal Company. Discussions with representatives of the Canal Company indicated that as much as 30 to 40 percent of the flow in the main canal is lost from the outlet of Springer Reservoir to the Prentice Check Structure which separates the east ditch from the west ditch.

Very few flow measurement structures are presently located within the irrigation delivery system. Given the lack of flow measurement structures, it is difficult to determine the actual delivery of water to the irrigators as well as the seepage losses within the conveyance system. Furthermore, it is equally difficult to ensure an equitable distribution of water to all of the irrigators.

**Goshen Mutual Irrigation Canal Company.** The most urgent problem for the Canal Company is rehabilitation of the outlet facilities to the Bump-Sullivan Reservoir. The reservoir headgate is not functional at this time. The headgate is jammed or the gatesstem has deteriorated such that the slidegate cannot be raised to release water from the reservoir. A temporary siphon was installed at the headgate location to withdraw water from the reservoir for this irrigation season.

The diversion structure at Horse Creek has severely deteriorated and is barely functional in its present condition. Annual maintenance of this structure is required to ensure the diversion of flows into the headgate. With respect to the headgate structure, the slidegates appear to be functional but are exhibiting some deterioration.

The supply ditch from Horse Creek to Bump-Sullivan Reservoir reportedly experiences high seepage losses. As much as 40 percent is reportedly lost from a diversion of 10 cfs from Horse Creek. In addition, the supply ditch was historically dredged to increase capacity. This maintenance activity has created an excessively deep ditch that holds water at several locations and
promotes excessive vegetation growth. Consequently, maintenance of the supply ditch is difficult and capacity has been reduced.

Very few flow measurement structures are presently located within the irrigation delivery system associated with the Goshen Mutual Irrigation Canal Company. Given the lack of flow measurement structures, it is difficult to determine the actual delivery of water to the irrigators as well as the seepage losses within the conveyance system. Furthermore, it is equally difficult to ensure an equitable distribution of water to all of the irrigators.

Inventory of Existing Structures

During the field investigation, an inventory of the existing structures was completed. The inventory included field measurements of the structures, estimation of the remaining design life, and a review of historic operation and maintenance efforts associated with the structures. The field measurements were taken to promote the hydraulic evaluation of existing facilities as well as design criteria for the proposed improvements. Several types of structures were identified during the inventory of the District facilities. The structures included: (a) diversion headgate and structures; (b) supply ditch; (c) road crossing structures; (d) reservoir outlet; (e) main canal; (f) irrigation ditch; (g) turnouts; and (h) reservoir inlet channel.

Rehabilitation Plan

Based on the results of the field investigation and the technical analysis, specific improvements to the existing facilities were earmarked for further evaluation and conceptual design. These improvements were presented to the Canal Companies and the WWDC in the form of a rehabilitation plan. Following the review of the rehabilitation plan, LA was directed to proceed with the conceptual design of the improvements identified below.

Goshen Hole Irrigation Canal Company

Improvement 1: Rehabilitate the Horse Creek Diversion Structure
Improvement 2: Install a Cipoletti weir on the supply ditch
Improvement 3: Install a Cipoletti weir below Springer Reservoir
Improvement 4: Install PVC liner in the main delivery canal below Springer Reservoir
Improvement 5: Rehabilitate West Goshen Hole Ditch below Prentice Check Structure
Improvement 6: Replace open channel with pipeline for West Goshen Hole Ditch immediately east of Yoder, Wyoming
Improvement 7: Rehabilitate historic conveyance system north of Yoder, Wyoming
Improvement 8: Improve check and drop structures in West Goshen Hole Ditch and East Goshen Hole Ditch
Improvement 9: Install headgates/flow measurement structures
Goshen Mutual Irrigation Canal Company

Improvement 1: Rehabilitate the Horse Creek Diversion Structure
Improvement 2: Install a Cipoletti weir on the supply ditch
Improvement 3: Rehabilitate three sections of the supply ditch
Improvement 4: Rehabilitate outlet facilities for Bump-Sullivan Reservoir
Improvement 5: Improve check structures and culvert crossing on main delivery canal
Improvement 6: Install headgates/flow measurement structures

Conceptual Design and Cost Estimates

Following the guidance received from the Canal Companies and the WWDC, conceptual design details were prepared for all recommended improvements. Based on the conceptual design details which were developed, detailed cost estimates for construction of the improvements to the irrigation systems for both canal companies were prepared. The construction cost components associated with each improvement were identified and construction costs assigned to each component.

