Bear River Canal Company

Hammond East Canal Lining and SCADA Project

WaterSMART: Water & Energy Efficiency
FY 2017

APPLICANT

Bear River Canal Company
276 North 1600 East, Tremonton, Utah 84337

PROJECT MANAGER

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Applicant Info

Date: January 11, 2016
Applicant Name: Bear River Canal Company (BRCC)
City, County, State: Tremonton, Box Elder County, Utah
Project Manager:

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Project Funding Request: $300,000 total project cost $600,940

Project Summary

The Hammond East Canal Lining and Metering Project will consist of installing 4,400 feet of Ethylene Propylene Diene Monomer (EPDM) liner and one solar powered SCADA Acoustic Doppler monitoring meter. The project will reduce seepage losses and conserve 3,930 acre-feet of water that is lost into the hillside throughout the irrigation season. The project was listed as a high-risk area within the Bear River Canal Company Safety Management Plan (SMP) that was developed and approved in 2015. This Project will result in better management of 17,900 acre-feet of water which is diverted into the Hammond East Canal each year. It will allow for conserved water to remain within Cutler Reservoir and Bear Lake for longer periods of time and water to reach the end of the canal and then flow into the U.S. Fish and Wildlife Service Bear River Migratory Bird Refuge (Bird Refuge).

This project falls under Task 1 – Water Conservation Canal Lining/Piping and Irrigation Flow Measurement and Task 4 – Supervisory Control and Data Acquisition and Automation.

Estimated Schedule

Length of time and estimated completion date

This project is ready to move forward as soon as it is awarded. An environmental document and preliminary and final design will be prepared September 2017- February 2018. The lining portion of the project will take three to four months and will need to take place outside of the irrigation season (April 15- October 15th). It is anticipated that the actual lining installation of the project will take place in the February 2018 – April 2018 timeframe. However, it may be necessary, because of the irrigation season, to construct the project October 2018 – March 2019. The installation of the meter will take 1 to 2 months and will take place through the spring months of March 2018 – April 2018. The project will be accomplished within the two-year allowance.

Federal Facility

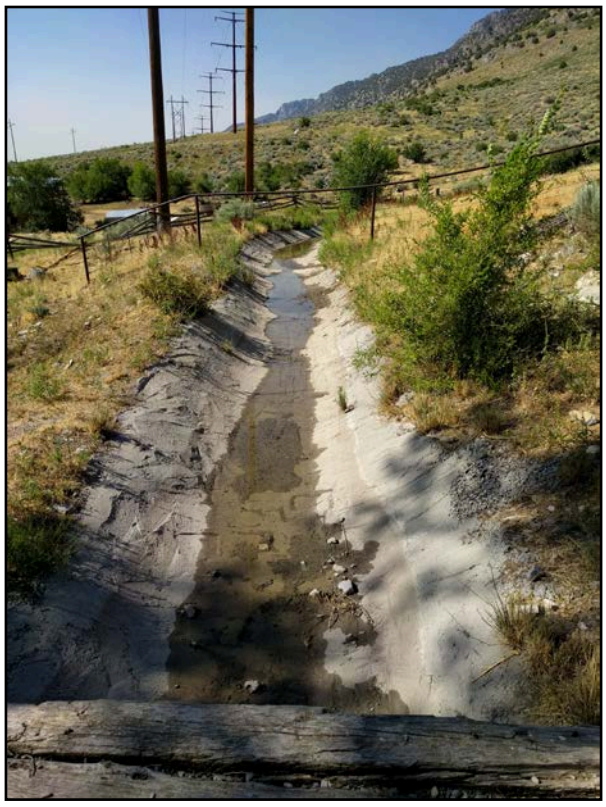
BRCC receives water through Cutler Reservoir. Cutler Reservoir belongs to PacifiCorp which has senior rights to the flows that are stored in Hyrum Reservoir which is a Reclamation Project. The Little Bear River also feeds Cutler Reservoir and is supplied by Hyrum Reservoir. Hyrum Reservoir provides water to run a PacifiCorp hydroelectric facility on the Bear River. PacifiCorp has an obligation to deliver all of BRCC's water through Cutler Reservoir.

Background Data

The BRCC has served many farmers and residents of Box Elder County for over 100 years starting around the year 1890. The original owner of the seven canals and four laterals was the U&I Sugar Company. The sugar company used the canals to supply irrigation water to sugar beet farmers in the area during the summer months and for processing sugar in the fall and winter months. The primary purpose of BRCC canals today is to provide irrigation water for a variety of crops that are produced within 65,490 acres of the service area of the canals.

The project is located on the Hammond East Canal which is 15 miles of earthen and lined canal that diverts about 50 CFS or 17,900 acre-feet per season. This Canal has had its share of difficulty in delivering adequate water to the end of the canal. A significant portion of the canal sits on the hillside above many homes with steep slopes below it. Seepage losses within this canal have caused water in the basements and fields below. There are 395 shareholders along the Hammond East Canal with about 2,950 shares of the water that comes through the Hammond East Canal. Many of the shareholders are frustrated by the losses. This past year litigation was initiated, and many others have been threatened by shareholders. BRCC has made many attempts to remedy the seepage losses, but year after year the leaks continue to reemerge or new seepage losses occur, which continues to add to the frustration of the water users.

Photo 1 Last Mile of Hammond East Canal



A water loss study was performed along the entire canal at the first of August 2016. Then in September 2016, a more detailed study was conducted on the areas identified in previous study to have had the greatest losses. Over the past few years BRCC has not been receiving any water at the end of the ditch. See

Attachment B for a copy of the August 2016 Water Loss Study and the Detailed Water Loss Memo

Last spring BRCC installed 1,000 feet of concrete pipe on the canal. They currently are focusing on lining the areas of the canal that have the highest seepage losses. They have a design and a contractor procured to install 1,600 feet of EPDM liner this spring from station 529+00 to 545+00. This winter they are also designing an additional 2,320 feet of EPDM liner that will be installed this spring from Station 414+50 to 437+70. Although this will help alleviate the losses, there is much more that needs to be done. The proposed project will allow **BRCC to continue the lining of an additional 4,400 feet of the canal reducing the seepage loss even more and conserving an additional 3,930 acre-feet of water.**

Geographic Location /Map

The service area of BRCC includes cities, towns, and unincorporated areas in Box Elder County. The incorporated cities and towns include Fielding, Garland, Tremonton, Deweyville, Elwood, Honeyville, Bear River, Corrinne, and Brigham City. The unincorporated areas within the BRCC service area are Riverside, Bothwell, Thatcher, Penrose, and Collinston. The service area covers 65,490 acres. The project location is shown in an overview of the entire service area and is indicated in Attachment A, Geographic and Project Location Map.

Water Supply

» ***The source of water supply:*** Water flows from Bear Lake through the Bear River through the Bear River directly flows into the Cutler Reservoir where it is delivered through a diversion structure and canal that is owned by PacifiCorp.

» ***Water rights involved:***

Bear River Right

Water Right (29-)	Source	Quantity	Priority Date
2633	Bear River	14,496.44 ac-ft	1904
2856	Bear River	333.0 cfs or 100,031.544 ac-ft	1889
2857	Bear River	133.0 cfs	1901
2858	Bear River	43.0 cfs	1914
3321	Bear River	300.0 cfs or 72,124.56 ac-ft	1987

» ***Current water uses and number of water users served:*** The majority of the water use (based on volume) is agricultural with 65,490 acres irrigated. Secondary water uses are very limited and are only happening in new residential developments that have installed their own secondary systems and mostly within incorporated cities.

» ***Current and projected water demand:*** Current demands are approximately 275,000 acre-feet based on water shares. However, much less than that is actually delivered because of

seepage losses in the canals. Local laws and policy changes, growth, and climate change have reminded the BRCC of the external risks and demands placed upon them and their water supply. A list of potential water demands includes the following:

- **New Secondary Water Demands** - Water to serve new residential, industrial, and commercial users who will require new secondary water opportunities. Many of the towns and cities in the BRCC service area hold shares in the BRCC. As communities grow, their residents are going to demand secondary water opportunities to avoid having to flood irrigate their properties.
- **Water shortage** - Tremonton City, the second largest community in the BRCC service area, is already suffering from the impact of residents using culinary water to water their lawns and gardens. They are concerned they will soon be short of culinary water and are wanting BRCC to consider how they could incorporate secondary water opportunities for their area.
- **Growth** - Growth and land use conversions are a real concern for the BRCC service area. Water required to help meet the growing needs of municipal and industrial areas will need to be evaluated and planned for. Water conversion strategies need to be developed to help meet the needs of a growing population. Over the next twenty years, residential populations in Box Elder County are estimated to nearly double. This population change has prompted BRCC to make efforts to prepare and evaluate their water management plans for the future. They understand that they need to prepare for greater secondary water needs beyond their existing agricultural users.

» ***Potential shortfalls in water supply:*** BRCC faces potential shortfalls in four main areas:

1. Water Loss – The number one potential shortfall for BRCC is water losses through seepage. These losses have impacted water delivery, caused damage to fields and basements, and reduced crop yield for shareholders. Conflict over not being able to receive water shares at the low end of the canal are threatening legal action against the canal company.

   Visual inspections show water seeping from the canal onto the hillsides and adjacent fields. The project area of the canal for consideration is earthen lined and is in very poor condition. The water that is seeping through the canal embankment areas is located above residential homes with steep side slopes. A breach in this area would have a significant impact on the water supply and to hundreds of users.

2. Past Drought and the Economy – BRCC potential shortfalls from drought can and have had an impact on the current water supply. BRCC service area is home to some of Utah's highest producing farms that still rely solely on farming as their only income. Extreme drought conditions in the past have had economic impacts to BRCC service area. In

2001-2003 the BRCC service area experienced intense drought and was affected by both reduced water availability and economic impacts. Within the 2003 Economic Report to the Governor of Utah, it indicated "the hardest hit sector (related to the drought) was agriculture, where 2,600 jobs and almost $40 million in income was lost."

3. Drought Conditions Today – According to the "*Drought Impact Reporter*" in 2016 "Utah's reservoirs were averaging 47 percent of capacity statewide, due to several months of hot, dry weather. As reservoirs continued to drop after the high demand during the summer, next year's water supply will be in jeopardy."

   Drought can impact not only BRCC but the areas with which their water rights are stored. In 1911, a canal was constructed that now diverts almost all the water in the Bear River at Stewart Dam southward to Mud Lake. From there, when spring runoff water is being stored, the water flows through Mud Lake to enter Bear Lake. The rest of the year it flows through Mud Lake and out the Outlet Canal to rejoin the original Bear River channel. The upper 6.5 meters of Bear Lake function as a reservoir. The Lifton Pumping Station releases water from Bear Lake to the Bear River during the summer for irrigation. The water levels in the lake fluctuate annually with these releases.

