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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)

AUSTIN & WALL CANALS LEVEL II PHASE II STUDY EXECUTIVE SUMMARY

WYOMING WATER DEVELOPMENT COMMISSION

August 2013

SUNRISE ENGINEERING

AUSTIN & WALL CANALS
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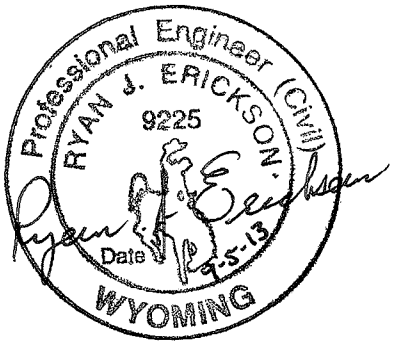

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1.0 INTRODUCTION

The Austin and Wall Canals and Reservoir Level II Phase II Study was commissioned by the Wyoming Water Development Commission (WWDC) and sponsored by the Austin and Wall Irrigation District (AWID). The intent of the study was to investigate potential improvements to the canals and reservoir that could improve system efficiency and operation. A Level I reconnaissance study was completed in December 2009 by Sunrise Engineering, Inc. for WWDC. This study determined that it was appropriate to move forward with irrigation district formation and to continue the study process and collect more information in preparation of application for Colorado River Basin Salinity Control Program (CRBSCP) funding. A Level II study was subsequently completed in September 2011. This study determined that additional data should be collected regarding canal seepage, seepage reduction alternatives, and salt loading in locations nearby the proposed canal improvements. This provided information in preparation of a second application for CRBSCP funding.

1.1 GENERAL STUDY LOCATION

The Austin and Wall Canals are located in the Bridger Valley of Southwestern Wyoming near the towns of Fort Bridger, Lyman, and Mountain View. The area is dry and cold with an average annual precipitation of 8 to 10 inches and a growing season of 90 to 110 days. Crops grown are primarily native hay and pasture, along with some alfalfa. The Austin Canal is known officially as Uinta Canal No. 3. The Wall Canal is known officially as the Deeben-Heinze Ditch.

1.2 SCOPE OF STUDY

The purposes of the Austin and Wall Canals Level II Phase II Study are to:

- Review and update the background information from the previous studies through various State and Federal agencies.
- Collect additional information regarding the Austin and Wall irrigation conveyance systems, including evaluation of seepage losses. This evaluation must meet USGS guidance and be appropriate for the CRBSCP.
- After identifying areas of highest salt loading within the canals, develop and evaluate all reasonable, cost effective alternatives.
- Develop updated salt loading figures for both Austin and Wall Canals. Data collected by Uinta County Conservation District will be used to update salt loading characteristics of the canals.
- Gather necessary information for submittal of an application for the CRBSCP.
- The existing GIS will be updated with information collected as part of this Level II Phase II Study.
- Identify all permits, easements, and clearances necessary for implementation of the plan or construction activities proposed under the plan and submittal of the CRBSCP Application.
- The conceptual level designs and cost estimates prepared for the Level II Study will be updated based on additional information collected as part of the Level II Phase II Study.

- Provide information on potential funding sources for implementation of the specific management activities and improvement projects.

2.0 REVIEW OF BACKGROUND INFORMATION

Background information was acquired from various State and Federal agencies through various means. Knowledgeable landowners, ranchers, irrigators and other individuals in the project area were also contacted for information on the existing Austin and Wall Canals.

3.0 CANAL EVALUATION AND SEEPAGE TESTING

Seepage loss evaluations were conducted along multiple Austin Canal reaches during this phase of the study. No measurements were taken in the Wall Canal because of the thick moss growing along the canal reaches and the significant areas of inflow. Seepage areas were also visibly observed and mapped using GPS. Physical viewing of seepage along the canals guided some of the flow measurements that were taken. Measurements were taken upstream and downstream of the visible seepage areas in an effort to quantify the amount of seepage in that area.

In several locations along the canals, ponding is taking place on the downhill side of the canal. In some locations the ponding is located several hundred feet from the canal. It appears that the ponds are created from seepage that travels underground and then surfaces at the pond. Field observations of visible seepage areas were taken on June 7, 2012. Pictures and GPS locations of seepage sites were recorded.

On June 20, 2012 flow measurements were taken along five reaches in the upper portion of the Austin Canal. No diversion structures were open along the reaches during the measurements. Three measurements were taken within 20 yards of each other at one reach location in an effort to compare measurements of the meter. Additional flow measurements were taken on June 28, 2012 along eight reaches of the Austin Canal in order to estimate the seepage rate. Measurements were taken during the irrigation season on reaches or segments which had no open diversion structures. The final set of flow measurements along the Austin Canal were taken on July 12th. After July 12th, flow in the canals was reduced to such a level that flow measurements could not be taken.