A final cost estimate and repayment plan is presented in Tables 1 and 2 for the Goshen Hole Irrigation Canal Company and Goshen Mutual Irrigation Canal Company, respectively. As indicated, the final cost estimate and repayment plan includes 10% for the preparation of final plans and specifications, 10% for engineering services during construction and 15% for construction contingencies. The WWDC funding for the project is assumed to be in the form of a 50% grant and 50% loan. The terms of the loan were assumed to be 6.25% for a period of 20 years.

Economic Analysis

An economic analysis was completed to assess the ability of the users for each canal company to pay for the cost associated with the proposed improvements. For the users associated with each canal company, an annual assessment is levied to each water user on the basis of irrigated acreage. This assessment is $7.00 per acre for the Goshen Hole Irrigation Canal Company and $10.00 per acre for the Goshen Mutual Irrigation Canal Company.

The annual payment to retire the debt associated with construction of proposed improvements is $23,400 for the Goshen Hole Irrigation Canal Company. Assuming a maximum irrigated acreage of 2,300 acres, the current annual assessment will need to be increased by $10.17 if the Canal Company constructs all of the project improvements. Construction of only the high priority items (Improvements 1, 5, 6, and 7) will increase the current assessment by approximately $6.25.

For the Goshen Mutual Irrigation Canal Company, the annual payment to retire the debt associated with construction of proposed improvements is $6,550. Assuming a maximum irrigated acreage of 640 acres, the current annual assessment will need to be increased by $10.23 if the Canal Company constructs all of the project improvements. Construction of only the high priority items (Improvements 1 and 4) will increase the current assessment by approximately $6.50.
Table 1. Final Cost Estimate and Repayment Plan for Goshen Hole Irrigation Canal Company.

<table>
<thead>
<tr>
<th>Improvement</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improvement 1. Replace diversion and headgate structure</td>
<td>$55,500</td>
</tr>
<tr>
<td>Improvement 2. Install Cipolletti weir in supply ditch</td>
<td>$3,700</td>
</tr>
<tr>
<td>Improvement 3. Install Cipolletti weir below Springer Reservoir</td>
<td>$3,700</td>
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<tr>
<td>Improvement 4. Install 30 mil PVC liner (Alternative 1)</td>
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<tr>
<td>Improvement 5. Improve West Goshen Hole Ditch sections</td>
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<tr>
<td>Improvement 6. Convert open ditch to pipeline (Alternative 2)</td>
<td>$39,300</td>
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<tr>
<td>Improvement 7. Install pipeline and siphon crossing</td>
<td>$132,100</td>
</tr>
<tr>
<td>Improvement 8. Replace/install check structures</td>
<td>$26,000</td>
</tr>
<tr>
<td>Improvement 9. Install headgate and flow measurement structures</td>
<td>$28,000</td>
</tr>
<tr>
<td>Cost of Project Components</td>
<td>$377,900</td>
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<tr>
<td>Contingency (15%)</td>
<td>$56,700</td>
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<tr>
<td><strong>Subtotal</strong></td>
<td>$434,600</td>
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<tr>
<td>Engineering (10%)</td>
<td>$43,500</td>
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<tr>
<td>Final Plans and Specifications (10%)</td>
<td>$43,500</td>
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<tr>
<td><strong>Total Construction Cost</strong></td>
<td>$521,600</td>
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<tr>
<td>Permitting and Mitigation</td>
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<tr>
<td>Legal Fees</td>
<td>$2,000</td>
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<tr>
<td>Access and Right-of-Way</td>
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<tr>
<td><strong>Total Project Cost</strong></td>
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<tr>
<td>50% Loan</td>
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<td>Repayment Factor (20 years @ 6.25%)</td>
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<tr>
<td><strong>Annual Payment</strong></td>
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Table 2. Final Cost Estimate and Repayment Plan for Goshen Mutual Irrigation Canal Company.

