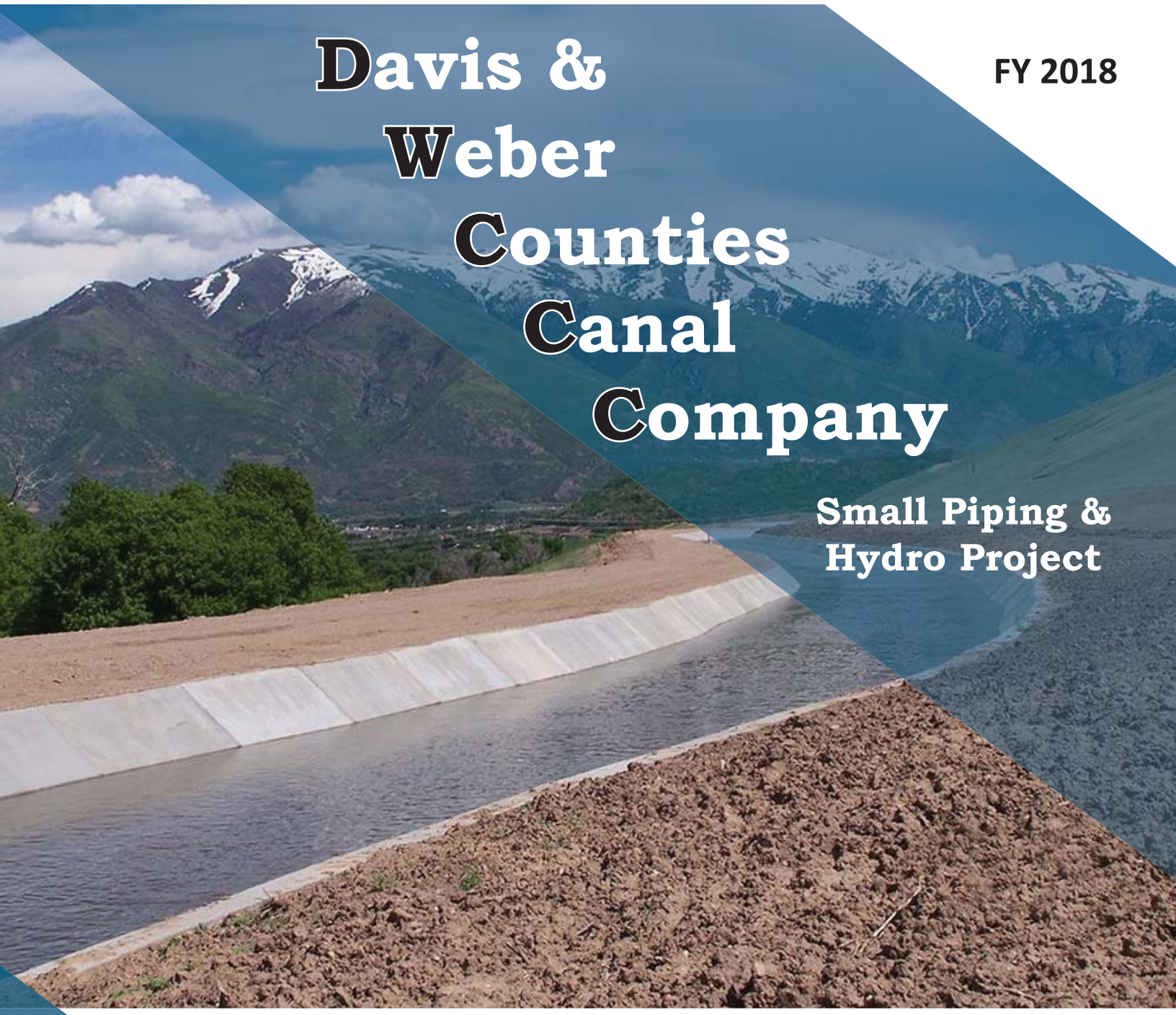
WaterSMART Grants: Water and Energy Efficiency Grants
FOA# BOR-DO-18-F006

Davis & Weber Counties Canal Company

FY 2018

Small Piping & Hydro Project



Applicant

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Applicant Info

Date: May 10, 2018

Applicant Name: Davis and Weber Counties Canal Company (DWCCC or Company)

City, County, State: Sunset City, Davis County, Utah

Project Manager:

Bryce Wilcox, P.E.
Project Manager
801-547-0393
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Project Funding Request: Funding Group I, $300,000; Total Project Cost, $750,000

Project Summary

Specify the work proposed, including how funds will be used to accomplish specific project activities and briefly identifies how the proposed project contributes to accomplishing the goals of this FOA.

The Davis and Weber Counties Canal Company (DWCCC) Small Piping and Hydro Project is being requested under Funding Group I and has been identified in the System Optimization Review (SOR), approved in 2013 and updated in 2017, as number three on the priority project list. This project will result in the conservation of approximately 523 acre-feet of water and the better management of approximately 5,499 acre-feet of water, which flows through the project area. The project will generate approximately 8,197 kWh of renewable energy that can be used by the Company to run their shop. The project consists of piping 1,200 feet of unlined canal and replacing 320 feet of deteriorated steel pipe with a single 66-inch reinforced concrete pipe. Along with this, a 2 kW cross float hydropower system will be installed in the canal by the DWCCC shop to generate 8,197 kilowatt hours (kWh) of energy per year. The DWCCC project is a positive step toward achieving the goals of the WaterSMART program by implementing methods and materials that have proven successful for water conservation and energy sustainability.

Length of Time and Estimated Completion Date

State the length of time and estimated completion date for the proposed project.

The preliminary master planning for the piping component of the project has been completed as part of an approved System Optimization Review. The environmental report has been completed for this project area. The project is ready to prepare the final design as soon as the contracts are signed. DWCCC anticipates that contracts will be signed between September and December 2018 and that design can begin by January 2019. Design is estimated to take 6 months (January 2019 – July 2019). The piping portion of the project will need to take place outside of the

irrigation season (April 15- October 15th) and will require six months to complete (October 2019 – April 2020). The project will be closed out by September 30, 2020. The project will be accomplished within the two-year allowance.

Below is an estimated project schedule that shows the stages and duration of the proposed work, including yearly funding, major tasks, milestones, and dates:

SCHEDULE *Milestone/Task*	Sept – Dec 2018	Jan – April 2019	May – Sept 2019	Oct – Dec 2019	Jan – Feb 2020	Mar - Apr 2020	May – Sept 30, 2020
Sign WaterSMART contracts							
Environmental Document prepared and approved by Reclamation	Completed						
Piping Design and Project Bid/Award and Hydropower design							
Project Construction							
Final reporting and project close-out							

Federal Facility

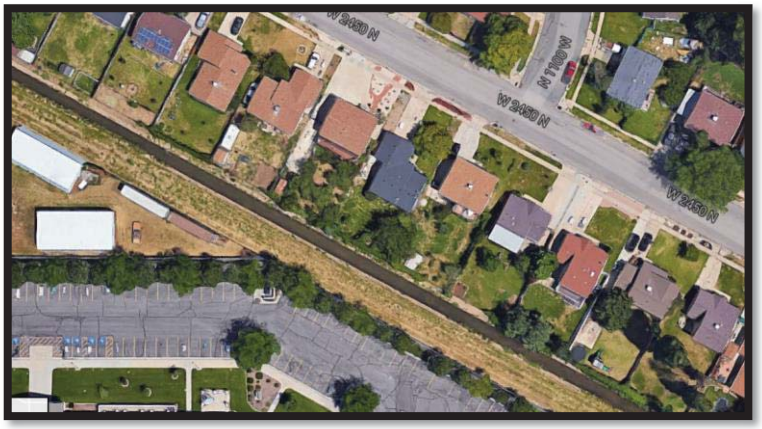
Whether or not the project is located on a Federal facility.

The project is not directly located on a federal facility. However, DWCCC receives water from the Echo and East Canyon reservoirs, which are owned by Reclamation. This project will permit better management of DWCCC's water, allowing water to stay in the reservoir longer during the irrigation season, which can benefit habitats and recreational opportunities within the reservoir.

Background Data

The proposed project area for the canal under consideration is located in Layton, Utah. The canal is surrounded on both sides by commercial and residential. The 100-year-old unlined earthen canal is in very poor condition and has had many seepage issues over the years. The canal's surrounding land users create many maintenance access issues. Water is seeping through the canal embankment into residential and commercial

Photo 1 Main Canal through Residential Area in Layton



properties, and into open fields along the canal. The weakened condition of the canal puts many of these surrounding properties at high risk of flooding. The seeping water erodes the fine soils and increases vegetation growth. If enough soil material is lost, voids occur and can potentially breach the canal. The voids are also an invitation for rodents and other small mammals to build homes. A larger breach in this area would be devastating! Homes, water users, municipalities, and farmers would lose their water supply; and the roads, intersection, and commercial businesses would experience significant impacts and property damage. This breach would also place more demands on municipal water supplies beyond DWCCC's capacity to deliver.

Water Supply

Describe the source of water supply, the water rights involved, current water uses (e.g., agricultural, municipal, domestic, or industrial), the number of water users served, and the current and projected water demand. Also, identify potential shortfalls in the water supply. If water is primarily used for irrigation, describe major crops and total acres served.

Source of water supply and water rights involved.

The source of DWCCC's water supply is from the direct flow rights of the Weber River, which is supplied from reservoir storage in the Echo and East Canyon Reservoirs. Water is delivered through a series of canals, ditches, and low and high pressure pipelines from the main canal.

Direct flow water rights from the Weber River, based upon the flow of the river for direct use, are as follows:

- Flood 433 cfs,
- High Water 216 cfs
- Low Water 133 cfs
- Storage rights of 57,154 acre-feet (28,000 from East Canyon Reservoir and 29,154 from Echo Reservoir)

The 5-year average annual water rights available is 63,758 acre-feet. The average annual use delivered through the canal system is 48,743 acre-feet. The remaining portion (15,016 acre-feet) is directly diverted from the Weber River by other shareholders.

Current water uses and number of water users served.

The majority of the water use (based on volume) is agricultural with over 40,790 irrigated acres. Secondary water uses for lawns and garden, parks, churches, and schools consists of over 31,439 connections within the DWCCC service area, including water supplied to the sub-districts of Roy, South Weber, Syracuse, and Weber Basin Water Conservancy District.

Current and projected water demand/potential shortfalls in water supply.

Current demands are for approximately 64,000 acre-feet of water. The Company has seen significant changes in safety requirements and laws regarding water use and water rights. Local laws and policy changes, terrorist threats, and natural disasters, including potentials for residential property flooding have reminded the Company of the external risks and demands placed upon them and their water supply. Through extensive planning and evaluation, a list of potential water demands includes the following:

- Water to serve an additional 10,000 secondary water connections within the next ten years as growth and land use conversions continue throughout the DWCCC service area.
- Additional water to meet municipal and industrial (M&I) demands as communities and commercial areas continue to evolve and grow. Information from the 2010 census indicates that the DWCCC service area, which includes areas within Weber and Davis Counties, doubled in population in 10 years instead of 20 years as projected earlier. The Company also supplies water to areas within Morgan and Summit Counties. They have also experienced significant and intense growth according to the 2010 census. This population change has prompted DWCCC to plan and prepare for greater secondary water needs beyond what had originally been anticipated.
- Water to service the fast-growing Summit County area. The Summit Water Distribution District has 303 shares of DWCCC water, and Weber Basin Water Conservancy District is currently leasing 5,000 acre-feet of water for the Park City/Snyderville Basin areas. Their thirst for water is growing at staggering rates and will have a significant impact upon demands on available existing DWCCC water supplies.

DWCCC faces potential shortfalls in three main areas:

1. The principal potential shortfall for the Company is water losses that could cause potential flooding to residents through the main canal. These losses have impacted water delivery in past drought years, which has caused significant shortages. Four of the last five years (2012-16) have been considered drought years. With the amount of water losses in the system, many users downstream have been impacted. Water seepage and losses within this project area are estimated to be at least 523 acre-feet of water annually; possibly more. Visual inspections show water seeping from the canal banks and into the adjacent backyards and fields.

The project area of the canal for consideration is an unlined earthen canal that is in very poor condition. A larger breach in this area would have a significant impact on the water supply because this section of the main canal delivers 5,500 acre-feet of water annually and transports all of the water to Layton and Kaysville cities. If a breach in the canal occurred, the entire canal would have to be shut down, impacting all users. The roadways, intersection, and commercial businesses would be highly affected and would have a major financial effect on the economies of Clearfield and Layton City; not to mention the traffic flow impacts that would occur in the area.

2. Drought - DWCCC potential shortfalls from drought can and have had an impact on the current water supply. The State of Utah does not have a detailed drought management plan, but has made strides since the severe drought of the late 1990s and early 2000s. However, extreme concerns exist in the DWCCC service area, which caused them to redefine their drought mitigation plans and implementations on an annual basis. In 2012 - 2016, the snowpack was minimal at best, which supplies reservoir storage. The Company was forced to start using their storage water much earlier than usual. In 2015, Utah had the hottest winter on record with the snow melt happening in March – three months earlier than usual, cutting water to the lowest allocation in 30 years. The current year has similar characteristics.

The irrigation season was cut short by fourteen days in 2013, 2014, and 2015. In 2012, the Company received only forty days of the natural flow of the Weber River for the season. This

required the Company to request that all users limit their water usage very early in the season and throughout the year.

The Company evaluates its drought situations and operational procedures each year, including its management decisions for existing water supply conditions. DWCCC gathers data and identifies potential areas of concerns by monitoring flow rates at various locations on a regular basis, which includes correlation with other entities. The amount of water available for delivery is determined each year by natural flow rights and storage rights.

The drought has severely impacted the amount of storage carryover water that has been available at the end of the irrigation season, and during the past few years of drought, the natural flow rights were limited or not available. The water losses from seepage, potential flooding, and drought conditions make this a high-priority project on the lower main canal.

3. Growth - Within the past ten years, DWCCC's service area has seen significant population increases with many new residential housing developments, businesses, schools, and churches; some of which border next to the main canal. Davis and Weber Counties are listed as two of the fastest growing counties in Utah. Both of these counties are served by DWCCC water. Further evidence of growth is shown in the conversion of water used for agriculture purposes to that of residential lawn and garden applications. In 1995, agricultural water usage was 80 percent of the total water used, whereas today, the use is approximately 55 percent; according to the Governor of Utah Water Task Force Committee. The 25 percent difference is water that has been converted from agriculture crop production to outdoor agriculture uses for lawns, gardens, parks, schools, churches, and municipal and commercial needs.

As the population increases in the service area, the need for more culinary and secondary water also increases. This demand could have significant impacts on the Company's ability to provide water for new customers in their service areas; which are running short on water due to drought conditions, insufficient storage, and transmission water losses from unlined or unenclosed distribution systems.

If water is primarily used for irrigation, describe major crops and total acres served.