   BRCC stores many of their water rights within Bear Lake. In 2002 - 2004, due to an extended drought, Bear Lake reached its lowest level in 70 years. The seepage losses along the Hammond East Canal will only complicate any new drought situation. The water losses from seepage, potential flooding, and drought conditions make this a high priority project.

4. Growth – over the past 10 years, BRCC service area has seen a 25% population increases with many new residential housing developments, businesses, schools, and churches. The impact of growth is revealed by the need to convert water from agriculture purposes to that of residential uses – lawns and gardens. According to the Utah Governor's Water Task Force Committee, agricultural water usage was 80% of the total water used in 1995. Today, however, the use is approximately 55% for agricultural. The 25% difference is water that has been converted from agriculture crop production to residential outdoor use for lawns, gardens, parks, schools and churches, municipal and commercial needs.

   As the population increases in the service area, the need for more culinary and secondary water will also increase. This demand could have significant effects on BRCC's ability to provide water the way it has always been accustomed to and could also have an impact on available water based upon drought conditions and transmission water losses from seepage or unlined/unenclosed distribution systems.

» ***Major crops and total acres served:*** Wheat, hay, onions, and corn. Box Elder county is also home to many fruit orchards.

Water Delivery System

In addition, 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.

The BRCC owns and operates roughly 124 miles of canals that distribute and deliver irrigation water across 65,490 acres of land. Two main canals come out of Cutler Reservoir with the West Main Canal on the north side of the Bear River and the Hammond Canal on the south side of the Bear River. PacifiCorp maintains the first 0.7 miles of these two main canals just downstream of Cutler Dam. These canals split into multiple canals as shown below:

Table 1 Length and Flows of the BRCC Canals

BEAR RIVER CANAL COMPANY CANALS			
Name	**Length (miles)**	***Max Flow (cfs)**	**Notes**
West Main	31	730	
East Main	24	350	
Central	15	150	
Highline			Operated and Maintained by others
Hammond Main	9	175	
Hammond West	18	120	
Hammond East	15	55	
Iowa String	4	55	
Lateral A	2	35	
Lateral B	3	100	
Lateral D	2	55	
Lateral F	1	25	
TOTAL	**124**		

*Estimated maximum irrigation flow at diversion point under normal operating conditions

BRCC delivers water to over a 100 ditch companies and has many elements to maintain, inspect, and supervise.

Table 2 BRCC Component Inventory

CANAL COMPONENT INVENTORY SUMMARY	
ITEM DESCRIPTION	TOTAL
Major Diversion Structures:	3
Bridges:	159
Culverts:	53
Debris Racks:	14

Discharge Points:	33
Flumes:	40
Foot Bridges:	69
Head Gates:	527
Highway Bridges:	85
Highway Culverts:	9
Inlets:	85
Inverted Siphons:	3
Sections of Lined Canal:	45
Monitoring Stations:	5
Sections With No Road:	24

Service Area

BRCC delivers irrigation water to farmers and residents in an area of approximately 65,490 acres in Box Elder County. The BRCC service area includes areas within Box Elder County. The cities are labeled and shown in Attachment A Geographic and Project Location Map.

- Fielding
- Garland
- Tremonton
- Deweyville
- Elwood
- Honeyville
- Bear River
- Corrinne
- Brigham City

Other unincorporated areas that are within the BRCC service are:

- Riverside
- Bothwell
- Thatcher
- Penrose
- Collinston

Energy Efficiency

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

This project will have renewable energy components of the project by installing a solar powered SCADA Meter. Currently, BRCC has another solar powered SCADA meter that saves them hundreds of dollars in electrical usage. By implementing this same type of SCADA meter and renewable energy opportunity, it will allow them to reduce their reliance on outside sources. It will permit the company to run the SCADA meter with the power generated from the solar source.

Past 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).

Bear River Canal Company has not received funding from Reclamation directly, but they have worked closely with them in many instances. They are members of the Bear River Water Users

Association (BRWUA) who has a working relationship with Reclamation. BRCC works with Bear River Water Users through planning and collaboration meetings.

Technical Project Description

The project description should describe the work in detail, including project milestones and specific activities that will be accomplished as a result of this project. This description shall have sufficient detail to permit a comprehensive evaluation of the proposal.

The Hammond East Canal Lining and Metering Project will consist of installing 4,400 feet EPDM liner and one solar powered SCADA Acoustic Doppler monitoring meter. The project will reduce seepage losses and conserve 3,930 acre-feet of water that is lost into the hillside throughout the irrigation season. This Project will result in better management of 17,900 acre-feet of water which flows through the Hammond East Canal. It will allow for conserved water to remain within Cutler Reservoir and Bear Lake for longer periods of time and for water to reach the end of the canal and then flow into the Bird Refuge and eventually into the Great Salt Lake.

The SCADA management meter will be located on the West Main Canal just downstream of where the East Main Canal splits off. This will help them manage the water downstream in their system more efficiently. The meter will be Open Channel Acoustic Doppler Current Profiler meter.

Evaluation Criteria

Evaluation Criterion A: Quantifiable Water Savings

***Describe the amount of water saved**. 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. Please provide sufficient detail supporting how the estimate was determined, including all supporting calculations.*

- *Estimated Water to be conserved: Where is the water that will be conserved currently going (e.g., back to the stream, spilled at the end of the ditch, seeping into the ground)?*

The estimated amount of water to be conserved by this project is 3,930 acre-feet per year. Water is seeping through the earthen canal into the ground, fields, basements of residents, and is also being taken up by vegetation. The soils around the canal are sandy/gravelly soils and allow the water to pass through very quickly. The water does not reach the end of the canal right now because of the extensive water loss.

Project proposed for funding:

Canal Lining/Piping: Canal lining/piping projects can provide water savings when irrigation delivery systems experience significant losses due to canal seepage. Applicants proposing lining/piping projects should address the following:

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.

Two inflow/outflow tests were done in August 2016. The first tests were done at intervals of approximately one mile along the entire length and a more detailed follow up study was done in the high flow loss areas. The canal diversion gates were closed during the tests. More details about the tests are given in the following section.

The water savings were determined for each of the canal segments by finding the difference in flow through a segment of canal, measured in cubic feet per second. These flows were then converted to an acre feet per year volume assuming a six-month irrigation season. The following equation shows how the total savings for the Project were calculated.

Overall project annual acre-feet savings per mile equation:

$$\left[\left(\frac{(35cfs-27cfs)+(14cfs-11cfs)}{(41450ft-39020ft)+(52600ft-50630ft)}\right)*\frac{60sec}{min}*\frac{60min}{hr}*\frac{24hr}{day}*\frac{30day}{mo}*\frac{6mo}{yr}*\frac{1ac}{43560ft^2}*\frac{5280ft}{1mile}\right]$$

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 conducted by J-U-B Engineers Inc. on August 2, 2016, starting at the upper end of the canal (Station 0+00) following the canal to the south. JUB selected sites that had concrete liners, where possible, to provide better flow control sections and reduced uncertainty in the flow calculations. All head gates were closed. Flows were measured at each site by dividing the canal cross section into two to four partitions. The cross-sectional area of each of the flow partitions was measured in the field, and an average flow velocity of each partition was measured using a digital velocity flow probe. The cross-sectional area of each partition was multiplied by the average velocity to calculate the flow in cubic feet per second (cfs). The calculated flows from

Photo 2 Hammond East Canal Bank Eroding

each of the partitions were then added together for a total flow at the given site. See Table 3 below for Flow Measurement Summary and Attachment B Water Loss Study.

The probe was placed in the center (horizontally) of each flow partition and then moved slowly, vertically up and down in the flow cross section for a period of 90 seconds. The flow probe provided the average flow velocity in that flow partition during the 90 seconds.

Photo 3 Hammond East Canal Above Homes

The initial flow loss study was done by taking flow measurements roughly every mile along the length of the canal. The results of the initial study indicated that 3 miles of the canal have significantly higher flow losses than the rest of the canal at mile 8 to 9, mile 10 to 11 and mile 11 to 12. The detailed study was completed by splitting the three high-loss miles into twelve shorter segments and doing flows measurements for each of those segments. Table 3 below summarizes the results of the detailed study.

Table 3 Summarized Flow Measurements and Losses

SITE	CANAL STATION	SEGMENT LENGTH (FEET)	TOTAL FLOW (CFS)	TOTAL LOST VOLUME BETWEEN SITES (ACRE-FEET/YEAR)	LOST VOLUME PER LINEAL FOOT OF CANAL (ACRE-FEET/YEAR)
8a	390+20		35		
8.25	40+315	1,295	32	1,070	0.83
8.5	414+50	1,135	27	1,790	1.58
8.75	426+00	1,150	22	1,790	1.56
9	437+70	1,170	17	1,790	1.53
10	484+50	4,680	14	1,070	0.23
10.25	494+25	975	14	0	0.00
10.75	515+60	2,135	14	0	0.00
11	526+00	1,040	11	1,070	1.03
11.25	538+40	1,240	5	2,140	1.73
11.75	567+55	2,915	5	0	0.00
12	580+80	1,325	6	0	0.00

c) *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)?*

The seepage losses in the proposed project area will be reduced by approximately 3,930 acre feet. The proposed project will line 4,400 feet of canal to reduce the seepage losses in the project area, but the canal will still be an open canal that is susceptible to evaporation. The water loss within the study did not include calculations for evaporation. BRCC has chosen to fix the areas of the canal with the most significant losses first. No spills are occurring at present because the water is not reaching the end of the canal at all. If the water could reach the end of the canal, it would then spill into the Bird Refuge that has always needed this water.

d) *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?*

The total water saved by the project is 4,700 acre-feet per year per mile. The entire length of the project is 0.83 miles. The total lost volume or acre feet per year per mile savings for each of the segments was calculated by subtracting the flow (cfs) at the lower end of each section from the flow at the upper end of the segment and then converting the flows into an annual volume by assuming that the flows are constant for 6 months of the calendar year. Evaporation losses are not included in the calculations.

Overall project annual acre-feet savings per mile equation:

$$\left[\left(\frac{(35cfs-27cfs)+(14cfs-11cfs)}{(41450ft-39020ft)+(52600ft-50630ft)}\right)*\frac{60sec}{min}*\frac{60min}{hr}*\frac{24hr}{day}*\frac{30day}{mo}*\frac{6mo}{yr}*\frac{1ac}{43560ft^2}*\frac{5280ft}{1mile}\right]$$

Savings = 4,700 acre-feet per mile per year

The project is made up of two canal segments with the highest seepage losses. The upper segment starts at Station 390+20 and ends at Station 414+50.