The results indicate that in general flows in the Austin Canal showed a reduction between upstream and downstream cross-sections with loss rates of up to 4.26 cfs/mile. Upper reaches of the Austin Canal experienced a loss of 2% per mile while the lower reaches measured a loss of 6% This may indicate that the canal is losing a larger percentage of water on the lower reaches than on the upper reaches.

4.0 DEVELOP AND EVALUATE ALTERNATIVES

In the Level II Phase I Study most of the emphasis concerning canal improvements involved investigations of piping alternatives. During Phase II of the Austin/Wall Level II Study, the consultant was charged with examining possible seepage reduction measures other than piping in

more detail. During the Level I Study and Phase I of the Level II Study, a number of potential seepage reduction alternatives were identified and characterized.

Additional information on various alternatives involving liners is addressed. The alternatives include soil sealants, geomembranes, geocomposites, compacted earthen liners, geosynthetic clay liners, HDPE corrugated liners and concrete. Advantages and disadvantages of each lining method are discussed.

The BOR has issued minimum standards for canal linings used on projects qualifying under the CRBSCP. The standards are listed in the Funding Opportunity Announcement (FOA).

Any canal lining projects to be constructed using full or partial BOR funding must meet or exceed the BOR standards. In addition, the final design and specifications for a 50 year design life must be designed and stamped by a registered professional engineer in the state of the project.

The maximum design seepage rate for the canal shall not exceed 0.25 inches per day. The liner shall be designed so as to not exceed that amount throughout the 50 year life of the project. Geomembrane linings with either a concrete/shotcrete cover material or sand and gravel cover material shall be the only design accepted that will meet the 50 year design life.

Acceptable geomembranes consist of PVC, Polypropylene, EPDM, LDPE, or HDPE and shall have a minimum thickness of 30 mil. Non-woven geotextile with a minimum weight of 10 oz. shall be placed on both sides of the geomembrane to provide protection from both the sub-grade and cover material. The cover material shall be either concrete/shotcrete or sand and gravel.

Groundwater shall be permanently controlled in order to prevent floating of the liner system with a designed drain system. Sub-grade shall be prepared in order to provide firm compacted foundation for the liner; densities shall be the greater of 85% proctor density or the densities of the surrounding soil as approved by a registered engineer. Sub-grade shall be free of organics and sharp objects/rocks.

Goemembrane liner systems must be anchored with a minimum horizontal lip of 2 feet that is keyed in underneath the O&M road or embankment and as recommended by the designer and manufacturer. All geomembrane liners must be field seamed. Construction and seaming of liners must be performed by an experienced installer with a minimum of five years of seaming experience. Geomembranes must be adequately protected during placement to avoid puncture on installation.

When sand and gravel cover is used, it shall be 1.5 feet thick minimum with consideration given to adequate cover if heavy maintenance activities are anticipated. The sand and gravel cover shall consist of material with a maximum particle size of 6 inches and no more than 15% fines with a gradation adequate to withstand canal velocities and wave action. The minimum side slope shall be 2.5:1 or as approved by a registered engineer and the stability of the cover material must be analyzed in final design by a registered engineer.

When concrete cover material is used, it shall have a minimum thickness of 3 inches with a minimum compressive strength of 3,000 psi. The minimum side slope shall be 1.5:1.

During Phase II of the Level II Study and with the approval of the irrigation district, two piping materials were investigated and preliminary opinions of probable costs were generated. The piping materials which were investigated were HDPE and steel reinforced HDPE.

A key point for the preferred alternative for the project was to fit within current available funding opportunities. A project that did not do this would not be feasible. For the levels of funding available from WWDC and BOR, it was determined that the first phase of the Austin & Wall project should cost approximately $3 million. This would only allow for replacement of a portion of one canal.

After a thorough review of estimated construction costs and salt load savings, it was determined by the Austin & Wall Irrigation District board that the Phase I project would replace the canal downstream from the Uinta County Road 231 crossing. Approximately 6 miles of canal would be replaced with pipe ranging from 20" to 48" diameter. It is estimated that approximately 17,000 feet of pipeline would require imported bedding. The remainder of the pipeline will be bedded using native material excavated along the pipeline route.