The canal supplies both pressure irrigation for lawn and garden irrigation systems and water for agricultural irrigation. The major agricultural crops are corn, grains, alfalfa, row crops such as watermelons, pumpkins, tomatoes, etc. With serving nearly 65 different ditch companies and thousands of residential lawn and garden users, it is difficult to estimate the total acres of agricultural lands served.

Water Delivery System

Describe the applicant's water delivery system as appropriate. For agricultural systems, please include the miles of canals, miles of laterals, and existing irrigation improvements (e.g., type, miles, and acres). For municipal systems, please include the number of connections and/or number of water users served and any other relevant information describing the system.

Reservoirs

- East Canyon Reservoir storage – 48,000 acre-feet capacity (DWCCC owns 28,000 acre-feet of this capacity)

- Echo Reservoir storage – 74,000 acre-feet capacity (DWCCC owns 39.4% of this capacity)

Canal System

- River Diversion includes four 18-foot wide radial gates across the Weber River to divert water into the DWCCC forebay channel
- Forebay channel includes trash racks, a canal gate that controls the flow into the main canal, and an overflow crest gate structure that diverts excess water back into the Weber River, which helps control deliveries and fish flow protection.
- The DWCCC canal system consists of 17.2 miles of main canal, which is defined as the upper main canal and the lower main canal sections, and includes:
    - No liner or Deteriorated 100 Year old liner – 4.3 miles
    - 1980's and 1990's Non-Reinforced Concrete Open Canal Liner – 2.2 miles
    - 2001 to 2011 Reinforced Concrete Open Canal Liner – 4.1 miles
    - Enclosed Pipe or Box Culvert – 6.2 miles
    - Box Culverts under Highways and Freeways – 0.4 miles
    - 60 diversion gates and siphons servicing 65 different ditch companies

Pressurized Secondary System

- Approximately 36 miles of pressurized secondary water transmission trunk lines
- Sunset Secondary Water Reservoir with 34 acre-feet capacity
- Church Street Secondary Water Reservoir with 43 acre-feet water storage capacity
- Kaysville East Secondary Water Reservoir with 24 acre-feet water storage capacity
- 200 South West Point Secondary Water Reservoir with 12 acre-feet water storage capacity
- Roy Water Conservancy District with a 125 acre-feet water storage capacity
- 112.4 miles of secondary water distribution piping in the West Point/Clinton System
- 64.8 miles of pressurized secondary water distribution piping in the Kaysville/Layton System
- 3.2 miles of pressurized secondary water distribution piping in South Weber System
- Syracuse City with three water storage reservoirs that total 106 acre-feet water storage capacity

Energy Efficiency

If the application includes hydropower or energy efficiency elements, describe existing energy sources and current energy uses.

The DWCCC is supplied power by the Rocky Mountain Power Company and uses approximately 464,366 kWh of electricity annually throughout its system. To help offset the electricity usage, DWCCC has been installing solar and hydroelectric facilities. DWCCC has been working hard to offset their usage over the past couple years by installing the following.

- 2 Smart Hydro 2kW turbines generating a total of 17,568 kWh per year (installed 2017)
- 2 Cross float 2 kW Turbines Generating a total of 17,568 kWh per year (to be installed June 2018)

- 2 Hydro-Power Pelton Wheel 4kW Turbines generating a total of 7,200 kWh per year (installed April 2018)
- 9.92 kW Solar array generating 16,723 kWh per year (to be installed May 2018)

These facilities will offset 59,059 kWh of electricity annually.

Relationship with Reclamation

Identify any past working relationships with Reclamation. This should include the date(s), description of prior relationships with Reclamation, and a description of the project(s).

DWCCC has had a number of projects in conjunction with Reclamation over the past years, starting in the 1930s with the construction of Echo Dam and in the 1964 expansion of the East Canyon Dam. Reclamation facilities exist in the same Weber River Basin as this proposed project. Some DWCCC stock is owned by Weber Basin Water Conservancy District (WBWCD), a Reclamation project. Some of their water is delivered through the DWCCC facilities, approximately 15,016 acre-feet.

In 2017, DWCCC received a WaterSMART Energy Efficiency Grant for $1,000,000. The Project includes piping 3,220 feet of unlined earthen canal with two 66-inch diameter pipes, 500 feet of earthen canal with a single 66-inch diameter pipe; and installing a 10kW solar array. The project will save 733 acre-feet of water and produce 16,723 kWh of power annually.

In 2016, DWCCC received a WaterSMART Energy Efficiency Grant for $300,000. The project included piping 950 feet of 100-year-old deteriorated canal liner, with an 8-foot wide by 7-foot high reinforced concrete box culvert, and a 2kW small hydropower generation turbine at key locations to generate 8,784 kWh of power per year for each project. The piping portion of this project is nearing completion and the hydropower portion will be constructed in June 2018.

In 2015, DWCCC received two WaterSMART Energy Efficiency Grants for $300,000 each. The projects included installing 650 secondary water meters and piping 2,000 feet of open, unlined canal. Both projects include small hydropower generation turbines at key locations to generate 11,664 kWh of energy per year.

In 2014, DWCCC received a WaterSMART Energy Efficiency Grant for $1 million towards a $3.05-million-dollar project. The project includes metering five turnouts, placing over 4300 feet of box culvert and large diameter RCP pipe in the main canal and the installation of two 5 kW small hydropower generation turbines at key locations to generate 8,784 kWh of energy per year.

In 2011, DWCCC received a WaterSMART System Optimization Review grant. This Plan was completed in 2013 and has identified the project priorities in the canal water system. The SOR is reviewed and updated as needed. This canal project has been designated as a top priority in the completed SOR Plan and will assist in accomplishing the goals of the Plan.

In 2009, DWCCC received a $3.6 million matching “Challenge Grant” to replace the forebay channel, river diversion structure, and gates, and install 1,300 feet of box culvert located in Weber Canyon. The SCADA system was also upgraded to allow for remote operation of the new facilities. That project also included 3,250 feet of two 66-inch diameter RCP pipes, 500 feet of three 66-inch diameter RCP pipes, and 1,650 feet of new open canal trapezoidal concrete liner with water stop to replace existing deteriorated concrete liner sections and areas with no liner at

all. Many entities, including Federal, State, County and City Governments, private property owners, water districts, and shareholders have participated in and worked toward the success of DWCCC's infrastructure rehabilitation projects.

In 2005, the Company received a Water 2025 "Challenge Grant" for a water measurement and automation project. This measurement and automation project is highly successful in that it has identified areas of water savings, provided for more accurate measurements and better monitoring, established faster reaction times for emergency responses, and implemented automation throughout DWCCC's system.

Project Location

Provide specific information on the proposed project location or project area including a map showing the geographic location. For example, {project name} is located in {state and county} approximately {distance} miles {direction, e.g. northeast} of {nearest town}. The project latitude is {##°##'N} and longitude is {###°##'W}. For larger project areas, please provide location information in one of the following formats: 1. Shapefile (.shp), 2. KMZ/KML (.kmz or .kml) aka Google Earth File, not an exported GoogleEarth map, 3. AutoCAD (.dwg), 4. PDF map (.pdf)

Geographic Location

The service area of DWCCC includes communities located in Weber, Davis, Summit, and Morgan Counties, including the cities of West Point, Clinton, Sunset, Layton, South Weber, Kaysville, Roy, Clearfield, West Haven, Riverdale, and Syracuse, with a total population of over 370,000 residents. They also provide water to the Snyderville Basin Area, South Weber, Roy, Clinton, West Point, Syracuse, Layton, and Kaysville for irrigation and secondary water use. The project location, latitude and longitude, and an overview of the entire service area is shown in the attached maps. See Attachments A, B, and C for maps for the project location map and detailed project information.

Technical Project Description

Describe the work in detail, including specific activities that will be accomplished. This description shall have sufficient detail to permit a comprehensive evaluation of the proposal.

The proposed project will pipe a total of 1,200 feet of the unlined earthen canal and replace 320 feet of deteriorated steel pipe through Layton City with a 66-inch diameter reinforced concrete pipe. This project will also install a metering station on one of the large turnouts to better manage water distributions. This project will fill in the last gap on the lower end of the canal and will make it so that the lower 14,750 feet of the canal will be completely enclosed, reducing losses and improving safety.

The existing unlined earthen canal is elevated above the adjacent ground and has many condition issues, significant seepage losses, and is difficult to access and clean. This project will allow DWCCC to better manage approximately 5,499 acre-feet of water that flows through this portion of the canal and to reduce seepage, which will conserve 523 acre-feet of water. The project also

includes placing a 2kW crossfloat hydropower turbine in the canal that will produce 8,197 kWh annually. This power production will provide DWCCC with the ability to power their shop.

This project is part of an approved SOR that was developed in 2013 and updated in 2017. See Attachments A, B, and C for maps for the project location map and detailed project information.

E.1. Technical Proposal: Evaluation Criteria

E.1.1. Evaluation Criterion A – Quantifiable Water Savings

Quantifiable Water Savings

Describe the amount of estimated water savings. For projects that conserve water, please state the estimated amount of water expected to be conserved (in acre-feet per year) as a direct result of this project.

This project will conserve an estimated 523 acre-feet per year. 5,499 acre-feet of water flow through this area annually. This is an approximate 10% water savings.

Describe current losses. Explain where the water that will be conserved is currently going (e.g., back to the stream, spilled at the end of the ditch, seeping into the ground)?

Water is seeping through the unlined canal into the ground, lost to evaporation, and is also being taken up by vegetation. The soils around the canal are granular soils and allow the water to pass through very quickly.

Describe the support/documentation of estimated water savings. Provide sufficient detail supporting how the estimate was determined, including all supporting calculations.

The flows through the canal are tracked and monitored. An inflow-outflow model over an irrigation season was used to calculate the water savings. Under the Canal Lining and Piping section below the calculations and assumptions are have been documented for the estimated water savings. Most recently (May 2017), DWCCC met with the Bureau of Reclamation who performed a Water Conservation Verification study. This Study verified water losses estimates for a very similar WaterSMART project within the same canal and for over a similar length. The calculated water losses DWCCC used were compared to the Reclamation Water Conservation Verification study and their conclusion corresponded with our calculations. See Attachment D for Reclamation Verification Report Section.

Canal Lining/Piping

a. *How has the estimated average annual water savings that will result from the project been determined? Please provide all relevant calculations, assumptions, and supporting data.*

   During the 2017 irrigation season, DWCCC monitored the inflow-outflow along the lower 7.7 miles of canal. There is a meter in the main canal, called the "Roy Flume." This meter was verified in the spring of 2013 by an outside company and was tested to be accurate within 5 percent. DWCCC currently has ten continuously recording metered turnouts and eleven turnouts with flumes and/or weirs as measuring devices along the lower portion of the canal. DWCCC took daily readings and measurements on all the non-SCADA recording flow measurement turnouts. All of the flow measurements were compiled on a monthly basis,

showing the water used at each turnout and how much water entered the system. To determine project water losses, DWCCC used an inflow-outflow method over the entire season. The total amount metered at all of the turnouts was subtracted from the Roy Flume measurements to calculate how much water was lost to the system.

The total that passed through the Roy Flume was 50,610 acre-feet. The total amount delivered through the turnouts was 43,643 acre-feet. From these measurements, we found that we lost 6,967 acre-feet through the 7.7 miles of the lower main canal system in 2017. The following table shows the results of the system monitoring for 2017.

Table 1 Metering and System Monitoring

Gates	Water Delivered (Acre-Feet)
WBWCD Roy Pond	1,963
North Flume	457
Roy WCD	7,093
Sunset Res	7,222
Gate 03A	396
Gate 8	105
Gate 9	13
Gate 11	536
Gate 15	2,180
Gate 18	6,638
Gate 19	96
Gate 23E	3,273
Gate 23W	6,236
Gate 24A	123
Gate 25	145
Gate 27	1,312
Gate 30	1,494
Gate 33	285
Layton Res	3,720
West 05 Butler	132
West 05 Kap	224
Totals	**43,643**
Total Water Delivered at Roy Flume	**50,610**
Difference or Water Lost to System	**6,967**

Water Loss of the Canal Per-foot

Below the Roy Flume, the main canal has 15,510 feet of unlined or deteriorating liner that the water has to pass through in order to be delivered to the DWCCC users. The water loss calculations on per-foot basis are being distributed equally across the main canal. Given these components, the water loss per foot is as follows: 6,967/15,510 = 0.449 acre-feet per foot of canal.

Project Water Losses

This project will enclose 1,200 feet of deteriorated and unlined canal within the main canal, for a total water savings of 539 acre-feet (1,200 ft * 0.449 acre-feet per foot). Waterlosses in the 320 feet of deteriorate steel pipe are not included in the calculations. Using a 3 percent loss for reinforced concrete pipe, the net water savings for the project will be 523 acre-feet per water season. The improvements to the canal will allow DWCCC to manage approximately 5,499 acre-feet of water better as it flows through the project area.

As stated previously in May 2017, the Bureau of Reclamation completed a Water Conservation Verification of a DWCCC WaterSMART Canal Piping Project. This WaterSMART project piped 950 feet of open canal. Reclamation's conclusion was that the 950 feet of canal would have a water savings of 548 acre-feet. See Attachment D for Reclamation Verification Report Section. The Reclamation water savings of 548 Acre-feet for 950 feet corresponds to the calculated water loss of 523 acre-feet for 1,200 feet of canal.

b. *How have average annual canal seepage losses been determined? Have ponding and/or inflow/outflow tests been conducted to determine seepage rates under varying conditions? If so, please provide detailed descriptions of testing methods and all results. If not, please provide an explanation of the method(s) used to calculate seepage losses. All estimates should be supported with multiple sets of data/measurements from representative sections of canals.*

An inflow/outflow test was done over the entire 2017 irrigation season. A known quantity of water passed the Roy Flume at the start of the lower portion of the canal. The water used at each turnout was subtracted from the total that was passing through the Roy Flume, giving the total water that was lost to the system. There are currently ten continuously metered turnouts on the canal and eleven turnouts with weirs and flumes. DWCCC took daily measurements on all of the non-continuously recording turnouts to quantify how much water was passing through each turnout. This information was taken each month to determine water lost within the system. These calculations were used to calculate the water lost in the system.

What are the expected post-project seepage/leakage losses and how were these estimates determined (e.g., can data specific to the type of material being used in the project be provided)?

Reinforced concrete pipe with sealed joints will be used, which has an estimated loss factor of minus 3 percent. These losses will be minimal and have been noted in the calculations for the water loss savings. Data specific information is available if needed. This is a commonly used material with historical loss information that is often used by Reclamation in projects.

c. *What are the anticipated annual transit loss reductions in terms of acre-feet per mile for the overall project and for each section of canal included in the project?*

Annual transit losses are estimated across the entire length of the main canal. The losses in the canal average of 6,967 acre-feet for 2.94 miles of deteriorated or unlined canal. This gives a loss of 2,372 acre-feet per mile per water season.

