This is a digital document from the collections of the Wyoming Water Resources Data System (WRDS) Library.

For additional information about this document and the document conversion process, please contact WRDS at wrds@uwyo.edu and include the phrase “Digital Documents” in your subject heading.

To view other documents please visit the WRDS Library online at: http://library.wrds.uwyo.edu

Mailing Address:
Water Resources Data System
University of Wyoming, Dept 3943
1000 E University Avenue
Laramie, WY 82071

Physical Address:
Wyoming Hall, Room 249
University of Wyoming
Laramie, WY 82071

Phone: (307) 766-6651
Fax: (307) 766-3785

Funding for WRDS and the creation of this electronic document was provided by the Wyoming Water Development Commission (http://wwdc.state.wy.us)
Executive Summary

WHEATLAND IRRIGATION DISTRICT
CONSERVATION STUDY, LEVEL II
PHASE 2 – RE-STORAGE RESERVOIRS

Prepared for:
Wheatland Irrigation District
and
Wyoming Water Development Commission

Prepared by:
States West Water Resources Corporation
Cheyenne, Wyoming

In association with:
Gannett Fleming, Inc. Phoenix, Arizona
Paul Reid, PLS, Cheyenne, Wyoming

September, 2007
Executive Summary

WHEATLAND IRRIGATION DISTRICT
CONSERVATION STUDY, LEVEL II
PHASE 2 – RE-STORAGE RESERVOIRS

Prepared for:
Wheatland Irrigation District
and
Wyoming Water Development Commission

Prepared by:
States West Water Resources Corporation
Cheyenne, Wyoming

In association with:
Gannett Fleming, Inc. Phoenix, Arizona
Paul Reid, PLS, Cheyenne, Wyoming

September, 2007
# TABLE OF CONTENTS

1. **INTRODUCTION** ...................................................................................................1
   1.1 General.................................................................................................................... 1
   1.2 Description...............................................................................................................1
   1.3 Purpose of Study......................................................................................................1

2. **GEOTECHNICAL PROGRAM**..............................................................................1
   2.1 Engineering Geologic Mapping/Surficial Investigation.................................2
   2.2 Subsurface Investigation......................................................................................2
   2.3 Preliminary Design...............................................................................................2

3. **SUMMARY** .............................................................................................................2
1. INTRODUCTION

1.1 General

This report presents the findings of Phase 2 of a Final Report Wheatland Irrigation District Conservation Study Level II (States West Water Resources Corporation, 2005). This study used the recommendations of the Level II report to further evaluate to potential re-storage reservoir sites. This study was conducted for the Wheatland Irrigation District (WID) under direction and funding of the Wyoming Water Development Commission (WWDC) by States West Water Resources Corporation in association with Gannett Fleming and Paul Reid, PLS.

1.2 Description

The results of the Level II study identified several potential re-storage reservoirs to assist the WID in their continuing efforts of water conservation. Recommendations presented in the Level II Study were to further evaluate two of the potential reservoirs and perform a geotechnical program to refine the conceptual designs and provide more detailed cost estimates.

1.2 Purpose of Study

The purpose of this study was to develop and implement a geotechnical program, provide preliminary designs and cost estimates for two potential re-storage reservoirs, and assess the needs to modify the ditch banks of an existing canal.

This report presents the results of the geotechnical program for the Kidd Re-Storage Reservoir and the Wheatland No. 1 Re-Storage Reservoir. Preliminary designs and cost estimates were developed based on the findings of the geotechnical program.

The costs estimates and ability to pay information is based on 2007 construction costs and presented in the standard WWDC format. The grant and loan terms were provided by the WWDC.

2. GEOTECHNICAL PROGRAM

A geotechnical program was developed and implemented for the purpose of obtaining information to develop preliminary designs and cost estimates for two re-storage reservoir sites and to evaluate on-site materials to be used to enlarge the capacity of an existing canal. The scope of the geotechnical investigation and preliminary dam design consisted of three elements; engineering geologic mapping/surficial investigation, subsurface investigation and preliminary design.

Based on the results of the geologic mapping and the subsurface investigations, preliminary designs were developed for three alternatives for the Wheatland No. 1 Re-
Storage Reservoir site and a determination on the feasibility of constructing a dam at the Kidd Site (See Figure 2.1).

2.1 Engineering Geologic Mapping/Surficial Investigation

Geologic mapping was performed at the two reservoir sites to identify any potential geologic hazards and evaluate the site engineering geologic conditions for the proposed embankment areas and to evaluate potential borrow source areas for use in dam construction. In addition, geologic reconnaissance was performed to identify potential borrow sources for rip-rap, located within a reasonable transport distance.

2.2 Subsurface Investigation

Subsurface investigations were performed at the two reservoir sites to characterize the subsurface conditions, particularly the thickness of potentially pervious granular terrace deposits and the characteristics and permeability of the underlying bedrock, identify potential borrow areas for dam construction materials (potential low permeability core materials, granular filter, drain and shell materials, and possible soil-cement aggregate).

Subsurface investigations included conducting exploratory soil boring, rock coring and test pitting, soil and rock core logging, and collection and laboratory testing of soil samples.

2.3 Preliminary Design

Based on the results of the geologic mapping and subsurface investigations, preliminary designs were developed for three alternatives for the Wheatland No. 1 Re-Storage Reservoir site.

