FUNDING OPPORTUNITY
R22AS00023
FOR
WATERSMART: WATER AND ENERGY EFFICIENCY GRANTS FY 2022

PROJECT 4
CONCRETE LINING OF THE REMAINING UNLINED SECTION OF THE MOHAVE CANAL (0.5 MILES/1.5 MILES)

Submitted To:

Bureau of Reclamation
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1. Technical Proposal and Evaluation Criteria

1.1 Executive Summary

Two Year Project
If NTP by 08/01/22
8/01/22 – 7/31/24

This application is being submitted on November 2 ,2021
by: Bard Water District (BWD), Winterhaven, Imperial County, California

The Bard Water District (BWD) is in Winterhaven, California, along the lower Colorado River and borders Arizona (Yuma) and Mexico (Algodones). BWD along with the Quechan Indian Tribe request funding under Category A to continue with this **Project 4 to line 0.5 miles of the upper Mohave Canal with concrete to improve the existing conveyance and delivery infrastructure.** The Mohave Canal (Total 2.78 Miles) project has and will be completed in 5 steps with **5 Grants over a 3-4** year period because of the large amount of funding needed for the cost share/matching (Estimates for upper 1.5 Mile section for E & D $155,900 alone and Concrete Lining $2,000,000 - $3,000,000), the larger dimensions of the remaining upper 1.5 Mile section (2-3 times depth and width), and the short time interval allowed for completing the work without adversely affecting our farmers. This project is listed as a Priority 1 in the USBR Reservation System Evaluation Technical Memorandum No. USBR 35-RDE-8150-STY-2016-02 conducted in January 2017, complies with our approved 2020 Five-Year Water Conservation Plan as well as our 10 Year Capital Improvement Plan. A HAER was also completed in June 2021 for Environmental Compliance (See Appendix for referenced documents).

In August 2021, Project 1: 2019 AWCE Grant: Concrete Lining of the lower Tail (1.28 Miles or 46% of the length) of the Mohave Canal **was 90% completed** Seasonal fallowing enabled us to complete this long section.
In October 2021, Project 2: WCFS Grant Application was submitted for Engineering and Design of this remaining 1.5 Mile section.
In November 2021, Project 3: AWUE submitted to complete another 0.5 Mile section.
In 2022, Project 5: AWUE or WEEG to finish last 0.5 Mile section.

We will accomplish the goals established for the Agricultural Water Use Efficiency AWUE) program by implementing activities that will **increase water supply reliability** by the concrete lining the earthen Mohave Canal and replacing or rebuilding required appurtenances; thus, **conserving water**. ***This Project 4*** *and the final 2 Projects (3 and 5 for Construction will* ***control water loss, reduce seepage and transpiration, prevent upstream flooding/erosion, provide a faster and more consistent, reliable and efficient flow/delivery down-stream and prevent over-topping of the turnout gates and laterals and the dirt banks to reduce water needed and prevent catastrophic crop damage from unscheduled flooding.*** The concrete lining of the entire Mohave Canal would conserve approximately 1,940 acre-feet/year. Plus, the amount of water required/delivered would be reduced by being able to safely increase flow rate. Subsequently, 23.4% or 1 acre-ft/per 4.27 acre-ft of water or 1.2 acre-ft of water/per 1 acre of land would no longer be lost from seepage/transpiration.

BWD is located on a Federal **USBR** facility and is a Reclamation project (Yuma Project, 1909). It receives water from the Colorado River via the All American Canal.

1. Technical Proposal and Evaluation Criteria

1.2 Project Location

The Mohave Canal is approximately 2.78 mile-long earthen canal and was built between 1909-1910 as part of the Yuma Project. The Yuma Project, initiated in 1909, was one of the earliest irrigation construction projects authorized by the newly created United States Reclamation Service. The Mohave Canal is in the city of Winterhaven, Imperial County, California. It begins at the bifurcation of Reservation Main Canal at Leathers Road and proceeds South running west of the Colorado River to the Vomical Lateral near 5th Street (Southeastern boundary of Bard Unit).

Geographic Markers:

Entire Mohave Canal:

UTM: 11 Easting: 731100 – 731700 Northing: 3628800 – 3632500

Head: 32°48'28.28"N 114°31'42.07"W to Tail: 32°46'15.52"N 114°32'7.19"W

Quad Map 0124, located within portions of Sections 35 (Start) – 33 (End)
Township 7G, Range 23 E
Bard 7.5' 1965 PR 1979 topographic map
Base Meridian: San Bernadino

The three 0.5 Mile Sections include (Only one section will be lined)

Head Gate and Turnout	32°48'28.28"N	114°31'42.07"W to
Hoopa Check Gate and Turnout	32°48'9.66"N	114°31'59.10"W to
Hopi Check Gate and Turnout	32°47'46.88"N	114°32'3.39"W to
Kawai Check Gate and Turnout	32°47'21.04"N	114°32'3.34"W

Please note, because of the length of time between now and the final NTP, **we will reserve the right to select which 0.5 Mile section we will line** because it will have to be coordinated with the farmer/producer who will be impacted.

The Mohave Canal provides water to agricultural fields in the Bard Water District (Bard and Indian Units). It is an unlined earthen canal with a capacity of 40 cubic feet/second. It is considered one of Bard Irrigation District's major canals and delivers water to six laterals: Hoopa, Hopi, Kawai, Klamath, Maricopa and Vomical and nine farm turnouts. The canal, laterals, and farm ditches are all above grade and were constructed with nearby borrow material. This design enables it to deliver water via gravity flow. It slowly begins to narrow and raise its bottom depth after the fourth check structure (Hopi) to maintain the required water elevation and flow to farmers downstream.

1. Technical Proposal and Evaluation Criteria

1.2 Project Location (continued)

A map of the Mohave Canal's location provided on the following page.

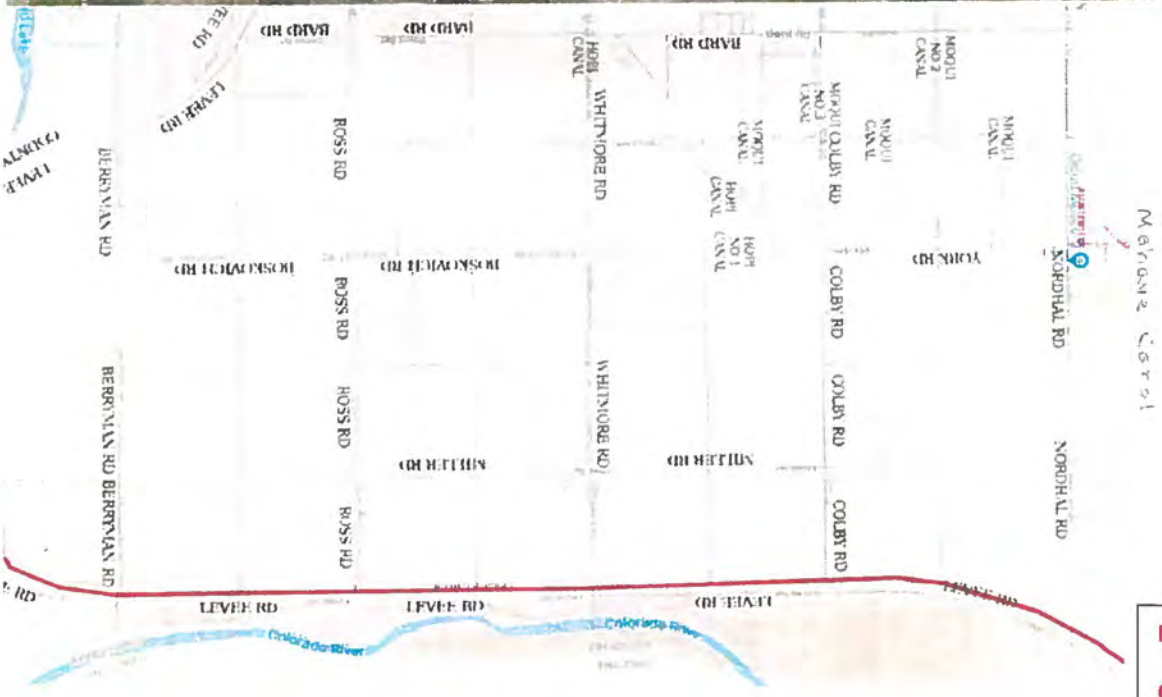
A map of the district is provided on page 27.

Photographs of the start and endpoints of each 0.5 Miles section have been provided in the Appendix.

A list of structures located in each 0.5 mile section is provided in the Appendix (Pages .

1. Technical Proposal and Evaluation Criteria

1.2 Project Location (continued)



1. Technical Proposal and Evaluation Criteria

1.3 Technical Project Description

This project complies with our approved Five-Year Water Conservation Plan and has been a priority 1 to us and the Quechan Indian Tribe for the last 18 years. The estimated total project costs total around 3 million dollars (USBR's Technical Service Center has estimated 6.4 million). Due to funding limitations (BWD matching), we plan to complete this project in five steps, for this grant application. this is **Project 4: Lining 0.5 Mile section of remaining 1.5 Mile section.** We applied for funding on October 2021 for a ***Water Conservation Field Services Program Region 8 Lower Colorado Basin Grant*** *for Engineering/Design Work for the Mohave Canal Lining and Appurtenances ($234,645, BOR $100,000 and BWD $134,645).*

The Mohave Canal was built to deliver water from the eastern to the western portion of the Bard Irrigation District. The Mohave canal runs parallel to the Colorado River and the levee constructed on the west side of the river on the Arizona side. The six laterals run perpendicular to the Mohave Canal flowing westerly. All the turnouts for these laterals are on the west side. Of the nine farm turnouts only one is on the east side. Beginning at the head of the Mohave, the first five check structures are adjacent double gates (side-by side) that allow for more accurate flow. The last check structure (Maricopa) is single gate to help maintain the required flow at the end of the Mohave Canal where it begins to narrow after the double Hopi Check structure.

The Mohave Canal, itself, and its small levees represent a "conveyance structure." The fifteen turnouts and six checks are "regulating structures." The six road crossing vary from the older wooden/concrete slab bridge to the newer pipe or box culverts. These "under road" crossings are examples of "protective structures." Photographs are provided in the Appendix.

The 2.78 mile-long unlined earthen Mohave Canal is trapezoid in shape and has a maximum top width of 16 LF and a bottom width of 4 LF. It has a maximum depth of 10 LF. Near the end of the Mohave Canal, its top width has narrowed to a maximum 8 LF and a bottom width of 2 LF. The depth is also less at 8 LF. It begins to narrow after the Hopi Check Structure (4th Check Structure).

Several turnouts, checks or road crossings will require work to tie them in to the concrete liner. This can include modifying, rebuilding or replacing some components of a structure. A brief description of these three structures is provided on the following page.

Figure 1
Cross Section of Trapezoid Canal

1. Technical Proposal and Evaluation Criteria

1.3 Technical Project Description

Turnouts

Most turnouts are for the **six** laterals that delivery water to the west. Turnouts are structures used to divert water from a main supply channel, such as the Mohave Canal to smaller Laterals or ditches. There are **nine** farm gates (1 on east and 8 on the west side of the Mohave Canal. The turnouts are of three types and photos and descriptions are provided in the Appendix. Each turnout structure for the **six** laterals is immediately upstream (North) of the check structure. This prevents loss of water downstream during water delivery.

Check Structures

Six check structures are located within the Mohave Canal. A check is a structure built to regulate or raise the water level in a supply channel. In some cases, a check combines the functions of both a check and a drop: the water level may be raised upstream of the structure and dropped on the downstream side. Almost all the checks appear to be as they were originally constructed. Four types of checks were identified and are listed below. They operate with Jack-type lifting mechanisms, a simple lever device, a hand wheel device, or a wooden handle attached to the top center of the wooden slide. None of the check structures are constructed under a road crossing, they are several feet downstream of each road crossing.

Road Crossings

There are six road crossings crossing along the Mohave Canal, constructed as part of the 1949/1950 Canal Betterment project or later. All the road crossing are covered by compacted dirt. They are also referenced on some maps as 1st through 9th Street. Beginning from the north end of the Mohave Canal they include:

Farm Road	Reinforced Concrete Box Culvert (2000-2005) In 0.5 Mile Section
Norhdahl Road (9th St)	Reinforced Concrete Pipe Culvert (Post 1992) In 0.5 Mile Section
Colby Road (8th St)	Reinforced Concrete Box Culvert (Post 1990) In 0.5 Mile Section
Whitmore Road (7th St)	Concrete Slab and Wood Bridge (1949-1950) – Rebuilt Project 1
Ross Road (6th St)	Reinforced Concrete Pipe Culvert (Post 1992) – In Project 1
Berryman Road (5th St)	Concrete Slab and Wood Bridge (1949-1950) - Rebuild Project 1

These crossings allow dirt roads and unimproved roads that cross the Mohave Canal continuing on the road or cross into fields or residences. Most have a pipe and culvert or box culvert with dirt, rip-rap or concrete used for side support. If a check is present the structure usually has more infrastructure present.

1. Technical Proposal and Evaluation Criteria

1.3 Technical Project Description

Work to Be Accomplished and Approach

Post Award/Review:

Environmental Compliance

Historic Architectural and Engineering Report completed July 2021 for entire 2.78 Mile Mohave Canal

Documentation/Submittals to BOR

Final Budget with Backup(Quotes) and Updated Staff, Salaries and Fringe

SOW – confirmed and Milestone/Task Schedule Updated

Contract Signed and NTP

BWD Project Activities:

Phase 1 : Engineering/Design/Planning

Coordinate selection of which 0.5 Mile section to be lined with farmer/producer. We anticipate starting at the Kawai Check Gate and Road Crossing where the previous lining project ended (1.5 Miles to 2.78 Miles). The section is between 1.0 - 1.5 Mile because it will have less impact. The other sections are 0.0 to 0.5 Miles and 0.5 to 1.0 Miles and will be funded with later grants. However, the selection of which 0.5 Mile section could change based on current crop conditions, but **only one** 0.5 Mile section will be completed with this grant.

Final Design Meetings, Plans, Specifications and Estimates for the Concrete Lining of the Lateral and Appurtenances (Tie-Ends, Turn-outs, Check Gates, Wingwalls).

Hydrology Study Data/Recommendation (Optimum/Required Flow Rates and Pressures, Elevations, capacity, etc.)