5.0 SALINITY TESTING AND INVESTIGATION

Discussions were held with USGS and BOR representatives regarding collection of salinity data in the Blacks Fork River drainage. The purpose of this is to determine if the area north of the Blacks Fork River contributes more salt to the river system than the area south of the river. This hypothesis has been suggested by the irrigators and NRCS representatives since the beginning of the Austin and Wall Canals study process. This is mainly due to experience on the ground, as there are many areas north of the river that exhibit saline properties, even to the extent that significant salts have formed on the ground surface.

Assistance in collecting salinity data was given by the Uinta County Conservation District (UCCD). The UCCD has assisted the NRCS in salinity studies in the past, and have an InSitu Troll 9500 water quality testing device used to obtain salinity and conductivity readings. The UCCD calibrates the instrument on a regular basis. The portable device allows for readings at virtually any location, and utilizes a hand-held data collector.

Testing was initially conducted on April 4, 2012 by representatives of UCCD, Austin/Wall District, and SEI. Testing was conducted as early in the season as possible to collect data prior to significant irrigation activities. Data were collected from 11 sites spaced through the area on both sides of the Blacks Fork River. The main analytes were Salinity and Conductivity. In addition to tests with the hand-held device, water samples were collected from 6 sites. These water samples were submitted to Energy Laboratories in Casper, Wyoming for analysis.

A second round of testing was conducted on June 11, 2012. Testing was conducted at five of the same sites as tested on April 4. Three additional sites were also tested. In addition to the data collected with the hand-held device, 5 additional water samples were collected and sent to the lab for analysis.

Following the compilation of the test results, a ratio of Total Dissolved Solids (TDS) to Specific Conductance (SC) was calculated for both sides of the river based on data from the laboratory samples. Using the calculated ratios and median SC values, an "average" TDS value for both north and south of the river was calculated along with a value for the river itself. SC data for the Blacks Fork River above Fort Bridger were obtained from UCCD, and represented their data collection efforts in 2009 and 2010.

The TDS values were converted to a salt loading using a ton/ac-ft unit. The salt loading factor was then determined for each side of the river in the same ton/ac-ft units. The resulting salt loading factors are 5.7720 tons/ac-ft north of the river, and 0.3371 tons/ac-ft south of the river. It is apparent that the north side of the river has a much higher salt loading factor based on the collected data.

The collected salinity data and analysis was submitted to the BOR CRBSCP for review. This data was presented to the Science Team and to the Technical Advisory Group (TAG) to the Advisory Council. The Science Team and the TAG were not supportive of results and did not recommend to the Advisory Council to fund additional study at this time.

6.0 SCP DATA COLLECTION AND APPLICATION PREPARATION

As part of the Level II Phase II study, preparations were made to apply a second time for funding through the Colorado River Basin Salinity Control Project (CRBSCP). Funding through the salinity project has occurred on a regular basis in the past, and has generally been available every two or three years. The Funding Opportunity Announcement (FOA) for the CRBSCP was issued by the BOR in August 2012 under FOA No. R12SF40034.

It was determined that the level of funding available through WWDC would be approximately $1.6 million over a three year period. This would not cause a funding crunch with regards to the WWDC rehabilitation budget. Also, the funding would be closer to 50%-50% between the two funding sources. With this level of funding, it was obvious that only a portion of one canal could be rehabilitated at one time. The Austin & Wall Irrigation District determined to start with the Austin Canal, and it was decided that starting at the bottom of the canal would give them more benefit for the given budget.

The project as proposed would replace the lower portion of the Austin Canal from the crossing of County Road 231 to the end of both legs. This resulted in an estimated salt load reduction of 1,092 tons/year at a cost of $1.35 million being funded through the CRBSCP. As part of the CRBSCP application, this cost is amortized over the design life of the project.

From the estimated salt reduction and the amortized cost of the project, a cost effectiveness value is calculated to determine the cost per ton of salt reduced per year. The cost effectiveness value for the Austin and Wall project was calculated to be $57.55 per ton of salt per year. According to the FOA, cost effectiveness is the prime criteria for selection. In a letter dated December 21, 2012, the BOR notified the AWID that they had been selected for award of funding.

7.0 GIS INVENTORY UPDATE

As part of the Level II Phase I Study completed in 2011, a Geographic Information System (GIS) was expanded which was created during the Level I Study in 2009. Additional information obtained in this Level II Phase II Study has been incorporated into the Project GIS. The GIS information has been prepared in a decimal degree ArcView 9.3 format. It includes locations of Phase II seepage testing, visible seepage locations along canals, salt loading testing sites and additional existing takeouts.

8.0 PERMITTING AND MITIGATION

Information regarding federal, state, and local permits and approvals was collected previously as part of the Austin and Wall Canals Level II Phase I Study. This research included wetland permitting and cultural resources investigations. A summary of the wetland and cultural resource reports were presented in the Level II Phase I Study.