The conceptual design included the following engineering analysis:

a. Evaluation of on-site materials.
b. Foundation treatment requirements
c. Preliminary slope stability analysis
d. Foundation seepage cutoff design and seepage loss estimates
e. Soil-cement upstream slope plating design
f. Cost Estimates

3. SUMMARY

WHEATLAND NO. 1 RE-STORAGE RESERVOIR

A potential reservoir site was identified in the Level II study located between the Lateral No. 1 Canal and the Wheatland No. 1 Reservoir. Excess water in the Lateral No. 1 could be diverted from into the proposed re-storage reservoir. The water could be stored until
demand increases and could be released either into the Wheatland No. Reservoir, or back into the Lateral No. 1 Canal.

Three alternative sizes of reservoirs were designed, a 300 Acre-Foot (Figure 3.1), a 500 Acre-Foot (Figure 3.2) and a 737 Acre-Foot (Figure 3.3). Two options were also developed for each reservoir size. Each reservoir design includes the option of lining the reservoir bottom and upstream slopes with a bentonite liner system or processing on-site fine-grained materials to minimize the seepage potential of the reservoirs. The bentonite lining system greatly reduces the potential for seepage loss from the reservoirs. The processed materials lining option reduces costs but has a potential for significant seepage. If seepage were to occur from the reservoir, the lost water would eventually find its way to the existing Wheatland Reservoir No. 1. Not all of the water lost due seepage would be lost from the system.

The preliminary designs include two outlets for each of the reservoir alternatives. The primary outlet would allow water to be released from the reservoir into an existing ditch that flows into an existing reservoir to be stored. The secondary outlet would release water from the reservoir back into the canal that delivers water to the reservoir. This would allow excess water in the canal to be stored in the reservoir until demand increases and the water is needed in the canal system.

The proposed reservoir could be operated in a manner that it would fill and drain several times throughout each irrigation season. This does not decrease the cost to construct the reservoir, but does decrease the cost per acre-foot of the water stored.

INCREASE CAPACITY OF THE NUMBER 1 LATERAL

The Number 1 Lateral diverts water from the No. 1 Canal and supplies water to Wheatland Reservoir No. 1 and irrigation along the canal (See Figure 3.4). The current operation of the Lateral requires that water be checked periodically to gain water depth in the canal to deliver to headgates and lands at elevations above the invert of the canal. To minimize the frequency of the checks and to provide more water to Reservoir No. 1 and additional flow to irrigators, potential modifications to the canal were developed. An analysis was performed to determine modification requirements to increase the capacity of the Lateral.

Computer modeling was performed to determine the existing capacity of the canal, and identify areas of the canal that are not adequate for an increased flow rate. The amount of imported fill material was estimated based on the model analysis of surveyed cross sections of the canal. Borrow material from the No. 1 Re-Storage Reservoir site could be imported to increase the bank height in areas where insufficient freeboard or capacities exist.
NOTES:
1. EXISTING CONTOUR INTERVAL IS 1'.
2. PROPOSED CONTOUR INTERVAL IS 5'.
3. TOP OF DAM ELEVATION 5005'.
4. BOTTOM ELEV OF RES. 4995'.
5. HIGH WATER LEVEL 5000'.
KIDD RE-STORAGE RESERVOIR

The Level II Study identified a reservoir site that would re-store excess water in Canal No. 1 and storm water from a drainage that the canal transects (See Figure 3.5). The water stored in this Reservoir could be released in Canal No. 3 and used for irrigation along this canal.

The Geotechnical Investigation for the site determined that a suitable geologic formation at the site differed from what was estimated from the reconnaissance level geotechnical analysis performed in the Level II study. The Geotechnical investigations presented in Appendix B of this report conclude that the extreme depth of bedrock suitable for a dam foundation render construction of a foundation cutoff infeasible. The lack of fine-grained materials present in the reservoir vicinity decrease the feasibility even further. For these reasons, it was concluded that a cost effective dam at this site is not possible.

COST SUMMARY

Table 3.1 provides a summary of the total costs for the No. 1 Re-Storage Reservoir alternatives and the modification to Lateral No. 1. The table also displays the annual repayment requirements of the WID.

<table>
<thead>
<tr>
<th>Item</th>
<th>Total Cost</th>
<th>Annual Repayment</th>
</tr>
</thead>
<tbody>
<tr>
<td>300 Acre-Foot Unlined</td>
<td>$3,000,000.00</td>
<td>$73,600.00</td>
</tr>
<tr>
<td>300 Acre-Foot Lined</td>
<td>$3,500,000.00</td>
<td>$85,866.67</td>
</tr>
<tr>
<td>500 Acre-Foot Unlined</td>
<td>$4,200,000.00</td>
<td>$103,040.00</td>
</tr>
<tr>
<td>500 Acre-Foot Lined</td>
<td>$5,000,000.00</td>
<td>$122,666.67</td>
</tr>
<tr>
<td>737 Acre-Foot Unlined</td>
<td>$5,900,000.00</td>
<td>$144,746.67</td>
</tr>
<tr>
<td>737 Acre-Foot Lined</td>
<td>$7,000,000.00</td>
<td>$171,733.33</td>
</tr>
<tr>
<td>Lateral No. 1 250 cfs Modification</td>
<td>$180,000.00</td>
<td>$4,416.00</td>
</tr>
<tr>
<td>Lateral No. 1 350 cfs Modification</td>
<td>$300,000.00</td>
<td>$7,360.00</td>
</tr>
</tbody>
</table>
FIGURE 3.5