EXECUTIVE SUMMARY

CROWHEART AREA/DINWOODY CANAL SYSTEM
LEVEL I STUDY
SEPTEMBER 2005

PREPARED BY
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September 30, 2005

Wyoming Water Development Commission
122 West 25th Street
Cheyenne, WY 82002

ATTN: Phil Ogle

RE: Crowheart Area/Dinwoody Canal System Level I Study
Executive Summary

Dear Mr. Ogle:

Find enclosed the required (50) copies of the Executive Summary of the Final Report completed for this project.

It has been a pleasure to complete the scope of work for this study and being of service to WWDC.

Sincerely,

[Signature]

Frank J. Grimes, PE & LS
Project Manager

FJG/dks

Enc.
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LEVEL I STUDY

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Executive Summary

CROWHEART AREA-DINWOODY CANAL SYSTEM LEVEL I STUDY

I. INTRODUCTION

A. GENERAL

The Project area is situated in Fremont County about 25 miles southeast from the Town of Dubois, and lies in the Wind River Valley. The general project location is illustrated on Figure I.1 Site Location Map. Irrigated lands lie on the north and south side of US Highway 26. The Crowheart Area/Dinwoody Canal System Level 1 Study is sponsored by the local irrigators and Tribal Water Engineers Office (TWE) of the Wind River Indian Reservation (WRIR). There are about 8,000 gross agricultural acres and 6,900 irrigated acres within the project area. Additional irrigated lands lie below the Crowheart Bench and just above the Wind River Floodplain, however these lands are outside the project area of this study.

B. BACKGROUND

The WRIR was created as a result of the 1868 Treaty between the United States and the Native Americans of the Northern Arapahoe and Eastern Shoshone Tribes. Subsequent to the Treaty permanent settlements and agricultural development evolved along the Crowheart Bench. In the early 1900's, plans were developed to implement a gravity irrigation system throughout the area, and during the first half of the century construction of the system was initiated and implemented by the Bureau of Indian Affairs (BIA). Copies of the BIA project maps are contained in the Final Report. In addition to initial construction, BIA has had continuous responsibility for operation maintenance and repair (O&M) of the system. As a result of adjudication of Division III Water Rights, the Court awarded a water duty to the Crowheart Project Area of 10.55 ac-ft per acre. Presently, irrigators under the Dinwoody Canal pay an annual assessment of $13.50 per acre. All crops raised are for livestock forage.

C. SETTING

The project area is located in west central Fremont County and irrigated lands lie on colluvial benches some 60-70 feet above the Wind River Flood Plain. Elevation of the area varies from about 6,480 feet at Dinwoody Lake Diversion to 6,380 feet at turnout 11C (near Dry Creek) and about 6,000 feet AMSL at the southeast end. The benches are transected by a number of major drainages that originate in the Wind River Mountains to the southwest and drain to the Wind River lying to the north east. The drainages include (north to south) Little Dry Creek, Dry Creek, Cottonwood Creek, Kane Draw, Meadow Creek, and Willow Creek.
SITE LOCATION MAP
Crowheart Area/Dinwoody
Level I Study
D. CLIMATE

The Climate in the Crowheart area is categorized as semi-arid with an average annual precipitation of 8.7 inches. Temperatures vary from below 0° F to highs of 80-90° F. Average annual snow fall in the area is about 30 inches. The growing season extends from mid-April through mid-October for forages and grass.

E. PURPOSE

The purpose of this project is two fold (1) evaluate the Dinwoody Canal system and identify solutions to remedy chronic water shortages at the end of the system, particularly below the Willow Creek drainage and (2) investigate the feasibility and cost/benefits of implementing storage on Willow Creek and/or enlargement of Dinwoody Lake. Water shortages occur during May and late in the season, particularly at the east or lower end of the system.

II. DINWOODY LAKE SITE

A. PREVIOUS STUDIES

1. GEI Consultants, Inc. (1993)

A feasibility level evaluation of adding additional storage at the Dinwoody Lakes site was performed by GEI Consultants, Inc. (GEI) in 1993 in a report titled “Feasibility Report for Enlargement of Dinwoody Lakes, Wind River Reservation, Wyoming.” For this report GEI performed a reconnaissance level investigation of the site including site geology and hydrology and prepared embankment alternative recommendations for three alternatives.

The existing storage volume of Dinwoody Lake was estimated to be 3,900 acre-feet. No estimate of the volume of Upper Dinwoody Lake was made.

B. CURRENT STUDY (2004-2005)

During this study, a bore hole was advanced at the selected embankment site to a depth of 89.5 ft. without encountering bedrock. The proposed embankment would therefore be constructed on variable glacial till and pose difficult technical challenges at, an expensive cost. Accordingly, review of increasing storage at Dinwoody Lake was not pursued other than updating costs previously prepared by GEI.