1. *How will actual canal loss seepage reductions be verified?*

The actual canal losses will be checked by using the same season long inflow/outflow test that was done to determine the initial losses. The Roy Flume provides a known quantity of water at the start of the lower portion of the canal. The water used at each turnout will be measured and then subtracted from the total passing through the Roy Flume. The remaining amount of water will be the total water lost to the system after the project has been completed.

DWCCC will take daily measurements on all of the non-recording water flow measurement devices to quantify how much water has passed through these turnouts. The information will be documented and calculated on a monthly basis. This will allow the Company to monitor and measure the benefits of the project to the water losses of the system.

2. *Include a detailed description of the materials being used.*

The canal will be enclosed with 66-inch diameter reinforced concrete pipe, with gasketed joints to prevent water seepage. Pre-cast boxes will be used to join the new pipe to the existing pipes in the canal.

E.1.2. Evaluation Criterion B – Water Supply Reliability

Address how the project will increase water supply reliability. Provide sufficient explanation of the project benefits and their significance. These benefits may include, but are not limited to, the following:

- *Does the project promote and encourage collaboration among parties in a way that helps increase the reliability of the water supply?*
  Yes
  - *Is there widespread support for the project?*
    This project has the support of all DWCCC water users, Clearfield City, Sunset City, Syracuse City, West Point City, Layton City, Kaysville City, South Weber City, Riverdale City, West Haven City, Clinton City, Weber Basin Water Conservancy District, Roy Water Conservancy District, the Utah Board of Water Resources, Weber River Water Users Association, Weber River Water Rights Committee, UDWR, and the Utah State Engineer's Office.
  - *What is the significance of the collaboration/support?*
    The support of the Cities, State of Utah Conservancy Districts, and all water users will allow DWCCC to work quickly through the process to construct the project. The project will be completed on property owned by DWCCC.
  - *Is the possibility of future water conservation improvements by other water users enhanced by completion of this project?*
    Yes, this project will allow other users along this area of the canal to pipe their own ditches and/or install their own sprinkling systems. If they enhanced their own ditches and developed a sprinkling system, they could realize significant water savings as well as the potential for higher crop yields. Over the past five years, other irrigators have seen the improvements that DWCCC has made on their system and have made significant changes in their ditch systems that DWCCC delivers water to.
- *Will the project make water available to address a specific water reliability concern? Please address:*
  - *Explain and provide detail of the specific issue(s) in the area that is impacting water reliability, such as shortages due to drought, increased demand, or reduced deliveries.*
    The impact to water reliability include:

    Drought: Drought has been a major concern to the reliability of the DWCCC system. Severe drought from 2012 through 2017 put a strain on the DWCCC water system and required them to shorten irrigation seasons. Snow pack for 2018 has not been any better. However this year DWCCC had a good amount of storage carryover in the Echo and East Canyon reservoirs. Drought years in the past have severely impacted the amount of storage carryover water that has been

available at the end of the irrigation season, and during the past few years of drought, the natural flow rights were limited or not available. This may be the case this irrigation season. The water losses from seepage, potential flooding, and drought conditions make this a high priority project on the lower main canal.

Growth: DWCCC's service area has seen significant population increases with many new residential housing developments, businesses, schools, and churches. As some of the fastest growing counties in Utah, Davis and Weber County are both having significant changes in water used for agriculture purposes to that of residential lawn and garden applications. As the population increases in the service area, the need for more culinary and secondary water also increases. This demand could have major impacts on the Company's ability to provide water to other new customer needs in their service areas which are running short of water based upon drought conditions, insufficient storage, and transmission water losses from unlined or unenclosed distribution systems.

- *Describe where the conserved water will go/how it will be used. Will the project directly address a heightened competition for finite water supplies and over-allocation (e.g., population growth)? Will it be left in the river system?*

  The conserved water will provide a more secure water right and be more available as a buffer during times of drought. It will also be available for secondary use as agricultural lands convert to residential lawns and gardens. Opportunities to benefit the environment, and fish and wildlife habitats on the Weber River can be considered which would allow a prolonged and better balanced stream flows of available water. The conserved water will allow flows to remain in the river system for longer periods of time and held for longer in the season in the Echo and East Canyon Reservoirs.

  DWCCC has always worked closely with local, state, and federal agencies to do their part to make percentages of their conserved water available to instream flows within the Weber River system and will continue to do so. Working with Utah Division of Wildlife Resources, Weber Basin Water Conservancy District, and others DWCCC use conserved water to increase water sustainability within the Weber River.

- *Describe how the project will address the water reliability concern?*

  The project will enclosure an open earthen canal. The canal loses significant water to seepage and root uptake. Enclosing the canal will allow the water that is seeping into the ground to be used by farmers and irrigators. This will provide additional water for use in times of drought and will allow the users to more fully use their water right.

- *Will the project help to prevent a water-related crisis or conflict? Is there frequently tension or litigation over water in the basin?*

  Yes, as mentioned in the section above, canal deterioration causes seepage and could result in a breach, which could have a significant impact on residential

areas. It will disrupt services to many communities and agricultural users. This project will secure the mainline canal and reduce the seepage into backyards and fields.

There is always tension when it comes to water. Natural disasters, drought, and un-maintained canals and ditches seem to be the major factors in developing tension within any service area. DWCCC has had its share and will continue to feel the tension, especially as demands for more water come from expanding residential growth. However, in the past few years, there has been more tension than usual. Lack of water due to the drought situation (irrigation season shortened by 14 days), and seepage losses within the main canal have increased the tension levels from medium to high.

- *Provide a description of the mechanism that will be used, if necessary, to put the conserved water to the intended use.*
  The development of this project will allow for more water to be saved and held in the Echo and East Canyon Reservoirs and within the Weber River system. DWCCC has always worked closely with local, state, and federal agencies to do their part to make percentages of their conserved water available to instream flows within the Weber River system and will continue to do so. Working with Utah Division of Wildlife Resources, Weber Basin Water Conservancy District, and others DWCCC use conserved water to increase water sustainability within the Weber River. See Attachment E – Letters of Support.

- *Describe the roles of any partners in the process. Please attach any relevant supporting documents.*
  DWCCC works closely with the Utah Division of Wildlife Resources, Weber Basin Water Conservancy District, and Bureau of Reclamation for operation of the diversions on the Weber River and reservoirs. The operations are all coordinated through the Weber River Commissioner. See Attachment E – Letters of Support.

- *Indicate the quantity of conserved water that will be used for the intended purpose.*
  The 523 acre-feet of water that is conserved will all be used to make the water system more reliable. This water will be used within the DWCCC systems to reduce the impact of droughts and water shortages.

- *Will the project benefit Indian tribes?*
  No.

- *Will the project benefit rural or economically disadvantaged communities?*
  No.

- *Will the project benefit species (e.g., federally threatened or endangered, a federally recognized candidate species, a state listed species, or a species of particular recreational, or economic importance). Please describe the relationship of the species to the water supply, and whether the species is adversely affected by a Reclamation project.*
  The Bonneville Cutthroat Trout and Bluehead sucker are native fish species found in portions of the Weber River. Both species are covered by conservation agreements that the State of Utah has entered into with the U.S. Fish and Wildlife Service and other parties. The population status of these two sensitive species warrants additional conservation efforts to diminish the likelihood of future listings under the Endangered Species Act.

  UDWR's approach to aquatic species conservation and management in the Weber River, in part, focuses on reconnecting and maintaining connectivity of priority habitats by removing unnecessary barriers to fish migration, or by modifying existing barriers to allow upstream movement of these species, particularly for Bonneville Cutthroat Trout and Bluehead Sucker; many of which have come about by building diversion structures and installing culverts that reduce the ability of fish migration. Many of these barriers originate from the private canal and ditch companies as well as a project built by Reclamation over the years.

  Stable and connecting flows between Bonneville Cutthroat Trout and Bluehead Sucker habitats are a fundamental requirement for conservation actions to be successful. Therefore, most any project that enhances the continuity and maintenance of flows within the Weber River is a step in the right direction. As DWCCC and UDWR work cooperatively to protect and conserve these native species, their habitats will be benefitted.

- *Will the project address water supply reliability in other ways not described above?*
  Water supply reliability is often times more than just getting water to the field. It is having if for purposes like recreation, the environment, or to improve water quality. Within the Weber River Watershed Plan of 2014, it says that "The goal of this plan is to recognize both the human and ecological values that the watershed provides and develop strategies to protect and enhance those values." Allowing for more water to remain in the Weber River, Echo and East Canyon Reservoirs recreational opportunities will be benefited, water quality will be improved, recreation fishing will be sustainable and economic development will continue. This project along with the other past and future projects that DWCCC has done, or will do, will all contribute the water reliability to improve the sustainability and economic development of the area.

E.1.3. Evaluation Criterion C – Implementing Hydropower

If the proposed project includes construction or installation of a hydropower system, please address the following:

***Describe the amount of energy capacity**. For projects that implement hydropower systems, state the estimated amount of capacity (in kilowatts) of the system. Please provide sufficient detail supporting the stated estimate, including all calculations in support of the estimate.*

DWCCC has been on the leading edge of very low head hydropower installations in canals in Utah. DWCCC has one very low head hydropower site in the canal in operation and a second site that will be placed in operation in June 2018. They have received qualifying conduit exemptions from FERC on the one site and the new site is waiting for approval. The hydropower site for this application is included on the submitted FERC permit application. No additional permits will be required. Environmental clearances have all been done as well for this site.

DWCCC will install a 2kW crossfloat turbine for this site. This is the same type of turbine that will be installed in June 2018. Two turbines will be installed in the canal in June. This project will add a third turbine, all running in a series. These small hydro power generation sites have shown to provide a good source of renewable energy to help offset the 464,366 kWh of electricity that DWCCC uses annually.

***Describe the amount of energy generated.** For projects that implement hydropower systems, state the estimated amount of energy that the system will generate (in kilowatt hours per year). Please provide sufficient detail supporting the stated estimate, including all calculations in support of the estimate.*

The crossfloat hydropower turbine is rated at 2kW. The hydropower turbine will operate for 4,320 hours, this would be the entire time that the canal in is use from April 15th to October 15th, or 183 days. The total power produced by one crossfloat turbine is 8,784 kilowatt hours per year.

2kW turbine * 183 days *24 hours = 8,784 kilowatt hours per year

***Describe any other benefits of the hydropower project.** Please describe and provide sufficient detail on any additional benefits expected to result from the hydropower project, including:*

- *Any expected reduction in the use of energy currently supplied through a Reclamation project*

  Electricity along the Wasatch Front comes from a variety of sources. One of those sources is the hydropower at Rockport Reservoir which is a Reclamation project. It is unlikely that this project will have any impact on hydropower generation from the Reclamation projects in the area.

- *Anticipated benefits to other sectors/entities.*

  Although this is a small amount of power in the overall scheme of things, the power generated will allow the Company to be more self-reliant and put less demand on the Rocky Mountain Power system. The old saying “every little bit helps” is true in this case, because of

the number of small hydro turbines that have been added over the past 2 years. The produced energy from all of the DWCCC small hydro's that have or will be installed by June 2018 add up to over 42,300 kW hours of renewable energy each year. It is estimated that the proposed small crossfloat hydro project will offset approximately 16,800 lbs of CO2 per year.

Over a twenty-year-span when compared with energy produced from a coal power plant this project will help reduce DWCCC's carbon footprint by 288,241lbs of CO2. This will help in a small way to reduce the need to use more fossil fuels to meet the demands of the Wasatch Front. This is a reduction to DWCCC's carbon footprint that is equivalent to:

- *Expected water needs, if any, of the system*

The small hydro generator will be placed in the main canal and will be operated by the water that flows through the canal to the users. No additional water will be needed to operate the generator and the generator will not use any water.

E.1.4. Evaluation Criterion D – Complementing On-Farm Irrigation Improvements

If the proposed project will complement an on-farm improvement eligible for NRCS assistance, please address the following:

- *Describe any planned or ongoing projects by farmers/ranchers that receive water from the applicant to improve on-farm efficiencies.*
    - *Provide a detailed description of the on-farm efficiency improvements.*

This project will help provide a safer, more reliable, and more efficient water delivery system for the canal. This will allow farmers to install pipes, sprinklers, and pivots to make their irrigation systems more efficient and will also allow for higher crop yields and less flooding potential in residential neighborhoods that are continually encroaching on the agricultural lands.

DWCCC provides water to approximately 60 different ditches and turnouts. The canal system is elevated so that anyone could connect onto the canal to provide sufficient pressure for an agricultural sprinkler system. This project will not change that ability to provide pressure irrigation to farms. This project will be a positive move toward ensuring that shareholders will receive their shares of water through a canal that is metered, piped, and lined, so that losses are minimal and conservation is maximized, hydropower is developed, the environment is protected, and the canal is made safe and water can be delivered efficiently.

The Company is aware of a few local farm projects that are being considered, most of which are ditch expansions, piping of ditches, and conversion of water deliveries

from flood irrigation to sprinklers. The following is a list of those who have interest in on-farm efficiency projects. See Attachment F – On-Farm Signature Page.

Landowner Name	Area	Location
Mike Kolendrianos	66 Acres	West Layton
The Nature Conservancy	500 Acres	West Layton
Robert Family Farms	78 Acres	West Layton
Day Farms	200 Acres	West Layton

- *Have the farmers requested technical or financial assistance from NRCS for the on-farm efficiency projects, or do they plan to in the future?*
  The four previously listed farm projects have expressed strong interest in participating in NRCS funding programs to accomplish similar goals contained in this application. These projects will allow for better safety and conservation. They have not requested assistance yet from NRCS they plan to in the future.

- *If available, provide documentation that the on-farm projects are eligible for NRCS assistance, that such assistance has or will be requested, and the number or percentage of farms that plan to participate in available NRCS programs.*
  The on-farm assistance have not been requested from NRCS. They have a strong interest to meet with NRCS to develop high-efficiency irrigation systems.

- *Applicants should provide letters of intent from farmers/ ranchers in the affected project areas.*
  The farmers have signed a signature page that can be found in Attachment F – On-Farm Signature Page. This form indicates the name, signature, and acreage of those irrigators benefiting from the project who are interested in applying for NRCS assistance.

