EXECUTIVE SUMMARY
FOR
CASPER ALCOVA IRRIGATION DISTRICT
REHABILITATION NEEDS ANALYSIS

Prepared For:

Wyoming Water Development Commission
6920 Yellowtail Road
Cheyenne, WY 82002

Prepared By:

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772 Whalers Way, Suite 200
Fort Collins, CO 80525
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October 31, 2003
I. INTRODUCTION

On March 16, 2000, Anderson Consulting Engineers, Inc. (ACE) entered into a contract with the Wyoming Water Development Commission (WWDC) to complete the Casper-Alcova Irrigation District (CAID) Rehabilitation Needs Analysis. ACE was instructed to conduct a rehabilitation needs analysis of the CAID’s irrigation system, to identify areas of the canal system where excessive losses are occurring and to identify opportunities to conserve water. The work effort was conducted in two phases; Phase I included the inventory and evaluation of existing facilities along with the development and evaluation of alternatives while Phase II consisted of the development of conceptual design and cost estimate information associated with the selected alternatives. The results of the Phase I work effort were summarized in a final report submitted to the WWDC and CAID on April 15, 2002. Following the submittal of the Phase I report, several alternatives were identified and recommended for further evaluation as well as the preparation of conceptual designs and cost estimates. The results of the Phase II work effort are documented in a final report submitted to the WWDC and the CAID on October 31, 2003.

During the completion of the Phase I work, the WWDC issued an amendment to the original contract to add an additional phase (Phase III) to the work effort. The Phase III work consisted of investigating the potential integration of a computerized irrigation scheduling system into the existing operation and management of the CAID. Specifically, utilization of a web-based operation and administration computer model, originally developed and modified for this feasibility study by University of Wyoming Professor Mohan Reddy, was investigated. The Phase III work effort culminated in the submittal of a final report on May 12, 2003.

1.1 History of the Project

The Casper-Alcova Irrigation District (CAID) is located along the north side of the North Platte River between Alcova Dam and the City of Casper, Wyoming. The CAID was formed with the development of the Kendrick Project (formerly Casper-Alcova) by the United States Bureau of Reclamation, Department of Interior (Reclamation). This project conserves waters of the North Platte River for irrigation and electric power generation.

The CAID irrigation delivery system consists of the Casper Canal (59 miles long), 190 miles of laterals and sublaterals, and 41 miles of drains (Reclamation, 1982). Principal structures include the headgate located on Alcova Reservoir, six concrete-lined tunnels totaling approximately 3.4 miles in length, several siphons, highway and farm road bridges, and measuring and control structures. The original capacity of the main canal was 1,200 cubic feet per second. Since construction of the canal, a V-notched weir has been installed which limits the flow into the Casper Canal to approximately 600 cubic feet per second. Reclamation operates and maintains all power facilities, Seminole Dam and Reservoir, and Alcova Dam and Reservoir. CAID operates and maintains all carriage, distribution, and drainage works (Reclamation, 1997). Figure 1 displays the Casper Canal and principal laterals.

The original canal was designed to convey irrigation water necessary to irrigate two units totaling 66,000 acres. The first unit was constructed to deliver water to 35,000 acres, however, drainage related problems have resulted in only partial development of the first unit. To
date, funding to advance the development of the second unit has not been realized (Reclamation, 1955). The total irrigated land in production during recent years is reported to be approximately 24,250 acres.

During its first year of operation in 1946, the Casper-Alcova Project irrigated only 600 acres on 14 farms. By 1976, there were 172 farms and 23,549 acres of irrigated land. Presently, 515 users divert water associated with the 24,250 acres of irrigated lands. The principal crops are alfalfa, irrigated pasture, and small grains.

Presently, most of the water users within the CAID rely on flood irrigation systems to deliver water to their crops. In the last few years, however, several center pivot and side-roll sprinkler irrigation systems have been installed.