III. WILLOW CREEK STORAGE SITE(S)

A. GENERAL

Two sites were reviewed on Willow Creek. The larger alternative would store an estimated 7,500 ac-ft. and the smaller site 4,000 ac-ft. Each alternative site would be supplied by the main canal system during the off-season, diverting water from Lower Dinwoody Lake.

The Willow Creek Dam site(s) are located in the NW ¼ of Section 36, T4N, R4W on the Wind River Indian Reservation in Fremont County, WY. The sites are located 1½ miles south of the Crowheart, Wyoming Post Office and gas station. The Meadow Creek Canal crosses Willow Creek just upstream.
of either proposed site and US Highway 287 crosses Willow Creek approximately 1½ miles downstream.

Reconnaissance level engineering geological studies were completed for the Willow Creek site and are contained in the Final Report. No subsurface exploration or geotechnical studies were completed for this site as part of this study.

B. GENERAL SITE DESCRIPTION

The elevation of the Willow Creek dam site(s) is approximately 6,100’ and the dam will be located on Willow Creek, which is a perennial stream that flows from the Wind River Mountains in a generally southwest to northeast direction.

The Meadow Creek Canal is located just upstream of either site. A tunnel through the ridge that forms the northwest end of the Willow Creek dam and reservoir has been constructed to convey the Meadow Creek Canal. The canal drops from the high ground northwest of Willow Creek into the creek bottom near the dam site.

Based on the topographic map of the area, it appears feasible to construct an embankment dam, which would be 100’ to 120’ tall. The crest of the dam would be at approximate elevation 6,160’ and the dam would be about 2,350’ long with a northwest to southeast alignment.

C. ENVIRONMENTAL IMPACTS AND CONSTRAINTS ON WILLOW CREEK STORAGE

1. Threatened, Endangered, and Candidate Species

The larger of the two reservoirs proposed for the Willow Creek Drainage will inundate 155 acres of potential habitat while the smaller will inundate 122 acres. Both reservoirs are expected to have similar impacts on threatened, endangered, and candidate species. If the proposed project has any federal involvement (through funding, permitting, licensing, or other authorization), then the federal agency(s) involved will be required to assure that its responsibilities under Section 7(a)(2) of the Endangered Species Act are met. Review of impacts to Threatened, Endangered, and Candidate Species was completed and is addressed in the body of the report.

2. Wildlife Species of Concern

The two different sized reservoirs proposed for the Willow Creek Drainage (155 acres and 122 acres) are expected to have similar impacts on wildlife species of concern. Full discussion on the following species is contained in the Final Report: ungulates, sage grouse, raptors, and migratory birds.
3. **Fish**

It is unknown whether spawning is occurring in the section of Willow Creek that will be impacted by the proposed reservoir; therefore, impacts on the recruitment of trout and other native fish is unknown at this time. The respective reaches of Willow Creek (10,670 lineal feet for the larger reservoir and 9,279 lineal feet for the smaller) that will be inundated represent both holding and feeding habitat for trout and other native fish. This lentic habitat will be lost as a result of reservoir construction but lotic holding and feeding habitat will be created by the reservoirs. Impacts on fish movement resulting from construction of the reservoir will depend on the engineering of the dam in relation to fish passage as well as the maintenance of in-stream flows down stream of the reservoir. Wyoming Game and Fish Department requested items be considered and they are noted in the report.

4. **Aquatic Resources**

Aquatic resources will be directly affected by reservoir construction as a result of inundating about 10,670 lineal feet of creek as a result of the larger reservoir and 9,279 lineal feet of creek as a result of the smaller reservoir. Seasonal flow reductions associated with this project have the possibility of further reducing (both directly and indirectly) the volume of water flowing in Willow Creek. According to the USFWS and WGFD, the selected reservoir site and associated operational plan should include provisions to maintain an adequate in-stream flow to provide continued hydrologic support for upstream and downstream aquatic resources. Other concern were specific listed by the WGFD and these are, in part, listed above.

5. **Wetlands**

A wetland delineation will need to be completed in the project area before official impacts can be determined. A preliminary wetland assessment below where the canal crosses Willow Creek indicates that wetlands are restricted to fringe areas adjacent to the creek and small backwater zones. More extensive willow bottomlands are present upstream of the canal crossing and inundation of this area will result in more significant impacts. This area supports predominantly scrub-shrub wetlands, a wetland type of both interest and concern to the ACOE. The larger reservoir site will increase impacts to willow-dominated riparian habitat by 13.4 acres (45%) over the smaller reservoir, potential wetland impacts associated with the larger site are expected to be significantly greater than the smaller site.