<table>
<thead>
<tr>
<th>Improvement</th>
<th>Amount</th>
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</thead>
<tbody>
<tr>
<td>Improvement 1. Replace diversion and headgate structure</td>
<td>$44,500</td>
</tr>
<tr>
<td>Improvement 2. Install Cipolletti weir in supply ditch</td>
<td>$3,500</td>
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<tr>
<td>Improvement 3. Install three sections of supply ditch</td>
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<td>Improvement 4. Rehabilitate reservoir outlet (Alternative 2)</td>
<td>$19,800</td>
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<td>Improvement 5. Replace check structure and culvert crossing</td>
<td>$12,100</td>
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<td>Improvement 6. Install headgate and flow measurement structures</td>
<td>$10,200</td>
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<tr>
<td>Cost of Project Components</td>
<td>$103,500</td>
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<td>Contingency (15%)</td>
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<tr>
<td></td>
<td><strong>$119,000</strong></td>
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<tr>
<td>Engineering (10%)</td>
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<td><strong>$147,300</strong></td>
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<td>50% Loan</td>
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<td></td>
<td><strong>$6,550</strong></td>
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</table>
During the completion of this project, discussions with the representatives of both canal companies indicated that the ability-to-pay among the majority of the water users was limited. Construction of improvements that would increase the annual assessment by $2.00 to $3.00 per acre is considered an upper limit by each canal company. Given these considerations, alternative sources of funding were identified and investigated. Two potential sources of additional funding were identified. These sources include: (a) the Wyoming Game and Fish Department (WGFD), and (b) members of the Hughes Ditch. Discussions with these entities are warranted to determine the potential for funding. In addition, the WWDC could approve utilization of the grant portion of the appropriation for the materials associated with the improvements. The individual canal companies would be responsible for the engineering and installation of the improvements. To be approved for this funding alternative, the WWDC typically requires that the canal companies own and operate the equipment necessary to install the improvements. Discussions with the Horse Creek Conservation District (HCCD) may be warranted to determine the feasibility of integrating into the HCCD and thereby having access to the majority of the equipment required for construction of the improvements.

**Permitting**

For this project to proceed to construction, the canal companies will be required to obtain certain permits, rights-of-way and easements. State and federal agencies were contacted regarding potential permitting requirements associated with construction of the project. Based upon these contacts, it was determined that 404 permitting through the U.S. Army Corps of Engineers would likely be required. If so, coordination with other agencies is necessary, including: Wyoming Game & Fish Department (404 approval), Wyoming DEQ, Water Quality Division (401 Certification), State Historic Preservation Office (404 approval), Wyoming State Engineer’s Office (approval of plans and specification), and property owners (right-of-access).

**Conclusions and Recommendations**

Based on the work effort completed in support of this Level II project, the following conclusions and recommendations are provided.

1. The Goshen Hole Irrigation Canal Company is experiencing problems with its diversion/headgate structure, seepage losses in the main delivery canal and the accurate measurement and equitable delivery of irrigation water to all water users. With irrigation requirements increasing in recent years, the canal company is struggling to find alternatives to more fully utilize the water diversions from Horse Creek.

The Goshen Mutual Irrigation Canal Company is urgently requiring rehabilitation of its outlet facilities from Bump-Sullivan Reservoir. A temporary structure is presently siphoning water from the reservoir to the main delivery canal. In addition, the diversion/headgate structure on Horse Creek is deteriorating and in need of repair or replacement. Significant seepage losses are reported in the supply ditch to the reservoir.
Improvements are necessary to ensure the accurate measurement and equitable delivery of irrigation water to all water users.