Phases 2: Construction/Lining the Canal *(0.5 Mile Section of the Remaining 1.5 Mile Canal)*

BWD Site Preparation (Clearing and Grubbing)

BWD Hauling dirt to fill entire 0.5 Mile trapezoid section build up sidewalls and bottom

BWD Final Grading and Compacting (Preparing for Trencher)

Contractor/Trencher – Cut Trapezoid and Pour Concrete (Boat) to Lining of the Canal

BWD work crew coordinate with Trenching Company to Tie-in to Appurtenances. Rebuild or Replace, as necessary. This additional finish work may be completed later during scheduled Dry-Downs as to not adversely affect the farmers/producers.

We have an exceedingly small interval to complete the construction portion of this project in order to minimize any adverse effects on our farmers (April through July); so, that is why we use a trencher that can complete a project in several weeks (during a dry-down). If we tried to line sections of canals ourselves it would take months instead of weeks and the farmer/producer would loss substantial income.

1. Technical Proposal and Evaluation Criteria

1.3 Technical Project Description

BWD Project Activities (continued):

Phase 3: On-Farm Component – Assessment and Planning

We will also provide technical assistance to our affected farmers to evaluate their on-farm irrigation systems/management to determine what improvements, modifications, or equipment they need to successfully handle the subsequent improvements to the Mohave Canal. This will include Evaluation of existing irrigation systems (delivery systems, elevations and grade), hydrological and soil evaluation, needs/shortcomings, recommendations, and EQIP funding opportunities to update/improve system. This will include long term planning to allow for growth and to address future needs.

Phase 4: Farmer's EQIP Grant Applications *(This component not funded by this grant)*
Based upon Phase 3 Recommendations and NRCS Report (provided in Appendix).

Materials:
Concrete
Pipe
Clean Fill Dirt
Fuel and Lubricants
Forms
Steel; Rebar, Eye Hooks, Plates, Strips, Grates

Equipment (All Bard owned except for Trencher): Will use USACOE Region 7 Rates for Equipment Listed on USACOE Table 2-1.

Motor Grader 12M3
CAT 938G
CAT 420F Backhoe
Tracked Excavator 330C
Rubber Tired Excavator 318F
Dump Truck
International Water Truck
Mac/Cozad Lowboy
Flatbed/Tilt bed
Ford F150 PU Trucks (2)
Ford F150 – Crew Cab Truck
Ford XLT Super Crew
Lighting (Night)
TIG Welder
ARC Welder
Stihl Concrete Saw
Tamper
Roller
730 & 830 Capital Trapezoid Trencher w/Boat (slip form for concrete) provided by Crawford Associates (Contractor)

1. Technical Proposal and Evaluation Criteria

1.4 Evaluation Criteria

1.4.1 Quantifiable Water Savings – Criteria A 28

Approximately 1,940 acre-feet/year. Plus, the amount of water required/delivered would be reduced by being able to safely increase flow rate. Subsequently, 23.4% or 1 acre-ft/per 4.27 acre-ft of water or 1.2 acre-ft of water/per 1 acre of land would no longer be lost from seepage/transpiration.

1) Amount of Estimated Water Savings **1,940 Acre-Ft/Yr or 23.4%**

Flow rates are measured at the head gate to the lateral which serves the customer. Run times, start, and stop times are on the ditch rider's inspection record. Volumes are computed and transferred to a water card. Pooling was also done to calculate seepage and evaporation.

Percentage of Total Supply **2.25%** 1,940.3 Acre-Feet/Yr
Based real-time data provided 86,412 Acre-Feet/Yr (Total)
in our annual report

2) Describe Current Losses: **1,940.3 Acre-Ft/Yr or *23.4%***

Operational	1,319.0 Acre-Ft/Yr	
Transportation	133.3 Acre-Ft/Yr	
Evapotranspiration	157.0 Acre-Ft/Yr	(Increased Flow Rate – Less Transpiration)[1]
Seepage	331.0 Acre-Ft/Yr	(Increased Flow Rate – Less Seepage)
Total	1,940.3 Acre-Ft/Yr	Water through Mohave System 8,289 Acre-Ft/Yr

[1] NRCS/Yuma – Calculated
Calculations (Seepage and evapotranspiration) as well as actual real-time measurements (Volume change over time for section of canal blocked). Volume (Original Water Depth) – Volume (End Water Depth after 24 hours). Volumes (Actual amount of water released).

Percentage of Mohave Water Supply Conserved: **23.4%** 1,940.3 Acre-Feet/Yr
8,289 Acre-Feet/Yr (Mohave)

a. Current losses are seeping into ground and any extra surface water into BWD's drainage system to return to Colorado River.

b. The drainage ditches are a constant O & M problem as they support invasive and noxious weeds, that the farmers/grower constantly mechanically remove along their fields. This further deteriorates the sidewalls and causes continual erosion, so the drainage ditches become wider. We are working with the farmers and NCRS to develop a remedy to provide better return flow system. However much of this water has high salinity and other contaminants, so it is of poor quality.

c. This water loss currently provides little or no benefit to the watersheds along the Colorado River because of its quality.

1. Technical Proposal and Evaluation Criteria

1.4 Evaluation Criteria

1.4.1 Quantifiable Water Savings – Criteria A

3) Describe Support/Documentation of Estimated Water Savings

NCRS and USBR assisted with these calculations in 2010 that are included in our 2020 Water Conservation Plan. ***Tables from this investigation been provided on the following pages to facilitate your review.***

NCRS completed calculations for Seepage and evapotranspiration

BOR assisted with actual real-time measurements (Volume change over time for section of canal blocked).

Volume (Original Water Depth) – Volume (End Water Depth after 24 hours).

Volumes (Actual amount of water released).

We plan to update these values with the SOR currently in progress.

Water Budget Description *(From BWD 2020 Water Conservation Plan)*

The water budget (hydrological balance) was the tool for analyzing water management problems and opportunities, provided that adequate and reliable flow data is available. It is a useful way to organize quantitative information. The water budget approach is very flexible and can be applied in different temporal and scalar dimensions. It can encompass the entire delivery system (water district) or focus on water applied to a field. The water budget can be described for various time periods, such as an annual, monthly, or daily time-step basis. Shorter time steps can assist in identifying problem areas in the system or the data.

The water budget concept is that the sum of system inflows is to equal the sum of system outflows, assuming the soil moisture is the same at the beginning and end of the period studied. Inflows consist of all the sources of water supply to the distribution system. Outflows consist of all water removed from the system. By comparing measured inflows and outflows in a water budget, it is possible to identify unaccounted-for water losses. For example, if the diversion into the canal and all the water deliveries from the canal (i.e., the farm turnouts) were known, the difference between the diversion and the sum of the water deliveries would be the conveyance loss from the canal. This conveyance loss is the result of seepage (-), evaporation (-), precipitation (+), operational spills (-), and the interception of surface-water runoff (+) and ground water flow (+/-). The various components of inflow and outflow available for the water budget are shown in Figure 1.

1. Technical Proposal and Evaluation Criteria

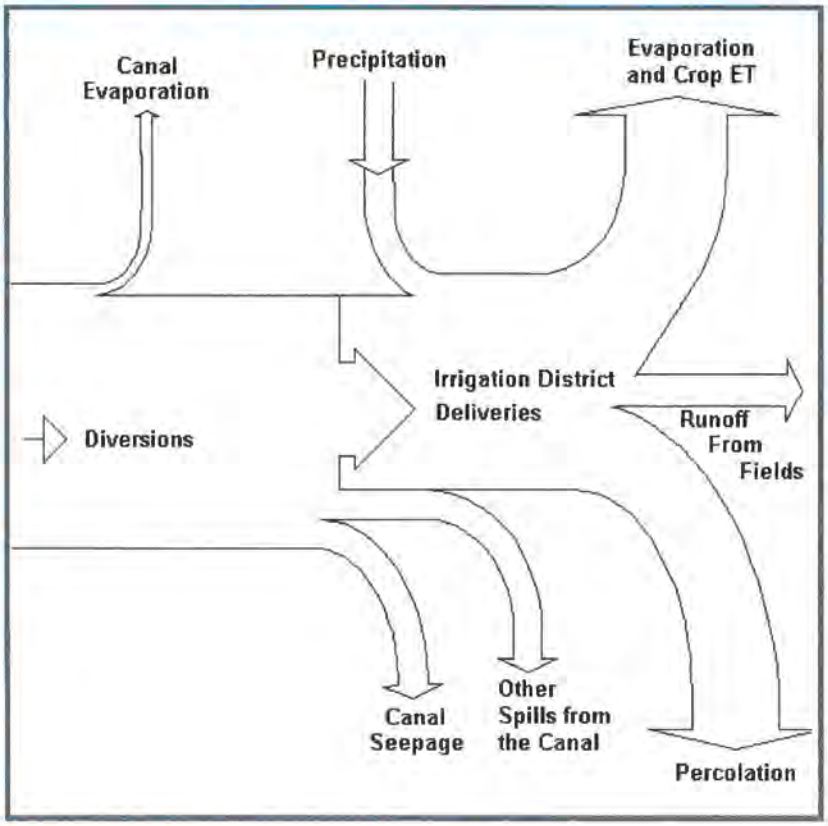
1.4 Evaluation Criteria

1.4.1 Quantifiable Water Savings – Criteria A

3) Describe Support/Documentation of Estimated Water Savings *(continued)*

Figure 2

Water Balance Components



1. Head of Canal (HOC) = Diversions at the Colorado River.

2. Transportation Losses (TL) = Canal Evaporation + Canal Seepage *See Table 1*

3. Operational Spills (OS) = Spills from the canal

4. On-Farm Delivery (OF) = Head of Canal - Transportation Losses - Operational Spills

5. On-Farm Losses = Deep Percolation + Runoff from Fields + Evaporation + Non-Effective Precipitation

6. Net Consumptive Use (NCU) = Consumptive Use (Crop ET) – Effective precipitation See Attached Water Balance on pages 12-21.

1. Technical Proposal and Evaluation Criteria

1.4 Evaluation Criteria

1.4.1 Quantifiable Water Savings – Criteria A

3) Describe Support/Documentation of Estimated Water Savings *(continued)*

Water Budget Description *(From BWD 2020 Water Conservation Plan)*

Table 1
Transportation Losses

2. TRANSPORTATION LOSS Year : 2010

Table 2a: Main Canal Wetted Area *(acres)*

Canal Name	From (mile)	To *(mile)*	Length *(mi)*	Average Wet Width *(ft)*	Area (Acres)	Total Area
Reservation Main	0.00	6.00	6.00	75.0	54.5	54.5
Mohave	5.00	10.00	5.00	40.0	24.2	78.8
			0.00		0.0	78.8
			0.00		0.0	78.8
			0.00		0.0	78.8
			0.00		0.0	78.8
			0.00		0.0	78.8
			0.00		0.0	78.8
Total length (*miles*)			11.00	Uncertainty +/- (%)		35%

Table 2b: Sub-Main / Major Lateral Wetted Area *(acres)*

Canal Name	From (mile)	To *(mile)*	Length *(mi)*	Average Wet Width *(ft)*	Area (Acres)	Total Area
Titsink	0.00	2.50	2.50	13.0	3.9	3.9
Yaqui	0.00	1.50	1.50	35.0	6.4	10.3
Pontiac	0.00	0.25	0.25	22.0	0.7	11.0
Ypsilanti	0.00	2.25	2.25	22.0	6.0	17.0
Seminole	0.00	2.25	2.25	22.0	6.0	23.0
			0.00	0.0	0.0	23.0
			0.00		0.0	23.0
			0.00		0.0	23.0
Total length (*miles*)			8.75	Uncertainty +/- (%)		35%

1. Technical Proposal and Evaluation Criteria

1.4 Evaluation Criteria

1.4.1 Quantifiable Water Savings – Criteria A

***3) Describe Support/Documentation of Estimated Water Savings** (continued)*

Water Budget Description *(From BWD 2020 Water Conservation Plan)*

Table 2d: Estimated Evaporative Loss *(acres)*

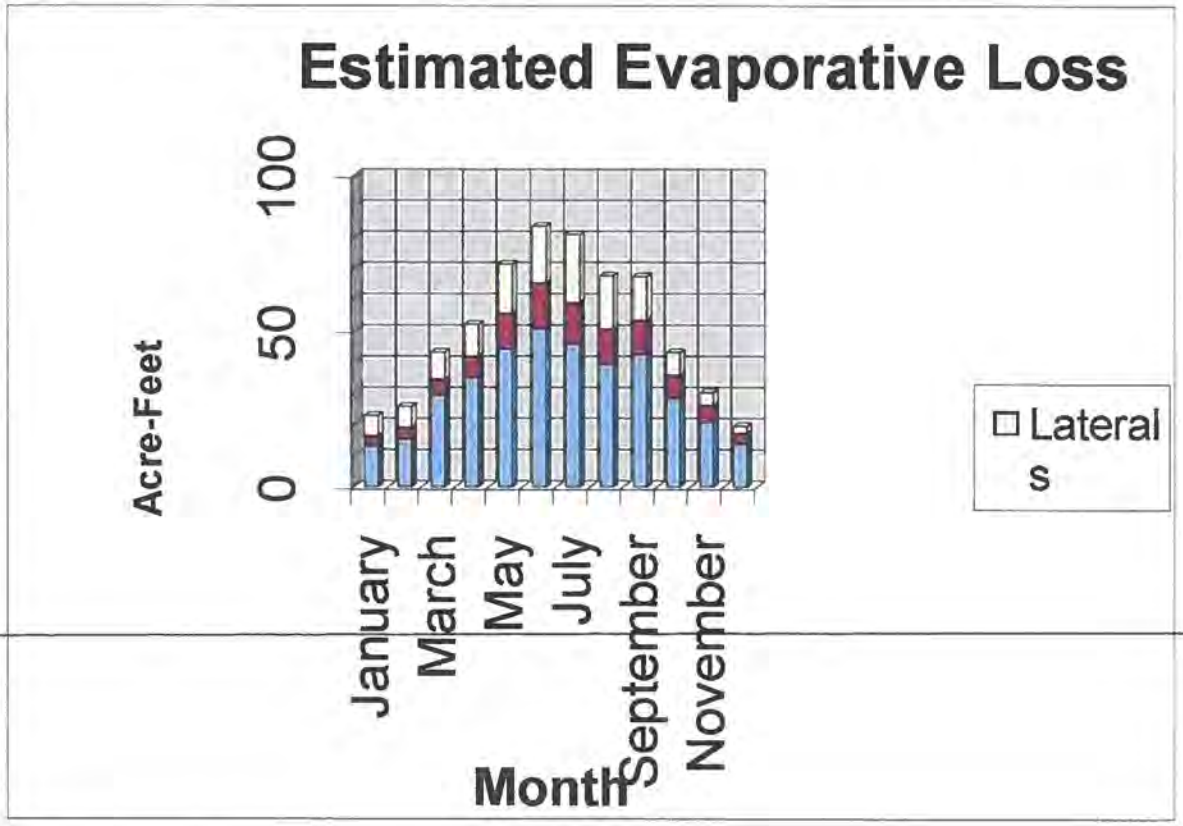
Ke (evaporation coefficient): 0.83 — Uncertainty for Ke *(+/-%)*: 15%