Upper segment of project annual acre-feet savings per mile equation

$$\left[\left(\frac{(35cfs-27cfs)}{(41450ft-39020ft)}\right)*\frac{60sec}{min}*\frac{60min}{hr}*\frac{24hr}{day}*\frac{30day}{mo}*\frac{6mo}{yr}*\frac{1ac}{43560ft^2}*\frac{5280ft}{1mile}\right]$$

Savings = 6,200 acre feet per mile per year

The lower segment of the project begins at Station 506+30 and ends at Station 526+00.

Lower segment of project annual acre-feet savings per mile equation

$$\left[\left(\frac{(14cfs-11cfs)}{(52600ft-50630ft)}\right)*\frac{60sec}{min}*\frac{60min}{hr}*\frac{24hr}{day}*\frac{30day}{mo}*\frac{6mo}{yr}*\frac{1ac}{43560ft^2}*\frac{5280ft}{1mile}\right]$$

Savings = 2,900 acre feet per mile-year

BRCC is currently focusing on lining the areas of the canal that have the highest identified seepage losses. They currently have a design completed and a contractor procured to install 1,600 feet of EPDM liner this spring from station 529+00 to 545+00. This project is extending beyond site 11.25 (Station 538+40) to add improved safety near some homes. This winter they are also designing an additional 2,320 feet of EPDM liner that will be installed this spring from Station 414+50 to 437+70. (Site 8.5 to Site 9). The projects that are being done this year as well as the Proposed projects are shown in Table 4. The two segments that are part of this WaterSMART Proposed Project are highlighted in blue.

Table 4 Projects and Stations

Project Description	Beginning Station	Ending Station	Length (Feet)	Water Volume Conserved (Acre Feet per Year)	Schedule
EPDM liner project with a contractor procured for construction	529+00	545+00	1600	2,140	Construct Spring 2017
EPDM liner project currently being designed	414+50	437+70	2320	3,580	Construct Spring 2017
EPDM liner to be installed for this project (upper segment)	390+20	414+50	2430	2,860	Construct Spring 2018 or 2019
EPDM liner to be installed for this project (lower segment)	506+30	526+00	1970	1,070	Construct Spring 2018 or 2019
Water conserved by this project				**3,930**	

Note: The canal segment from 526+00 to 529+00 has already been lined with EPDM.

e) How will actual canal loss seepage reductions be verified?

Seepage loss reductions will be verified through inflow/outflow meter readings that will be performed at different times of the irrigation season similar to the way the water loss study was conducted. This data will then be analyzed and compared to evaluate the estimated water losses. This comparison will determine the amount of water conserved.

f) Include a detailed description of the materials being used.

The project materials will include 4,400 feet of an EPDM polymer liner that is a cured single-ply membrane and one SCADA solar powered management meters.

Supervisory Control and Data Acquisition and Automation:

a) How have average annual water savings estimates been determined? Please provide all relevant calculations, assumptions, and supporting data.

Throughout the entire service are of BRCC there is only one SCADA meter. This meter is located at the top of the system before the water is turned down into two of the largest canals the West Main and East Main canals. The system is such that some shareholders have irrigated land on both of these canals and many times see water being spilled at the end of the West Main canal

and no water even getting to the bottom of the East Main canal. If they had the ability to regulate the water that is turned into both of the canals, then they would be able to reduce the spills at both ends of the canals and ensure that water is getting to the end of the canals. Thus better managing all the water within these two canals – each of the two canals have an annual volume is 125,000 acre-feet per year.

Estimated Flows at East Man and West Main Split

Name	*Max Flow (cfs)	Annual Volume (acre-feet per year)
West Main	350	125,000
East Main	350	125,000

b) Have current operational losses been determined? If water savings are based on a reduction of spills, please provide support for the amount of water currently being lost to spills.

No formal water loss studies have been completed to understand the spills. The information comes from water users along both of these canals that are frustrated by the over spilling of water in at the end of the West Main canal and the lack of water getting to the end of East Main canal. With the addition of this SCADA meter, BRCC will have access to real-time flow data. This data will assist the company in determining if less flow can be sent down one or the other canals based on the amount of flow that is present at the end of each canal as a result of a given diversion setting. This information will improve the management of the water in the East Main and the West Main canals.

c) Will annual farm delivery volumes be reduced by more efficient and timely deliveries? If so, how has this reduction been estimated?

The water will be better managed in both of these canals thus allowing for users to receive their full allocations.

d) Will canal seepage be reduced through improved system management? If so, what is the estimated amount and how was it calculated?

Seepage losses have not been calculated for these two Main canals.

e) How will actual water savings be verified upon completion of the project?

BRCC will have access to real-time flow data. This data will assist BRCC in determining if less flow can be sent down one or the other canals based on the amount of flow that is present at the end of each canal as a result of a given diversion setting. This information will improve the management of the water in the East Main and the West Main canals and will allow them to compare previous diversion information to understand the past and current diversion better.

Evaluation Criterion B: Water Sustainability Benefits

- *Is there a specific water supply sustainability concern in the region? What factors are contributing to the concern? Please include a description of the impacted geographic area and stakeholders, the partners that are collaborating to resolve the concern, and any other applicable information.*

There are significant water sustainability concerns within the Bear River Watershed and the Great Salt Lake. The Bear River is the largest tributary of the Great Salt Lake, supplying 60 percent of its water. Diversions on all of the tributaries to the lake have taken 39 percent of the lake's inflows and have caused the lake level to drop 11 feet, and lost 48 percent of its

Photo 4 Looking West to the Great Salt Lake

volume. Dust storms occur regularly in the Great Salt Lake region, and research suggests the lake breathes contaminants – inhaling dirty air from cities, adding to it and then exhaling it right back at population centers. Geography, atmospheric conditions, and the desert landscape are a perfect recipe for dust in an area that already regularly exceeds federal pollution standards.

Effects on wildlife can and would be equally severe – and costly. Up to 5 million birds stop at the Great Salt Lake on their migrations every year.

Utah's population is expected to double to 6 million by 2060, more water for municipal and agricultural use will be required. Utah is considering major development along the Bear River. They have proposed a $1.5 billion project that would include multiple dams and reservoirs to serve cities and farms in northeastern Utah. It would significantly reduce the amount of water that reaches the lake, exposing miles more of the lake bed. Water Districts such as the newly formed Cache County Water District have been collaborating with canal

companies, other districts, and state and federal agencies to see what steps they need to take to postpone the development of the 1.5 billion project. Projects like the BRCC proposed project, where conservations, maintenance, and efficiency are the central elements, are going to be vital in postponing the Bear River Development Project.

BRCC is trying to make a difference. They are evaluating their system and developing a Water Management Plan to help them better understand the inefficiencies within their delivery system. They have enlisted NRCS to perform a water loss study on the main areas of their delivery system to be able to plan for and work towards better managing and maintaining their delivery system.

- *How will the proposed project help to address that concern? Will water conserved through the project result in reduced diversions or be made available to help alleviate water supply shortages due to drought, climate variation, or over-allocation?*

Drought and climate variation are not the only issues driving this project. BRCC is concerned by the over-allocation needed to get water down the canal. When you look at the amount of water that is being lost anything BRCC can do will reduce the amount they are diverting. BRCC is working hard to make the changes. They have already started installing a liner in some of the highest loss areas, spending just over one million to make a difference. This WaterSMART funding request is another effort they are making to reduce the losses. Between the projects, they are doing right now (loss of 5,720) and the one they are requesting funding for from Reclamation (loss of 3,930) they will see a huge water savings. The proposed project will allow BRCC to reduce the amount of water it has to divert to deliver to the users along the Hammond East Canal. They will be able to get water to the end of the canal. BRCC will apportion 30 acre-feet and possibly more to spill at the end of the canal after they have completed the projects and the shareholders are able to receive their full water right. This spill water will go directly to the Bird Refuge. BRCC will also be leaving more water in Cutler Reservoir and in the Bear River as they reduce the over allocations they have had to take just to get water to the users at the end. This water saved in the River and Reservoir will have a direct impact on Bird Refuge and the Great Salt Lake.

- *Will the project make additional water available to Indian tribes, and/or rural or economically disadvantaged communities)? If so, please explain.*

This project will benefit the many rural populations served by Bear River Canal Company by providing water supply sustainability. Tremonton City the second largest community – population 7,900 – in the BRCC service area is suffering from the impact of residents using culinary water to water their lawns and gardens. They are concerned they will soon be short of culinary water. This concern is not limited to only Tremonton. By making a real effort to make changes to BRCC's delivery system residents of Honeyville – where the project is mostly located – will see more water sustainability.

- *Will water conserved through the project help to address water supply sustainability in a way not listed above?*

At the end of the Hammond East Canal, is a spillway that goes directly to the Bird Refuge. Over the past year, water was not even gotten to the last mile of the canal, so the Bird Refuge was not able to have any of the spills. BRCC will apportion 30 acre-feet and possibly more to spill at the end of the canal after they have completed the projects and the shareholders are able to receive their full water right. This project will have a direct impact on the ability to get water to the end of the canals and into the spillway, as it has in the past. Other users in BRCC's service area will also see benefits as BRCC will no longer be required to over allocate large amounts of water to the Hammond East Canal.

Evaluation Criterion C: Energy-Water Nexus

Subcriterion No. C.2: Increasing Energy Efficiency in Water Management

Describe any energy efficiencies that are expected to result from implementation of the water conservation or water management project (e.g., reduced pumping).

The energy efficiencies and other benefits that will come from installing solar powered Open Channel Acoustic Doppler Current Profiler SCADA meter include no energy required to run the meter. The system is so efficient that it only requires 0.1W @ 10% duty cycle for typical use.

Will the project result in reduced vehicle miles driven, in turn reducing carbon emissions? Please provide supporting details and calculations. Describe any renewable energy components that will result in minimal energy savings/production (e.g., installing small-scale solar as part of a SCADA system).

The energy efficiencies and other benefits that will come from installing solar powered SCADA meter include no energy required to run the meter. The system is so efficient that it only requires 0.1W @ 10% duty cycle for typical use.

The completion of this project will reduce the time, energy, and money spent to manage the water in the East Main and the West Main Canals. Often times, one of the canals has excess water that is spilled out the end while the other canal does not have enough water to get to the end. The staff is required to travel back and forth between the diversion point and the ends of these canals to make adjustments to the diversion in order to get the most efficient use of the water.