A variety of federal, state, and local permits and approvals could be required for the rehabilitation of the Austin and Wall Canals.

9.0 CONCEPTUAL LEVEL DESIGNS AND COST ESTIMATES

The BOR standards require that any liner used on a project funded under the CRBSCP must have a projected life of 50 years. The only lining which qualifies under this standard is a 6" reinforced concrete liner. HDPE pipe became the chosen alternative for canal rehabilitation in each of the previous studies. During this Study, HDPE pipe and steel reinforced HDPE pipe were investigated. HDPE pipe has the longevity required by the funding agencies.

Improvement	Cost per running foot
Concrete Liner	$155.00
Open Channel HDPE Pipe	$92.00
Open Channel Flow HDPE Pipe w/ Steel Reinforced HDPE for Pipe Sizes of 48" Diameter	$88.00

Because of the cost of using a concrete liner and concerns with freeze thaw and the uncertainty involved with pressure ratings associated with the use of steel reinforced HDPE, it was determined that the use of regular HDPE would be the choice most likely to meet the needs of the irrigation company and remain within the funding limits required by the Bureau of Reclamation.

The construction portion of the project will need to be accomplished over portions of two years during the period from September 1 through the end of May the following year. Water flow will be required in the canals during irrigation season. Thus no construction can take place prior to September 1st each year. Construction work beyond the end of December will encounter winter

conditions but work could continue depending on the seasonal weather. Completion of the project would take place in May.

Austin Canal Replacement Project
Proposed Funding and Construction Schedule

- 2013 Funds Request:
  CRBSCP = $150,000
  WWDC = $150,000
  Total 2013 – $300,000
    - May - September: Begin NEPA Compliance, Cultural Resources, Habitat Evaluation, Survey, Aerial Photography
    - October – December: Detail Design, Easement Preparation

- 2014 Funds Request:
  CRBSCP - $850,000
  WWDC = $850,000
  Total 2014 – $1,700,000
    - January– June: Detail Design, Easement Preparation, Agency Review
    - June: Advertise & Bid Project
    - September– December: Construction

- 2015 Funds Request:
  CRBSCP - $350,000
  Loan = $100,000 (from WWDC)
  WWDC = $500,000
  Total 2015 – $950,000
    - January– May: Construction
    - Substantial Completion – May 2015

Construction Complete – July 2015

10.0 PROJECT FINANCING

The total project cost for replacing approximately 32,000 lineal feet of the lower reaches of the Austin Canal with piping is just under $3,000,000. Project funding will be supplied using WWDC and CRBSCP funding. A portion can also be funded by the AWID. Funding of future projects, such as for the Wall Reservoir and additional portions of the Austin & Wall Canals, would require additional applications for funding and would be subject to the rules and regulations in place at the time of application.

The AWID will provide approximately $100,000 of funding for the proposed project through a loan provided by the WWDC. The WWDC has indicated that because the project qualified for CRBSCP funding, they will participate in funding the balance of the total costs of the project pending WWDC and State Legislature approvals. This would amount to approximately $1,600,000, of which roughly $1,500,000 would be grant and $100,000 would be loan to be repaid by the AWID. Upon review of the application, the determination was made by the BOR that the proposed Austin and Wall pipeline

project would create salt loading savings in excess of the required amount necessary to receive funding under the CRBSCP. Therefore, the BOR will fund at most $1,350,000 of the proposed project.