Month	Eto (inches)*	Portion of Time Canal is Wet			Evaporation (*acre-feet*)		
		Mains	Sub Mains	Laterals	Mains	Sub Mains	Laterals
January	3.00	80%	70%	60%	13	3	6
February	3.10	90%	80%	60%	15	4	7
March	5.40	100%	60%	45%	29	5	9
April	6.40	100%	70%	45%	35	7	10
May	8.10	100%	90%	55%	44	12	16
June	9.30	100%	100%	55%	51	15	18
July	11.20	75%	75%	55%	46	13	22
August	9.60	75%	75%	50%	39	11	17
September	7.80	100%	90%	50%	43	11	14
October	5.20	100%	90%	40%	28	7	7
November	3.80	100%	90%	30%	21	5	4
December	2.50	100%	90%	25%	14	4	2
TOTAL	75.40				378	98	0
AVERAGE		93%	82%	48%			
Uncertainty	10%	10%	15%	30%			

Total Calculated Delivery System Evaportion *(acre-feet)*: 19

Uncertainty in Evaporative Losses (+/- %): 25.54%

* Reference Evapotranspiration from CIMIS/AZMET station name: Yuma North Gila



1. Technical Proposal and Evaluation Criteria

1.4 Evaluation Criteria

1.4.1 Quantifiable Water Savings – Criteria A

3) Describe Support/Documentation of Estimated Water Savings (continued)

Water Budget Description *(From BWD 2020 Water Conservation Plan)*

Table 2e: Estimated Seepage/Leakage Loss

Canal Name	From (Table 2a-2c -mile)	To (Table 2a-2c mile)	Wet Area (Table 2a-2c acres)	Lining Type	Seepage Rate (gallons/sq ft/day)	Average % Time Wet (Table 2d)	Estimated Seepage (ac-ft/yr)
Main Canals:						93%	
Reservation Main	0.00	6.00	54.5	clay loam	3.0		7451
Mohave	5.00	10.00	24.2	clay loam	3.0		3312
0	0.00	0.00	0.0		0.0		0
0	0.00	0.00	0.0		0.0		0
0	0.00	0.00	0.0		0.0		0
0	0.00	0.00	0.0		0.0		0
0	0.00	0.00	0.0		0.0		0
0	0.00	0.00	0.0		0.0		0
						Subtotal	10762
Sub Mains:						82%	
Titsink	0.00	2.50	3.9	silty clay loam	2.2		345
Yaqui	0.00	1.50	6.4	clay loam	3.0		761
Pontiac	0.00	0.25	0.7	silty clay loam	2.2		58
Ypsilanti	0.00	2.25	6.0	Concrete good	1.0		239
Seminole	0.00	2.25	6.0	Concrete good	1.0		239
0	0.00	0.00	0.0		1.0		0
0	0.00	0.00	0.0		0.0		0
0	0.00	0.00	0.0		0.0		0
						Subtotal	1642
Laterals:						48%	
Acoma	0.00	1.85	4.9	clay loam	3.0		343
Bannock	0.00	1.25	3.3	silty clay loam	2.2		170
Hoopa	0.00	0.20	0.2	silty clay loam	2.2		9
Modoc	0.00	2.40	2.0	silty clay loam	2.2		104
Kaiwa	0.00	0.50	0.4	silty clay loam	2.2		22
Klamath	0.00	0.75	0.6	silty clay loam	2.2		32
Maricopa	0.00	0.88	0.7	silty clay loam	2.2		38
Vomical	0.00	0.70	1.2	silty clay loam	2.2		61
Apache	0.00	1.75	2.2	Concrete fair/poor	2.0		103
Moqui	0.00	1.50	3.1	silty clay loam	2.2		158
Hopi	0.00	1.50	3.1	silty clay loam	2.2		158
Cocopeh #1	0.00	0.25	0.5	silty clay loam	2.2		26
Cocopeh #2	0.00	0.35	0.7	clay	1.5		25
Cocopeh #3	0.00	0.35	0.7	silty clay loam	2.2		37
Cocopeh #4	0.00	0.25	0.5	silty clay loam	2.2		26
Paiute	0.00	1.60	1.4	silty clay loam	2.2		89
Papago	0.00	1.40	2.0	clay loam	3.0		142
Pima	0.00	1.75	1.5	Concrete new	0.5		17
Pueblo	0.00	1.25	1.1	Concrete new	0.5		12
Supai	0.00	1.25	1.1	Concrete new	0.5		12
Waco-Pipe	0.00	0.13	0.0	Concrete excellent	0.1		0
Waco-Ditch	0.00	0.13	0.2	clay loam	3.0		11
Ute	0.00	0.25	0.3	clay loam	3.0		23
Osage	0.00	0.75	0.0	silty clay loam	2.2		0
Wilson	0.00	0.45	0.7	silty clay loam	2.2		33
Yuma Stub	0.00	0.35	0.5	silty clay loam	2.2		28
Yaqui #1	0.00	0.50	0.4	silty clay loam	2.2		22
Yaqui #2	0.00	0.90	0.8	Concrete good	1.0		18
Yaqui #3	0.00	0.75	0.6	silty clay loam	2.2		32
Zuni	0.00	1.45	1.4	silty clay loam	2.2		72
Pequod	0.00	0.50	0.0	Concrete good	0.5		0
Zuquod	0.00	0.75	0.0	silty clay loam	2.2		0
Navajo	0.00	1.50	1.3	Concrete new	0.5		15
Rainbow	0.00	0.65	0.9	loamy sand	13.5		271
Walapai	0.00	1.70	2.3	silty clay loam	2.2		116
Cherokee	0.00	0.35	0.5	silty clay loam	2.2		24
Comanche	0.00	0.75	1.0	Concrete new	0.5		12
Concow	0.00	1.00	1.3	silty clay loam	2.2		68
Tonawanda	0.00	2.50	3.6	silty clay loam	2.2		185
Sioux	0.00	1.25	1.8	Concrete good	2.2		93
Santee	0.00	0.50	0.7	clay loam	2.2		37
Tenino	0.00	1.00	1.5	silty clay loam	2.2		74
						Subtotal	2894

1. Technical Proposal and Evaluation Criteria

1.4 Evaluation Criteria

1.4.1 Quantifiable Water Savings – Criteria A

***3) Describe Support/Documentation of Estimated Water Savings** (continued)*

Water Budget Description *(From BWD 2020 Water Conservation Plan)*

Table 2e: Estimated Seepage/Leakage Loss (Continued)

Total Estimated Seepage Loss *(acre-feet)*:	15,099
Uncertainty in Individual Canal Reach Seepage Rate Estimates *(+/-%)*:	100%

Calculated Uncertainty in Seepage Volume:

	Acre-Feet +/-	*+/- %*
Mains:	4,866	45.2%
Submains:	1,229	11.4%
Laterals:	3,645	135.3%
Total Calculated Uncertainty *(+/-)*:	3,532	23.4%

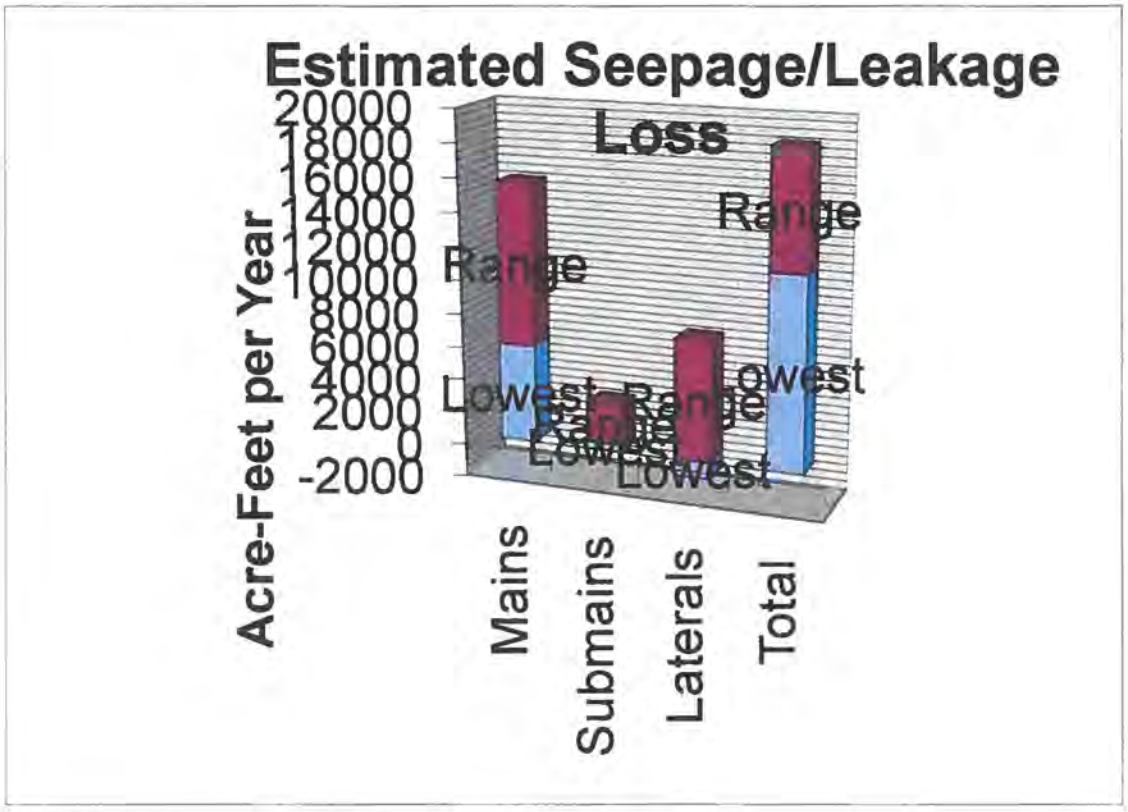


Table 2f: Combined Transportation Loss:

Value in *acre-feet/year*

Category	Amount	Uncertainty	Lowest	Range	Highest
2d. Evaporation	19	5	14	10	24
2e. Seepage	15099	3532	11568	7063	18631
2f. Combined Transport-ation Loss	15119	3527	11592	7054	18646

1. Technical Proposal and Evaluation Criteria

1.4 Evaluation Criteria

1.4.1 Quantifiable Water Savings – Criteria A

***3) Describe Support/Documentation of Estimated Water Savings** continued)*

Water Budget Description *(From BWD 2020 Water Conservation Plan)*

3. OPERATIONAL LOSSES — Year: 2010

Table 3a: Operational Spills

Location	Rate Measurement	Volume Measurement	Annual Volume *(ac-ft/yr)*	Uncertainty (+/- %)	Uncertainty (ac-ft/yr)
Drain #4	Sharp crested weir	Strip chart recorder - USBR	461.0	5.0%	23.1
Drain #8	Sharp crested weir	USGS Recorder	91.0	5.0%	4.6
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
		Total:	552	3%	19

Table 3b: Charging or Emptying Canals and Partial Use of Water in Dead End Lines

Location	Length *(miles)*	Cross-Sectional Area *(sq ft)*	Volume *(ac-ft)*	Number of Times / yr	Annual Volume *(ac-ft)*
Cocopah	6.00	105.0	76.4	3	229.1
Mohave	3.00	60.0	21.8	10	218.2
Titsink	3.33	35.0	14.1	52	734.6
Yaqui	2.50	35.0	10.6	45	477.3
Pontiac	1.00	20.0	2.4	45	109.1
Ypsilanti	5.00	22.0	13.3	35	466.7
Seminole	2.25	22.0	6.0	40	240.0
Acoma	1.85	16.0	3.6	40	143.5
Bannock	1.25	12.0	1.8	40	72.7
Modoc	2.40	10.0	2.9	40	116.4
Apache	1.75	10.0	2.1	40	84.8
Paiute	1.60	10.0	1.9	40	77.6
Papago	1.40	12.0	2.0	40	81.5
Pima	1.75	10.0	2.1	40	84.8
Navajo	1.50	10.0	1.8	40	72.7
Walapai	1.70	12.0	2.5	40	98.9
Tonawanda	2.50	12.0	3.6	40	145.5
			0.0		0.0
			0.0		0.0
			0.0		0.0
			0.0		0.0
			0.0		0.0
		Uncertainty *(+/- %)*:	10%	25%	
				Total *(ac-ft)*:	3453.3
				Uncertainty for Total (+/- ac-ft):	4.3
				Uncertainty for Total (+/- %):	0.1%