The savings will come from fewer vehicle miles traveled, reduced gasoline consumption, decreased CO2 pollutants released and more man hours saved. The staff will no longer need to drive back from the end of the East Main Canal to the East Main Diversion Point four times per week. The distance from the end of the canal to the diversion point is 26 miles. The distance that the staff will need to travel each week will be reduced by 104 miles. Over a 6-month irrigation season, the distance travelled by the canal rider will be reduced by 2,704 miles. The resulting annual savings are based on the following assumptions:

- **IRS standard mileage rate:** 53.5 cents per mile
- **Vehicle:** 2008 Chevrolet Silverado 4-wheel drive pickup. Carbon footprint information provided at www.carbonfootprint.com/calculator.aspx
- **Social Cost of Carbon Monoxide:** $36 per metric ton at 3% discount rate. (www.epa.gov/climatechange/social-cost-carbon)

Mileage savings based on IRS rates: $1,446 per year

Pollution savings: 2.1 metric tons of CO2 per year which equates to an annual social cost of carbon of $75.60

Evaluation Criterion D: Addressing Adaptation Strategies

- *Identify the specific WaterSMART Basin Study where this adaptation strategy was developed. Describe in detail the adaptation strategy that will be implemented through this WaterSMART Grant project and how the proposed WaterSMART Grant project would help implement the adaptation strategy.*

There is not a basin study developed for the Bear River area, however, many of the same conservation strategies listed in the Colorado *River Basin; Water Supply and Demand Study Update Plan* (2013 Plan) are ones that are universal and can and should be implemented within any basin in the western United States. Within the 2013 Plan, there are six options submitted that related to agricultural water conservation measures listed to reduce demand. They consist of advanced irrigation scheduling, deficit irrigation, on-farm irrigation system improvements, controlled environment agriculture, conveyance system efficiency improvements, and fallowing of irrigated lands. Many of these options were related to specific agricultural conservation programs in two categories: (1) implementation approaches which are incentive-based programs and (2) water transfers that might provide additional opportunities for conservation. The BRCC project incorporates conveyance efficiency improvements. These improvements will prove to be a major accomplishment toward conservation within the BRCC's delivery system.

Within the State of Utah, there is not a prepared study for the Bear River Basin equivalent to the one for the Weber River Basin. However, because the Weber River Basin affects the Bear River Basin so much with the Bear River Development Act, it is applicable to address how this project correlates with the State Regional Water Plan for the Weber River Basin. In the State Regional Water Plan, it discusses irrigation efficiency, leak detection, and loss control.

The BRCC project implements all of this efficiency and shares the goals found in the "Weber River Basin Planning for the Future" a document prepared in September 2009 (WRBP). The WRBP indicates, in Chapter 4, several conservation goals that they would like to implement, most of which this project will help to satisfy. The specific goal that this project will help implement is to reduce irrigation and outdoor use through better monitoring and more efficient application and delivery of the water.

Just as the Weber River Basin, the Bear River Basin must be mindful of ways to meet future water needs, water managers and planners within all Basins 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, irrigation needs, and they need to implement innovative water management strategies.

The 2009 Plan is available at http://www.slideshare.net/StateofUtah/weber-river-basin-2009-water-plan

- *Describe how the adaptation strategy and proposed WaterSMART Grant project will address the imbalance between water supply and demand identified by the Basin Study.*

This project has two implementation approaches defined in the 2013 Plan: incentive-based programs and water transfers. It is indicated that the water conservation programs should address the following issues:

  - Conserved water needs to be measurable by a reduction in demand, conservation measures need to be easily observable, and, where costs are not prohibitive, should be verified by volumetric water use measurement.
  - Legal mechanisms must be in place to protect conserved water in-stream for intended uses, especially in areas where insufficient stream flow currently limits downstream water users from exercising their full diversion rights.
  - Controls may be needed to prevent expansion of effectively irrigated areas associated with water conservation investments.
  - Continuing to maintain a healthy agricultural economy and development of associated policy.

This project will focus on improvements in conveyance system efficiency through delivery and improved canals and SCADA water management. It will have measurable conservation and will protect flows to help ensure that water users will be able to exercise their full diversion right; at present, they are not receiving their full right.

The State Water Plan indicates that "as the basin's population grows, so will the demand for water." This BRCC project will help reduce the extreme loss in their system that hinders them in delivering a full right of water to its users.

- *Identify the applicant's level of involvement in the Basin Study (e.g., cost- share partner, participating stakeholder, etc.).*

BRCC is a member of Bear River Water Users Association that is involved in planning with the State of Utah, Weber River Water Users Association, many Water Conservancy Districts and with Reclamation. The have always been a participating stakeholder in the planning process.

- *Describe whether the project will result in further collaboration among Basin Study partners.*

This project will require the collaboration with PacifiCorp, Honeyville City, Utah Department of Natural Resources, U.S Fish and Wildlife Service Bear River Migratory Bird Refuge,

Chesapeake Duck Club, and others who are major shareholders in Bear River. It will allow for the collaboration between all these parties and BRCC as they build the project.

Evaluation Criterion E: Expediting Future On-Farm Irrigation Improvements

If the proposed projects will help expedite future on-farm improvements, please address the following:

- *Include a detailed listing of the fields and acreage that may be improved in the future.*

The Hammond East Canal provides water to approximately 395 shareholders about 2,950 shares of the water that comes through the main delivery system and delivers to many ditch companies and residential users. This project will be a positive move toward ensuring that shareholders will receive their shares of water. The canal system is elevated so that anyone could connect on to 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 lined so that losses are minimal and conservation is maximized, and so the environment is protected, and the canal is made safe so water can be delivered efficiently.

BRCC is aware of one of the largest shareholders on the Hammond East Canal that is interested in a few projects most of which are ditch expansions, piping of ditches, and conversion of water deliveries from flood irrigation to sprinklers. This shareholder will make contact with their local NRCS office to evaluate the best form of action to take to implement some of the above projects. The water user that would use NRCS funds for on-farm and near farm upgrades include:

1. Ryan Adams 100 Voting Shares 100 Acres
2. Trevor Gardner 209 Voting Shares 209 Acres
3. Curtis Marble 195 Voting Shares 195 Acres Currenting waiting for ranking to implement an EQIP on-farm piping project.

- *Describe in detail the on-farm improvements that can be made as a result of this project. Include discussion of any planned or ongoing efforts by farmers/ranchers that receive water from the applicant.*

This project will help provide a safer, more reliable, and more efficient water delivery system for the canal. This will allow farmers to pipe ditches and laterals and install sprinklers and pivots. These types of improvements will permit their irrigation systems to be more efficient and will also allow for higher crop yields and less flooding potentials in residential neighborhoods that are continual encroaching on the agricultural lands.

- *Provide a detailed explanation of how the proposed WaterSMART Grant project would help to expedite such on-farm efficiency improvements.*

This project will provide:

- a system that is more efficient and with reduced water loss

- access to stream flows that will allow water users to exercise their full diversion rights
- better management, metering, and monitoring of the system

- *Fully describe the on-farm water conservation or water use efficiency benefits that would result from the enabled 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 submitted already as part of this application returned savings in water for agriculture would be 22% water savings. Better use of the water will come about by reducing water wasting and losses due to seepage this request has outlined the water savings in detail.

- *Projects that include significant on-farm irrigation improvements should demonstrate the eligibility, commitment, and number or percentage of farmers/ranchers who plan to participate in any available NRCS funding programs. Applicants should provide letters of intent from farmers/ ranchers in the affected project areas.*

The farmers previously listed have expressed strong interest in participating through NRCS funding programs to accomplish similar goals as are listed in this application. These projects will allow for higher crop yields, enhanced safety, and increased conservation.

- *Describe the extent to which this project complements an existing NRCS- funded project or a project that either has been submitted or will be submitted to NRCS for funding.*

There have been several canal lining and piping projects through WaterSMART grant awards that have been completed and which are proven examples in the accomplishment of goals similar, if not identical to the goals of this project. Many BRCC shareholders have taken advantage of NRCS EQIP funds to perform on-farm and near-farm projects. Rayan Adams just finished a large irrigation piping project with Equip funds this past year. Others have applied and are waiting for approval.

Evaluation Criterion F: Implementation and Results

Subcriterion No. F.1: Project Planning

Does the project 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.

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.*

BRCC prepared a Safety Management Plan in 2015. This project was listed as a high priority because of the seepage losses and flooding of residents and field below this canal. See Attachment C Safety Management Plans for a table of safety concerns and proposed actions.

BRCC has made an application this year to the Water Conservation Field Service Program to prepare a Water Management Plan.

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).*

As stated above the BRCC project implements all of the efficiencies and shared the goals found in the WRBP. The WRBP has several conservation goals that they would like to implement, most of which this project will help to satisfy. The specific goal that this project will help implement is to help reduce irrigation and outdoor use through better monitoring and more efficient application and delivery of the water.

Subcriterion No. F.2: Support and Collaboration

Describe the extent to which the project garners support and promotes collaboration.

Does the project promote and encourage collaboration among parties? Consider the following:

- *Is there widespread support for the project?*

Yes, the Hammond East Canal has such high water losses that all of the shareholders feel that it in the best interest of the Canal Company to make significant strides to repair this canal.

- *What is the significance of the collaboration/support?*

Collaboration with all parties has been happening over the past few years with shareholders, PacifiCorp, Bear River Water Users, users, municipal, county, state and federal agencies, and others.

- *Will the project help to prevent a water-related crisis or conflict?*

BRCC has been working for the past few years to fix the seepage losses but earlier year shareholders along the Hammond East Canal hired a lawyer and are requiring that more be done and done faster. BRCC went to Water Resources and borrowed funds to help line areas of the Hammond East Canal with a concrete liner but had not performed a water loss study. After completing the study and seeing the large losses all throughout the canal, they felt that they had to do more than what was planned. They decided that they could do more feet of liner if they used the EPDM liner and could reduce the losses even further with the funds that they had. The water loss study opened their eyes to the amount of water being lost, and they felt that they had even greater losses that they needed to address that is the reason for the request for funding from Reclamation. The need to get water to the end of the canal is necessary and a priority.

- *Is there frequently tension or litigation over water in the basin?*

Yes. There is always tension when it comes to water. Natural disasters, drought, and un-maintained canals, pipes and ditches seem to be the major factors in developing tension within any service area. Shareholders this year initiated litigation and many more have been threatened. The collaboration between agricultural users, ditch companies, and residential users is necessary to reduce tension and litigation. By BRCC working toward better and more efficient water management tension and litigation can be lessened.

- *Is the possibility of future water conservation improvements by other water users enhanced by completion of this project?*

Yes. This project is the result of a similar project constructed in the region – Davis and Weber Counties Canal Company, Wellsville-Mendon, Highline Canal, etc. BRCC has seen the benefits of those projects to their shareholders and better understands the need to conserve and be more efficient with one of their most valuable renewable resources. The project will educate BRCC shareholders and others to understand that conservation is not losing your water right but being more efficient and productive with your water right.

Subcriterion No. F.3: 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).

Inflow/outflow testing will be performed again in the project areas and will be compared to the 2016 water loss study. At least two tests, one early and one late season, will be done to evaluate any losses that may occur after the system has run a bit of time. SCADA information will be documented and compared with historical information to evaluate the flows and spillage at the ends of the West and East Main canals. Annual reports of water loss and distribution will be delivered to and reviewed by the BRCC Board.