1.2 Proposed Platte River Recovery Implementation Program

The Platte River Cooperative Agreement was signed by the Department of the Interior and the states of Wyoming, Colorado, and Nebraska in July 1997. The Cooperative Agreement addresses the wide-ranging needs of four threatened or endangered species in the central Platte River region in Nebraska. The U.S. Fish and Wildlife Service (FWS) developed recommendations for flows that it believes are needed at different times of the year for endangered species and other wildlife. In a cooperative approach with other federal, state, and local interests, the FWS agreed to an incremental approach with a goal of providing 130,000 to 150,000 acre-feet per year of water over the next 10 to 13 years to reduce shortages to the target flows identified by the FWS. Three projects, one each in Colorado, Nebraska, and Wyoming, are to provide 70,000 acre-feet of this shortage (Boyle, 1999). The Pathfinder Modification Project represents Wyoming's contribution to reduction of flow shortages. The parties are presently negotiating the terms and conditions of the proposed Platte River Recovery Implementation Plan (PRRIP). If the negotiations are successful, the PRRIP will be subject to the approval of the respective governors and legislatures. The PRRIP, or a state equivalent, must be in place before the Pathfinder Modification Project can be implemented. The implementation of the Pathfinder Modification Project is subject to the approval of the Wyoming Governor and Legislature.

The Pathfinder Modification Project would increase the capacity of the existing Pathfinder Reservoir by approximately 54,000 acre-feet to recapture storage space lost to sediment. The recaptured storage space would store water under the existing 1904 storage right for Pathfinder Reservoir and would enjoy the same entitlements as other uses in the reservoir with the exception that the recaptured storage space could not place regulatory calls on existing water rights upstream of Pathfinder Reservoir other than the rights pertaining to Seminoe Reservoir.

Reactivation of the storage lost to sedimentation will affect the users and contractors for water from Glendo, Pathfinder and Seminoe Reservoirs. The WWDC contracted with Reclamation to conduct modeling of the North Platte River system to determine the impact of the Pathfinder Modification Project on the water supply of the CAID and the drought protection capability of Seminoe Reservoir. The initial results have indicated a reduction or adverse impact to the irrigation water supply of the CAID due to its relatively junior water rights compared to other irrigation users.
To address the impacts to CAID and other federal storage water contractors, the State of Wyoming has agreed to pay the Wyoming and Nebraska federal storage water contractor's share of the Safety of Dams Modifications to federal reservoirs to be implemented by Reclamation in the near future. In addition, as Seminoe Reservoir is the project most affected by the enlargement, the State of Wyoming has agreed to assist the CAID, the federal contractor for water stored in Seminoe Reservoir, with the resolution of existing selenium issues that are impacting its existing irrigation operation.

1.3 Project Goals and Purpose

In view of the previous discussions, the primary goals and purpose of this project are to: (a) identify the potential impact of the Pathfinder Modification Project on the water supplies of the CAID, and (b) evaluate alternatives that reduce the impact to the irrigation water supply of the CAID.

To accomplish these goals, Phase I addressed the following items:

1. Identify and evaluate alternatives for reducing water losses in the main canal, lateral ditches and appurtenant conveyance structures.

2. Identify management opportunities for the conservation of water including:
   • automation of the existing facilities to reduce operational waste and promote the more efficient operation and management of the water deliveries;
   • lining canals; and
   • installation of on-farm improvements and/or changes in irrigation practices.

3. Identify existing structures that are inadequate or new structures required to ensure that water savings are realized.

4. Identify financially viable opportunities to save water.

5. Update the costs estimated to implement the NIWQP alternatives as well as the costs associated with the Safety of Dams Modifications to Seminoe and Alcova Reservoirs.

Following the selection of alternative improvements during Phase I, Phase II provided for the preparation of conceptual design information for the selected alternatives and rehabilitation improvements.

The purpose of the Phase III study was to assess the potential for integrating an Internet-based water administration and operation model into the daily management of the CAID. A proto-type of the model, prepared by Dr. Mohan Reddy of the University of Wyoming, was modified to reflect the irrigation and delivery system maintained by the CAID. The model is intended to promote:
• placement of daily orders by water users through the use of the Internet;
• identification of delivery requirements on each lateral and along the Casper Canal through the evaluation of daily requests for water by the users;
• integration of data associated with seepage losses and operational waste to more accurately identify the diversion requirement from Alcova Reservoir; and
• operational management of the diversion from Alcova Reservoir to minimize the operational waste within the delivery system.