- *Describe how the proposed WaterSMART project would complement any ongoing or planned on-farm improvement.*
  - *Will the proposed WaterSMART project directly facilitate the on-farm improvement? If so, how? For example, installation of a pressurized pipe through WaterSMART can help support efficient on-farm irrigation practices, such as drip-irrigation.*

    OR

  - *Will the proposed WaterSMART project complement the on-farm project by maximizing efficiency in the area? If so, how?*
    Yes, the proposed project will complement the on-farm project in the following ways:
    - Less tail water wasting from flood irrigation
    - Better metering and monitoring of system
    - Innovation for better technologies such as sprinkler and drip irrigation methods

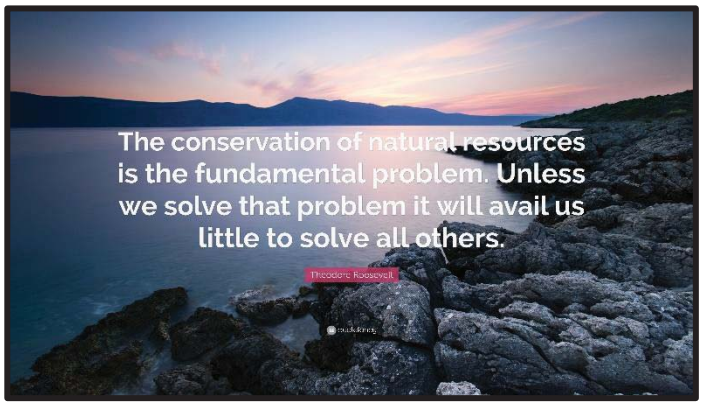
- *Describe the on-farm water conservation or water use efficiency benefits that would result from the on-farm component of this project.*
    - *Estimate the potential on-farm water savings that could result in acre-feet per year. Include support or backup documentation for any calculations or assumptions.*

    Based upon calculation and information already submitted as part of this application, returned savings in water for agriculture would be between 8 to 10 percent water savings, besides creation of additional water resources through conservation that will benefit future water development needs. Better use of the water will come about by reducing water wasting and losses due to seepage. This documentation was outlined within the Quantifiable Water Savings section in detail.

E.1.5. Evaluation Criterion E – Department of the Interior Priorities

Address those priorities that are applicable to your project. Points will be allocated based on the degree to which the project supports one or more of the priorities listed, and whether the connection to the Priority(ies) is well supported in the proposal.

1. *Creating a conservation stewardship legacy second only to Teddy Roosevelt*



Teddy Roosevelt said, "The conservation of natural resources is the fundamental problem. Unless we solve that problem, it will avail us little to solve all others." DWCCC's proposed project will contribute to solving this "fundamental problem" by piping and enclosing it's unlined and open canal. By piping their system it will allow the Company to better manage approximately 5,499 acre-feet of water, and conserve 523 acre-feet of water.

Concern over water conservation is most prevalent in the western United States, and especially in Utah – the second driest state in the nation. Because of drought, water conservation in Utah is something that is taken seriously by water distributors and users throughout the state. Although DWCCC can do nothing to stop drought, the Company actively seeks ways to reduce the disastrous effects of drought on the state, and by extension, their water users. By enclosing their unlined and open canal system, DWCCC is protecting Utah's water resources and ensuring that these resources are made available to sustain those living within their service area.

2. *Utilizing our natural resources*

The proposed project will contribute to ensuring American Energy is available to meet our security and economic needs by installing a 2kW crossfloat turbine. The small hydro generator will be placed in the main canal and will be operated by the water that flows through the canal to the users. No additional water will be needed to operate the generator.

DWCCC's small hydro power generation sites have shown to provide a good source of renewable energy to help offset the 464,366 kWh of electricity that the Company uses annually. Although this is a small amount of power overall, the generated power will allow the Company to be more self-reliant and put less demand on the Rocky Mountain Power system. The produced energy from all of the DWCCC small hydro units that have or will be installed by June 2018 add up to over 42,300 kW hours of renewable energy.

3. *Restoring trust with local communities*

Both residential and commercial areas surround the proposed project canal area. The unlined, 100-year-old earthen canal is in poor condition, putting local residences and businesses at risk of flooding; and eroding soils and increased vegetation have invited small mammals to live in or near the canal. Also, because the canal is surrounded on all sides by residences and businesses, DWCCC's access to private property is a large issue that delays service and compromises water reliability.

It is quite obvious that the issue is getting worse, and as soils continue to erode, there will eventually be a major canal breach that will devastate the area. If this happens, homes, water users, municipalities, and farmers will lose their water supply; and the surrounding roads, intersection, and commercial businesses will experience significant property damage. Such a breach will place more demands on municipal water supplies. DWCCC seeks to restore trust with local communities by preventing a major breach from ever happening, thus mitigating the disastrous effects described.

4. *Modernizing our infrastructure*

100-year-old infrastructure is not DWCCC's definition of *modern*! Today's housing developers thrive off Utah's increasing demand for housing, and are buying land wherever they can find it; even if that land backs right up to a 100-year-old canal. It is not uncommon for modern housing developments to have canals that run up against the fence lines of backyards; nor is it uncommon for local business owners who are willing to settle almost anywhere. An aged, unlined canal does not provide the water reliability and safety required for nearby developments.

Through this grant opportunity, DWCCC has the opportunity to improve their water reliability using modern infrastructure design. Achieving this will reduce water loss and increase safety. Modern infrastructure design prides itself in its ability to not only outlive the useful life of dated design, but requires minimal maintenance. The proposed piping project lives up to these modern design expectations. By piping 1,200 feet of the proposed unlined earthen canal, the last gap on the lower end of the canal will be filled in, and the lower 14,750 feet of this important canal will be completely enclosed.

E.1.6. Evaluation Criterion F – Implementation and Results

E.1.6.1. Subcriterion No. F.1 – Project Planning

Does the applicant have a Water Conservation Plan and/or System Optimization Review (SOR) in place? Please self-certify, or provide copies of these plans where appropriate to verify that such a plan is in place.

Yes. A SOR was completed by DWCCC in 2013. The SOR was reviewed and approved by Reclamation at that time. The SOR was updated in 2017 to account for recent improvements on the canal. See Attachment G – SOR Project Priorities for a list of DWCCC's priority projects.

The DWCCC also has a Water Conservation Plan in place. This plan was updated in 2017 and submitted to the Utah Division of Water Resources for approval. (Copies of both of these plans can be made available upon request).

Provide the following information regarding project planning:

1) *Identify any district-wide, or system-wide, planning that provides support for the proposed project. This could include a Water Conservation Plan, SOR, or other planning efforts done to determine the priority of this project in relation to other potential projects.*

   DWCCC completed a SOR for the 17.2-mile canal system in October 2013 and updated the SOR in 2017. The SOR planning process allowed DWCCC to evaluate the entire delivery system and give them direction on priority projects that can allow for the highest water conservation renewable energy production. The proposed project is listed as number three within the SOR 2017 update. Projects one and two are in design and have been funded by another WaterSMART project.

   The Weber River Waters Users' Association developed a "Water Management and Conservation Plan" in 2009 with a Reclamation grant, addressing the needs for the Weber River Basin. In Chapter 4 of the Weber River Basin Plan of 2009, it indicates several conservation goals that they would like to implement, most of which this project will help satisfy. The specific goal that this project will help implement is to reduce outdoor use through monitoring and more efficient application and delivery of the water.

   DWCCC has a Conservation Plan that includes aspects of this project. They also have Emergency Action and Response Plans, and an Operation and Management Plan, which includes responses during times of drought or water shortage conditions. They also participated in developing a conservation plan with the Weber River Water Users' Association, which has recently been updated (Copies of these plans can be made available upon request).

2) *Describe how the project conforms to and meets the goals of any applicable planning efforts, and identify any aspect of the project that implements a feature of an existing water plan(s).*

   The Weber River Water Users' Association has a number of goals and issues that this project will help fulfill. They have been addressed previously and are listed in Criterion D. Other plans that this project is consistent with is the State Regional Water Plan for the

Weber River Basin. In the "Weber River Basin Planning for the Future" document prepared in September 2009, it states:

"In order to meet future water needs, water planners and managers within the Weber River Basin must promote effective water conservation programs and measures. They must also ensure that agricultural water conversions are transferred to meet both indoor and outdoor urban water needs, and implement innovative water management strategies. This, along with carefully planned water developments, will secure sufficient water for the future."

E.1.6.2. Subcriterion No. F.2 – Performance Measures

Provide a brief summary describing the performance measure that will be used to quantify actual benefits upon completion of the project (e.g., water saved or better managed, energy generated or saved). For more information calculating performance measure, see Appendix A: Benefit Quantification and Performance Measure Guidance.

There are two areas of this project where performance measures can be documented and quantified to show the actual benefits upon completion of the project. These include renewable energy that will be generated, and water that is saved and/or better managed.

Energy Generated Performance Measures

The energy produced by the hydropower turbine will be metered. The metered output will be recorded monthly and compared to the estimation of power generation in this application. This information will be provided in an annual report to the DWCCC Board of Directors.

Water Savings and/or Better Water Management Performance Measures

The System Optimization Review identifies the water tracking and water usage procedures for the DWCCC canal. These are the same procedures that were followed to calculate the water losses in this application. The same procedures will be used to measure the actual water saved/better managed after the completion of this project.

A season long inflow and outflow summary of the lower portions of the canal will be taken There is a meter on the main canal, called the "Roy Flume," at the start of the lower portion of the canal. DWCCC currently has ten continuously reading meter turnouts and eleven turnouts with weirs and flumes along the lower part of the canal. Daily flow measurements at each turnout and flow measuring device readings are taken and recorded. Each

Figure 1 Daily Turnout Measurement Sheet

Byram Estates	Measurements (CFS)	Estimated Delivery (CFS)	Total Estimated Delivered (Acre-Feet)		Flow Alotment (CFS per day)	Total Alotment (Acre-Feet)		Running Total Available (Acre-Feet)
April 15, 2013					-	-		-
April 16, 2013					4.64	9.19		9.19
April 17, 2013					4.64	18.39		18.39
April 18, 2013					4.64	27.58		27.58
April 19, 2013					4.64	36.78		36.78
April 20, 2013					4.64	45.97		45.97
April 21, 2013					4.64	55.17		55.17
April 22, 2013					4.64	64.36		64.36
April 23, 2013					4.64	73.56		73.56
April 24, 2013					4.64	82.75		82.75
April 25, 2013					4.64	91.95		91.95
April 26, 2013					4.64	101.14		101.14
April 27, 2013					4.64	110.34		110.34
April 28, 2013					4.64	119.53		119.53
April 29, 2013					4.64	128.73		128.73
April 30, 2013					4.64	137.92		137.92

month, the flow measurements will be taken and used to determine how much water has passed the Roy Flume, how much water went down each turnout, and how much water was lost to the system for that month. The water lost for the entire irrigation season will be compared to the water savings calculations in this application. A portion of the gate usage tracking sheet is shown in Figure 1, Daily Turnout Measurement Sheet.

The individual gates are combined into a summary of all gates on the lower canal. The sheet in Figure 2, Summary Sheet is a sample of how the information will be recorded. This summary sheet will be completed the 15th of each month and reviewed by the DWCCC Board of Directors.

Figure 2 Summary Sheet

Gate	Estimated Water Delivered (Acre-Feet)	Water Allocated To Date (Acre-Feet)	Water Allocated For Year (Acre-Feet)	Difference Column 1-2 (Acre-Feet)	Total Remaining for Year Column 3-1 (Acre-Feet)
WBWCD Gateway					
WBWCD Roy Pond					
Byram Estates					
North Flume					
North 10					
North 11					
Roy WCD					
Sunset Res					
Gate 03A					
Gate 8					
Gate 11					
Gate 15					
Gate 16					
Gate 18					
Gate 19					
Gate 23E					
Gate 23W					
Gate 24A					
Gate 25					
Gate 27					
Gate 30F					
Gate 30J5					
Gate 33					
Layton Res					
West 05 Butler					
West 05 Kap					
Totals					

E.1.7. Evaluation Criterion G – Nexus to Reclamation Project Activities

Is the proposed project connected to Reclamation project activities? If so, how? Please consider the following:

The Weber Basin Water Conservancy District is a major shareholder in DWCCC, and supplies water to Reclamation projects. Water supplies for the DWCCC canal came from the East Canyon and Echo Reservoirs, which are both Reclamation projects.

- *Does the applicant receive Reclamation project water?*
  Yes. DWCCC receives water from Echo and East Canyon Reservoirs, which are Reclamation projects.
- *Is the project on Reclamation project lands or involving Reclamation facilities?*
  No.
- *Is the project in the same basin as a Reclamation project or activity?*
  Yes, the project is located in the Weber River Basin where the Echo and East Canyon Reservoirs are located.
- *Will the proposed work contribute water to a basin where a Reclamation project is located?*
  Yes, the project will conserve water that can now be held up in the Echo and East Canyon Reservoirs, contributing to the storage and potential flow of the Weber River.

Will the project benefit any tribe(s)?

No.

E.1.8. Evaluation Criterion H – Additional Non-Federal Funding

State the percentage of non-federal funding provided using the following calculation: Non-Federal Funding divided by Total Project Cost.

$$\frac{\$450{,}000.00 \text{ – Non-Federal Funding}}{\$750{,}000.00 \text{ – Total Project Cost}}$$

= 60%

Project Budget

Funding Plan and Letters of Commitment

Describe how the non-Federal share of project costs will be obtained.

How you will make your contribution to the cost-share requirement, such as monetary and/or in-kind contributions and source funds contributed by the applicant (e.g., reserve account, tax revenue, and/or assessments).

DWCCC will use money from their own Construction Reserve Account and operation funds for their contribution.

Describe any donations or in-kind costs incurred before the anticipated Project start date that you seek to include as project costs. For each cost, identify:

N/A

Describe any funding requested or received from other Federal partners. Note: other sources of Federal funding may not be counted towards the required cost share unless otherwise allowed by statute.

N/A

Describe any pending funding requests that have not yet been approved, and explain how the project will be affected if such funding is denied.

No other requests for financing have been made. DWCCC already has the funds for their cost-sharing portion for this project.