Evaluation Criterion G: Additional Non-Federal Funding

State the percentage of non-Federal funding provided using the following calculation:

$300,940 Non-Federal Funding
$600,940 Total Project Cost = 50%

Evaluation Criterion H: Connection to Reclamation Project Activities

1. *How is the proposed project connected to Reclamation project activities?*

   BRCC receives water through Cutler Reservoir. Cutler Reservoir belongs to PacifiCorp which has senior rights to the flows that are stored in Hyrum Reservoir which are a Reclamation Project. Hyrum Reservoir provides water to run PacifiCorp hydroelectric facility on the Bear River. PacifiCorp has an obligation to deliver all of BRCC's water through Cutler Reservoir.

2. *Does the applicant receive Reclamation project water?*

   No. BRCC receive out water through the Bear River.

3. *Is the project on Reclamation project lands or involving Reclamation facilities?*

   No.

4. *Is the project in the same basin as a Reclamation project or activity?*

   Yes, the project is located in the Bear River Basin where a number of Reclamation projects are located.

5. *Will the proposed work contribute water to a basin where a Reclamation project is located?*

   Yes, as the project conserves water and reduces losses and will help contribute to the storage and potential flows in the Bear River and eventually to the Great Salt Lake. The Bear River is a main tributary to the Bear River Migratory Bird Refuge and the Great Salt Lake by conserving water and allowing it to move through the river to enhance habitats and recreational opportunities.

6. *Will the project help Reclamation meet trust responsibilities to Tribes?*

   No.

Environmental and Cultural Resources

1. *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.*

   Impacts will be those associated with lining and installing a SCADA meter within the right-of-ways and canals. The proposed project improvements will take place entirely within the existing right-of-ways. In the past, similar projects have had minimal impacts. The surface vegetation will be restored upon completion of the project.

2. *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?*

   BRCC is not aware of any impacts concerning threatened or endangered species in this area.

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

   BRCC is not aware of any impacts to wetlands in this area.

4. *When was the water delivery system constructed?*

   Many improvements have been made over the years. As part of the completed environmental document the required historical documentation for the project will be completed.

5. *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.*

   No. This project will line existing unlined canals.

6. *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.*

   BRCC is not aware of any building, structures or features that would qualify. A cultural resource inventory will be completed as part of the submitted environmental document.

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

   BRCC is not aware of any impacts to or locations of archeological sites.

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

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

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

   No.

10. *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.

Letters of project support

- Chesapeake Duck Club – J.T. Bowen, President
- U.S. Fish and Wildlife Services Bear River Migratory Bird Refuge – Bob Barrett, Project Leader
- J.Y. Ferry & Son, Inc. – Joel M. Ferry, Treasurer
- NRCS – Bronson Smart, P.E. State Conservation Engineer

CHESAPEAKE DUCK CLUB

1015 SOUTH 6800 WEST
CORINNE, UTAH 84307

January 12, 2017

DARIN MCFARLAND,
GENERAL MANAGER
BEAR RIVER CANAL COMPANY
275 NORTH 1600 EAST
TERMONTON, UTAH 84337

Dear Darin:

As the end user of the East canal, the Chesapeake Duck Club is vitally interested in anything that will increase the efficiency of the canals. As you know, we are often shorted on our allotted distribution, especially in the early part of the irrigation season, due to lack of available water and/or an inefficient delivery system.

I understand that you are pursuing funds from the Bureau of Reclamation Water and Energy Efficiency Grants Program. The Club supports you in these efforts and hopes that through these funds the efficiency of the canal flows will be increased, such that all canal users, and particularly those, like us, at the end of a canal, will have a reliable flow of water throughout the entire irrigating season.

I appreciate your efforts to search for ways to preserve the limited water that we have in this area and anticipate that the contemplated projects will be beneficial to all of us.

If there is anything that we can do to assist you in this quest, please let me know.

Sincerely,

J. Thomas Bauer

President, Chesapeake Duck Cluib

United States Department of the Interior
FISH & WILDLIFE SERVICE

Bear River Migratory Bird Refuge
2155 West Forest Street
Brigham City, Utah 84302
(435) 723-5887

January 12, 2017

FWS-17-0001

Darin McFarland, General Manager
Bear River Canal Company
275 North 1600 East
Tremonton, Utah 84337

Dear Mr. McFarland,

The Bear River Migratory Bird Refuge, U.S. Fish and Wildlife Service, is pleased to write in support of your grant application being submitted to the Bureau of Reclamation Water and Energy Efficiency Grants Program. We applaud your efforts to increase the efficiency of your system to safeguard valuable water and energy. These water resources are critical for supporting wildlife resources.

The U.S. Fish and Wildlife Service recognizer's the importance of water preservation in our often water-short basin. The water saved through these improvement projects will provide benefit to water users and the regional environment. We have worked with the Bear River Canal Company closely to identify opportunities to work as partners for water conservation that untimely returns water to the refuge and the Great Salt Lake ecosystem.

We strongly support your grant application and appreciate the advancements it will make in improving efficiency for Bear River Canal Company.

Sincerely,

Bob Barrett
Project Leader
Bear River Migratory Bird Refuge, USFWS, Department of Interior

TAKE PRIDE® IN AMERICA

J.Y. Ferry & Son, Inc.

January 12, 2015

Darin McFarland, General Manager
Bear River Canal Company
275 North 1600 East
Tremonton, Utah 84337

Dear Mr. McFarland,

J. Y. Ferry & Son, Inc. is pleased to write in support of your grant application being submitted to the Bureau of Reclamation Water and Energy Efficiency Grants Program. We appreciate your efforts to increase the efficiency of your system to safeguard valuable water and energy. We have been implementing water efficiency projects over the past 15 years on our farm and ranch including the piping of earthen ditches, laser leveling fields and installing efficient irrigation systems.

J. Y. Ferry & Son, Inc. recognizes the importance of water preservation in our often water-short basin. The water saved through these improvement projects will provide benefit to water users and the regional environment. We have used Bear River Canal water for the past 117 years to manage farm and grazing lands in the Bear River Valley. We also use the Canal water to manage and maintain five duck clubs on several thousand acres of wetlands. We recognize the importance the canal water plays in maintaining these wetlands. We encourage the conservation and efficient use of water in the Bear River Canal system to help protect this valuable resource.

We strongly support your grant application and appreciate the advancements it will make in improving efficiency for Bear River Canal Company.

Sincerely,

Joel M. Ferry
Treasurer
J.Y. Ferry & Son, Inc.

USDA

January 17, 2017

Darin McFarland, General Manager
Bear River Canal Company
275 North 1600 East
Tremonton, Utah 84337

Dear Mr. McFarland,

NRCS is pleased to write in support of the Bear River Canal Company's application to the WaterSMART: Water and Energy Efficiency grant program. NRCS has received your request and is willing to conduct a Water Loss Study of Bear River Canal's system.

The proposed project will help the members of your Canal Company to be resilient to drought or shortages and better manage the water in their system. NRCS supports the company in their dedication to address the water needs of our area.

If you have any questions please contact me at (801) 524-4559.

Sincerely,

/s/

Bronson Smart, PE

Cc: Chris Slater, JUB Engineers

Natural Resources Conservation Service
125 South State St., Room 4010, Salt Lake City, UT 84138
Voice 801 524-4550 Fax 801 524 4403

Required Permits or Approvals

A complete review of any required permits will be prepared during the design phase of the project.

Official resolution

The Official Resolution will be submitted by February 18, 2017

Project budget

Funding Plan and Letters of Commitment

- *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).*

BRCC will use money from their previously awarded loan from Board of Water Resources and funds from assessments for their contribution.

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

Pre-Award Work				
Initial Water Loss Study	Each	1	$ 7,000.00	$ 7,000.00
Detailed Water Loss Study	Each	1	$ 8,400.00	$ 8,400.00
Grant Application	Each	1	$ 5,000.00	$ 5,000.00
Pre-award Design Work (Station 390+20 to 414+50)	Each	1	$ -	$ 30,000.00
Sub-Total				**$ 50,400.00**

Preparations for application included the water loss studies and mapping to help prepare the WaterSMART application. All of these expenditures are part of the overall project and will be considered in the context of the match required by Reclamation. The water loss studies took place in August and September of 2016. These studies were an important aspect of the project because it gave us the direction and stations that needed to be addressed immediately in order to have the biggest benefit for water conservation.

Another pre-award cost will be the design work for Station 390+20 to 414+50 this design work will be completed in the March – May 2017-time frame and will be considered part of the match

required by Reclamation to develop the project. This advanced design work will allow Bear River advance the project construction as soon as the environment report is approved. Because of the significant water losses BRCC wants to get on the project as soon as possible. With the design ready the environmental report can start as soon as awards are announced and can move forward as soon as possible.

- *Provide the identity and amount of funding to be provided by funding partners, as well as the required letters of commitment.*

No letters of commitment will be necessary as all cost sharing will come from BRCC previously awarded loan and from assessments.

- *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.*

N/A

FUNDING SOURCES	AMOUNT
Non-Federal Entities	
Recipient funding Pre-award cost in –kind	***$50,400.00***
Recipient funding cash	***$250,540.00***
Non-Federal Subtotal	$300,940.00
Other Federal Entities	
N/A	**0.00**
Other Federal Subtotal	0.00
Requester Reclamation funding	$300,000.00
Total Project Funding	$600,940.00

Budget Proposal

Budget Proposal Funding Group I

Funding Sources	Percent of Total Project Cost	Total Cost by Source
Recipient Funding	50%	$300,940
Reclamation Funding Group I	50%	$300,000
Other Federal Funding	0%	$0.00
TOTALS	100%	$600,940

BUDGET ITEM DESCRIPTION	COMPUTATION		Quantity Type	TOTAL COST
	$/Unit	Quantity		
Salaries and Wages			**Total $0.00**	
Fringe Benefits			**Total $0.00**	
Travel			**Total $0.00**	
Equipment			**Total $0.00**	
Supplies and Materials			**Total $0.00**	
Contractual/Construction			**Total $600,940**	
Contractual Pre-Award Work				
Initial Water Loss Study	$7,000	1	EA	$7,000
Detailed Water Loss Study	$8,400	1	EA	$8,400
Grant Application	$5,000	1	EA	$5,000
Pre-award Design Work	$30,000	1	EA	$30,000
Sub-Total				$50,400
Contractual Post Funding work				
Environmental	$35,000	1	EA	$35,000
Post Funding Design Work (Station 510+30 to 526+00)	$19,500	1	EA	$19,500
Construction Observation	$25,000	1	EA	$25,000
Sub-Total				$79,500
Construction				
Mobilization	$46,000	1	EA	$46,000
Storm Water Pollution Prevention Plan	$5,750	1	EA	$5,750
Tree Removal (Clear trees along west	$3,450	1	EA	$3,450
Clear and Rough Grade Canal Surface	$14.95	4,400	LF	$65,780
Imported Canal Shaping Material	$23.00	1550	Tons	$35,650
Geotextile, EPDM Liner and Installation	$48.30	4400	LF	$212,520
Turnout Construction	$1,955	6	EA	$11,730
Beginning Anchor Trench	$1,840	2	EA	$3,680
Terminal Anchor Trench	$1,840	2	EA	$3,680
Liner Attachment at Bridges	$3,450	4	EA	$13,800
Construct Flow and SCADA Station	$69,000	1	EA	$69,000
Subtotal				$471,040
Other			**Total $0.00**	
Total Direct Cost				**$600,940**
Indirect Costs			**Total $0.00**	
Total estimated Project Cost				**$600,940**

Budget narrative

Salaries and Wages
No BRCC Salaries or Wages will be included. All services will be contracted. BRCC'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, BRCC relied upon contract unit prices from a bid that has come in for the EPDM liner for other parts of the Hammond East Canal this past winter that is being constructed winter 2017.
BRCC 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 and construction observation. The Contractor will be hired to perform mobilization, 4,400 feet of EPDM liner, 1,550 tons of imported fill materials, 6 turnouts, 4 anchor trenches, and SCADA station.