2. Following the preparation of the Rehabilitation Plan, the Goshen Hole Irrigation Canal Company directed that conceptual designs and cost estimates be prepared for the items listed below.

Improvement 1: Replace the Diversion/Headgate Structure
Improvement 2: Install a Cipoletti weir on the supply ditch
Improvement 3: Install a Cipoletti weir below Springer Reservoir
Improvement 4: Install a PVC liner in the main delivery canal
Improvement 5: Improve the West Goshen Hole Ditch
Improvement 6: Replace an open ditch to a pipeline (West Ditch)
Improvement 7: Install a pipeline and siphon crossing (West Ditch)
Improvement 8: Replace/install check structures
Improvement 9: Install headgate and flow measurement structures

The total project cost associated with the construction of these items is estimated to be $526,100. Assuming a 50% grant and 50% loan (20 years @ 6.25%), the annual payment necessary to retire the loan is estimated to be $23,400.

3. Following the presentation of the Rehabilitation Plan, the Goshen Mutual Irrigation Canal Company directed that conceptual design and cost estimates be prepared for the items listed below.

Improvement 1: Replace the Diversion/Headgate Structure
Improvement 2: Install a Cipoletti weir on the supply ditch
Improvement 3: Improve supply ditch to reduce seepage losses
Improvement 4: Rehabilitate outlet facilities to Bump-Sullivan Reservoir
Improvement 5: Replace/install check structures and culvert crossing
Improvement 6: Install headgate and flow measurement structures

The total project cost associated with the construction of these items is estimated to be $147,300. Assuming a 50% grant and 50% loan (20 years @ 6.25%), the annual payment necessary to retire the loan is estimated to be $6,550.

4. To meet the debt retirement, the Goshen Hole Irrigation Canal Company would need to increase the existing assessment of $7.00 per acre. The assessment would be increased by $10.17 per acre. If only the high priority items (Improvements 1, 5, 6, and 7) are selected, the assessment will be increased by $6.25.

5. To meet the debt retirement, the Goshen Mutual Irrigation Canal Company would need to increase the existing assessment of $10.00 per acre. The assessment would be increased by $10.23 per acre. If only the high priority items (Improvements 1 and 4) are selected, the assessment will be increased by $6.50.
6. Alternative funding sources may provide monies to offset the potential loan obligations associated with construction of the improvements. For the Goshen Hole Irrigation Canal Company, the WGFD may be willing to provide funds to construct the proposed improvements associated with the outlet facilities to Bump-Sullivan Reservoir. In addition, irrigators of the Hughes Ditch may contribute money since they will benefit by improvements to the Horse Creek diversion/headgate structure.

For both canal companies, the WWDC could approve the utilization of the grant portion of the appropriation for the materials associated with the improvements. The individual canal companies would be responsible for the engineering and installation of the improvements. This funding alternative has been successfully implemented for the Horse Creek Conservation District (HCCD) in Hawk Springs, Wyoming. To be approved for this funding alternative, the WWDC would require that the canal companies own and operate the equipment necessary to install the improvements. It is recommended that the canal companies consider this alternative to reduce the costs associated with the improvements. Discussions with HCCD may be warranted to determine the feasibility of integrating into the district and thereby having access to the majority of the equipment required for construction of the improvements.

7. To proceed to Level III design and construction, the canal companies will need to form a district. It is recommended that formation of a district be investigated in a timely manner to promote the appropriation of the necessary funds and the construction of the improvements.

Given the information presented above, we recommend that the canal companies immediately proceed with the legal work necessary to form a district. A district could be formed by integrating the lands associated with each canal company thereby creating savings with respect to operation and management costs. Alternatively, discussions with the Horse Creek Conservation District should be initiated to more fully investigate the feasibility of integrating the lands under both canal companies into the HCCD. Following formation of the district, an application for funding of the proposed improvements should be prepared and submitted to the WWDC. Depending on the ability-to-pay of the individual landowners as well as the availability of alternative funding sources, several project improvements should be seriously considered for Level III design and construction.