6. **Riparian and Upland Vegetation**

Impacts to vegetative communities resulting from construction of a reservoir on Willow Creek vary slightly depending on the reservoir size as indicated in the following table of Vegetation Impacts.

<table>
<thead>
<tr>
<th>Vegetation Type</th>
<th>4,000 acre-foot Reservoir</th>
<th>7,500 acre-foot Reservoir</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sagebrush shrubland</td>
<td>57.2 acres</td>
<td>76.4 acres</td>
</tr>
<tr>
<td>Cottonwood-dominated riparian</td>
<td>35.6 acres</td>
<td>35.6 acres</td>
</tr>
<tr>
<td>Willow-dominated riparian</td>
<td>29.6 acres</td>
<td>43.0 acres</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td><strong>122.4 acres</strong></td>
<td><strong>155.0 acres</strong></td>
</tr>
</tbody>
</table>
D. CULTURAL RESOURCES

A reconnaissance level review of the sites was completed during the course of the study.

IV. CANAL SYSTEM REHABILITATION

The entire water distribution system was mapped and inventoried. All information was placed into a GIS database. Evaluations were completed and a Rehabilitation Plan was formulated. Mean Crop Irrigation Requirements for the project are estimated at 20,400 ac-ft. The Rehabilitation Plan directly responds to the need for distributing the water more efficiently. The plan was delivered to Sponsor members at the August 5, 2005 meeting, and they were responsive to making the improvement. Project costs were estimated and budgets were developed for the main canal and laterals. Detailed budgets are contained in the Final Report.

V. ABILITY TO PAY ANALYSIS

A. GENERAL DISCUSSION

The economic analysis of the Crowheart/Dinwoody Supply Canal study provides an estimate of the producers “ability to pay” for improvements to the water delivery system. The canal improvements will enhance water delivery by reducing seepage loss, which will improve water conveyance resulting in better efficiency of water use. This should benefit existing irrigators on the canal by increasing production on existing irrigated acres. Increased storage will provide adequate water supply throughout the season.

Each of the “ability to pay” estimates are weighted by the proportion of acreage in each land type (alfalfa/hay mixture -60%; straight hay-40%) and summed resulting in the estimated per acre ability-to-pay. Since projected yield increases, future hay prices and fertilizer prices greatly impact the ability-to-pay estimates, different combinations of yield increases and future hay and fertilizer prices were used in estimating the “ability-to-pay”. The different combinations included two projected yield increases (0.5 & 1 ton per acre); two hay prices for both alfalfa and grass (ten year average 1994-2003 & 5% decrease of the 10 year average); and two fertilizer prices (local price this year & approximately a 15% reduction in that price). The biggest impact on producers “ability-to-pay” would be a reduction in hay price, using the 1 ton increase in per acre yield and average price the estimated “ability-to-pay” is approximately $7.00 per acre. Just reducing the hay price by 5% changes this estimate to a negative $-7.00 per acre.

A conservative estimate of the producers “ability-to-pay” would be $5.44 per acre. This estimate is based on the 0.5 ton per acre increase in yield, the 10 year average hay price and local fertilizer prices for spring 2005.

VI. PROJECT FORMULATION AND COST ESTIMATES

A. GENERAL

Project Formulation compares the cost of proposed improvements to the funding that can be developed to pay for those improvements. Additionally, annual cost to the sponsors is generated to ascertain if the project is affordable. In regards to the Crowheart/Dinwoody Canal System, two different project should be considered:
1) Willow Creek Storage Project  
2) Distribution System Rehabilitation Project

B. STORAGE PROJECT

Three alternative projects have been considered at the reconnaissance level:

<table>
<thead>
<tr>
<th>Project</th>
<th>Storage</th>
<th>Project Cost Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Dinwoody Lake Dam</td>
<td>29,300 ac-ft</td>
<td>$40,086,000</td>
</tr>
<tr>
<td>• Willow Creek Site – Alternative 1</td>
<td>7,500 ac-ft</td>
<td>$52,486,000</td>
</tr>
<tr>
<td>• Willow Creek Site – Alternative 2</td>
<td>4,000 ac-ft</td>
<td>$41,186,000</td>
</tr>
</tbody>
</table>

Input from the sponsors at progress meetings in January and March of 2005, indicate they favor a smaller project located on Willow Creek. Project estimates for the alternatives are illustrated in Tables X.1, X.2, and X.3 of the Final Report.