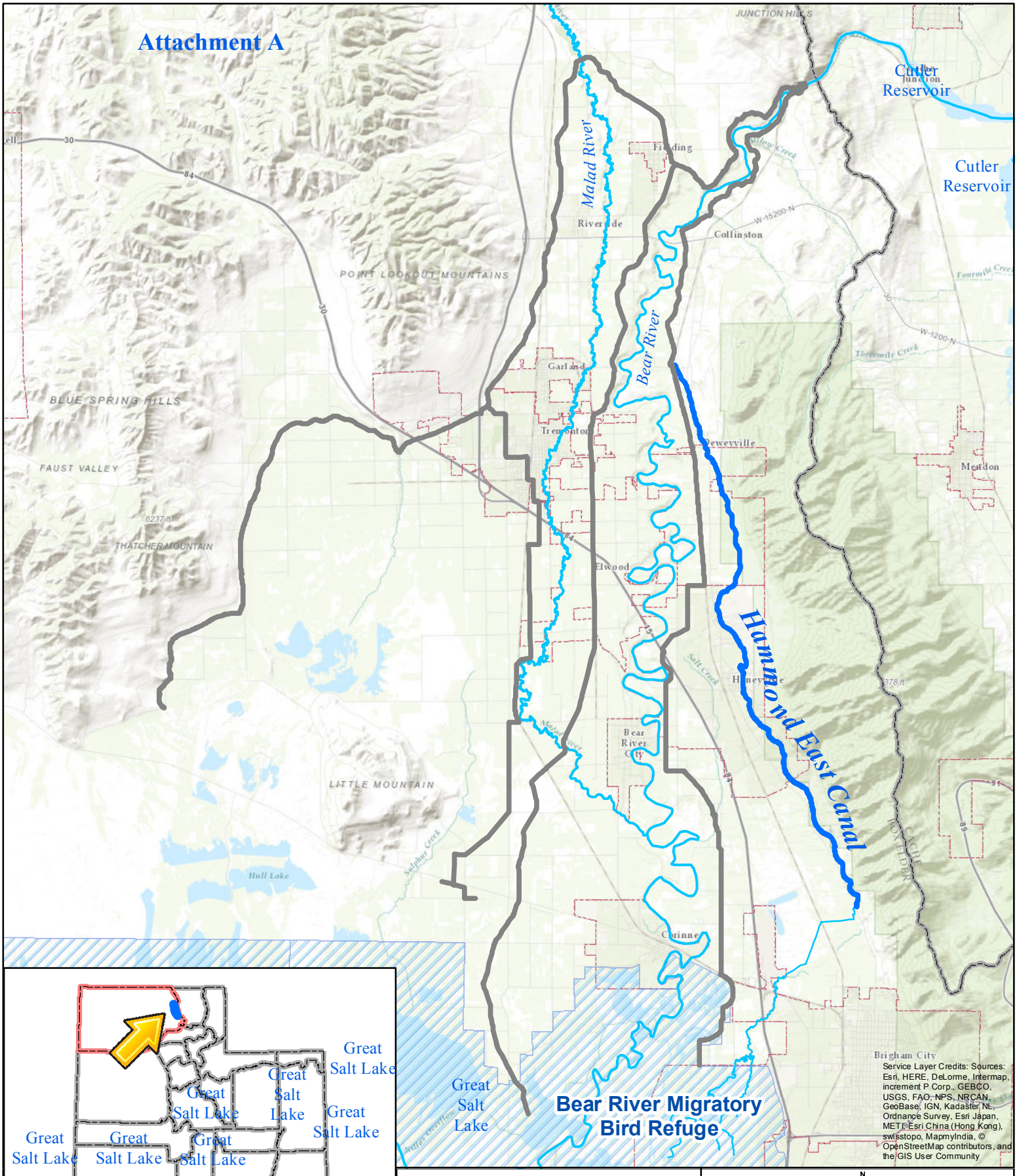
Environmental and Regulatory Compliance Costs
Environmental report preparation $35,000

Other Expenses
No, other expenses will be part of the project.

Indirect Costs
No, indirect cost will be part of the project.

Total Amount Project Cost

BRCC Portion	Fed Portion	Total
$300,940	$300,000	$600,940



Bear River Canal Company Hammond East Canal

Vicinity Map

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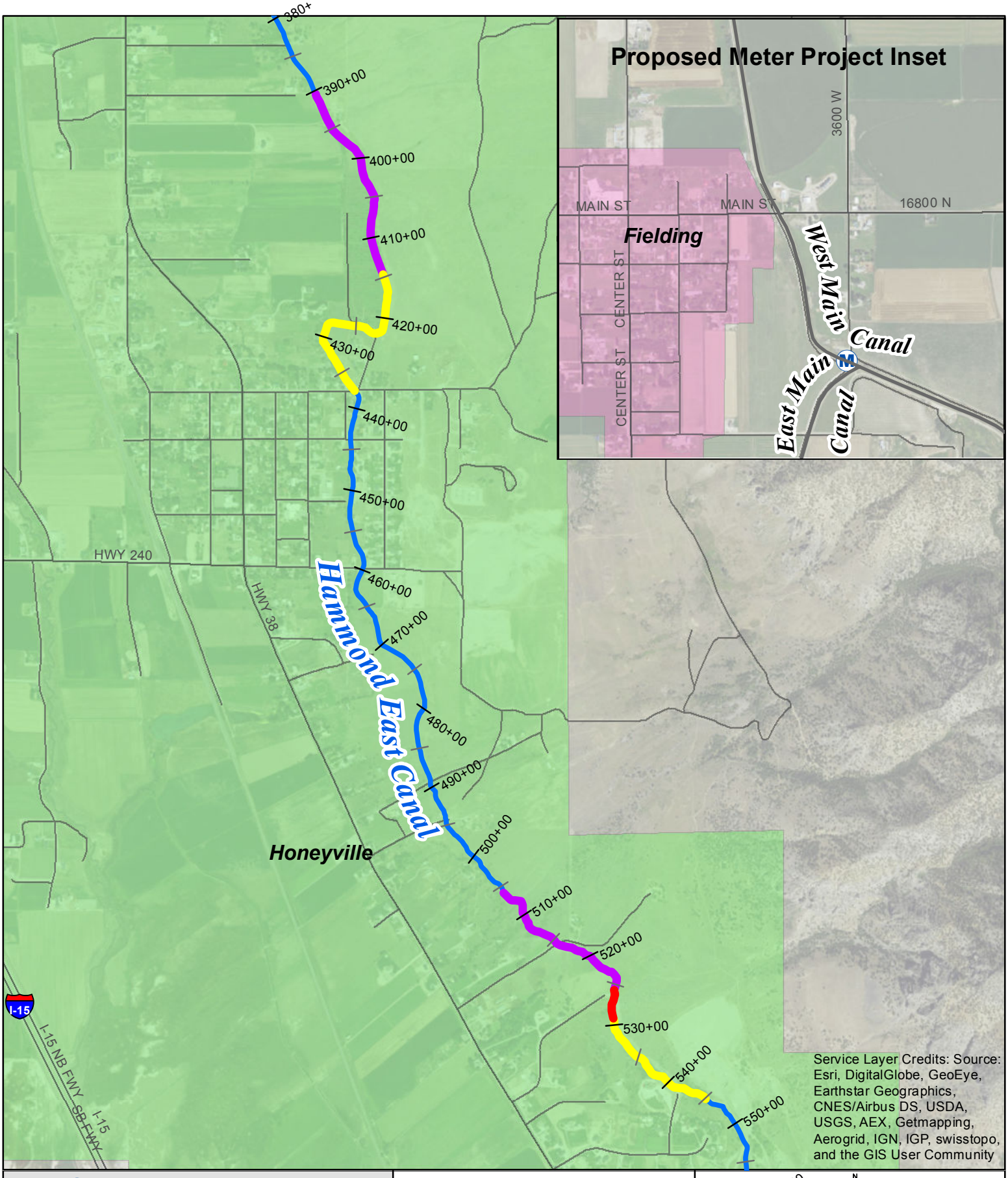
0 15,000 30,000 Feet

J-U-B ENGINEERS, INC.