1. Technical Proposal and Evaluation Criteria

1.4 Evaluation Criteria

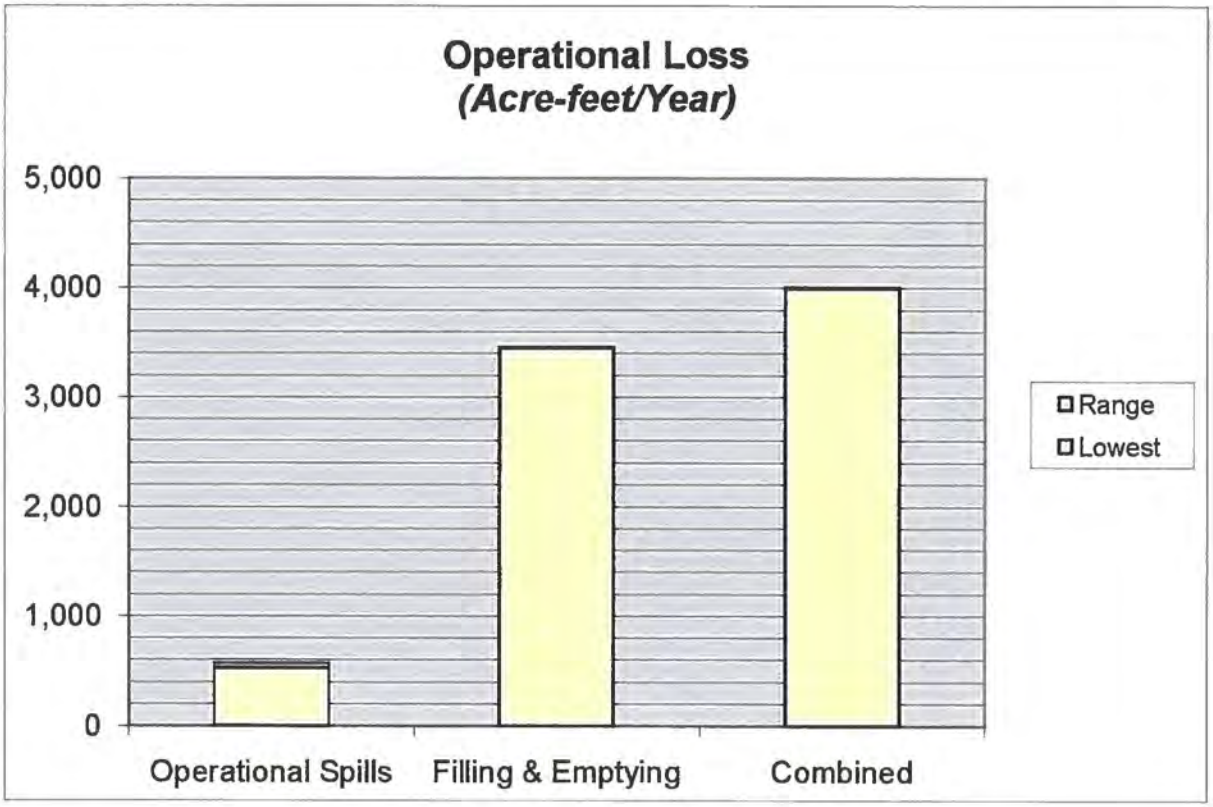
1.4.1 Quantifiable Water Savings – Criteria A

3) Describe Support/Documentation of Estimated Water Savings *(continued)*

Table 3b: Summary for Operational Losses

Value in *acre-feet/year*

Category	Estimated Total	Uncertainty	Lowest	Range	Highest
3a.Operational Spills	552	19	533	39	571
3b. Filling and Enptying	3,453	4	3,449	9	3,458
CombinedOperational Loss	4,005	5	4,001	9	4,010



1. Technical Proposal and Evaluation Criteria

1.4 Evaluation Criteria

1.4.1 Quantifiable Water Savings – Criteria A

3) Describe Support/Documentation of Estimated Water Savings *continued)*

Water Budget Description *(From BWD 2020 Water Conservation Plan)*

4. ACCOUNTING LOSS/GAIN Year: 2010

Table 4a: Subtotals: Water Available for Agricultural Delivery (balances brought forward)

	Amount (ac-ft)	Uncertainty (ac-ft)	Uncertainty %
1. Agricultural Supply	71,542	1,286	1.8%
2f. Transportation Loss	15,119	3527	23.3%
3b.Operational Loss	4005	5	0.1%
4a. Available for Agricultural Delivery	52,418	1,015	1.9%

Amount of water available for delivery to users varies from 51,403 ac-ft, to 53,433 ac-ft.

Table 4b: Unauthorized and/or Unbilled Use

Source	Amount *(ac-ft/yr)*
Unauthorized gate opening	100
Livestock Water	0
Dust Control	50
Total	150

Uncertainty of Unauthorized use (+/- %): 65%

Varies between 52.5 acre-feet and 247.5 acre-feet

Table 4c: Accuracy of Farm Delivery Measurement

Field data from individual deliveries:

Type of Measurement Device Used by District for Billing	Type of Spot Check *Flow* Measurement	Type of Spot Check *Time* Measurement	Billed *ac-ft*	Spot Checked *ac-ft*	Over Delivery *(+%)*	Under Delivery *(-%)*
Broad-Crested Weir	Flume	Reported	20.00	21.00	4.8%	0.0%
Broad-Crested Weir	Flume	Reported	15.00	14.00	0.0%	-7.1%
Broad-Crested Weir	Flume	Reported	15.00	14.00	0.0%	-7.1%
Gate Opening	Current meter	Logged	15	12	0.0%	-25.0%
Gate Opening	Current meter	Logged	20	18	0.0%	-11.1%
Gate Opening	Current meter	Logged	20	19	0.0%	-5.3%
Gate Opening	Current meter	Logged	15	15	0.0%	0.0%
Gate Opening	Current meter	Logged	20	18	0.0%	-11.1%
Gate Opening	Current meter	Reported	15	16	6.3%	0.0%
-	-	-			0.0%	0.0%
-	-	-			0.0%	0.0%
-	-	-			0.0%	0.0%
-	-	-			0.0%	0.0%
-	-	-			0.0%	0.0%
-	-	-			0.0%	0.0%
-	-	-			0.0%	0.0%
-	-	-			0.0%	0.0%
-	-	-			0.0%	0.0%
-	-	-			0.0%	0.0%
-	-	-			0.0%	0.0%
-	-	-			0.0%	0.0%
-	-	-			0.0%	0.0%

1. Technical Proposal and Evaluation Criteria

1.4 Evaluation Criteria

1.4.1 Quantifiable Water Savings – Criteria A

3) Describe Support/Documentation of Estimated Water Savings (continued)

Water Budget Description *(From BWD 2020 Water Conservation Plan)*

Table 4c (continued) : Accuracy of Farm Delivery Measurement

Type of Measurement Device Used by District for Billing	Type of Spot Check *Flow* Measurement	Type of Spot Check *Time* Measurement	Billed *ac-ft*	Spot Checked *ac-ft*	Over Delivery *(+%)*	Under Delivery *(-%)*
-	-	-			0.0%	0.0%
-	-	-			0.0%	0.0%
-	-	-			0.0%	0.0%
-	-	-			0.0%	0.0%
-	-	-			0.0%	0.0%
-	-	-			0.0%	0.0%
-	-	-			0.0%	0.0%
-	-	-			0.0%	0.0%
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-	-	-			0.0%	0.0%
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-	-	-			0.0%	0.0%
-	-	-			0.0%	0.0%
-	-	-			0.0%	0.0%
-	-	-			0.0%	0.0%
-	-	-			0.0%	0.0%
-	-	-			0.0%	0.0%
-	-	-			0.0%	0.0%
		Totals:	155.00	147.00	0.0%	-5.4%

[Input] Average Accuracy of Individual Spot Checks*(+/-%)*: 10.0%

Results:

Number of Random Spot Checks:	9		
Uncertainty of Total Spot Check Delivery *(+/-%)*	3.5%		
Average UNDER-Delivery [%]	-5.4%		
Individual Delivery to Customers Varies between	75.5%	and	113.6% of Actual.
Individual deliveries vary + or -	19.0%		

Table 4d: Summary for Accounting Losses/Gains *(ac-ft/yr)*

Category	Loss (ac-ft)	Gain (ac-ft)	Average	Lowest	Range	Highest
4a. Total Water Available for Agricultural Delivery			52,418	51,403	2,029	53,433
4b. Unauthorized and/or Unbilled Use	(150)		(150)	(248)	195	(53)
4c. Accuracy of Farm Delivery Measurement	0	0	0	101	(202)	(101)
4d. Combined Accounting Loss/Gain	(150)	0	(150)	(248)	195	(53)

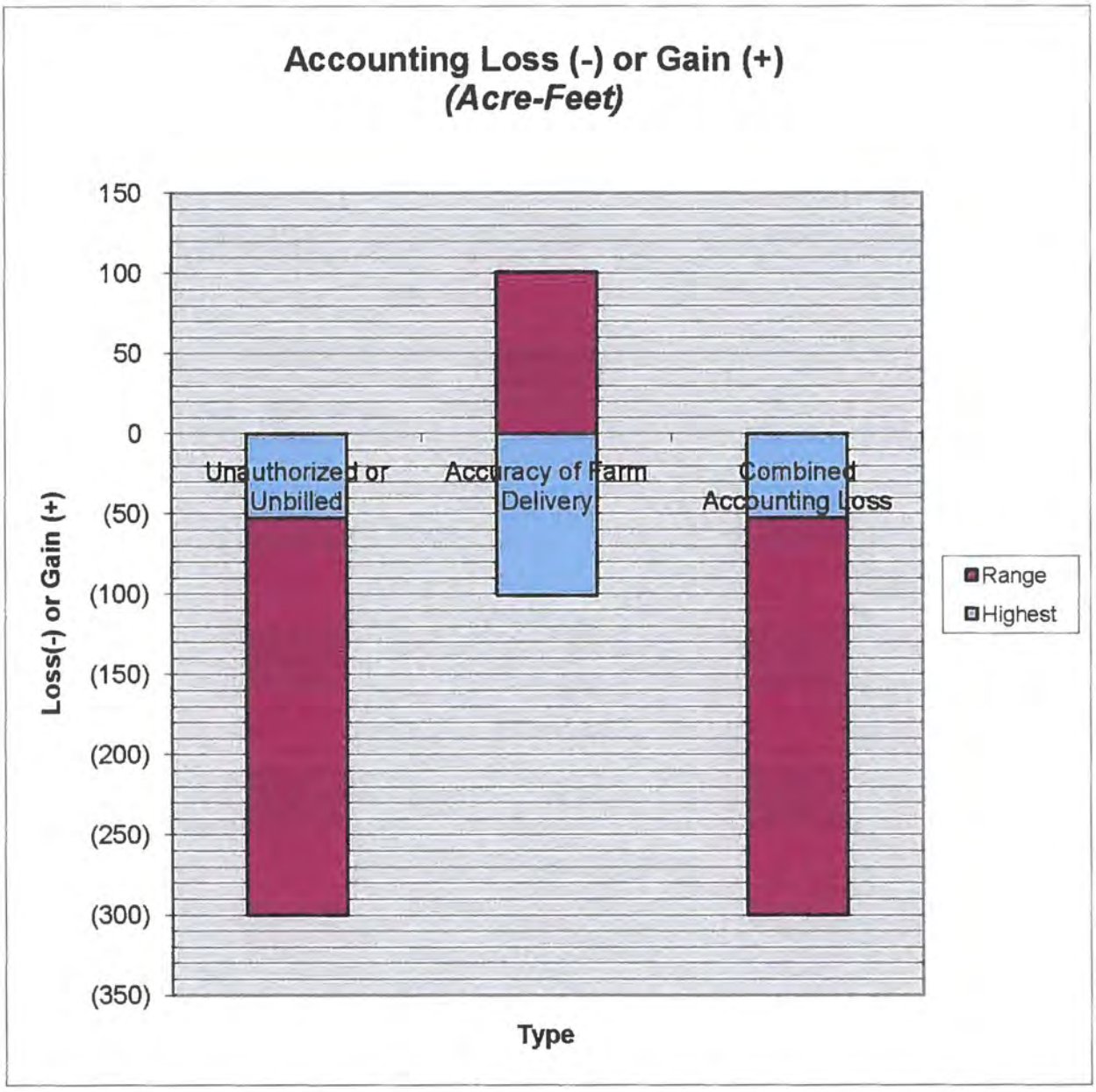
1. Technical Proposal and Evaluation Criteria

1.4 Evaluation Criteria

1.4.1 Quantifiable Water Savings – Criteria A

3) Describe Support/Documentation of Estimated Water Savings *(continued)*

Water Budget Description *(From BWD 2020 Water Conservation Plan)*



1. Technical Proposal and Evaluation Criteria

1.4 Evaluation Criteria

1.4.1 Quantifiable Water Savings – Criteria A *(continued)*

3) Describe Support/Documentation of Estimated Water Savings

Water Budget Description *(From BWD 2020 Water Conservation Plan)* continued

5. WATER BALANCE Year: 2010

Table 5a - Summary of Quantities Brought Forward from Parts 1-4

	Amount *(ac-ft)*	Uncertainty *(+/- ac-ft)*	Uncertainty *(% of agricultural Supply)*	Varies from *(ac-ft)*	Varies up to *(ac-ft)*
1. Agricultural Supply	71,542	1,286	1.8%	70,256	72,828
2. Transportation Loss					
d. Evaporation	19	5	0.0%	14	24
e. Seepage/Leakage	15,099	3,532	4.9%	11,568	18,631
f. Total Transportation Loss	15,119	3,527	4.9%	11,592	18,646
3. Operational Loss					
a. Operational Spills	552	19	0.0%	533	571
b. Filling/Emptying	3,453	4	0.0%	3,449	3,458
c. Total Operational Loss	4,005	5	0.0%	4,001	4,010
4a. Subtotal: Water Available for Agricultural Delivery	52,418	1,015	1.4%	51,403	53,433

	Amount *(ac-ft)*	Uncertainty *(+/- ac-ft)*	Uncertainty *(% of Water Available for Delivery)*	Varies from *(ac-ft)*	Varies up to *(ac-ft)*
4. Accounting Loss (+) or Gain (-)					
b. Unauthorized and/or Unbilled Use	150	98	0.2%	53	248
c. Over Delivery (+), or Under Delivery (-)	0	(101)	-0.2%	-101	101
d. Combined Accounting Loss(+) or Gain (-)	150	98	0.2%	53	248
5a. Subtotal: Water Available for Agricultural Delivery less Unauthorized and/or Unbilled Use, Only:	52,268	1017	1.9%	51,251	53,285

5b. Balance Estimates with Reported and Billed Agricultural Water Deliveries

Reported and Billed Agrucultural Water Deliveries should be between 52,204 ac-ft , and 52,332 ac-ft. for a 90% confidence level.

Reported Agricultural Water Deliveries for 2010 were 70,168 acre-feet.

This Water Balance closes at a 0% confidence level.
Note: "Confidence Level" varies from 0% (low) 100% (high).