Summary of Non-Federal and Federal Funding Sources

FUNDING SOURCES	***AMOUNT***
Non Federal Entities	
Recipient Funding	450,000.00
Non-Federal Subtotal	450,000.00
Other Federal Entities	
Other Federal Subtotal	0.00
Requested Reclamation Funding	**300,000.00**
Total Project Funding	**750,000.00**

Budget Proposal

Budget Item Description	Computation		Quantity Type	Total Cost
	$/Unit	Quantity		
Salaries & Wages	$0.00	-	-	$0.00
Fringe Benefits	$0.00	-	-	$0.00
Travel	$0.00	-	-	$0.00
Equipment	$0.00	-	-	$0.00
Supplies and materials	$0.00	-	-	$0.00
Contractual /Construction				
Mobilization	$19,000.00	1	LS	$19,000.00
Traffic Control	$11,200.00	1	LS	$11,200.00
Storm Water Pollution Prevention Plan	$4,730.00	1	LS	$4,730.00
Clear and Grub	$6,260.00	1	LS	$6,260.00
Imported Fill Material	$12.40	1529.355	TON	$18,964.00
Imported Structural Fill Material	$17.30	4560	TON	$78,888.00
66" Diameter Class III RCP	$252.00	1520	LF	$383,040.00
36"Dia. Access Manhole	$2,220.00	2	EA	$4,440.00
8Ft x 8Ft Manholes	$10,200.00	3	Each	$30,600.00
Fort Lane Turnout Including Boxes	$26,600.00	1	LS	$26,600.00
Surface Restoration	$10,200.00	1	LS	$10,200.00
Pothole Utilities	$300.00	10	HR	$3,000.00
University Park, Traffic Control	$4,000.00	1	LS	$4,000.00
University Park, Remove Pipes & Asphalt	$3,100.00	1	LS	$3,100.00
University Park, Granular Borrow Backfill	$18.10	220	Tons	$3,982.00
University Park, Untreated Base Course	$19.50	160	Tons	$3,120.00
University Park, Hot-mix Asphalt	$172.00	60	Tons	$10,320.00
University Park, Temporary Asphalt Patch	$243.00	30	Tons	$7,290.00
University Park, Asphalt Painting	$830.00	1	LS	$830.00
Remove and Replace Curb and Sidewalk	$35.40	120	LF	$4,248.00
6' Chain Link Fence	$25.40	120	LF	$3,048.00
Relocate 12' Wide Chain Link Fence Gate	$670.00	2	EA	$1,340.00
Hydropower Generation	$15,700.00	1	EA	$15,700.00
Design Engineering		7%	EA	$45,800.00
Construction Engineering		7%	EA	$45,800.00
Reporting	$125.00	12	HR	$1,500.00
Environmental Document (Completed. Includes time to update as needed.)	$125.00	24	HR	$3,000.00
Other				
Total Direct Costs				**$750,000.00**
Indirect Costs				
Type of rate	Percentage	$base		**$0.00**
Total Estimated Project Costs				**$750,000.00**

Budget Narrative

Salaries and Wages

No DWCCC Salaries or Wages will be included. All services will be contracted. DWCCC's staff time will be over and above the cost of the project and will not be counted toward the project cost.

Fringe Benefits

No fringe benefits will be required.

Travel

No travel will be necessary.

Equipment

Equipment will be part of the contracted portion of the project.

Materials and Supplies

Materials and Supplies will be part of the contracted portion of the project and will be documented as required.

Contractual

In order to determine unit costs which were included in the cost estimate for this project, DWCCC relied upon contract unit prices from a similar project bid in October in 2013 and October 2016. Items bid match the bid items from these projects.

DWCCC will bid the construction portion of the project to several prequalified construction companies. The contractual costs shown are estimates for each of the components to furnish and install all the equipment. Generally, the low bidder will be selected based on a determination of acceptable qualifications.

Contractual will include design at approximately 7 percent, and construction observation at approximately 7 percent. The Contractor will be hired to perform mobilization, 1,520 feet of 66-inch RCP, 4,560 tons of structural fill, 1,530 tons of backfill material, perform 1,520 feet of surface restoration, install of the hydropower generation, and the other contractual items listed.

Environmental and Regulatory Compliance Costs

The environmental document for this project was included in a previously completed report and has been approved by Reclamation. Reclamation may require additional information, therefore, 24 hours of time at $125.00 = $3,000 will be included in this project.

Other Expenses

None.

Indirect Costs

No indirect costs are included.

Total Costs

DWCCC Portion: $450,000 Fed Portion: $300,000 Total: $750,000

Environmental and Cultural Resources Compliance

Will the proposed project impact the surrounding environment (e.g., soil [dust], air, water [quality and quantity], animal habitat)? Please briefly describe all earth-disturbing work and any work that will affect the air, water, or animal habitat in the project area. Please also explain the impacts of such work on the surrounding environment and any steps that could be taken to minimize the impacts.

DWCCC has an approved Environmental Report for this project. Impacts will be those associated with piping the canal. The proposed project improvements will take place entirely within the existing canal corridor. In the past, similar projects have had minimal impacts. This proposed area of the canal to be improved has an established access allowing work within the recognized easement of the project. The surface vegetation will be restored upon completion of the project.

Are you aware of any species listed or proposed to be listed as a Federal threatened or endangered species, or designated critical habitat in the project area? If so, would they be affected by any activities associated with the proposed project?

After having completed the Environmental Document and submitting it to Reclamation, DWCCC is not aware of any impacts concerning threatened or endangered species in this area.

Are there wetlands or other surface waters inside the project boundaries that potentially fall under CWA jurisdiction as "Waters of the United States?" If so, please describe and estimate any impacts the proposed project may have.

After having completed the Environmental Document and submitting it to Reclamation, DWCCC is not aware of any impacts to wetlands in this area.

When was the water delivery system constructed?

The canal system was originally built in 1884 with concrete liner constructed around 1910 to 1920. Many improvements have been made over the years. As part of the completed environmental document, the required historical documentation for the canal has been finalized.

Will the proposed project result in any modification of or effects to, individual features of an irrigation system (e.g., headgates, canals, or flumes)? If so, state when those features were constructed and describe the nature and timing of any extensive alterations or modifications to those features completed previously.

The proposed project will pipe 1,200 feet of an earthen canal and replace 320 feet of deteriorated steel pipe through Layton with a single 66-inch diameter reinforced concrete pipe, and will add a 2 kW crossfloat hydropower turbine near the DWCCC shop. The unlined canal was excavated in the 1920s and is difficult to maintain and is in terrible condition; hence, it needs to be piped. The steel pipe was installed in 2001. As part of the completed environmental document, the required historical documentation for the canal has been completed.

Are any buildings, structures, or features in the irrigation district listed or eligible for listing on the National Register of Historic Places? A cultural resources specialist at your local Reclamation office or the State Historic Preservation Office can assist in answering this question.

After having completed the Environmental Document and submitting it to Reclamation, DWCCC is not aware of any building, structures or features that would qualify. A cultural resource inventory was completed as part of the submitted environmental document.

Are there any known archeological sites in the proposed project area?

After having completed the Environmental Document and submitting it to Reclamation, DWCCC is not aware of any impacts to or locations of archeological sites.

Will the proposed project have a disproportionately high and adverse effect on low income or minority populations?

No, the project will not require a right-of-way or relocations from adjacent properties, and will have no impact on residential properties or uses within the study area.

Will the proposed project limit access to and ceremonial use of Indian sacred sites or result in other impacts on tribal lands?

No.

Will the proposed project contribute to the introduction, continued existence, or spread of noxious weeds or non-native invasive species known to occur in the area?

No. In fact, the project will help with the control of noxious weeds and invasive trees. The project will allow DWCCC to have better access to the canal for weed control.

Required Permits or Approvals

Applicants must state in the application whether any permits or approvals are required and explain the plan for obtaining such permits or approvals.

The crossfloat hydropower turbine will require a conduit exemption from FERC. This permit from FERC has been applied for already as part of another project and approval is pending. No additional permits will be required from Rocky Mountain Power since this turbine will be added in series to existing turbines.

Excavation permits will be required from Layton City to cross University Park Blvd. Plans will be submitted to Layton City prior to construction to obtain this permit.

Letters of Support

Include letters of support from interested stakeholders supporting the proposed project.

Letters of Support from the following are included in Attachment E – Letters of Support:

- Trout Unlimited – Paul Burnett, Weber River Project Coordinator
- Utah Division of Wildlife Resources – Clint Brunson, Aquatics Habitat Restoration Biologist

Official Resolution

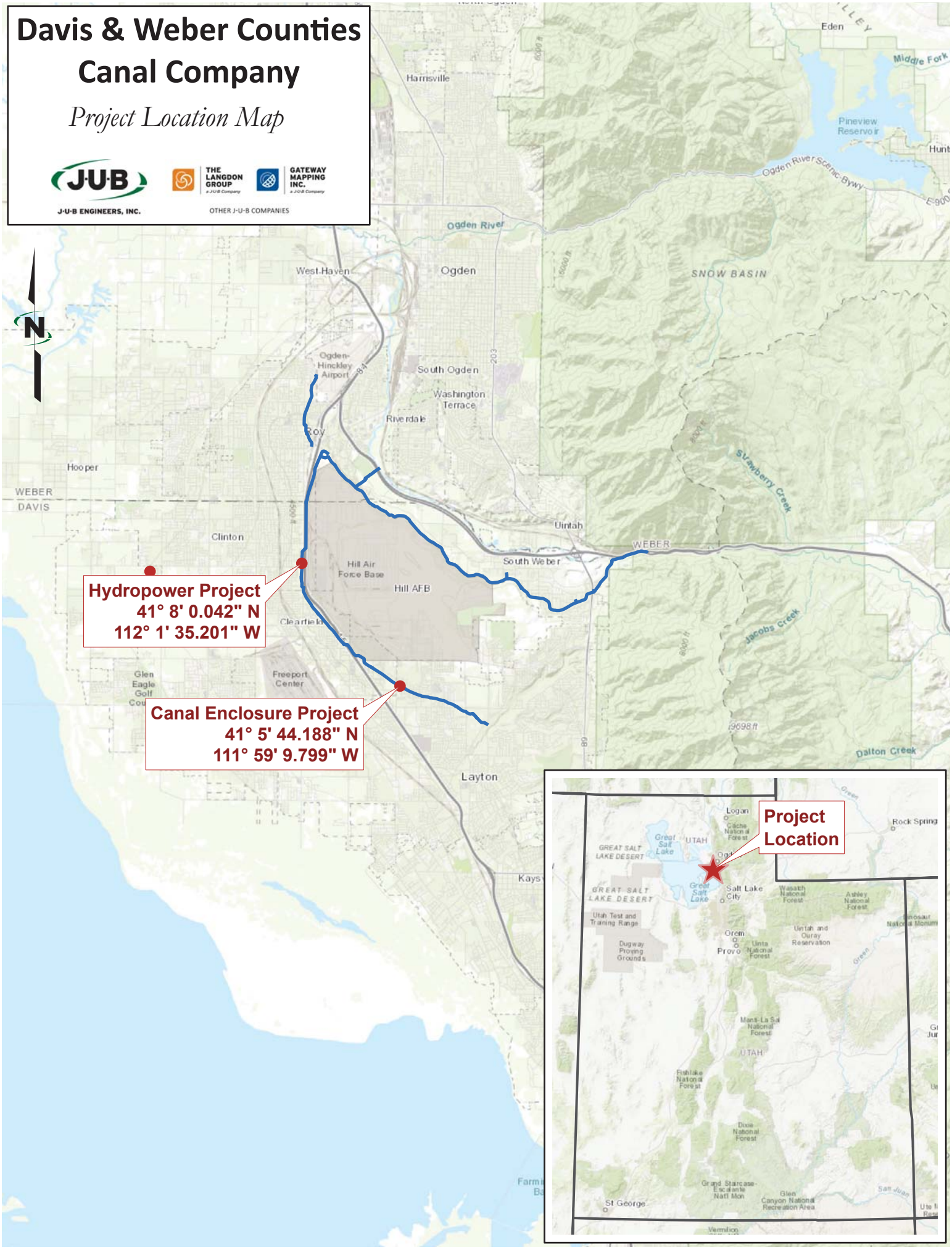
Include an official resolution adopted by the applicant's board of directors or governing body. The official resolution may be submitted up to 30 days after the application deadline.

The Official Resolution for the Davis and Weber Counties Canal Company (DWCCC) Small Piping and Hydro Project will be submitted within 30 days after the application deadline.

Davis & Weber Counties Canal Company

Project Location Map

J-U-B ENGINEERS, INC. | THE LANGDON GROUP | GATEWAY MAPPING INC. | OTHER J-U-B COMPANIES

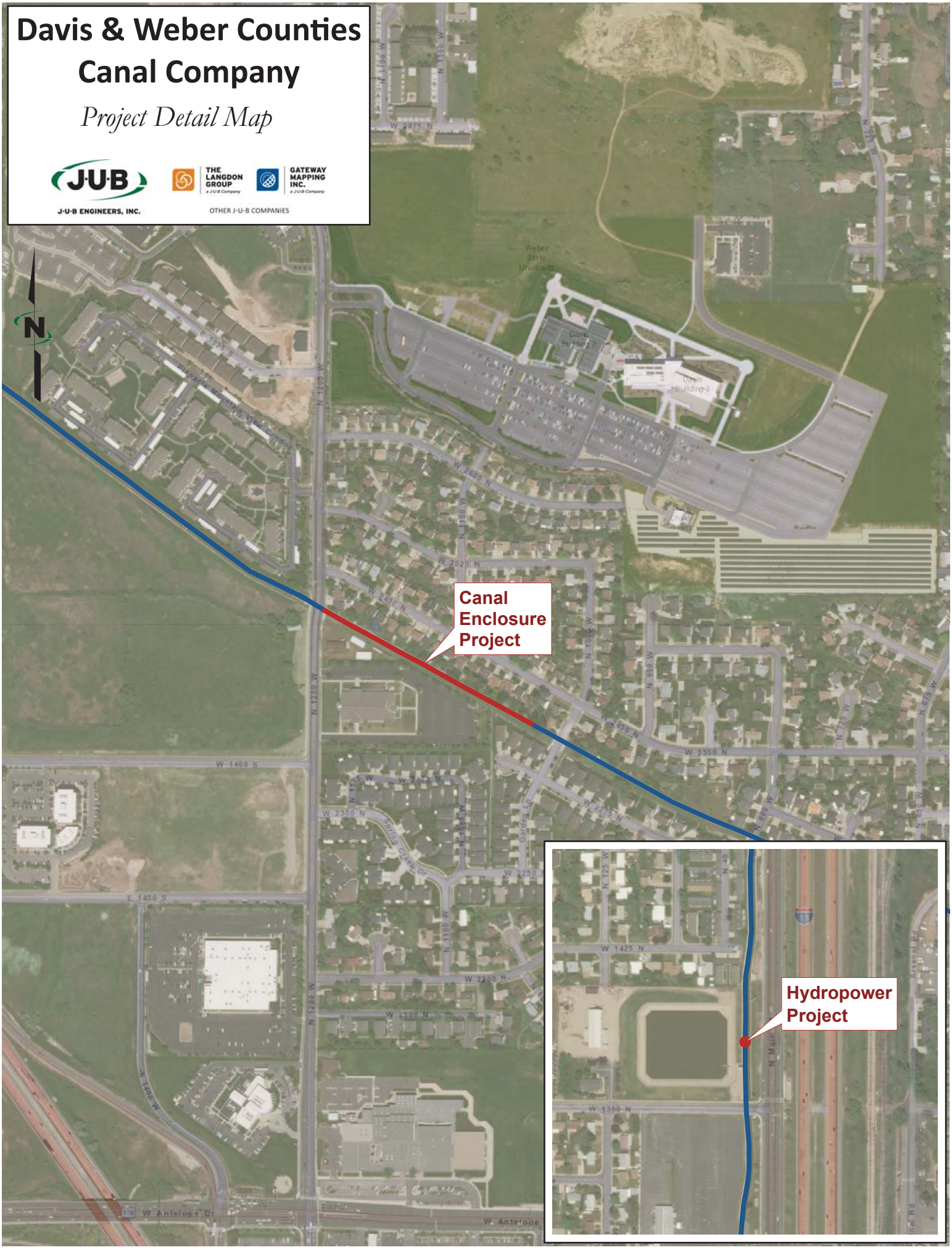


Davis & Weber Counties Canal Company

Project Detail Map

J-U-B ENGINEERS, INC.