GATEWAY MAPPING INC.
a J-U-B Company


Proposed Meter Project Inset
3600 W
MAIN ST
MAIN ST
16800 N
Fielding
CENTER ST
CENTER ST
West Main Canal
East Main Canal
380+
390+00
400+00
410+00
420+00
430+00
440+00
450+00
460+00
470+00
480+00
490+00
500+00
510+00
520+00
530+00
540+00
550+00
Hammond East Canal
HWY 240
HWY 38
Honeyville
I-15
I-15 NB FWY
I-15 SB FWY
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
Proposed Meter Project
Proposed EPDM Lining Projects
Current BRCC EPDM Lining Projects
Existing EPDM Lining
Hammond East Canal
Other BRCC Canals
Bear River Canal Company
Hammond East Canal
Project Proposal Map
0+00
N
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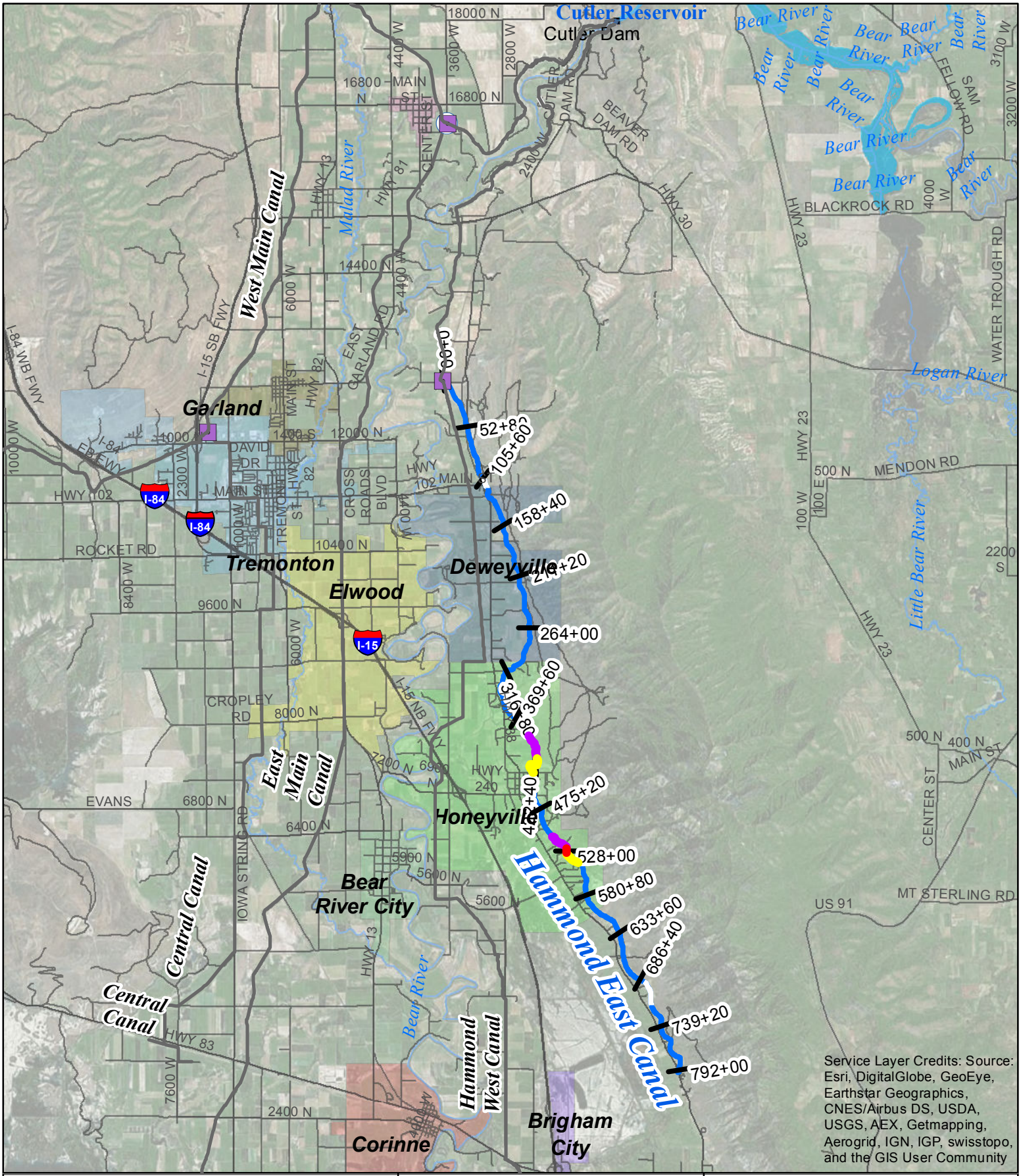
Feet
J-U-B ENGINEERS, INC.
GATEWAY MAPPING INC.
a J-U-B Company



Proposed Meter Project
Major Diversion Structure

BRCC Canals
- Hammond East
- Other BRCC Canals
- BRCC Piped Areas

- Proposed EPDM Lining Projects
- Current BRCC EPDM Lining Projects
- Existing EPDM Lining

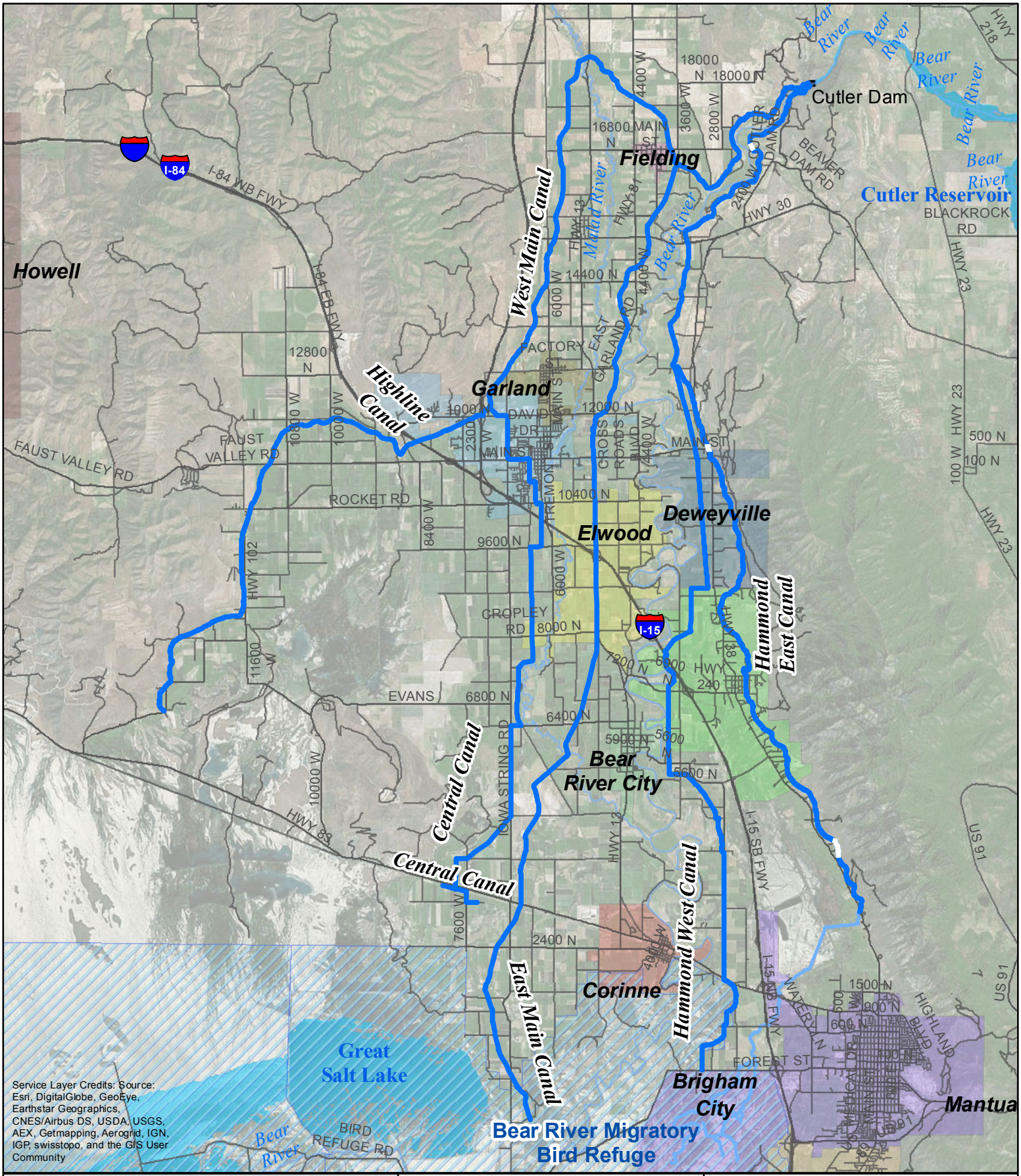
Bear River Canal Company
Hammond East Canal
System Map

N W E S

0 12,000 24,000 Feet

J-U-B ENGINEERS, INC.

GATEWAY MAPPING INC. a J-U-B Company



Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

BRCC Piped Areas

BRCC Canals

BRCC Canals

Bear River Migratory Bird Refuge

Bear River Canal Company

Service Area Map

N W E S

0 15,000 30,000 Feet

J-U-B ENGINEERS, INC.

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Attachment B

J-U-B ENGINEERS, INC.

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

MEMORANDUM

DATE: 8-11-16

TO: Darin McFarland

CC:

FROM: Chris Slater

SUBJECT: Hammond East Canal Seepage Study

Background

The Bear River Canal Company (BRCC) has had some difficulty delivering adequate water to the end of the Hammond East Canal this irrigation season. Because of these difficulties, BRCC hired J-U-B Engineers, Inc. (JUB) to complete a seepage loss study along the canal. The purpose of the study is to identify the areas along the canal where seepage reducing efforts will provide the most benefit to BRCC.

Flow Measurements

J-U-B completed the following steps to quantify the amount of irrigation water that is lost due to seepage along the canal:

1. **Selected preliminary measurement locations** - JUB created a preliminary flow measurement location map with the sixteen proposed measurement sites spaced approximately every mile along the canal. The sites were selected at locations where vehicle access was possible.
2. **Met with BRCC to plan measurements** - JUB met with the canal manager and canal staff to plan an approach and strategy to perform the flow measurements. In this meeting it was determined that BRCC would notify water users along the Hammond East canal that the head gates would be closed while JUB performed the measurements. BRCC contacted water users and placed fliers on all of the head gates to provide notice that no water could be diverted out of the canal between the hours of 8:00 a.m. and 5:00 pm on Tuesday August 2nd through Thursday August 4th. These weekdays are typically the lowest water use days of a calendar week along this canal.
3. **Measured flows** - JUB started measuring flows on August 2nd at the upper end of the canal (Station 0+00) and followed the canal south. JUB selected sites that had concrete liners where possible. This helped provide better flow control sections and reduced uncertainty in the flow calculations that arise where the shape of the canal is less uniform. The locations of sites measured are shown in the Flow Measurement Sites Maps in Appendix A. Photos of each site are given in Appendix B.

BRCC staff went ahead of the JUB staff to close any head gates that were left open during the flow measurement times. Flows were measured at each site by dividing each canal cross section into two to four partitions. The cross sectional area of each of the flow partitions was measured in the field and an average flow velocity of each partition was measured using a digital velocity flow probe. The cross sectional area of each partition was multiplied by the average velocity for a flow given in cubic feet per second (cfs). The calculated flows from each of the partitions were then added together for a total flow at the given site. The field cross section sketches, notes and calculations for each site are included in Appendix C.

Figure 1 below shows the velocity probe used for the velocity measurements. The probe was placed in the center (horizontally) of each flow partition and then moved slowly, vertically up and down in the flow cross section for a period of 90 seconds. The probe provided the average flow velocity in each flow partition during the 90 second period.

Figure 1 – Velocity Probe

4. **Schedule –** JUB measured flows along the first approximate 6 miles of canal on Tuesday August 2, 2016 (Sites 1-7). Flows along the next 8 miles of canal were measured on Wednesday August 3, 2016 (Sites 8-16). JUB checked and verified the difference in flow between Site 7 and Site 8 on Thursday August 4, 2016. The flows measured on August 4th were documented as Site 7a and site 8a with site 8a being at a bridge just south of the bridge used for site 8.