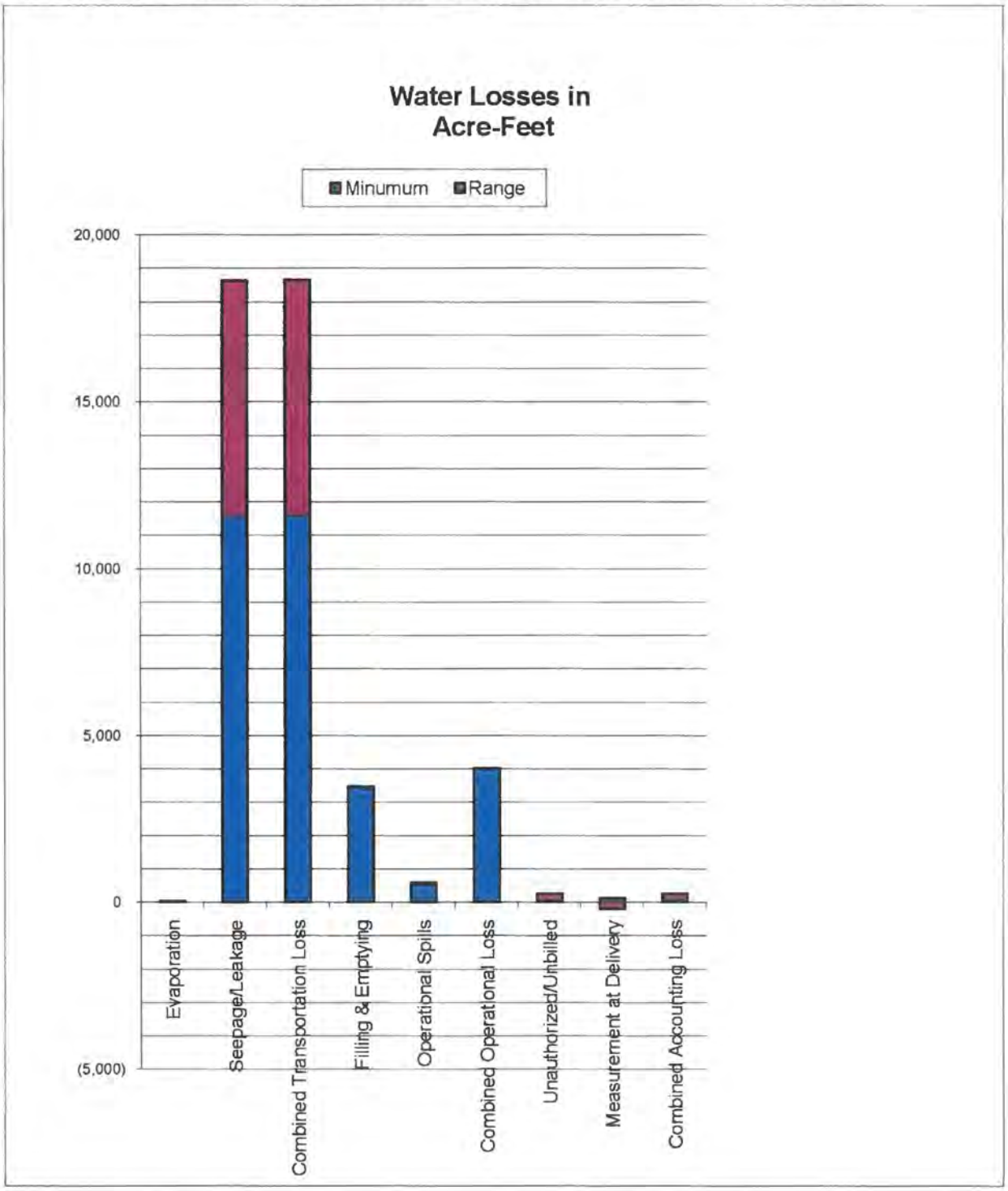
1. Technical Proposal and Evaluation Criteria

1.4 Evaluation Criteria

1.4.1 Quantifiable Water Savings – Criteria A *(continued)*

3) Describe Support/Documentation of Estimated Water Savings

Water Budget Description *(From BWD 2020 Water Conservation Plan)* continued



1. Technical Proposal and Evaluation Criteria

1.4 Evaluation Criteria

1.4.1 Quantifiable Water Savings – Criteria A

4) Questions Specific to a Canal lining/Piping Project

a. How was the estimated average annual water savings from this project determined? NRCS and USBR helped us collect data in 2010 for our first

NCRS and USBR assisted with these calculations in 2010 for our first ***Water Conservation Plan*** *and they are* included in our 2020 Water Conservation Plan. ***Tables from this investigation been provided on the pages 12-22 to facilitate your review.***

NCRS and USBR completed calculations for Seepage and evapotranspiration

They assisted with actual real-time measurements (Volume change over time for section of canal blocked).

Volume (Original Water Depth) – Volume (End Water Depth after 24 hours).

Volumes (Actual amount of water released).

We plan to update these values with the SOR currently in progress.

b. How has the annual canal seepage losses been determined?

Volume (Original Water Depth) – Volume (End Water Depth after 24 hours***).***

c. What is the expected post-project seepage/leakage losses and how were these estimates determined? 76 Acre-Feet/Year for one 0.5 Mile Section

We anticipate an 90% reduction or 298 acre-feet/year for the total canal in seepage/leakage losses based on literature review of earthen vs. concrete lined canals.

Since the upper section is twice the size the 0.5 Mile section would be 77% of 298/3 = 76.5

Research and Development Office, Reclamation R & D (up to 95%), Xudong Han, *An Experimental Study on Concrete and Geomembrane Lining Effects on Canal Seepage in Arid Agricultural Areas* (86%).

This will be confirmed by pre-water delivery data for specific intervals/crops with post-data.

d. What are the anticipated annual transit loss reductions in terms of acre-feet per mile for overall project and for each section of canal included in project. 373 Acre-Feet/Year for one 0.5 Mile Section

Operational and Transportation loss for total canal is 1,452.3 Acre-Feet per year,

Since the upper section is twice the size the 0.5 Mile section would be 77% of 1,452.3/3 = 373

e. How will actual canal seepage losses be verified?

Ponding (Data from 2010 studies) compared to current ponding studies during several intervals (High and low temperatures) after canal lined.

f. Include a detailed description of materials being used.

Concrete 4000 PSI	Retarder	Plasticizers
Micro NS Fibers	Non-Structured Fibers	NC Accelerators 4000 PSI

1. Technical Proposal and Evaluation Criteria

1.4 Evaluation Criteria

1.4.2 Renewable Energy Criteria B 20

1) Sub Criteria B1 – Not Applicable to Canal Lining Project

2) Sub Criteria B2 – *Increasing Energy Efficiency in Water Management*

Climate Change: Reduction on Greenhouse Gas Emissions: The EPA estimates that only 10% of Greenhouse gas emission come from agriculture, and these are primarily from livestock, soils and rice production. However, this project, the lining of a canal can reduce emissions by:
Improving operating practices – less time required for O & M and vehicle use.
On-Farm components, EQIP Grant to farmers to replace older equipment with high emission releases as well as being able to uses fuel with less carbon output.
Improving soil health, better water quality from lined conveyance systems, less CO_2 and N_2O Emissions.

Reduced Pumping: Less water required, not need to do a pre-run to clean canal and flush fields prior to irrigation.

Energy Savings Origin: Based on section of Canal where O & M occurs as well as specific farmer/producer/field that new equipment and operating practices are modified.

Treating Water: We currently use tanks with gravity flow for most additives (Herbicides, pesticides, growth promoters, food safety chemicals/agents).

Reduced Vehicle and Heavy Equipment Miles: O & M will be reduced from weekly activities to monthly. 75% Reduction
Required Dry-downs (2-3 Months) to remove sediment, stabilize earthen sidewalls, invasive and noxious plant removal (including aquatic plants) will most likely occur yearly. 75% Reduction

SCADA: Once the Mohave Canal lining project is completed, we intend to apply for another grant for solar powered SCADA systems (10 locations).

1. Technical Proposal and Evaluation Criteria

1.4 Evaluation Criteria

1.4.3 Sustainability Benefits – Criteria C 20

BWD meets the terms of Section 9504(a)(3)(B) of Public Law 111-11 in that no additional acreage will receive irrigation water saved from this project. We currently abide by our quota and have strived to reduce it by encouraging our growers to implement seasonal fallowing, upgrading to water reduction irrigation delivery systems, and growing crops that require less water. All our saved water goes to "lower priority" users.

1) Enhancing Drought Resiliency

Living in the southwestern United State in a Semi-Arid region, BWD is accustomed to natural variations in climate from rare flood events to persistent drought conditions. These shortages have been magnified by climate change, population growth. In order to do our part, we initiated a seasonal fallowing program in 2015 to reduce our water consumption which continues to this day.

Bard Water District (BWD) provides agricultural irrigation water to the Bard Unit and Indian Unit (Fort Yuma Indian Reservation) in Winterhaven and Bard, California. BWD has developed their Drought Contingency Plan to address water shortage issues in the Lower Colorado River Basin. Our goals are to conserve available water and minimize the adverse impacts of water supply shortages or other water supply emergency conditions. We are primarily focused on Best Management Practices and Value Engineering Designs to modernize and upgrade our antiquated and deteriorating infrastructure. This includes lining our canals, laterals, and ditches; installing new gate structures; new technology for meters, measurement devises and water/soil absorption units. We have determined that 30% to 50% of our water is loss due to these poor conditions. Even though we are a small, rural water district we border Mexico and are at the end of the Colorado River on the U.S. side. We have 2nd Priority Water Rights but being at the end of this river system is of great concern to us.

Our second focus is working in partnership with NRCS and our farmers and ranchers to help them to develop strategies for reducing water consumption, without causing adverse economic impacts to themselves and the community. This includes seasonal fallowing, drip or spray irrigation instead of flood irrigation, planting crops that uses less water, as well anticipating water seasonal water fluctuation needs.

We have developed our Drought plan to create a collaboration framework that enables us to easily implement responses and actions as well as being flexible and functional. Our plan is pro-active in that we want to conserve water year-round during both drought and non-drought conditions.

1. Technical Proposal and Evaluation Criteria

1.4 Evaluation Criteria

1.4.3 Sustainability Benefits – Criteria C 20

1) Enhancing Drought Resiliency

A key element for critical resource planning is an incremental or staged triggering criteria for drought severity and corresponding response actions. Each stage is triggered by an anticipated actual water shortage condition and each stage has several triggering criteria. The triggering criteria is based upon the analysis of the vulnerability of the water source under anticipated drought conditions. The drought condition stage, water shortage triggering criteria, and corresponding demand reduction goals are presented in the Table below.

Level of Water Shortage, Triggering Efforts, and Demand Reduction Goals

Stage Level	Stage Title[1]	Water Shortage & Triggering Criteria	Voluntary Efforts	Reduction Goal
1	Normal	Abnormally Dry Minor Shortage 10%	Seasonal Fallowing, Efficient Irrigation, Low Water Crops, Measurement Devices – 5% Reduction Capital Improvements: Conveyance Repair/Lining (3 Mile) – 5% Reduction	10%
2	Alert	Moderate Shortage 11-25%	Cumulative Effect Baseline 5% Farmers Efforts Conveyance(3 Mi) Each Year Add 5% so 10%	15%
3	Warning	Severe Drought 26%-35%	Cumulative Effect Baseline 5% Farmers Efforts Conveyance (3 Mi) Each Year Add 5% so 15%	20%
4	Critical	Extreme Drought 36%-50%	Cumulative Effect Baseline 5% Farmers Efforts Conveyance(3 Mi) Each Year Add 5% so 20%	25%
5	Emergency	Exceptional Drought Over 50%	Cumulative Effect Baseline 5% Farmers Efforts Conveyance (3 Mi) Each Year Add 5% so 25%	30%

[1] Most droughts occur after several years of little rainfall so have shown a cumulative effect of our voluntary efforts. For example, during any year we plan to conserve 10%, 2nd year 15%, 3rd year 20%, 4th year 25%, and 5th year 30% due to our yearly infrastructure improvements growers' actions.

1. Technical Proposal and Evaluation Criteria

1.4 Evaluation Criteria

1.4.3 Sustainability Benefits – Criteria C 20

1) Enhancing Drought Resiliency

a) Does the Project Seek to Improve Ecological Resiliency to Climate Change?

We have limited natural resources in this fragile desert environment, other than water. We are using a "Best Practices" model by **conserving, protecting, and restoring** our natural resources (water and subsequent watersheds and habitats) through BWD system improvements and On-Farm voluntary activities (as discussed in section 1.4.4 On Farm Criteria). We also will comply with Executive Order 14008: Tackling the Climate Crisis at Home and Abroad and the 30 – 30 initiative.

b) Will Water Remain in the System for Longer Periods of Time?

No, which will help conserve water by reducing losses from transportation, seepage and transpiration. We will be able to increase flow rates and water levels (elevation) so less water will be required. There will also be reducing water logging.

c) Will the project benefit species (T & E)? Please describe the relationship of the species to the water supply, and whether the species is adversely affected by a Reclamation project.

Water left in the Lower Colorado River System could benefit the Yuma Clapper Rail and the Southwest Willow Flycatcher. These birds' nest and raise their young along the Lower Colorado River watershed in the spring. This watershed is the corridor for wildlife preserves as well as small lakes and recreational areas. We have a local conservation group Friends or Haugthlin Lake who are working to protect the watersheds in our area. By conserving water, we promote biodiversity, endangered species in this desert habitat rely on the Lower Colorado River and its backwaters, riparian areas and natural lakes and the marshy habitat it supports for nesting, spawning and daily life. It also is part of the migration pathway for many bird species. Their habitat was greatly affected by the dams constructed along the Colorado River and then by the increased demand for water by towns and farming. During drought conditions this is intensified, and their critical habitat threatened. Especially during the summer when water demands are increased.

Numerous riparian and marshy areas form a perimeter between the agricultural fields and the All-American Canal, the Colorado River (East) and desert (West) as well as the Mesas (North) that divert runoff from rainfall into overshoots maintaining natural riparian areas.

Bard Water District is a participant in the Multi-Species Conservation Plan/Program that was developed for the Lower Colorado River area. We work closely with AZ Fish and Game and the Audubon Society. We alert and assist Fish and Game with mammal rescues from the large canals and participate in Bird Species Counts and Surveys.

1. Technical Proposal and Evaluation Criteria

1.4 Evaluation Criteria

1.4.3 Sustainability Benefits – Criteria C

1) Enhancing Drought Resiliency

c) Will the project benefit species (T & E)? Please describe the relationship of the species to the water supply, and whether the species is adversely affected by a Reclamation project.