11.0 FINDINGS AND RECOMMENDATIONS

11.1 SUMMARY OF FINDINGS

- Seepage loss rates for the Austin Canal ranged from -0.39 to 4.26 cfs/mile on June 20th, 0.06 to 0.76 cfs/mile on June 28th, and -0.67 to 3.7 cfs/mile on July 12th.
- Canal liners investigated during this study included; soil sealants, geomembranes, geocomposites, earthen, geosynthetic clay, corrugated HDPE, concrete, shotcrete, shotcrete with liner, and liners covered with gravel. The installed cost per square foot of the liners varied from $0.17/sq-ft for soil sealants to $7.00/sq-ft for corrugated HDPE.
- The durability of the liner types varied from one to two years for soil sealants to 40-60 years for a 6" concrete liner. Concrete liners were the only liners which met the durability requirements of the Bureau of Reclamation.
- The estimated cost of 6"concrete liners is $155.00 per foot. This compares with $92.00 per foot for HDPE pipe and $88.00 per foot for steel reinforced HDPE. The steel reinforced HDPE would only be considered for use when required pipe sizes are 48" in diameter.
- The salinity levels of water from seeps and drains were observed. It appears that levels north of the Blacks Fork are roughly 8 to 10 times the levels south of the river.
- Measurements of salinity and Total Dissolved Solids (TDS) can be taken directly using a handheld meter. Measurement of major ions can be made from lab testing of water samples.
- Mean TDS values were calculated for both sides of the river based on data from the lab samples. The TDS values were converted to salt loadings.
- There are numerous locations of water seepage along each canal. These locations were added to the GIS database.
- Salinity testing results were submitted to the Bureau of Reclamation (BOR) for review. It was determined by the BOR that salt loading rates in the Blacks Fork drainage would not be adjusted at this time. A complete study by the BOR or USGS would be required prior to adjustment of the salt loadings.
- The BOR did not appropriate funding for a salt loading study of the Blacks Fork drainage at this time.
- Any construction schedule for projects associated with the Austin and Wall Canals will be constrained by the available funding. This will restrict the amount of work that can be complete in a given year.
- A project was proposed to replace roughly 6 miles of canal with pipe. This project would have an annual salt savings of 1,092 tons of salt. The project is estimated to cost $2.95 million with funding to be provided by the BOR ($1.36 million), WWDC ($1.5 million), and a loan from WWDC ($100,000).
- A Funding Opportunity Announcement was issued by the Bureau of Reclamation (BOR) in August 2012. Interim applications in order to obtain salt loading calculations were required, and the final application was due on November 16, 2012. Salt loading values for the various segments of the Austin Canal were calculated by the BOR.

- Funding to be awarded through the Colorado River Basin Salinity Control Program (CRBSCP) was limited to a maximum of $6 million dollars for a given project. This maximum was for CRBSCP funding only, not matching funding. Preference was given to projects estimated to reduce the salt load by at least 1,000 tons per year and would be completed in 5 years or less.
- In a letter dated December 21, 2012, funding was awarded for the Austin and Wall Irrigation District project in the amount of $1,350,000.
- The main source of funding for any improvement project is the Wyoming Water Development Commission (WWDC). WWDC funding is provided through their Rehabilitation account, which is somewhat limited. The WWDC was willing to fund approximately $500,000 annually for this project, for a 3-year total of $1.5 million. An additional $100,000 of loan funds would also be available.
- Funding for the proposed project was approved by the WWDC and the Wyoming Legislature as part of the 2013 Omnibus Water Bill for construction.
- WWDC and BOR funding is scheduled for 2013 through 2015.
- There are a number of other sources of funding available, however these sources would contribute only a relatively small amount of funds to any project and may not provide much value in relation to WWDC and CRBSCP funding.
- There are numerous improvements not covered by this project that could possibly obtain funding in the future from the BOR/CRBSCP and WWDC.

11.2 RECOMMENDATIONS

- Any adjustment to or variation from the current canal alignment should be done carefully and should take ownership of affected property into account. Easements will be required for any new right of way required to accommodate the pipeline.
- Adjustments to the canal alignment should also take existing wetland areas into account, as placement of fill in an existing wetland area not associated with either canal would require a 404 permit through the Corps of Engineers.
- HDPE pipe cost and strength characteristics make the alternative of choice for seepage reduction in the canals. Steel reinforced HDPE may provide a cost effective alternative to regular HDPE for locations requiring 48" diameter pipe.
- As funding through the CRBSCP has been awarded for improvements to the Austin Canal, necessary steps to take advantage of this funding to improve these water delivery systems should be taken. This will have a significant positive impact to the agricultural production of areas within the Austin and Wall Irrigation District.
- The location of the two lithic scatters that are National Register of Historic Places eligible should be avoided if possible. Care should be taken during the design phase to ensure preservation if at all possible.
- Other studies and investigations required for the National Environmental Policy Act (NEPA) process as well as other federal and state required clearances should take place early in the design process. These investigations and approvals should also take place as soon as possible in order to prevent future conflicts or delays.
- The preferred option is to construct a pipeline roughly following the existing canal alignments via open channel flow. Some variation from the alignment will be advantageous

in order to shorten the length of installed pipe. The pipe should be sized to deliver roughly 80% of the permitted flow rate. This will allow the project to be financially feasible, and will still convey the peak flow rate available on most years. The positive of eliminating seepage loss throughout the year (particularly later in the growing season) vastly outweighs the negative of not delivering the larger peak flows during runoff on some years. This will significantly lengthen the irrigation season during each water year. Also, water purchased from the Bridger Valley Conservation District will not be subject to significant seepage losses prior to arriving on farm.

- Continued request(s) should be made to the BOR and USGS to appropriate funding for additional study of the sources of salinity in the Blacks Fork drainage. This may enable additional funding for areas with high salt loading in the future.