Measurement Results

Table 1, on the following page, summarizes the results of the study. The table identifies the estimated amount of flow that was lost during the flow measurement study due to seepage per mile of canal between each of the measurement sites. The table also provides an estimated percentage of flow that is lost per mile between each of the measurement sites.

A more detailed version of Table 1 is given in Appendix D. The table in the appendix includes columns that show the dimensions used to measure the cross sectional areas of each partition and the measured velocity of each partition.

Table 1 – Flow Meaurement Summary Table

				RESULTS			
SITE	SITE DESCRIPTION	CANAL STATION	SEGMENT LENGTH	TOTAL FLOW (CFS)	*FLOW LOSS (CFS/MILE)	*FLOW LOSS (PERCENT/MILE)	NOTES
1	Concrete floor and walls near bend in canal that creates high velocities on the south side	0		50			First flow measurement taken on Tuesday August 2nd.
2	Concrete rectangular section with a lot of sediment and some weeds on the east side	60+30	6,030	49	1.0	2.3%	Flow loss results for this site and sites 3 through 7 are based on flows in the canal on Tuesday August 2nd.
3	vertical concrete walls and earth floor	116+10	5,580	47	1.9	4.3%	
4	Circular 48" ADS Pipe (depth = 3.1 ft, velocity = 4 fps)	163+20		42			There was not a good uniform section of canal to measure for this site resulting in less reliable flow measurement.
4a	Earth channel with poor shape and vegetation	165+00		35			There was not a good uniform section of canal to measure for this site resulting in less reliable flow measurement.
5	Under bridge, near downstream side, concrete walls, earth bottom	217+30	10,120	45	1.0	8.2%	Flow loss for this segment is calculated as the average loss per mile between Site 3 and Site 5 because of unreliable measurements at Site 4 and Site 4a.
6	Concrete trapezoidal liner	300+27	8,297	41	2.5	14.0%	
	3.05 cfs diverted out of canal through a weir between sites 6 and 7			38			No flow measurement taken in the canal at this point
7	Concrete vertical walls and floor under roadway	328+90	2,863	38	0.0	0.0%	This was the last flow measurement taken on Tuesday August 2nd.
7a	Concrete vertical walls and floor under roadway	328+90	2,863	38			This site is at the same location as Site 7. The flows were re-measured for this site on Thursday August 4th at the same time as Site 8a to provide an accurate representation of the flow loss between Site 7 and site 8 because they were initially measured on two separate days.
8	Under bridge, vertical concrete walls	383+60		29			This was the first flow measurement taken on Wednesday August 3rd.
8a	Under bridge, vertical concrete walls	390+20	6,130	36	1.7	6.1%	This is the loss from Site 7a to Site 8a. This site is slightly downstream of Site 8. The flows were re-measured for here on Thursday August 4th at the same time as Site 7a to provide an accurate representation of the flow loss between Site 7a and Site 8a.
9	Under bridge - vertical concrete walls and earth bottom	437+70	5,410	17	11.7	42.4%	This is the Loss from Site 8 to Site 9. Flow loss results for this site and sites 10 through 16 are based on flows in the canal on Wednesday August 3rd.
10	Vertical concrete walls and earth bottom	484+50	4,680	15	2.3	10.4%	
11	Concrete trapezoidal liner	526+00	4,150	12	3.8	15.7%	
12	Under bridge - vertical concrete walls and earth bottom	580+80	5,480	7	4.8	43.2%	370 feet of this section is lined with EPDM
13	Trapezoidal concrete liner	656+30	7,550	5	1.4	40.9%	
14	Trapezoidal concrete liner	690+20	3,390	4	1.6	12.8%	
15	Trapezoidal concrete liner with no flow	783+50	9,330	0			No flow in the canal at this location
16	Trapezoidal concrete liner with no flow	789+60	610	0			No flow in the canal at this location

*Values pertain to the sections of canal between the site upstream of the site listed on this table row and the site listed on this table row.

Seepage Conclusions

Based on the results of the study, the upper (northern) half of the canal alignment does not have as much seepage loss as the bottom (southern) half. The seepage loss along the northern half to measurement Site 8 has an average loss of less than 2 cfs per mile. The distance from the beginning of the canal to Site 8 is 38,360 feet (7.3 miles)

The southern half of the canal from Site 8 south has more loss than the northern half. The canal segment between Site 8 and Site 9 has the largest loss of about 11 cfs per mile. There are many large trees growing along the canal banks (both sides) between Site 8 and Site 9 which likely contribute to the loss through this segment. The segment of canal between Site 10 and Site 12 also has quite a bit of loss (approximately 4 cfs). Improvements to these sections of canal would increase the flows to the end of the canal.

BRCC should focus on making seepage loss reduction improvements to the southern half of canal for a few reasons:

1. Most of the seepage loss occurs in the southern half of the canal
2. The canal cross section reduces in size from the north to the south, so improvements begin to cost less than for areas to the north with larger cross sections
3. The percent of flow lost per mile is greatest along the southern half of the canal.

Table 2 lists priority seepage loss areas that BRCC should address. These are prioritized based on the flow loss results without an evaluation of other factors such as safety. Other factors such as constructability or access may dictate which areas are improved first.

Table 2 – Seepage Priority Areas

Priority	Description	Beginning Station	Ending Station	Length (ft)	Length (miles)	Flow Loss (cfs/mile)
1	Between Sites 8 and 9	383+60	437+70	5,410	1.0	11.7
2	Between Sites 11 and 12	526+00	580+80	5,480	1.0	4.8
3	Between Sites 10 and 11	484+50	526+00	4,150	0.8	3.8
			Totals	**15,040**	**2.8**	

Recommendations

JUB recommends the following:

1. If seepage losses need to be repaired immediately, install an EPDM liner along the segment of canal between measurement site 11 and site 12 to address the 4 cfs flow loss. This could be completed this year in a few weeks while only needing to remove water from the canal for a few days. This segment would be faster to line than the segment between site 8 and 9 because the segment between 8 and 9 has more trees and vegetation. This is a relatively inexpensive way to improve the canal and is the only alternative that could be constructed before the end of this irrigation season.

2. Complete a more detailed seepage loss study this October if inadequate funds are available to repair the segments identified because they are too long. The study could evaluate seepage loss over much shorter segments within the mile long segments that have been found in this study to have high seepage rates. BRCC may find that most of the flow loss in a given one mile segment comes within a shorter length.

3. In addition to addressing the immediate seepage issues along areas of the Hammond East Canal, JUB recommends that BRCC complete a master plan for the entire length of the canal. This will identify the most efficient methods to deliver irrigation water to all of its users in the future and address seepage loss issues. Funding to help pay for these kinds of plans is available and a long-term plan would provide a roadmap for the future. This plan would:

    - Identity materials to be used along the entire canal
    - Provide schedules for construction
    - Provide a breakdown of the costs to complete the improvements
    - Minimize the chances of repairing canals a certain way, only to later find that those canals need to be changed to fit in with other improvements

4. Create a funding plan that identifies strategies to fund improvements and a schedule for the improvements based on the master plan results. Funding strategies may include low interest loans through the state of Utah, federal grants and or adjusted user fees.

Table 3-1 Prioritized Areas of Concern and Proposed Actions

PRIORITIZED AREAS OF SAFETY CONCERN & PROPOSED ACTIONS							
PRIORITY	CANAL BRANCH	APPROXIMATE STATION		LOCATION DESCRIPTION	RISK CLASS-IFICATION	PAST SLOPE INSTABILITY SIGNS	PROPOSED ACTION
		START	END				
1	Hammond East	106+00	112+00	Above a home near the intersection of HWY 102 and HWY 38	Very High	Yes	Install concrete trapezoidal liner or HDPE pipe in canal. Pipe spring near the canal away from homes.
2	West Main	50+00	70+50	Above Camp Fife	Very High	Yes	Monitor for signs of slope instability utilizing the Slope Stability and Land Use Inspection Sheet in Appendix D. If signs increase, install concrete trapezoidal liner or HDPE pipe in canal.
3	Hammond East	325+00	335+00	Just North of Crystal Hot Springs, next to farm.	Very High	Yes	Monitor for signs of slope instability utilizing the Slope Stability and Land Use Inspection Sheet in Appendix D. If signs increase, install concrete trapezoidal liner or HDPE pipe in canal.
4	Hammond East	430+00	440+00	In Honeyville next to home. Near crossing of 7200 North Street	Very High	Yes	Monitor for signs of slope instability utilizing the Slope Stability and Land Use Inspection Sheet in Appendix D. If signs increase, install concrete trapezoidal liner or HDPE pipe in canal.
5	Hammond Main	405+00	420+00	Upstream of head Gate HM46	Low	Yes	Line canal with clay and monitor. Install pipe or concrete liner if seeps continue
6	East Main	50+00	65+00	Upstream of head gate 8E In Hillside above Bear River	Low	Yes	Monitor for signs of slope instability utilizing the Slope Stability and Land Use Inspection Sheet in Appendix D.

3.4.1 Improvement Summary

Priority #1 on the Hammond East Canal near the canal crossing with Highway 38 should be lined with concrete or piped as soon as possible. Priority 5 is currently being addressed this winter by installing clay along the canal and should be monitored during the upcoming irrigation season. Continued effort may be needed to identify exactly where water is seeping out of the canal in this area.

The other four priorities should be monitored very closely this upcoming irrigation season. If any signs of slope instability are seen, these priority areas should be addressed.

3.4.2 Hammond East Canal Improvements

The Hammond East canal is a canal with many potential risks. This is due to the fact that it is located on steep hill sides for most of its length and it has many homes and a highway located below it. This canal does not carry as much water as most of the other BRCC canals which make it more feasible to line with concrete or to enclose in a pipe. BRCC should begin to evaluate and quantify water losses along this canal and pursue funding in order to fund improvements to this canal.

3.4.3 Opinions of Probable Cost for Improvements

Some very conceptual opinions of probable cost are provided below to help BRCC in planning for the funding of future improvement projects. These costs are not site specific and there are many variables that could affect (raise or lower) the actual costs. The actual costs will need to be estimated more accurately during design of the improvements.

Most of the Hammond East Canal has been classified as high or very high risk with section of the canal that is the top risk priority (Priority #1). Opinions of probable costs have been prepared to line or pipe the canal based on lining or piping a canal with a flow capacity of 65 cfs.

The approximate cost to design and construct a concrete liner for the Hammond East Canal is $350 per lineal foot of canal. The approximate cost to pipe the Hammond East Canal is $425 per lineal foot of canal. Table 3-2 provides the total estimates to line or to pipe the Hammond East canal in its entirety. A phased approach to improving this canal may be needed over a long period of time.