Endangered Species in Bard Water District

Birds	Reptiles	Fish	Mammals
SW Willow Flycatcher Nest along our river corridor.	Desert Tortoise Nest/Feed in washes with creosote bushes.	Colorado Pike Minnow – Not seen below Glen Canyon Dam anymore.	Lesser Long Nosed Bat Bat Boxes were placed along our river corridor to improve habitat.
Yuma Clapper Rail (Ridgeway) Nest in dense Cattail and Tule marshes along our river corridor.	Flat Tailed Horn Lizard Resides in areas surrounding our district, eats Harvester ants.	Razorback Sucker Not seen below Grand Canyon anymore.	Sonoran Pronghorn Rarely sighted, primarily Big Horn Sheep, Deer and Wild Donkeys utilize washes and river for food and water. YPG to the North provides water stations.
Burrowing Owl Nest on ground burrows near agricultural fields.			

d) Describe any other Ecosystem Benefits

This project utilizes sound hydrological strategies coupled with time-tested structures (concrete lining) to create a more efficient and responsive water delivery system. Located in a rural area, and surrounded by desert, we are uniquely positioned to promote stewardship. Through our partnerships with our water users (farmers) we are creating a balance between water conservation, planning, efficiency, and cost savings. We are addressing issues brought about by changes in the environment, especially drought. We are using a "Best Practices" model by conserving water and subsequent watersheds and habitats) by a variety of voluntary activities (BWD as well as On-Farm) as previously discussed (seasonal fallowing, irrigation method, crop vs. water requirements, system delivery improvements, etc.). Through our partnerships with our water users (farmers) we are creating a balance between water conservation, planning, efficiency, and cost savings.

1. Technical Proposal and Evaluation Criteria

d) Describe any other Ecosystem Benefits

East of us, the Colorado River Gila River areas create watershed and riparian areas. The buffer zone that exists between us and that area consists of desert with washes (replenished by rainfall, complemented by the surrounding mountainous terrain). Most of the viable habitat is located along this river corridor, with native plants (reeds, cottonwood, willow, and sedges) then native shrubs and trees. These provide habitat for our native species as well as migratory birds. This watershed creates a natural wildlife corridor from New Mexico to California. We are southwest of the Gila River (and its tributaries: Aqua Fria and Salt Rivers) that continues west to join the Lower Colorado River in Yuma that support wildlife preserves (KOFA. Mittry Lake and Cibola). We work closely with our state and federal agencies to solve conflicts from wildlife in agricultural fields and water delivery systems.

This project , by increasing surface and ground water retention, will inherently improve water quality by increasing volume and promoting natural attenuation from aquatic plants and from its flow along its 2 mile sand and gravel bottom. These plans will improve water supply reliability and sustainability by lining this canal (infrastructure), conserving water (significantly reducing water loss) and increasing efficiency of the system.

e) Will the Project Directly Result in More Efficient Management of the Water Supply?

Yes, any canal lining project , results in a more efficient management of the water supply by

1) Reduced water volume requests due to more reliable water levels (elevation) and faster flow rates
2) Reduced water volume requests due to improved check/turnout gates (leakage)
3) Reduced water volume requests if drip lines or sprinklers used instead of flood irrigation.
4) Reduced water volume requests due to lining ditches or repairing concrete (reduce seepage and transpiration).
5) Reduced water volume requests due to more accurate field data (size and soil intake characteristics).
6) Reduced water volume requests due to system assessment and subsequent improvements.
7) Prevent monetary loss and wasted water from crops destroyed because of uncontrolled flooding or bacterial contamination.

2) Addressing a Specific Water or Sustainability Concern(s)

a) Specific Issues in our Area that Impact Water Sustainability

The recent Lower Colorado River Drought Contingency Plan signed in 2019 clearly demonstrates the seriousness of the water supply for the lower Colorado River. This project is part of our Drought Plan to modernize 1-3 miles of our conveyance systems to reduce our water demand (as well as seasonal fallowing). As shown in the plan most districts are facing mandatory reductions in time of drought or short-falls. Bard Water Users have Priority Two rights and as such have adequate water for agricultural use. We, however, as a steward of the Colorado River, have been putting forth an effort since 2013, to conserve water so it is available to other lower priority users. Every modernization project we complete, contributes to our water conservation effort.

1. Technical Proposal and Evaluation Criteria

2) Addressing a Specific Water or Sustainability Concern(s)

b) Specific Issues in our Area that Impact Energy Sustainability

The following local issues impact our energy sustainability:
Brown-outs due to high energy usage, especially in the desert summers.
Power outages due to windstorms.
Pollution – we are a non-attainment area for dust (PM-10).
Fuel supply/costs for vehicles and farm equipment

c) How will BWD Address the Issues Described Above?

The following steps can be taken to address these issues:
Solar power for critical units
Electric vehicles or low carbon emission
EQIP grants to replace older farm equipment
Wind rows or cover crops to reduce dust

d) Where will the Conserved Water Go?

Conserved water will go to lower priority users. The water we save will remain in the system under the stewardship of the BOR because it will not be diverted. They will be able to determine its best use. This project will also enable us to conserve approximately 24% of the water going through the delivery system. Allowing us to be pro-active in addressing drought, short-falls and other critical water issues.

e) Mechanism to Put Conserved Water to Use

USBR controls water not requested (due to less volume needed after lining) and water that enters are drain systems just return to the Colorado River.

f) Quantity of Water to Be Conserved

Entire Canal 1,940 Acre-Ft/Yr or 23.4% for **one 0.5 Mile section 77% of 1,940/3 = 498 Acre Ft/Yr**
Flow rates are measured at the head gate to the lateral which serves the customer. Run times, start, and stop times are on the ditch rider's inspection record. Volumes are computed and transferred to a water card. Pooling was also done to calculate seepage and evaporation.
Since the upper section is twice the size the 0.5 Mile section would be 77% of 298/3 = 76.5
Research and Development Office, Reclamation R & D (up to 95%), Xudong Han, *An Experimental Study on Concrete and Geomembrane Lining Effects on Canal Seepage in Arid Agricultural Areas* (86%).
This will be confirmed by pre-water delivery data for specific intervals/crops with post-data.

1. Technical Proposal and Evaluation Criteria

2) Addressing a Specific Water or Sustainability Concern(s)

3) Other Project Benefits

a) Combating the Climate Crisis

How Will this Project Address the Impacts of Climate Change and Help Combat the Climate Crisis?

Reduced time required for O & M will reduce CO_2 emissions from vehicles and heavy equipment.
Water conservation during drought conditions brought about by climate change.
EQIP grants for farmers/producers for newer equipment (better emission rating)
USDA grant for solar powered (lights. pumps, gates/controls, refrigeration)

Does the Project Strengthen Water Supply Sustainability to Increase Resilience to Climate Change?

Yes, by conserving water, increasing efficiency, and water quality. Especially since the local residents and Tribes rely on wells for their municipal water supplies. Increase water can also be used to fight fires, in this rural area where there are few hydrants.

Will the Project Establish and Utilize a Renewable Energy Source?

This lining project will not, but because of the modernization of this conveyance system, we will be able to install solar power SCADA units on the Mohave Canal to control delivery system flow.

Will the Project Result in Lower Greenhouse Emissions?

The EPA estimates that only 10% of Greenhouse gas emission come from agriculture, and these are primarily from livestock, soils and rice production. However, this project, the lining of a canal can reduce emissions by:
Improving operating practices – less time required for O & M and vehicle use.
On-Farm components, EQIP Grant to farmers to replace older equipment with high emission releases as well as being able to uses fuel with less carbon output.
Improving soil health, better water quality from lined conveyance systems, less CO_2 and N_2O Emissions.

b) Disadvantaged and Underserved Communities

Does the Project Directly Serve and/or Benefit a Disadvantaged or Historically Underserved Community? Yes, West Imperial County is a rural, low-income, disadvantaged community (Bard, Winterhaven, and Fort Yuma Indian Reservation).

1. Technical Proposal and Evaluation Criteria

2) Addressing a Specific Water or Sustainability Concern(s)

3) Other Project Benefits

Does the Community Meet the Disadvantaged Community Definition?

The nearest towns to the project area are Bard and Winterhaven, which includes the Fort Yuma Indian Reservation. These locations are considered severely disadvantaged and economically distressed communities. The MHI for Fort Yuma is $27,188 and the MHI for Winterhaven is $9,719 which are both substantially lower than the California average MHI of $67,169. Unemployment Rate is more than 2% higher than the statewide average. Fort Yuma's unemployment rate is 22.1% and Winterhaven's unemployment rate is 57.1%. This project will serve 1,295 residents of the Yuma Indian Reservation because this structure is on the Indian Unit. It will reduce the costs due to water losses during use as well as costs for this large project.

Does the Community Meet the Underserved Community Definition?

This rural area represents a population that has historically been excluded from funding sources, planning, and development. The Quechan Indian Reservation and the cities of Bard and Winterhaven represent a large minority of Hispanics and Native Americans interspersed with families from early settlers. The Quechan Indian Tribe were excluded from the initial water right negotiations and had to sue the federal government over 30 years ago to be included. They only received compensation for the water but nothing for the impact on their way of life that changed drastically (using natural flooding for managing and harvesting their produce and desert plants as well as the cleansing and reconstructing their homes each year).

c) Tribal Benefits

Does the Project Directly Serve and Benefit a Tribe?

Yes, the Quechan Indian Tribe is part of the Indian Irrigation Unit which is serviced by this system. The Cocopah Tribe in AZ also receives water through the Bard system via the Yuma Main Canal.

It also meets Executive Order 13985: Advancing Racial Equity and Support of Underserved Communities

Does the Project Directly Support Tribal Resilience to Climate Change?

Yes, by conserving water for the Tribe, especially since they rely on wells for their water supply.

d) Other Benefits

1. Will the Project Assist States and Water Users in Complying with Interstate Compacts?

Yes, I would make it easier, especially if there during drought/water shortages that mandate reductions.

2. Will the Project Make Water Available to Achieve Multiple Benefits or to Benefit Multiple Users? Yes, it will go to lower priority users who are more effected by water shortages. USBR can use this water to aid other growers, municipalities or other nearby entities. This will be especially important in times of shortages and drought.

1. Technical Proposal and Evaluation Criteria

2) Addressing a Specific Water or Sustainability Concern(s)

e) Larger Initiative

State of CA Integrated Water Management Program – planning and program development. Demonstrate strategies and actions for small, disadvantaged rural communities.
USBR Colorado River Lower Basin Drought Contingency Plan – recently signed.
We will work to incorporate components the goals or these documents into our Ten-Year Capital Improvement Plan, Water Conservation Plan, and funding strategies.

4) Will the Project Help prevent a Water-Related Crisis or Conflict?

Yes, our diverse water conservation efforts are three-fold and have a cumulative effect.

a) We carefully balance our **voluntary seasonal fallowing** program (number of acres and time interval – early spring) to reduce water use and prevent adverse economic impact to our workers and ourselves.
b) With infrastructure improvements/modernization projects planned each year based on the 10 Year Capital Improvement Plan, USBR Technical Service Center evaluation of our system for Measurement Devices, Repairs, Replacements and Conveyance Linin and our Water Conservation Plan. These voluntary efforts demonstrate our projected water savings from these two components (see Table below from our Drought Plan).
c) With stepwise modernization of our irrigation systems, growers can then proceed with their improvements funded by the USDA/EQIP.

Describe How our Water Source (Lower Colorado River) is Impacted by Uncertainties Related to Hydrologic Water Conditions. The Lower Colorado River is affected by the lakes and reservoirs above the Hoover Dam.

Will the Project Help Address an Issue that Could Potentially Result in an Interruption to the Water Supply if Unresolved? Our main concern is a catastrophic failure of one of our delivery systems causing unsurmountable crop damage. Most of our funds are used for O & M, repair and replacement of extremely old, deteriorated structures and additional staff time to just keep us operating without major incident. *The overall condition of the delivery and drainage systems is relatively poor due to aging infrastructure , flood damage, maintenance challenges and other causes,* USBR TM 86-68210-2016-07, Evaluation of O & M Costs Allocation, July 2016. We have approximately 67 miles of canals, laterals and ditches of which only 30% are lined. We have 465 gate check structures, the majority of which are over 35 years old (life of concrete is only 20 years) and need to be repaired or replaced. Our staff's efforts are well over 100% because of the additional time and effort required to manage our delivery systems to prevent crop damage. We are constantly trying to prevent component failures while slowly addressing our and USBR priority 1 projects. This project, however, will also enable us to conserve approximately 24.3% of the water going through this delivery system. Allowing us to be pro-active in addressing drought, short-falls and other critical water issues.

1. Technical Proposal and Evaluation Criteria

1.4 Evaluation Criteria

1.4.4 On-Farm Efficiencies Criteria D 10

1) Describe How the Proposed Project Would Complement Any Ongoing or Planned Farm Improvement.

This will complement projects already developed by our local NRCS office to assist growers in this area. One grower already received EQIP funding for water that passes through our system for lining his ditches. NRCS has new projects listed for twenty-one land parcels. Last week we held a meeting for growers about EQIP and USDA had a workshop here in October 2019. We also have contacted Bobbi McDermott a retired NRCS employee, and she has met with us several times and has agreed to work with our local growers. We also have asked our new NRCS representative to meet with us at Bard and she will be available the first of the year. We have provided our growers a tentative list of accepted projects and have met with our new NRCS representative. We are also reviewing the new USDA Regional Conservation Partnership Program and meeting with our Board to develop strategies for this new grant opportunity. The three growers listed below have provided Letters of Intent to collaborate with Bard Water District and NRCS for an EQIP grant.

Acreage Likely to Be Improved: 1,216.93 Acres out of 1,804 acres or 67.5%

Harrison Farms	682.2 Acres
Top Flavor Farms	221.73 Acres
Tanimura & Antle	313 Acres

Once the Mohave Canal is lined, flow rates and elevations determined; NRCS and our growers will work together to address their concerns and identify potential system improvements. This could include:

1. Check Gate Systems – New Check Gates - replacing poorly functioning or leaking, increasing size, or upgrading type.
2. Ditches – concrete lining, increasing size or elevation,
3. Irrigation systems – purchasing drip lines or sprinklers
4. Evaluating Field Irrigation Systems - Surveys/Measurements - Field elevations, water/soil absorption rates as well as cost analysis.
5. Hydrology Study – Flow rates and volumes – modeling to determine most efficient design
6. Measurement devices – Installing flow meters, water/soil absorption
7. Innovative Methods to kill bacteria in concrete liner (copper or zinc composites in concrete mortar), chemical additives to water supply, UV or ozone treatment.