II. REHABILITATION AND CONSERVATION PLANNING NEEDS

2.1 Pathfinder Modification Project Impact to CAID Water Supply

Based on the hydrologic simulation of existing demands and historic operations of the North Platter River System, a total shortage of 40,500 acre-feet to the irrigation supplies of the CAID was determined. This value represented the baseline conditions that were utilized to compare the impact associated with implementation of the proposed Pathfinder Modification Project and any alternatives to reduce the impact.

Implementation of the proposed Pathfinder Modification Project reflected a total shortage ranging from 103,600 to 161,300 acre-feet or an increase in shortage to the CAID water supply ranging from 63,100 to 120,800 acre-feet.

Two alternatives were identified to mitigate the impact shortages to the CAID water supply identified during the hydrologic simulations. Floating Alcova Reservoir involves displacement of water stored in Pathfinder Reservoir to promote the diversion of Kendrick Project water (approximately 154,000 acre-feet) that is contained below the diversion headgate to the Casper Canal. No shortages were experienced during the historical simulation. Furthermore, the shortage of 40,500 acre-feet associated with the baseline conditions is also mitigated thereby providing an additional benefit to the CAID.

The second alternative involved reducing the annual demand from the headgate at Alcova Reservoir by 10,000 acre-feet. Reduction of the annual demand may be satisfied through alternative improvements that conserve water within the CAID. By reducing the annual demand by 10,000 acre-feet, the total shortages range from 32,900 acre-feet to 78,800 acre-feet compared to a baseline condition of 40,500 acre-feet.

2.2 Rehabilitation of Existing Structures

Several structures on the Casper Canal and Lateral 256 were identified for rehabilitation. The total project cost to rehabilitate these structures is estimated to be $176,000. These projects are eligible for WWDC Level III funding; accordingly, the economic analysis indicated an annual payment obligation of $7,674 to retire the loan (assuming a 50% grant/50% loan). The impact of the payment obligation on the existing assessment is an increase of $0.32.
2.3 Rehabilitation of Measurement Structures

Eighteen (18) locations were identified where measurement structures were identified for rehabilitation, replacement or installation. The total project cost for improvements to measurement structures is estimated to be $112,600. These project costs are eligible for WWDC Level III funding. Assuming a 50% grant/50% loan, the economic analysis indicated an annual payment obligation of $4,909. The payment obligation will result in an increase of $0.20 with respect to the existing assessment.

2.4 Installation of Re-regulation Reservoirs

Three locations were identified for the construction of re-regulation reservoirs within the Casper Canal. The total project cost for the three re-regulation reservoirs was determined to be $1,916,400. These project costs are eligible for WWDC Level III funding. Assuming a 50% grant/50% loan, the economic analysis indicated an annual payment obligation of $83,555. The payment obligation will result in an increase of $3.45 with respect to the existing assessment.

Construction of the re-regulation reservoirs is estimated to conserve not less than 1,500 acre-feet annually. Based on this level on water savings, the unit cost of conservation is determined to be $55.70 per acre-foot.

2.5 Installation of Canal Liners

Three locations along the Casper Canal were identified for installation liners to reduce seepage losses. The total project cost estimated for the three canal lining projects is $1,364,300. These project costs are eligible for WWDC Level III funding. Assuming a 50% grant/50% loan, the economic analysis indicated an annual payment obligation of $59,480. The payment obligation will result in an increase of $2.45 with respect to the existing assessment.

Installation of the canal liners is estimated to conserve not less than 830 acre-feet annually. Based on this level on water savings, the unit cost of conservation is determined to be $71.66 per acre-foot.

2.6 Installation of Information-based Irrigation Scheduling Measures

Installation of two AgriMet weather stations will provide for as much as 1,400 acre-feet of annual conservation. The total project cost for installation of the weather stations is estimated to be $51,400. Assuming Level III funding is available through the WWDC (50% grant/50% loan), the annual payment obligation is $2,240. The payment obligation will result in an increase of $0.09 with respect to the existing assessment. Based on annual water savings of 1,400 acre-feet, the unit cost of conservation is determined to be $1.60 per acre-foot.
2.7 Irrigation System Automation

Automation of the selected irrigation conveyance and delivery facilities may reduce operational waste not less than 1,500 acre-feet. Thirteen sites were identified for automation, including the three previously discussed re-regulation reservoirs. The total project cost estimated for the irrigation system automation is $570,200. System automation costs are eligible for WWDC Level III funding. Assuming a 50% grant/50% loan, the economic analysis indicated an annual payment obligation of $24,860. The payment obligation will result in an increase of $1.03 with respect to the existing assessment.