C. DISTRIBUTION SYSTEM REHABILITATION PROJECT

The distribution System Rehabilitation Project would be comprised of various components of work from the Draft Rehabilitation Plan and/or reconfiguration items that the sponsor group prefers to implement. Project Costs for a delivery system rehabilitation project is illustrated in Table X.4 of the Final Report with an estimated project cost of $2,583,000.

D. PROJECT FUNDING

WWDC Projects may be funded in the following manner:

• New Projects  50% Grant  50% Loan
• Rehabilitation Projects  50% Grant  50% Loan

WWDC will consider 75% grant – 25% loan if requested by sponsor.

Present interest rate on loan(s) is 6%, with the loan term as set by the WWDC. Sponsor groups may utilize Federal sources of funding to complement the Wyoming program. The Project Sponsor must form a legal entity for the state to participate in the project financially.

The proposed Rehabilitation Project could be funded as follows:

• Proposed Project Cost  $2,583,000
• 50% Grant           $1,291,500
• Balance             $1,291,500

From the Ability to Pay Analysis, it was determined that producers (sponsors) could pay an additional $5.44/acre for a project. Assume $5.00/acre is committed on 6,900 acres, thus, $34,000/year can be obligated for debt retirement of a project. $34,000/year, at 6% annual interest rate, for a term of 30-years would retire a debt of $460,000, thus:

• Balance  $1,291,500
• Sponsor Payment - $460,000
Balance  $831,500
From the foregoing evaluation it is clear that to complete the project as proposed, a third funding source will have to be developed through the Tribal Council, BIA or from Federal Legislation. Alternatively, the Rehabilitation Project could be reduced in scale to about $920,000 basic construction cost to enable the Sponsors and WWDC to jointly fund the project without further assistance.

Funding of the storage project is a more daunting task in view of the estimated project costs. Inevitably, Federal, State, and tribal sources will have to be relied upon to fund a project of such magnitude. However, WWDC’s policy for a storage project is still 50% grant–50% loan at 6% interest. The ratio can be increased to 75% grant – 25% loan if requested by the sponsor. Again, other sources of funding will have to be obtained to underwrite the entire project.

VII. CONCLUSIONS AND RECOMMENDATIONS

A. GENERAL

Study and evaluation of the irrigation water supply and distribution system serving the Crowheart Bench via Dinwoody Supply Canal has resulted in a number of conclusions relating to the efficiency of the system, they are noted in this section.

B. CONCLUSIONS

1. Irrigators low on the system, below Willow Creek, suffer from lack of water both early (May) and late in the irrigation season.
2. Irrigators within the Sponsor group favor implementing additional storage in the middle of the system.
3. The canals and laterals comprising the distribution system need a significant amount of repair and maintenance improvements to increase the efficiency.
4. As reflected by visual indicators including porous soils, heavy vegetation growth, and standing water significant seepage loss occurs within the system.
5. Numerous water control, conveyance and regulating structures need repair and/or replacement.
6. Many of the larger structures warrant improved safety features.
7. Dinwoody Tunnel is in reasonably good repair with a capacity of about 180 cfs. The concrete lining is lightly abraded in some areas and should be inspected annually and patched where required.
8. Capacity of the highway box culverts downstream from Dinwoody Tunnel could most likely be improved by cleaning the downstream channel to reduce backwater effects.
9. Management of irrigation water is hampered by the lack of measurement devices.
10. There is about 1,550 acres of "Potentially Irrigated Land" that could be placed into production with improved supply and distribution of water.

C. RECOMMENDATIONS

In accordance with the Sponsors objectives and as a result of this Level I Study, a number of recommendations are offered in effort to improve water storage, distribution, and management under the Dinwoody Canal System.
1. Continue working to form a legal entity so that State of Wyoming funding can be received for project funding.
2. Review the Draft Rehabilitation Plan, select a project size, and apply to WWDC for a Level II Study to further investigate the feasibility of implementing the improvements.
3. Consider in part placing some of the laterals in pipe, to reduce losses, to reduce maintenance costs, improve distribution, and preserve pressure to operate sprinkler systems. The highest priorities are a new lateral downstream from Lateral 11C and the upper 1,200 LF of Lateral 7D.
4. Where the upper end of the other lateral pass through unirrigated land, consider placing those portions in pipe also.
5. Apply to WWDC for a Level II Study to further investigate the feasibility of implementing storage on Willow Creek Drainage. As a minimum areas of study should include a subsurface foundation investigation, reservoir sizing, environmental impacts, cultural resource impacts and refinement of project cost estimates.
6. Complete ownership mapping in the vicinity of the proposed Willow Creek Reservoir site.
7. Utilize the GIS data base and mapping completed as part of this study to prioritize and target maintenance activities on an annual basis.