OTHER J-U-B COMPANIES: THE LANGDON GROUP a J-U-B Company; GATEWAY MAPPING INC. a J-U-B Company

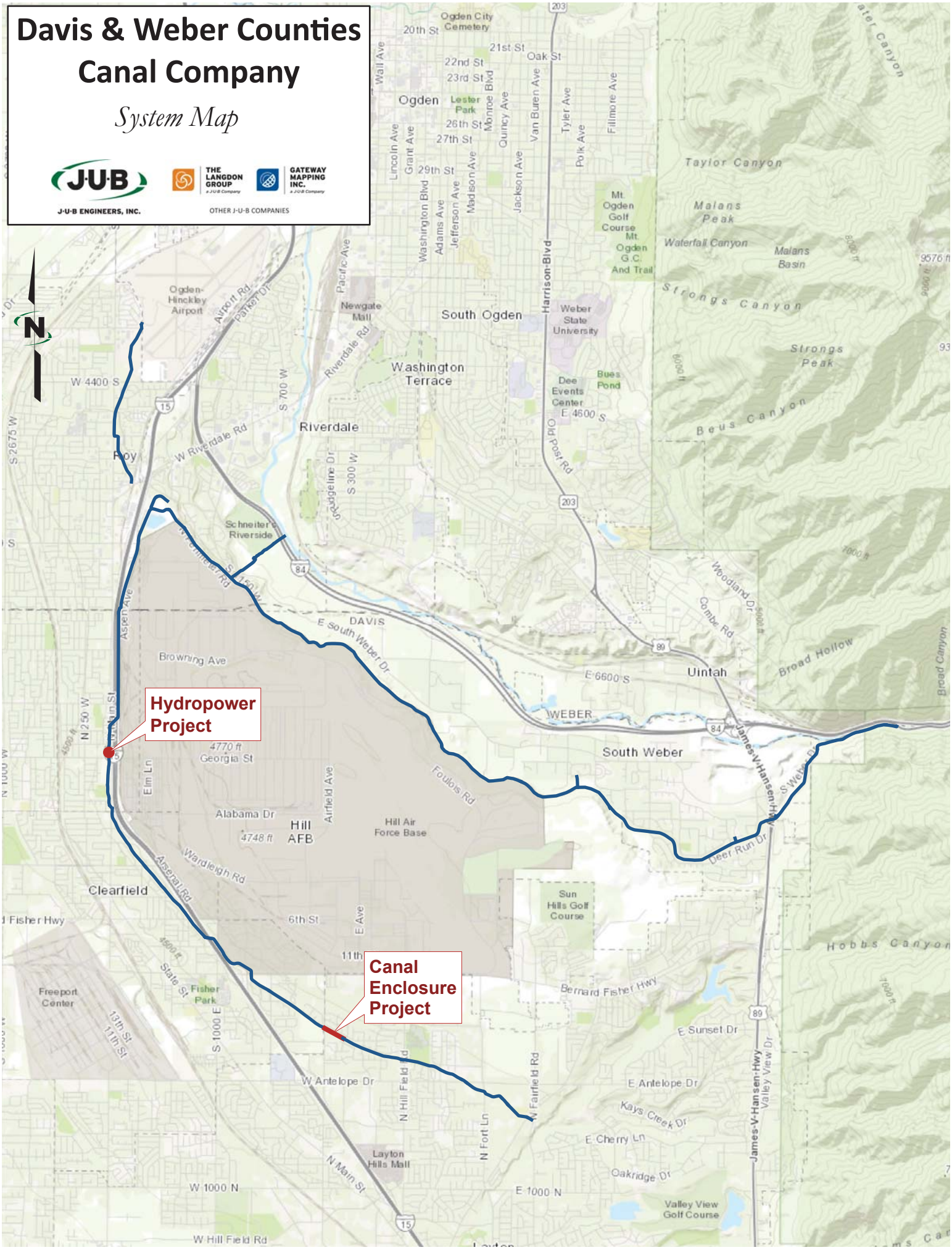


Davis & Weber Counties Canal Company

System Map

J-U-B ENGINEERS, INC.

OTHER J-U-B COMPANIES: THE LANGDON GROUP, GATEWAY MAPPING INC.



RECLAMATION

Managing Water in the West

Water Conservation Verification of Davis & Weber Counties Canal Company Canal Piping Project

Davis County, UT* near *Salt Lake City, UT

Upper Colorado Region

U.S. Department of the Interior

Bureau of Reclamation

Technical Service Center

Water, Environmental, & Ecosystems Division

Water Resources Planning & Operations Support Group

May 2017

Water Conservation Verification of Davis & Weber Counties Canal Company Canal Piping Project

Davis County, UT* near *Salt Lake City, UT

Upper Colorado Region

Brandon House, Hydrologic Engineer

Mark Spears, Hydraulic Engineer

U.S. Department of the Interior

Bureau of Reclamation

Technical Service Center

Water, Environmental, & Ecosystems Division

Water Resources Planning & Operations Support Group

May 2017

Acronyms and Abbreviations

ADCP	acoustic Doppler current profiler
AFY	acre-feet per year [L3/T]
cfs	cubic feet per second [L3/T]
DWCCC	Davis & Weber Counties Canal Company
ET	Evapotranspiration
ft	feet [L]
hrs	hours [T]
in	inches [L]
mi	miles [L]
PVC	Polyvinyl Chloride
Reclamation	Bureau of Reclamation
SMART	Sustain and Manage America's Resources for Tomorrow
WEEG	Water and Energy Efficiency Grant

Contents

List of Figures

Introduction

Davis & Weber Counties Canal Company (DWCCC) received funds for a surface water conservation project from the Bureau of Reclamation's (Reclamation) Fiscal Year 2016 WaterSMART Water and Energy Efficacy Grants (WEEG) cost-share program under funding opportunity number R16-FOA-DO-004 – reference code WEEG-76. The project is located in central-northern UT, 26 miles (mi) north of Salt Lake City, UT in Clearfield, UT (Figure 1). DWCCC will use the funds to pipe 950 feet (ft) of open, concrete-lined canal and construct a small hydropower station. DWCCC estimates that piping the canal will conserve 144 acre-feet per year (AFY) of surface water, and the hydropower station will generate 21,600 kilowatt hours of power per year.

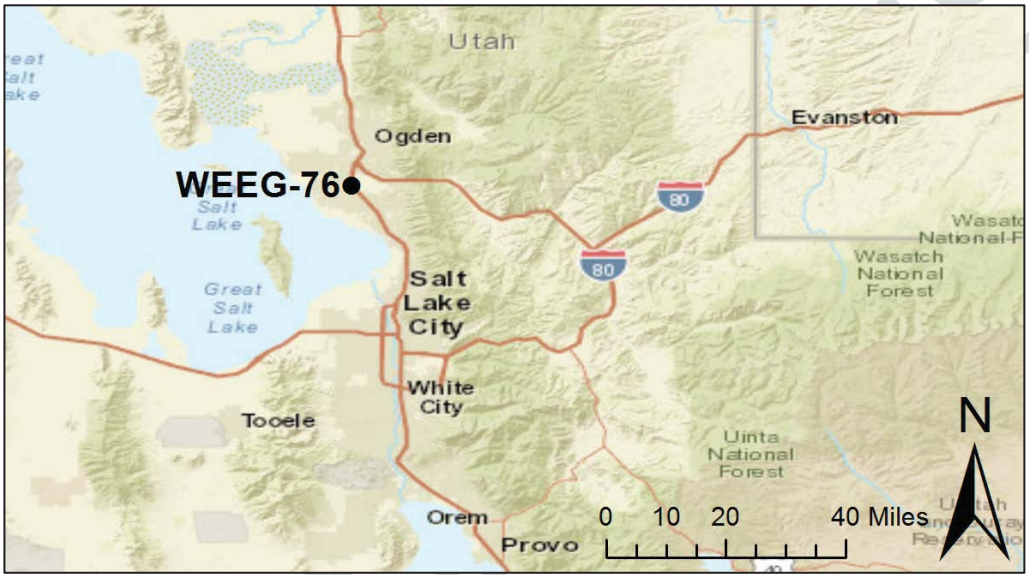


Figure 1 – Canal piping project vicinity in central-northern Utah

Every year after WEEG recipient selection is completed, several recipients are selected to have a Reclamation representative visit the recipient and verify the amount of water expected to be conserved by the project. Verification is done to improve WEEG selection criteria for future funding opportunities and the results do not affect receipt of funds from current or future grants.

Verification of hydropower generation is outside the scope of this project; therefore, this work will focus on the surface water conservation realized from piping the 950 ft reach of canal – the reach of interest (Figure 2). The reach of interest will have the current 100-year-old concrete liner replaced with a reinforced concrete box culvert. Piping canals is known to conserve surface water by (1) eliminating evapotranspiration (ET) from the canal water surface and from plants near the canal and (2) eliminating seeping of water from the canal into the material surrounding the canal [*Jensen et al.*, 1967]

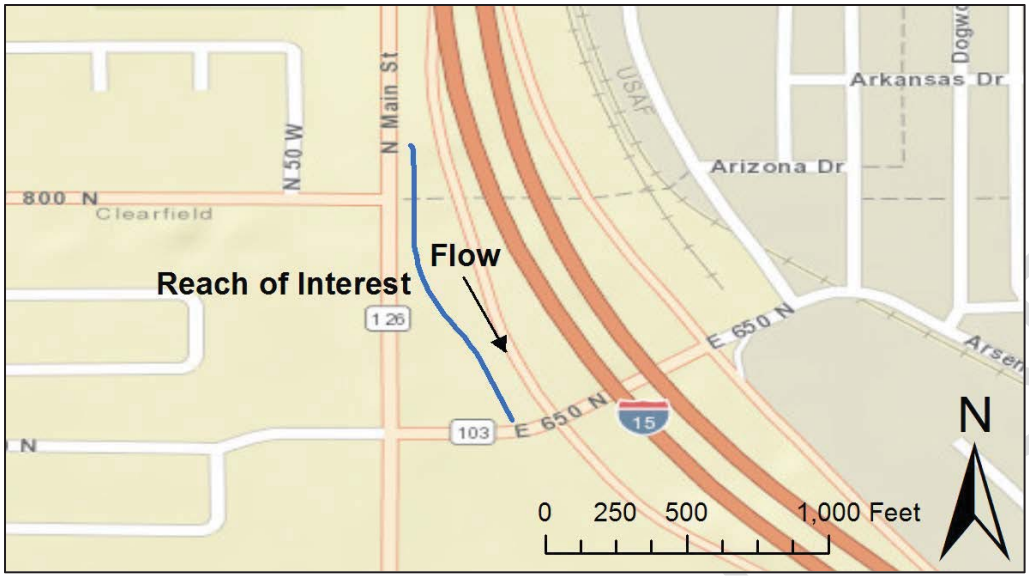


Figure 2 - Reach of Interest. The open, concrete-lined canal reach which is to be piped with WEEG funds. Surface water flow is from north to south. The reach is 950 ft long.

Background

DWCCC presents their method used to estimate current surface water losses from seepage and ET over the reach of interest in their grant application. From analysis of multiple years of supply and delivery data, it is estimated that the system-wide losses per foot of canal are 0.156 AFY. DWCCC estimates the reinforced concrete pipe will be 97% effective at mitigating surface water losses. As 950 ft of canal is to be converted to pipe, an expected 144 AFY of surface water will be conserved.

Methods

To estimate the amount of water expected to be conserved by lining the reach of interest, Reclamation used a method based on the continuity equation. The continuity equation states that, assuming no change in storage, the discharge of water entering a system (inflow) must be equal to the discharge of water exiting the system (outflow) (Figure 3). In this case the “system” is the reach of interest. It is assumed that the water entering the canal via the upstream end is the only inflow. Other possible inflows include precipitation and groundwater; however, the assumption that these inflows are, at the very least, negligible is likely valid as: no precipitation occurred during the measurement and the groundwater table in the region is below the canal bottom elevation. Seepage, ET, and the volume of water exiting the reach of interest are assumed to be the only outflows. The lumped outflows of seepage and ET can be estimated by measuring the upstream and downstream discharges (Figure 3).

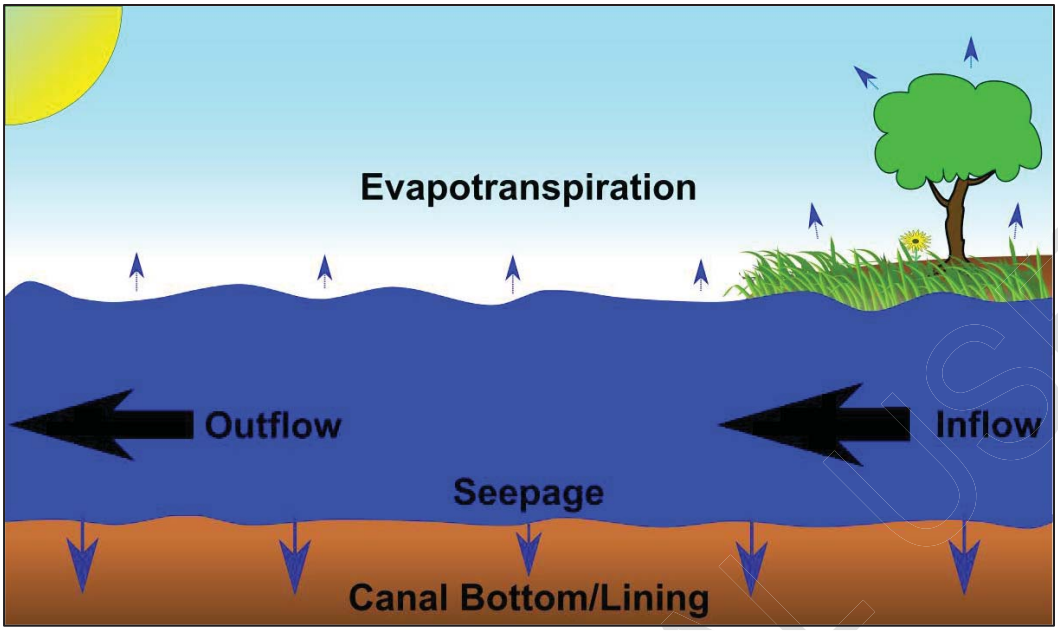


Figure 3 - Schematic depiction of the inflows and outflows of the reach of interest. The lumped outflows of seepage and ET can be estimated by measureing inflow and outflow.