Based on an annual water savings of 1,500 acre-feet, the unit cost of conservation is determined to be $16.57.

2.8 On-farm Improvements

On-farm improvements can provide for a reduction in diversions from Alcova Reservoir of 10,000 acre-feet. To achieve this level of conservation will require the installation of 71 center pivot sprinkler systems and 9 side roll sprinkler systems. The implementation cost for this alternative is estimated to be $5.155 million. Assuming a design life of 25 years and 2.5% inflation, the unit cost of conservation is determined to be approximately $28 per acre-foot.

Two funding options have been identified for implementation of the on-farm improvement alternative. The first funding option assumes implementation of the Platte River Basin Endangered Species Program, and specifically the Pathfinder Modification Project. Under this option, the cost to implement the on-farm improvements may be funded by a grant obtained through the Wyoming Water Development Program. Reportedly, approximately $3.5 million is available from the State of Wyoming for selenium remediation. Funding of a grant at this level will provide for the installation of 49 center pivot sprinkler systems and 6 side roll sprinkler systems associated with the conversion of 6,600 acres from furrow irrigation methods. The annual water conservation is approximately 6,900 acre-feet at Alcova Reservoir.

Should the Platte River Basin Endangered Species Program not be implemented, other sources of funding must be obtained. Traditional funding through the WWDC is not available for on-farm improvements. Alternative sources of funding to support the implementation of on-farm improvements include the Farm Service Agency (USDA), Natural Resource Conservation Service (NRCS), and Wyoming Department of Environmental Quality-Water Quality Division (WDEQ-WQD). Loans are also available through the Wyoming State Loan and Investment Board. Presently, the most likely source of funding for on-farm improvements is through the EQIP program funded by the NRCS.

Additional benefits will be achieved through the installation of on-farm improvements. Recent studies of selenium concentrations, completed within the CAID, indicate that on-farm improvements will reduce the selenium problems within the CAID.
2.9 Update to Selenium Remediation Costs

Given the State of Wyoming’s commitment to assist the CAID with the remediation of the selenium issues, the costs associated with implementation of the remediation alternatives were to be updated during the completion of this project. Presently, however, the nature of the remediation alternatives continues to change. Given these uncertainties, it is difficult to identify the obligations of the CAID, or the State to the extent that assistance is provided, with respect to remediation of the selenium contamination problem. Consequently, construction cost estimates were not provided.

2.10 Safety of Dam Modification Costs

In accordance the State of Wyoming’s commitment to pay CAID’s share of the Safety of Dams Modifications to Seminoe Dam, the cost estimates associated with the corrective measures were updated. The CAID share of the corrective measures was determined to be $554,230. Potential funding for these improvements may be realized through a grant obtained from the WWDC (if the Pathfinder Modification Project is implemented) or through Level III funding (50% grant/50% loan). Assuming a 20-year term and 6% interest, the annual payment obligation for the corrective measures is $24,165. The payment obligation will result in an increase of $1.00 with respect to the existing assessment.

2.11 Computerized Irrigation Scheduling

With respect to computerized irrigation scheduling, it was concluded that the issues related to acceptance by the water users and the administrative staff must be resolved before an internet-based water ordering program will be considered by the CAID. Furthermore, additional effort by the developers of the program is warranted to tailor the existing program to reflect the CAID irrigation system.

III. RECOMMENDATIONS

Following the completion of the Level II project, the recommendations itemized below are provided.

1. Floating Alcova Reservoir is the best alternative to mitigate the impact of implementing the Pathfinder Modification Project on the water supply of the CAID. Although institutional constraints may exist to prevent implementation of this alternative, additional coordination with the Wyoming Area Office of the Bureau of Reclamation is recommended to more fully identify potential issues that need resolution. Furthermore, a memorandum of agreement/understanding should be developed to ensure that the storage displacement would be provided in future
years where shortages may occur. Efforts to develop the MOA with the Wyoming Area Office of the Bureau of Reclamation should be initiated by the CAID with support from the WWDC.