1. Technical Proposal and Evaluation Criteria

1.4 Evaluation Criteria

1.4.4 On-Farm Efficiencies - Criteria D *(continued)*

Our local NRCS office has developed a Conservation Implementation Strategy for water conservation improvements for a total of twenty-one fields. This report has been provided in Appendix. A list of **proposed CIS/EQIP** project sites from this report that receive water from the Mohave Canal have been provided below:

Harrison Farms[1]	Glenda Spencer	H. Berryman	Martha Hill
Top Flavor Farms[1]	Evelyn Berryman	Tanimura & Antle [1]	

[1] Three growers have provided Letters of Intent/support for this grant application. Their acreage encompasses 67.5% of the land served by the Mohave Canal. They also lease other small parcels of land in this area.

Describe How the Proposed Project Would Complement Any Ongoing or Planned Farm Improvement. Steve Alameda, Top Flavor Farms received EQIP funding in 2018 for water that passes through our system for concrete lining two of earthen ditches.
Other growers (34.5% of the land) that receive water from the Mohave include: Ross Martin, Griffin Family Properties, Anthony Costa and Sons, NexGen Farms, and Johnny Cloud. We plan to encourage these growers to collaborate with NRCS for EQIP funding also.

2) Will the Proposed Project Complement the On-Farm Project by Maximizing Efficiency in the Area? If so, How? The Mohave Canal is badly deteriorated and requires constant monitoring during water delivery to reduce erosion and prevent overflows. The flow is also reduced which in-turn requires more water to be released. There is also the problem of bacteria (E.coli) being present in the bottom sludge. All these conditions negatively impact the farmer. If the Mohave is lined, a greater volume water can be delivered faster and more efficiently so less water is needed (shorter duration); less damage from erosion and risks of bacterial contamination; and less chance of overflows and uncontrolled flooding causing contamination subsequent destruction of an entire crop. Also, we will collaborate with our farmers to determine what best practices/improvements are needed to meet the requirements of the newly lined canal. This will include evaluation of existing irrigation systems (delivery systems, elevations and grade), hydrological and soil evaluation, needs/shortcomings, recommendations. This will also include long term planning to allow for growth and to address future needs.

We will assist with their EQIP grant (e.g., irrigation system upgrades – more efficient/less water needed, structural improvements (gates, outlets, drains, sidewalls, aprons) construction (leveling, trenching, compaction, fill) or monitoring equipment (moisture sensors, etc.).

1. Technical Proposal and Evaluation Criteria

1.5 Evaluation Criteria

1.4.4 On-Farm Efficiencies – Criteria D *(continued)*

The water delivered from the Mohave Canal must flow slowly for several reasons.

1) Prevent erosion of the sidewalls
2) Prevent overflow along the Mohave, and uncontrolled water loss
3) Prevent uncontrolled flooding of the agricultural field and subsequent contamination of produce (crop must be destroyed).
4) Minimize agitating the bottom sludge (loaded with bacteria)

Once the Mohave Canal is lined, flow rates and elevations determined. NRCS and our farmers can work together to improve their end of the system. This could include their check systems, ditches, irrigation systems, field elevations, soil monitoring, measurement devices, etc. Based on collaboration with NRCS, our growers will select their project to improve efficiency, conserve water and subsequently reduce their costs.

3) Describe the On-Farm Water Conservation or Water Use Efficiency Benefits that are expected to result from any On-Farm Work. Estimate of On-Farm Water Savings in Acre-Feet/Year.

These **irrigation efficiency improvements** can be achieved by EQIP funding for one or more of these improvements:

1) *Replacing deteriorated leaking check gates and structures to* ***prevent operational losses.***

2) Concrete lining, thus ***eliminating seepage*** *issues from deteriorated earthen field ditches and deteriorated concrete ditches. Also* ***reduce evaporation*** *and* ***transportation losses*** *due to less time spent in conveyance system.*

3) Installing larger capacity concrete ditches containing high-flow turn-out structures ***for better management and to reduce water quantities needed.***

4) More closely matching water volume to field dimensions and soil moisture intake qualities structures ***for better management and to reduce water quantities needed.***

5) Purchasing/Utilizing drip irrigation or sprinklers when practical(seed germination, light watering) and cost effective ***to reduce water quantities needed.***

6) Evaluating Field Irrigation Systems - Surveys/Measurements - Field elevations, water/soil absorption rate as well as cost analysis ***for better water management and efficiency.***

7) Hydrology Study – Flow rates and volumes – modeling to determine most efficient design since volumes the most constant FACTOR ***for better water management and efficiency.***

1. Technical Proposal and Evaluation Criteria

1.5 Evaluation Criteria

1.4.4 On-Farm Efficiencies – Criteria D *(continued)*

8) *Evaluating Field Irrigation Systems - Surveys/Measurements - Field elevations, water/soil absorption rate as well as cost analysis* ***for better water management and efficiency.***

9) *Hydrology Study – Flow rates and volumes – modeling to determine most efficient design since volumes the most constant FACTOR* ***for better water management and efficiency.***

10) *Innovative Methods to kill bacteria in concrete liner (copper or zinc composites in concrete mortar), chemical additives to water supply, UV or ozone treatment to* ***eliminate catastrophic crop destruction.***

11) *Improved conveyance and perimeter berms to prevent uncontrolled flooding* ***to eliminate catastrophic crop destruction.***

Amount of Estimated Water Savings

Entire Canal 1,940 Acre-Ft/Yr or 23.4% for **one 0.5 Mile section 77% of 1,940/3 = 498 Acre Ft/Yr**

Flow rates are measured at the head gate to the lateral which serves the customer. Run times, start, and stop times are on the ditch rider's inspection record. Volumes are computed and transferred to a water card. Pooling was also done to calculate seepage and evaporation.

Percentage of Total Supply	**2.25%**	1,940.3 Acre-Feet/Yr
Based real-time data provided in our annual report		86,412 Acre-Feet/Yr (Total)

Describe Current Losses: **1,940.3 Acre-Ft/Yr or *23.4%***

Operational	1,319.0 Acre-Ft/Yr	
Transportation	133.3 Acre-Ft/Yr	
Evapotranspiration Transpiration)[1]	157.0 Acre-Ft/Yr	(Increased Flow Rate – Less
Seepage	331.0 Acre-Ft/Yr	(Increased Flow Rate – Less Seepage)
Total	1,940.3 Acre-Ft/Yr	Water through Mohave System
8,289 Acre-Ft/Yr		

[1] NRCS/Yuma – Calculated

Calculations (Seepage and evapotranspiration) as well as actual real-time measurements (Volume change over time for section of canal blocked). Volume (Original Water Depth) – Volume (End Water Depth after 24 hours). Volumes (Actual amount of water released).

Percentage of Mohave Water Supply Conserved: **23.4%** 1,940.3 Acre-Feet/Yr

8,289 Acre-Feet/Yr (Mohave)

1. Technical Proposal and Evaluation Criteria

1.5 Evaluation Criteria

1.4.4 On-Farm Efficiencies – Criteria D *(continued)*

Amount of Estimated Water Savings

Entire Canal 1,940 Acre-Ft/Yr or 23.4% for **one 0.5 Mile section 77% of 1,940/3 = 498 Acre Ft/Yr**

Flow rates are measured at the head gate to the lateral which serves the customer. Run times, start, and stop times are on the ditch rider's inspection record. Volumes are computed and transferred to a water card. Pooling was also done to calculate seepage and evaporation.

Percentage of Total Supply **2.25%** 1,940.3 Acre-Feet/Yr
Based real-time data provided 86,412 Acre-Feet/Yr (Total)
in our annual report

Describe Current Losses: **1,940.3 Acre-Ft/Yr or *23.4%***

Operational	1,319.0 Acre-Ft/Yr	
Transportation	133.3 Acre-Ft/Yr	
Evapotranspiration	157.0 Acre-Ft/Yr	(Increased Flow Rate – Less Transpiration)[1]
Seepage	331.0 Acre-Ft/Yr	(Increased Flow Rate – Less Seepage)
Total	1,940.3 Acre-Ft/Yr	Water through Mohave System 8,289 Acre-Ft/Yr

[1] NRCS/Yuma – Calculated

Calculations (Seepage and evapotranspiration) as well as actual real-time measurements (Volume change over time for section of canal blocked). Volume (Original Water Depth) – Volume (End Water Depth after 24 hours). Volumes (Actual amount of water released).

Percentage of Mohave Water Supply Conserved: **23.4%** 1,940.3 Acre-Feet/Yr
8,289 Acre-Feet/Yr (Mohave)

Support/Documentation of Estimated Water Savings

NCRS and USBR assisted with these calculations in 2010 that are included in our 2020 Water Conservation Plan. ***Tables from this investigation were provided on pages 12-22 to facilitate your review.***

NCRS completed calculations for Seepage and evapotranspiration
BOR assisted with actual real-time measurements (Volume change over time for section of canal blocked).
Volume (Original Water Depth) – Volume (End Water Depth after 24 hours).
Volumes (Actual amount of water released).

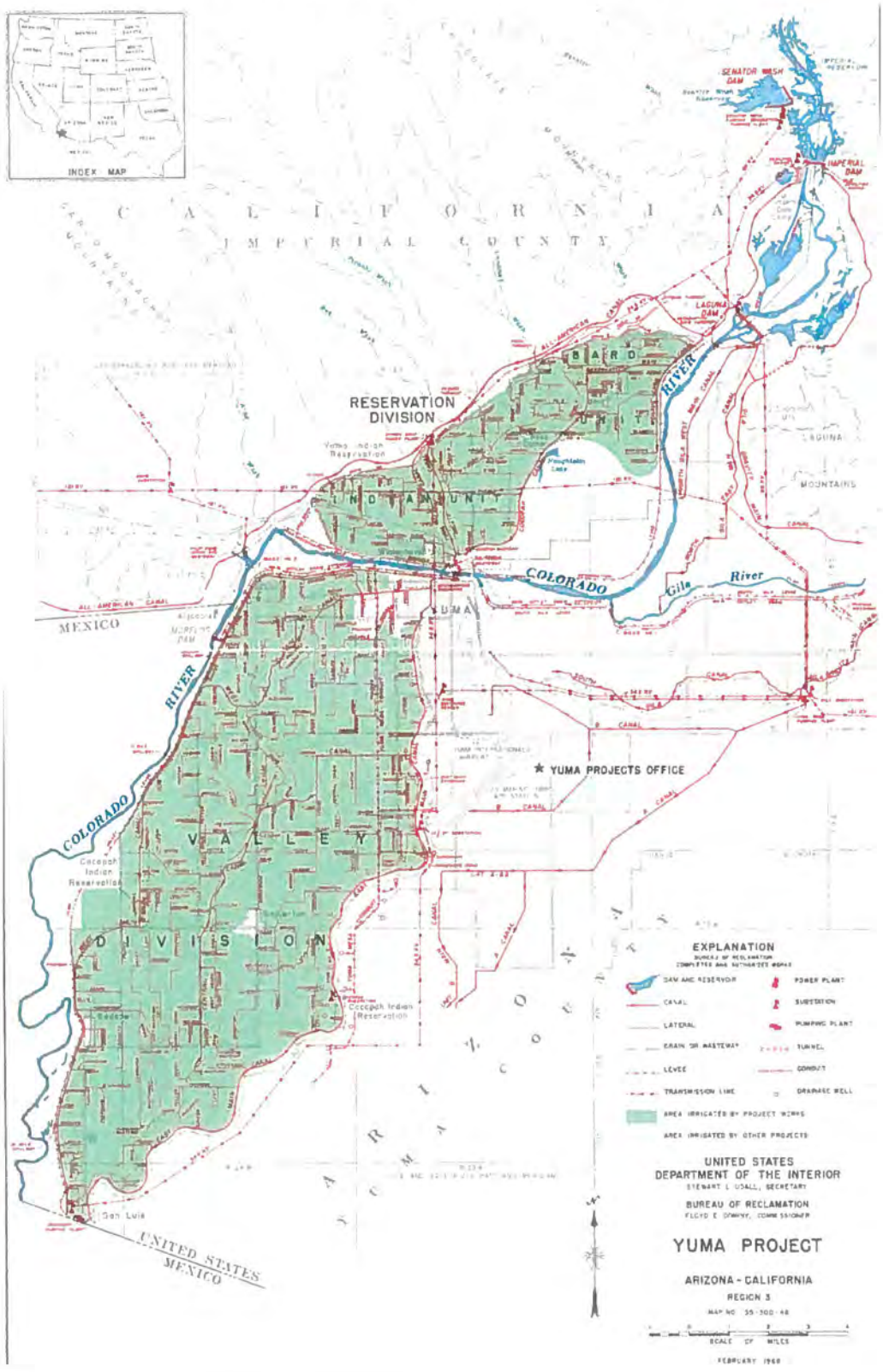
We plan to update these values with the SOR currently in progress.

A map of Bard Water District Area Boundaries Has Been Provided on Following Page. Our district includes the Bard Unit and the Indian Unit, see the Appendix for Background and History.

1. Technical Proposal and Evaluation Criteria

1.5 Evaluation Criteria

1.4.4 On-Farm Efficiencies – Criteria D *(continued) Map of BWD*



1. Technical Proposal and Evaluation Criteria

1.5 Evaluation Criteria

1.4.4 On-Farm Efficiencies – Criteria D *(continued)*

Describe fully, the On-Farm Water Conservation or Water Use Efficiency Benefits that would result from the enabled On-Farm component of this project. Estimate of On-Farm Water Savings in Acre-Feet/Year *(continued).*

Water Conservation and Costs Savings to Farmers

8) Reduced water volume requests due to more reliable and faster flow rates (enlarged and concrete lined ditches).
9) Reduced water volume requests due to new check gates (leakage)
10) Reduced water volume requests if drip lines or sprinklers used instead of flood irrigation.
11) Reduced water volume requests due to lining ditches or repairing concrete (reduce seepage and transpiration).
12) Reduced water volume requests due to more accurate field data (size and soil intake characteristics).
13) Reduced water volume requests due to system assessment and subsequent improvements.
14) Prevent monetary loss and wasted water from crops destroyed because of uncontrolled flooding or bacterial contamination.
15) Reduce costs for water treatment for produce by determining best method (chemical treatment, UV, Ozone, Copper/zinc composites) and precautions.