Data Collection

Measurement Equipment Theory

Discharge measurements were made using a StreamPro (*Teledyne RD Instruments*) piston-type, acoustic Doppler current profiler (ADCP) (Figure 4) and companion data collection software *WinRiver II* (*Teledyne RD Instruments*). The ADCP measures water velocity at discrete depth intervals as it traverses the canal profile. Velocities are measured by emitting high frequency sound waves and measuring the frequency shift of the reflected wave. Depth of the velocity measurement is calculated by the two-way travel time of the wave. The cross section of the canal, perpendicular to the direction of flow, is discretized into cells. The velocity within each cell is approximated from multiple measurements by the ADCP. After a traverse is complete, the discharge over the measured portion of the canal cross section can be calculated by summing the products of the velocity and area of each cell (Figure 5). Due to ADCP measurement constraints, portions of flow through the top, bottom, and sides of the canal cross-section cannot be measured. The discharge through these areas is approximated. Discharge near the banks is estimated by assuming a triangular cross-sectional area with dimensions of the depth measured by the ADCP near the bank and the user measured distance from

Figure 4 – Teledyne RD Instruments' StreamPro ADCP. Similarly equipped to model used. [*Teledyne Marine*, 2004].

the ADCP to the bank. The velocity through the triangular area is approximated using the average velocity in the nearest ensemble of cells and a scaling factor of 0.35 [*Teledyne RD Instruments*, 2008]. The velocity through the top and bottom is estimated by fitting a best-fit power curve to the measured velocity profile. The curve is then extrapolated to the water surface and canal bottom. The top and bottom areas are calculated by user entered values and ADCP measurements.

When collecting measurements, it is desirable for the canal to be straight and unobstructed for approximately 10x the canal width upstream of the measurement location. This allows flow to be conditioned by reducing turbulence and interaction with the hyporheic zone[1]. Absence of vegetation also increases measurement accuracy. Vegetation can cause turbulence and interfere with sound waves generated by the ADCP.

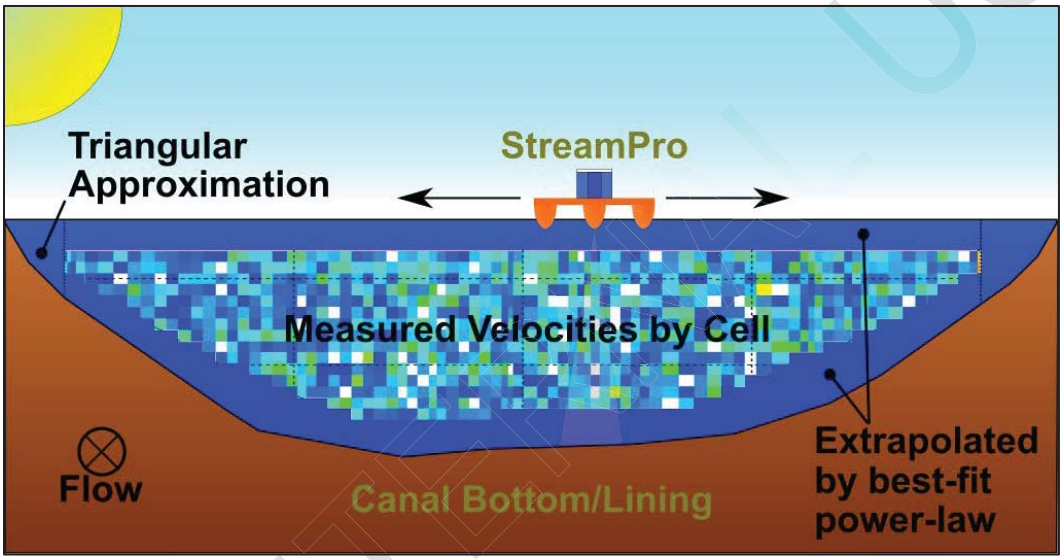


Figure 5 - Schematic depiction of the StreamPro collecting a measurement and the resulting discretization of the flow into cells. The colors of the cells represent varying velocities. The discharge through the area around the perimeter of the cells, in blue, is estimated. Flow direction in the canal is into the page.

Measurement Site Selection & Description

Reclamation Hydrologic Engineer, Brandon House, visited the reach of interest on the morning of May 18, 2017 to collect inflow/outflow discharge measurements. Due to damage from heavy equipment to the existing concrete liner, DWCCC installed a temporary polyvinyl chloride (PVC) lining on the lower third of the reach of interest – reducing seepage losses in this section (Figure 6). Any measurements including flow through the PVC lined reach would underestimate seepage losses. A downstream measurement location was selected just upstream of the PVC lined reach (Figure 6). A section of canal just upstream of the reach of interest had similar properties (aged, fractured concreate liner) and so was included in the measurement plan. DWCCC had been running water in the canal for at least several days prior. Pressure transducers were submerged in the canal near each measurement location to record absolute pressure for the duration of all the discharge measurements.

[1] The hyporheic zone is a subsurface volume of porous media beneath and alongside a stream/canal through which surface water readily exchanges.

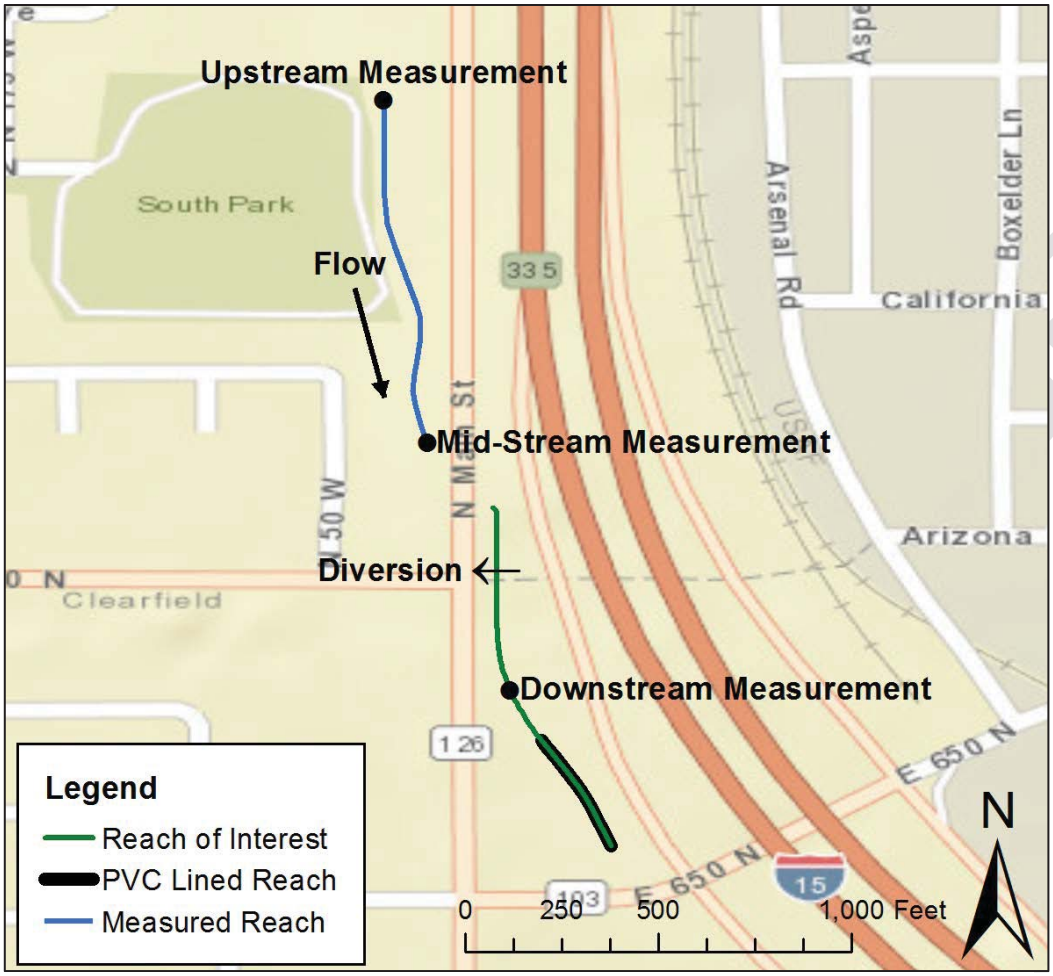


Figure 6 - Location of discharge measurements. The blue line represents the reach of canal between the upstream and mid-stream discharge measurement locations – the measured reach. The measured reach is approximately 0.17 mi long.

The canal was straight and had minimal flow disruptions just upstream of the mid-stream and upstream measurement locations. A slight bend was located just upstream of the downstream measurement location, but likely had little influence on measurement accuracy. Sparse vegetation was present in the fractures of the concrete lining near all measurement sites. This was most prevalent on the right bank of the upstream measurement site (Figure 7). High turbidity did not allow visual inspection for vegetation on the submerged portion of the canal lining. A gauged diversion of approximately 8 cfs was located between the mid-stream and downstream measurement locations (Figure 6)

After a measurement location was selected, stakes with pulleys were pressed into the canal banks opposite each other (Figure 8). A rope was looped through the pulleys spanning the canal. The StreamPro was tethered to a fixed point on the rope. Excess tether rope was looped around the StreamPro control housing. This increased stability of the float by causing it to sit lower in the water. The bounding edges for the traverse were located by positioning the StreamPro as near the canal banks as possible while maintaining enough water depth to be discretized into two cells. This location was marked on the tether rope for repeatability. Data collection was then initiated. Per standard practice, a minimum of ten measurements were collected at each bank with the float stationary at the beginning and end of each traverse [*Mueller and Wagner*, 2009]. Using the tether rope, the StreamPro was traversed across the canal at a velocity at least

3x less than the water velocity. Several traverses were collected at each location.

Figure 7 - Upstream measurement location. Note vegetation growing in cracks of fractured concrete liner. ADCP is in boom position.

Figure 8 – Mid-stream measurement location data collection setup. Note highly fractured concrete liner. ADCP is mounted in boom position.

Two discharge measurements were collected at the upstream location (Figure 7) and one each at the mid-stream (Figure 8) and downstream (Figure 9) locations. Field review of

the difference between the first upstream and downstream discharge measurements, adjusted for the diverted flow, would indicate that the reach between the measurement points was gaining water. This is more likely a result of the dynamics of the canal system from varying inflows or inaccuracy of the diversion measurement. Field review of the difference between first upstream and mid-stream measurements also would indicate that the reach between the measurements was gaining water. Again, this is more likely the result of canal flow conditions changed in the time between when the measurements were collected. Therefore, an additional discharge measurement was collected at the upstream location (Figure 7).

Figure 9 - Downstream measurement location. Black line indicates approximate location of measurement.

Data Processing

Data from a weather station 3 mi east of the field site indicated an increase in barometric pressure during field measurement collection (Automated Weather Observing System, Station ID: KHIF). Pressure transducer data was adjusted for this increase using the slope of the best fit line to the weather station barometric pressure data. Transducer recorded absolute pressure was parsed into barometric and water pressures by subtracting the transducer reading immediately prior to submerging the transducer in the canal. The resulting adjusted pressure was then converted to an approximate depth of water. To ease comparison between measurement locations, water depth data was converted to change in water depth since a common start time.

ADCP discharge data were processed using *WinRiver II* (*Teledyne RD Instruments*). Four transects were collected at the up-stream location, and six at the mid- and down-stream measurement locations (Figure 6). Inclusion of multiple measurements at the canal banks has the potential to compound errors. Defining subsections of each transect which excluded several, redundant bank measurements was also found to increase total discharge agreement between transects. A combination of transects which had good total discharge agreement were selected for inclusion in the average for the final, total discharge. Due to the possibility of traverse directional bias (i.e. travel from the left to the

right bank or visa-versa), an equal number of left and right transects were included in the final discharge measurement.

Assuming the transect total discharge measurement population is normally distributed, the confidence intervals for the mean total discharge ($\bar{X}$) were calculated using the *t* distribution, standard deviation of the transect total discharge data sets (*S*), and the number of transects used in the mean total discharge calculation (*n*) [*Spiegel et al.*, 2013]. The *t* distribution was used in place of the Normal distribution since *n* is less than 30. Standard deviations were calculated by *WinRiver II* and measurement summaries presented in Appendix A (page 14). The confidence intervals are then calculated by:

$$\bar{X} \pm t_c \frac{S}{\sqrt{n}} \qquad \text{(Equation 1)}$$

where t_c is the *t* distribution critical value read from a table based on the desired confidence level and the degrees of freedom ($n - 1$). The confidence interval for the difference between the two total discharge means ($\bar{X}_1$ and $\bar{X}_2$):

$$\bar{X}_1 - \bar{X}_2 \pm t_c \sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}} \qquad \text{(Equation 2)}$$

In this case, the difference between the two total discharge means will be the measured losses.

Results

The canal lining was highly fractured in all observed sections (Figure 7, Figure 8, and Figure 9). Vegetation was growing in most of the fractures.

Change in water depth, in inches (in), near the upstream (blue), mid-stream (red), and downstream (green) discharge measurement locations are presented in Figure 10. Dashed, vertical lines bound the periods of time during which discharge measurements were collected. The color of the dashed lines corresponds to the measurement location.

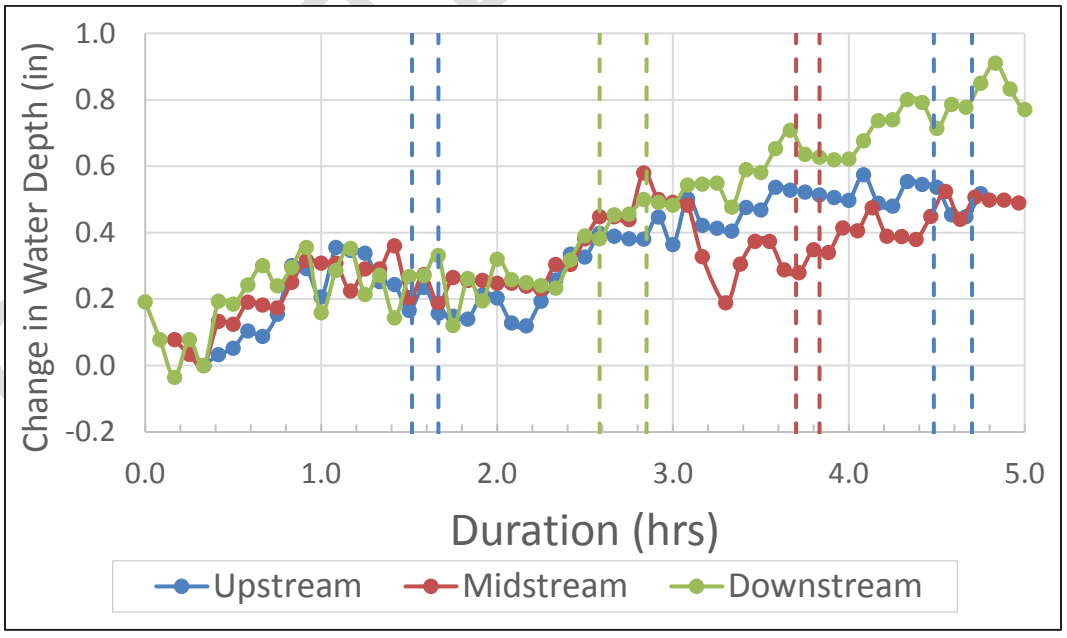


Figure 10 - Change in water depth adjusted for increasing atmospheric pressure and zeroed at a common time. Dashed lines bound canal discharge measurements at the color corresponding location.