2. With respect to implementation of the Pathfinder Modification Project and the modeling effort completed during this Level II study, the following issues warrant additional investigation:

- Discussing the potential to limit the depletions from the municipal account in the Pathfinder Modification Project to not more than 9,600 acre-feet in any year. Conceivably, additional depletions could occur since the maximum storage in the municipal account is 20,000 acre-feet.

- Initiating conversations with the State of Wyoming regarding a statement in the stipulation that states “In any year that the municipal demand is less than 9,600 acre-feet, the remaining balance of the annual firm yield may be contributed by Wyoming for release to the benefit of the endangered species and the critical habitat in Central Nebraska.” It should be noted that any reductions in the 9,600 acre-foot demand would reduce the impact of the Pathfinder Modification Project on the water supply for the CAID.

- Initiating conversations with the City of Casper, BOR and the State of Wyoming to provide for the future municipal demand for the City of Casper to be initially satisfied through the municipal account in Pathfinder Modification. These discussions should include potential credit for 7,000 acre-feet that presumably has been purchased through the implementation of conservation measures within the CAID.

3. Reductions in the annual diversion of 10,000 acre-feet at the Alcova Reservoir headgate can be accomplished through on-farm improvements. Furthermore, these improvements will likely result in a reduction to the selenium problems within the CAID. Consequently, it is recommended that on-farm improvements be implemented to the maximum extent possible within the CAID. Funding alternatives include utilization of grant monies set aside for selenium remediation, EQIP funding through the NRCS or Section 319 funding.

4. Several alternative improvements were identified to provide water savings within the CAID. These included installation or construction of canal lining, system automation, re-regulation storage reservoirs, and weather stations. The most cost effective improvement involves the installation of two AgriMet weather stations within the CAID and results in a cost of $1.60/acre-foot. This alternative merits serious consideration. The remaining alternative improvements should also be considered depending on the sources of potential funding and the impact on the annual assessment. Implementation of the alternative improvements should focus
on measures or improvements that not only conserve water but also provide benefit for the reduction of selenium concentrations within the CAID.

5. Several structures presently require rehabilitation in the near future. Level III funds available from the WWDC should be obtained and construction completed for these structures. Similarly, several measurement structures should be either rehabilitated, replaced or installed within the CAID. Level III funds available from the WWDC should be obtained and construction completed for these measurement structures.

6. Several structures within the extensive system of laterals and sublaterals are in need of rehabilitation. Since this study focused on structures within the Casper Canal and Lateral 256, an inventory of all the laterals and sublaterals was not conducted. To facilitate the rehabilitation of the structures within the laterals and sublaterals, a Level II study should be completed on behalf of the CAID. During this Level II study, water in the Johnson Siphon should be removed to promote a more detailed investigation of potential rehabilitation requirements.

Lining the Casper Canal will provide water savings within the CAID. However, seepage losses are the most significant within the system of laterals and sublaterals and measures to mitigate these losses may be more cost effective, i.e., conversion of open ditches to pipelines. Furthermore, conversion of open ditches to pipelines may provide additional benefits by reducing the operational waste within the lateral/sublateral. The Level II study should identify those locations where seepage is occurring and recommend improvements to mitigate the seepage loss.

In view of the discussion, it is recommended that the CAID submit an application to the WWDC for funding of a Level II study associated with the remaining laterals and sublaterals.

7. It is recommended that procedures be instituted to record the total diversion at the headgates associated with each lateral and sublateral on a daily basis. In addition, it is recommended that measurements of operational waste be recorded where measurement structures exist. Operationally, this data will significantly improve the tracking and equitable delivery of water to all users and will promote the quantification of losses within the irrigation delivery system.

8. Prior to the implementation of alternative improvements, additional evaluation of permitting obligations should be conducted. Specifically, coordination with the Cheyenne Regional Office of the Corps of Engineers should be initiated prior to final design of the improvements to identify permitting requirements under Section 404 of the Clean Water Act. Furthermore, coordination with the Wyoming Area Office of the Bureau of Reclamation should be conducted for improvements to all major conveyance and delivery facilities.