Total measured discharge from the three measurement sites is presented in sequential order in Table 1. Eighty-percent confidence intervals were calculated using the *t* distribution (Equation 1)$\bar{X} \pm t_c \frac{S}{\sqrt{n}} \bar{X} \pm t_c \frac{S}{\sqrt{n}}$. Summary details for each measurment can be found in Appendix A (page 14).

Table 1 – Discharges from the three measurement locations and associated 80% confidence intervals.

First Upstream Discharge (cfs):	55.7 ± 1.21
Downstream Discharge (cfs):	48.6 ± 0.64
Mid-Stream Discharge (cfs):	59.2 ± 0.62
Second Upstream Discharge (cfs):	60.7 ± 0.76

Discussion

Though the submerged portion of the lining could not be seen, it is not unreasonable to assume it is in similar condition to the exposed lining. Fractures impair the linings effectiveness at reducing seepage since surface water can flow through these cracks. Fractures also provide areas for vegetation to take root, increasing transporation water losses.

The increase in canal water depth from 2.2 hours (hrs) to 2.6 hrs indicate that the first upstream discharge measurement was collected under different flow conditions than the subsequent three measurements (Figure 10). This is supported by the 5.0 cfs increase between the first and second upstream measurements (Table 1). Therefore, the first upstream measurement is not a reasonable inflow for comparison to the mid- and down-stream measurements. The continued water depth increase at the downstream location from 2.3 hrs on, after the up- and mid-stream locations stabilize, could indicate a steady decrease in the discharge of water being diverted at the diversion site (Figure 10). Due to this uncertainty, the downstream measurement was not used.

Based on the above decisions, the second upstream and mid-stream measurements were used to estimate losses for the reach of interest. The difference of the up- and mid-stream discharge measurements indicate 1.47 ± 0.98 cfs in losses over the measured reach under these flow conditions (Equation 2)$\bar{X}_1 - \bar{X}_2 \pm t_c \sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}}$ (Equation . The losses were then normalized for the length of the measured reach to account for the difference in length from the reach of interest. With 80% confidence, this yields approximate annual surface water loss of 565 ± 378 AFY (Table 1 and Table 2).

Table 2 - Estimation of surface water losses from the reach of interest with 80% confidence intervals

Second Upstream Discharge (cfs):	60.7 ± 0.76
Mid-Stream Discharge (cfs):	59.2 ± 0.62
Measured Reach Losses (cfs):	1.47 ± 0.98
Irrigation Season Duration (days):	183
Measured Reach Length (mi):	0.17
Reach of Interest Length (mi):	0.18
Annual Loss (AFY):	**565 ± 378**

Conclusions

The measured surface water losses are assumed to be entirely from seepage and ET. By piping the reach of interest it is assumed that the seepage losses will be mitigated and ET losses eliminated. DWCCC assumes reinforced concrete pipe is 97% effective at reducing seepage. Based on review of testing requirements for pressurized, non-cylindrical reinforced concrete pipe, this effectiveness is reasonable [*American Water Works Association*, 2008]. With 80% confidence, the canal piping project will result in a surface water savings of **548 ± 367 AFY**. This is 280% ± 255% more than the estimated surface water savings of 144 AFY stated in DWCCC's grant application.

There is a high level of uncertainty in these results due to variability between transect discharge measurements (Appendix A), the relatively low losses discharge compared to the total discharge, and the number of measurements. The cause of uncertainty is that each transect does not measure the same total discharge. The greater the central tendency of the total discharge measurements the less uncertainty. This uncertainty is amplified by the low discharge of losses relative to the total discharge. Taken individually, the confidence intervals for the total discharge values are tight (± 1.3% and ± 1% for upstream and mid-stream discharge, respectively). However, when the difference of these is calculated, the uncertainty is amplified relative to the discharge of annual losses (± 67%). Uncertainty can be reduced by collecting additional transect measurements; however, this was not deemed necessary to accomplish the project scope.

The scope of this work is to verify that the grant recipient’s estimate of annual losses is reasonable. The low-end of the 80% confidence interval results in a conservation of surface water which is 26% greater than that estimated by DWCCC. It is recommended that DWCCC’s grant application surface water conservation estimate be considered reasonable.

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Trout Unlimited
1777 N Kent Street, Suite 100
Arlington, VA 22209
(703) 522-0200

April 19, 2018

Rick Smith, PE
General Manager
Davis and Weber Counties Canal Company
138 W 1300 N
Clearfield, UT 84015

Dear Mr. Smith:

Over the past several years, Trout Unlimited has had the great opportunity and privilege to be involved in a positive effort within the Weber River Watershed, known as the Weber River Partnership. We value the involvement and perspective that the Davis and Weber Counties Canal Company has brought to this partnership, which represents a broad and diverse array of interests within the basin. The Weber River Partnership has made great progress in the Weber River by providing a platform for communication, coordination and collaboration among the diverse stakeholders and we believe this diversity has brought considerable value to developing a cohesive vision that includes water security, agricultural interests, community development and natural resources values.

Trout Unlimited has been working on the ground with a number of partners throughout the Weber River Basin, including the Utah Division of Wildlife Resources, agricultural producers and water users to protect and restore populations of Bonneville cutthroat trout and bluehead sucker though habitat restoration, fish passage and water efficiency projects. The bluehead sucker and Bonneville cutthroat trout populations have declined and are considered to be in jeopardy and petitions for listing under the Endangered Species Act are possible. Understandably, all partners in the watershed benefit by preventing the listing of imperiled species, but beyond that, we believe that many watershed partners also greatly value the fact that these species still persist in the Weber River, a sign of the great resilience of these native species and a reflection of the rich economic vitality they bring to our communities. Nevertheless, these species need our help and a cohesive strategy through the Weber River Partnership broadens the scope of our actions on the ground to provide broad benefits to all stakeholders in the Basin.

Trout Unlimited is encouraged by and supportive of your proposed project to improve the water conveyance efficiency of and metering within your system under the WaterSMART water and energy efficiency program. We are encouraged by your consideration of leaving a portion of the saved non-consumptive water in-stream, as water demands at certain times of the year can leave lows in the Weber River at critically low levels, a condition that continues

to be the one of the most existential threats faced by native fish in the Weber River. We support your proposal and are committed to working with the Davis and Weber Counties Canal Company on this efficiency project if our assistance is needed. We look forward to the continued collective progress, working in partnership with your organization on the broader goals of improving communication, coordination and collaboration within the Weber River Basin.

With Kind Regards.

Paul Burnett - Utah Water and Habitat Program Lead
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Ogden, UT 84405
801-436-4062
pburnett@tu.org

GARY R. HERBERT
Governor
SPENCER J. COX
Lieutenant Governor

State of Utah
DEPARTMENT OF NATURAL RESOURCES
MICHAEL R. STYLER
Executive Director
Division of Wildlife Resources
MICHAL D. FOWLKS
Division Director

April 24, 2018

Richard D. Smith, P.E.
General Manager
Davis &Weber Counties Canal Company
138 West 1300 North
Sunset, Utah 84025

Subject: U.S. Bureau of Reclamation WaterSMART Water Efficiency Grant

Dear Mr. Smith:

As the Aquatics Habitat Restoration Biologist in Northern Utah for the Utah Division of Wildlife Resources (UDWR), I am pleased to write in support of the grant application you are submitting to the U.S. Bureau of Reclamation Water and Energy Efficiency Grants Program. I applaud your efforts to increase the efficiency of your system to conserve valuable water and energy. All water savings in the Weber River are valuable to ensure that we have adequate water for future generations.

The Bonneville Cutthroat Trout and Bluehead Sucker are native fish species found in portions of the Weber River. Both species are covered by conservation agreements the State of Utah has entered into with the U.S. Fish and Wildlife Service and other parties. The population status of these two sensitive species warrants additional conservation effort to diminish the likelihood of future listings under the Endangered Species Act. UDWR's approach to aquatic species conservation and management in the Weber River, in part, focuses on reconnecting and maintaining connectivity of priority habitats by removing unnecessary barriers to fish migration, or by modifying existing barriers to allow upstream movement of these species, particularly for Bonneville Cutthroat Trout and Bluehead Sucker. Naturally of course, stable and connecting flows between those habitats are a fundamental requirement for those conservation actions to be successful. Within that context, most any project that enhances the continuity and maintenance of flows within the Weber River is a step in the right direction, as we work cooperatively to protect and conserve these native species.

The Weber Basin Water Conservancy District has been a great partner and contributed to a graduate student project that is currently studying Bluehead sucker in the Weber River. The outcome from this study will be to determine important spawning locations (including spawning habitat requirements) and the type of low velocity/backwater habitats needed for juvenile Bluehead sucker survival and recruitment. The results from this study will guide future management of Bluehead sucker in the Weber River into the future and will help guide future habitat restoration projects.

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UTAH DNR WILDLIFE RESOURCES

The population of Bonneville Cutthroat Trout in the lower Weber River is quite unique in that they travel significant distances in the main stem Weber River and ultimately up into tributary streams to spawn. This life history attribute has been lost from almost all Bonneville Cutthroat Trout populations, but still persists in the Weber River! We are very excited regarding the objective in this grant application that specifically addresses two specific lengths of canal needing repair. Water saved by piping both reaches of canal will benefit both Bonneville Cutthroat Trout and Bluehead sucker in the lower stretches of the Weber River. Both the UDWR and TU are fully committed to partner with the Davis and Weber Counties Canal Co. to ensure that the work on these two sections of canal is completed, thus allowing more water for fish use in the lower Weber River. This project will help ensure that Bonneville cutthroat trout and Bluehead sucker do not become a federally listed species under the Endangered Species Act in the future.

Sincerely

Clint Brunson
Aquatics Habitat Restoration Biologist
Utah Division of Wildlife Resources

Davis and Weber Counties Canal Company (DWCCC)
On-farm Intent Signatures - Small Piping and Hydro Project
FOA# BOR-DO-18-F006

Landowner Name	Claimable Acreage	Landowner Signature I have an interest to install a high-efficiency irrigation system when sufficient water quantity, quality, and application requirements are met.
Mike Kotendrianos	66	Mike Kotendrianos
The Nature Conservancy	500	Mike Kotendrianos
Roberts Family Farms	78	Dix B. Roberts
Day Farms	200	Thomas Day

Davis & Weber Counties Canal Company **Attachment G**

Priority Projects

10/9/2017

High Priority Projects

Priority	Segment #	Stationing Start	Stationing End	Length (ft)	Current Condition	Proposed Improvement	Estimated Replacement Year	Estimated Replacement Cost	Location and Description
0	35	631+75	642+00	1,025	Open Liner	Box Culvert	2018	$ 804,713	Funded by WaterSmart by 650 North
1	50	873+75	891+00	500	2017 66" Pipe	1-66" RCP	2019	$ 231,045	Layton, Connection to Church St Reservoir
2	46	756+75	788+25	3,150	No Liner	2-66" RCP	2024	$ 2,260,343	Clearfield, South/East of 1500 East
3	47	788+25	800+00	1,175	No Liner	1-66" RCP	2025	$ 639,970	Layton, South/East of University Parkway
4	21a	425+00	425+00	-	72" Rivited Steel Pipe	HDPE	2025	$ 280,784	Penstock Pipe
5	43	725+50	742+50	1,700	Open Liner	2-66" RCP	2028	$ 1,307,776	Clearfield, Gate 23E to SR 193
6	33	619+75	630+25	1,050	Open Liner	Box Culvert	2030	$ 884,603	Sunset, Behind American Stone
7	30	604+75	611+25	650	Open Liner	Box Culvert	2031	$ 614,636	Sunset, South of 1300 North (Sierra RV)
8	48	800+00	852+40	5,240	2000 54" CMP/RCP	1-66" RCP	2034	$ 2,511,840	Layton, Replace Existing 54" CMP
9	45	743+50	756+75	1,325	1999 84" Al. Steel	2-66" RCP	2035	$ 962,255	Clearfield, Replace 84" at Tai Pan Trading
10	25	530+40	585+00	5,460	Open Liner	Box Culvert	2040	$ 4,683,967	Roy, Railroad Crossing to I-15
11	42	714+25	725+50	1,125	Open Liner	2-66" RCP	2040	$ 806,788	Clearfield, I-15 to Gate 23E
12	27	590+50	593+75	325	Open Liner	Box Culvert	2041	$ 331,826	Sunset, Parallel SR126 by Sunset Pond
13	29	601+25	604+75	350	1993 Liner	Box Culvert	2041	$ 323,564	Sunset, In front of Sunset Pond
14	28	593+75	601+25	750	2011 Open Liner	Box Culvert	2041	$ 647,751	Sunset, By Sunset Pond
15	52	90130	90375	245	Open Ditch	1-48" RCP	2041	$ 109,912	End of canal after Church Street Pond
16	23	471+00	497+00	2,600	1988 Open Liner	Box Culvert	2042	$ 2,273,573	Roy, Breach Box Culvert to 5600 South Box
			Total	26,670			Total	$ 19,675,346	

Watch List

Priority	Segment #	Stationing Start	Stationing End	Length (ft)	Current Condition	Proposed Improvement	Estimated Replacement Year	Estimated Replacement Cost	Location and Description
17	37	643+00	652+00	900	2011 Open Liner	Box Culvert	2043	$ 763,880	Clearfield, South of 650 N
18	38	652+00	666+75	1,475	1988 Open Liner	Box Culvert	2044	$ 1,460,092	Clearfield, South of 650 N
19	31	611+25	615+00	375	3-60" Al Steel Pipes	Box Culvert	2044	$ 339,909	Sunset, Replace 60" CMP at Sierra RV
20	21	392+00	458+00	6,600	2000 102" Dia Pipe	Box Culvert	2047	$ 5,990,469	Riverdale, 102" AL Pipe
21	14	282+25	293+80	1,155	1993 Open Liner	Box Culvert	2048	$ 1,204,035	South Weber, Open Liner
22	20	374+75	392+00	1,725	1992 Open Liner	Box Culvert	2049	$ 1,863,160	Riverdale, Open Liner
23	8	140+84	144+68	384	1998 Open Liner	Open Liner	2049	$ 226,127	South Weber, Open Liner
24	18	335+00	352+40	1,740	1995 Open Liner	Open Liner	2050	$ 1,033,409	South Weber, Open Liner
25	26	585+00	590+50	550	Box Culvert	UDOT Box Culvert	2050	$ 185,414	Sunset 1600 North SR 126
26	34	630+25	631+75	150	1945 Box Culvert	UDOT Box Culvert	2050	$ 133,414	Sunset 800 North SR 126
27	44	742+50	743+50	100	Box Culvert	UDOT Box Culvert	2050	$ 120,904	Clearfield, SR 193
			Total	15,154			Total	$ 13,320,812	
	Total High Priorities and Watch List			41,824		Total High Priorities and Watch List		$ 32,996,158	