On-Farm Water Savings Estimate: 20-30% or 852 to 1,278 acre-feet/year
Interpolated from data below for Mohave Canal (See Page 13).
67.5% Land proposed EQIP funding so minus 32.5%.
Since our water savings for Mohave is 51%
Then reduced 67.5% by a conservative factor of 2.25 to 3.375 (divided) or ½ to 1/3.

Mohave Canal Water Anticipated Water Savings		
Operational (100%):	1,319.0 Acre-Ft/Yr	
Transportation (100%):	133.3 Acre-Ft/Yr	
Transpiration (25%):	157.0 Acre-Ft/Yr	(Increased Flow Rate – Less Transpiration)
Seepage (25%):	331.0 Acre-Ft/Yr	(Increased Flow Rate – Less Seepage)
Total	1,940.3 Acre-Ft/Yr or 23.4% Savings	
Water through Mohave System	8,289 Acre-Ft/Yr	

1. Technical Proposal and Evaluation Criteria

1.4 Evaluation Criteria

1.4.4 Implementation and Results – Criteria E 15

1) Project Planning Sub Criteria E1

Five Year Water Conservation Plan – Updated October 2020 (See Appendix)

SOR – In progress (February 2021- December 2022)

a) Planning Efforts:

This project has been in the planning stages for the last 18 years, but in 2017 this became a reality when USBR listed it as a Priority 2 in the USBR Reservation System Evaluation Project conducted in January 2017: *Technical Memorandum No USBR 35-RDE-8150-STY-2016-02*. It is also identified as our **Number One** priority in our Ten-Year Capital Improvement Plan. This project is also listed on our Water Conservation Plan and on page 14 of our Drought Contingency Plan (Page provided in Appendix).

The only reason it has been difficult to implement this project is because it is an exceptionally large undertaking, and the costs are prohibitive. We are a small rural Water District, and it is difficult for us to compete for the larger grants based on Water savings. However, if you compare the percentage of our water savings instead of the quantity it is quite high (30%-50%). We have been successful leveraging funding for small projects with less competitive funding sources (Small-Scale and Lower Colorado River Region) and have developed a strategy to complete these larger projects in 2-5 Phases to be able to leverage our 50% funding match. We anticipate the lining of the entire Mohave Canal to take place with five funding components or phases with work being performed 2021-2024. We have met with USBR, our Engineering/Design contractors and discussed this project many times. We have tried to develop a strategy to succeed.

The strategy we developed for lining the 2.78 Mile Mohave Canal is listed in the steps below.

In August 2021, Project 1: 2019 AWCE Grant: Concrete Lining of the lower Tail (1.28 Miles or 46% of the length) of the Mohave Canal **was 90% completed** (Some additional finish work needed during Dry-Downs). Our partnership with our farmers/producers enabled us to complete this section because they agreed to seasonal fallowing (April-July) so we could complete the work.

In October 2021, Project 2: WCFS Grant Application was submitted for Engineering and Design of this remaining 1.5 Mile section (E & D Consultant estimate alone is $155,900). Estimates to line the remaining 1.5 Mile section ranges from $2,000,000 - $3,000,000, so we will split this section in thirds at major checks/turnouts).

In October 2021, Project 3: AWUE to compete another 0.5 Mile section.

In 2022, Project 5: AWUE or WEEG to finish last 0.5 Mile section.

1. Technical Proposal and Evaluation Criteria

1.4 Evaluation Criteria

1.4.5 Implementation and Results Criteria E *(continued)*

1) Project Planning Sub Criteria E1

b) This Project Conforms and Meets the Goals of our Water Conservation Plan, Capital Improvement Plan, and Drought Contingency Plan by

1) Engineering/Design, Hydrology Studies and Assessments for **Better Water Management** for water delivery and distribution from the Mohave Canal.
2) Subsequent construction actions (Appurtenances) will **increase water supply reliability and sustainability.**
   Other subsequent outcomes include water conservation by **significantly reducing water loss** (1,940.acre-feet per year: 331 from seepage, 157 from transpiration, 133 from transportation, 1,319 from operational.
3) **Seepage 331 acre-feet/year and transpiration 157 acre-feet/year) will be significantly reduced** when water is delivered from the Colorado River via the All-American Canal and Reservation Main Canal to the Mohave Canal. **Laterals that run off the Mohave Canal include: Vomical, Maricopa, Klamath, Kawai, Hopi, and Hoopa.**
4) **Operational and evaporation losses will also be reduced**.
5) **Improvement and modernization of our overall system** and infrastructure, specifically, by developing engineering/design plans for the Mohave Canal Lining Project.
6) Accomplish BWD and Agricultural Water Use Efficiency goals of Water Conservation
7) Accomplish BWD and Agricultural Water Use Efficiency goals of **preventing possible water-related crisis (shortfalls and flooding).**
8) **Mitigate future conflicts or risks** in this high-profile area.
9) **Develop Partnerships**: We will work together with NRCS and our farmers (Water users – Bard Unit) and USBR to share costs by leveraging funding and resources. Our most valuable resources are our seasoned staff and our own well- maintained heavy equipment.
10) Canals and laterals that are lined are **easier to maintain, thus more time can be allotted to other deteriorated sites that require more overwatch, O & M, repair/replacement**.
11) **Reduce risk of bacterial contamination of produce from the E. Coli present in the bottom sludge.** That we cannot effectively remove without increasing the depth of the canal which then requires more water to be utilized to maintain the required elevation for delivery. For food safety, irrigation water is required to be treated with agents (acidic/chlorine) to kill bacteria during irrigation (sprinklers), so the water is not ideal for consumption by wildlife.
12) **Reduce Invasive and noxious plant species.**
13) When the Mohave is lined it will be able to provide water at a higher elevation so the **flow will be faster further reducing the quantity required by around 20%.** Higher elevations raise the water table which helps maintain our riparian area.
14) When there is adequate resources and habitat beyond the fields in these riparian, groves, washes and marshy areas, there is **less risk of contamination from bacteria in the conveyance systems and from the fields.**

1. Technical Proposal and Evaluation Criteria

1.4 Evaluation Criteria

1.4.5 Implementation and Results CRITERIA E *(continued)*

3. WaterSMART Basin Study or Water Management Options Pilot – NA but see section 1.4.3. Drought.

2) Readiness to Proceed Sub Criteria E2

a) Summary of Major Tasks

Phase 1 : Engineering/Design

Design Meetings, Plans, Specifications and Estimates for the Concrete Lining of the Lateral and Appurtenances (Tie-Ends, Turn-outs, Check Gates, Wingwalls).

Phase 2: Construction/Lining the Canal *(0.5 Mile Section of the remaining 1.5 Mile Canal)*
Site Preparation, Earthwork: Trenching, Grading and Compacting, Concrete Lining of the Canal and Constructing Appurtenances

Phase 3: On-Farm Component – Assessment and Planning

We will also provide technical assistance to our affected farmers to evaluate their on-farm irrigation systems/management to determine what improvements, modifications, or equipment they need to successfully handle the subsequent improvements to the Mohave Canal

Phase 4: Farmer's EQIP Grant Applications *(This component not funded by this grant)*
Based upon Phase 3 Recommendations

b) Permits Required – NONE

c) Identify and Describe any Engineering and Design Work Performed Specifically in Support of this Project

We met with George Cairo Engineering LLC this summer to discuss this project. He did a preliminary cost estimate for this 1.5 Mile section of the canal including all check gates and appurtenances. He is going to provide a more detailed quote that identifies the preliminary work, costs per mile for just the lining and for the check gates or appurtenances (not all need to be replaced, but some additional work may be required based upon changes in the height and elevation of the newly lined Canal. We also submitted grant application to USBR in October 2021 for Engineering and Design work: *Water Conservation Field Services Program Lower Colorado Region for Preliminary Engineering/Design for Mohave Canal Lining and Appurtenances* (E & D Consultant estimate alone is $155,900). Estimates to line the remaining 1.5 Mile section ranges from $2,000,000 - $3,000,000, so we will split this section in thirds at major checks/turnouts).

1. Technical Proposal and Evaluation Criteria

1.4 Evaluation Criteria

1.4.4 Implementation and Results Criteria E

2) Readiness to Proceed Sub Criteria E2 *(continued)*

Tasks and Milestones with Tentative Schedule

Phase	Milestones/Tasks	Duration Weeks	Interval
Pre-Work Activities			
	USBR Environmental Compliance	0	HAER Completed July 2021
	USBR – USBR Review and Award NTP	26	5/01/22 – 8/01/2022
	BWD Contractors' Bid Packages/Award/Selection	4	8/01/22- 9/01/22
Work Activities			
1	Engineering/Design for Lining Mohave Canal	31	9/01/22- 3/31/23
	Structural Design, Lining, Appurtenances 60%	13	10/01/22 – 12/31/22
	Structural Design, Lining, Appurtenances 90%	9	1/01/23 – 2/28/23
	Final Design/Engineering Plans BOR Approved 100%	9	3/01/23 – 3/31/23
2	Construction – Lining Mohave Canal	56	05/31/23 - 7/31/23
	Bid Packages/Award/Selection	4	4/01/23 – 4/30/23
	Site Preparation: Earthwork, Grading/Compacting	4	4/01/23 – 4/30/23
	Trenching and Concrete Lining	4	5/01/23 – 5/31/23
	Concrete Finish Work (Tie-Ends, Supporting structures)	9	5/01/23 – 6/30/23
	Appurtenances, Gates, Structures – During Trenching and Periodically During Dry-Downs	56	5/01/23 – 5/31/24
On Farm Components - Concurrent			
3	On-Farm Component – Assessment and Planning	4	10/01/23 - 2/01/23
	Assessment of Current Conditions (Water, Soil, Grade, Elevation, Delivery Systems/Structures)		
	Impact(s) on Existing System from Canal Lining		
	Possible Solutions/Projects with EQIP		
4	NRCS/Farmers EQIP grant applications	8	2/01/23 - 05/31/24
	Assist farmers with application process, provide documentation and support.		
	Project Closeout	1	05/31/24 - 07/31/24

1. Technical Proposal and Evaluation Criteria

1.4 Evaluation Criteria

1.4. 6 COLLABORATION CRITERIA F 6

2) Does the Project Promote and Encourage Collaboration Among District and Growers?

Even though our district is small and rural which puts us at a disadvantage in competing for larger grants; this also makes us a close-knit community. We must work together to survive. Our local office serves as a nexus for all our operations. Our Board members and growers are very active in our planning efforts. They want the most for their funding contributions. They have plans and a wish list for their and their children's future.

1) Is there Widespread Support for this Project?

Yes, this project demonstrates collaboration between our water district and our agricultural users. It can be used as an example to other water managers reflecting how assessment, planning, usage, need, and corrective measures can be achieved to benefit a district. Even though the costs for modernizing irrigation systems can be prohibitive, we demonstrate that we can slowly upgrade and replace our conveyance systems and appurtenances, a few at a time and line our canals and laterals in sections one mile at a time. We can finance a major capital improvement project or every 20 years (2014 for Concrete Lining 8 miles at $8 million through NAD Bank). Our water uses recently pledged $25/acre for O & M. They also provide a percent of their fallowing money. They are very supportive of any funding we receive to help improve our system. They actively participate our water conservation methods because not only is good for our water resources it provides them a cost savings, especially with labor costs increasing.

Our collaboration efforts are an ongoing process with our stakeholders (landowners, growers, our District Board the Quechan Indian Tribe). We also help facilitate interaction with the NRCS and just recently the state of CA IRWM program. The Quechan Tribe was just awarded a grant from USBR for the Tonowanda Canal for check Gate replacement. applied for this grant in February 2018 for the Five Gates but were unsuccessful. The USBR Yuma office and Technical Service Center and NRCS assist to provide information, data and reports (See Appendix A for excerpts).

1. Technical Proposal and Evaluation Criteria

1.4 Evaluation Criteria

1.4.6 COLLABORATION CRITERIA F 6

2) What is the Significance of the Collaborative Support?

Without the collaborative support we would not be able to develop our Drought Contingency Plan, Water Conservation Plan and implement the improvements we need **better manage and reduce** water use. Our partnership is demonstrated in several ways:

a) Voluntary seasonal fallowing program.
b) Irrigation methods that promote water use reduction (sprinklers, drip, etc.)
c) Crops that require less water
d) Helping fund O & M costs (Percent of fallowing)
e) Helping Fund Capital Improvement Projects ($25.00/Acre)
f) Helping with NCRS grants
g) Stakeholders agreeing to 50% match for grants and encouraging grant applications.
h) Strategies/Support/approval for proposals/grants that require matching funds.
i) Creating a mutually beneficial partnership that improves efficiency and reduces costs.
j) Creating the framework for addressing and responding incidents (ranging from routine to emergencies).
k) Working with Quechan Tribe to leverage funding for projects as well as providing staff and heavy equipment for their projects.

3) Will this Project Increase the Possibility/Likelihood of Future Water Conservation Efforts?

Yes, NRCS currently uses our district to demonstrate projects to others. These include both district and grower activities. We also work with Arizona Western College and participate in their symposiums as well as other agency workshops and meetings. We are in the process of updating our website to provide information to provide updates about our projects and activities. We also work closely with the Quechan Tribe and collaborate with them for their irrigation infrastructure grant applications.

4) Supporting Documents

Letters of support from three farmers/producers as well as the BWD board President have been provided in the Appendix. A study conducted by NRCS to assist farmers/producers in our district has also been provided.

1. Technical Proposal and Evaluation Criteria

1.4 Evaluation Criteria

1.4.7 Additional Non-Federal Funding - Criteria G 4

Our funding match will be the **50%** from our Water User's Account and In-Kind. The In-Kind will be our Labor and use of our Heavy Equipment. This project is required to keep the water users supplied during their year-round growing season.

We have taken a more conservative approach, so we can leverage funding and resources from ourselves as well with the USBR in a step by step process. In 2018, our water users pledged $25/acre for Capital Improvements. They also provide a percent of their fallowing funds for system efficiency improvements. They are incredibly supportive of any funding we receive to help correct system deficiencies as well as improving efficiency.

Without this funding it is exceedingly difficult to proceed, even with our Capital Improvements funds, this would take all our funding for other projects away for at least ten years and delay the project significantly. This would put the BWD's system at considerable risk, diverting all our funds to only one project. The 50% matching funds help tremendously for these costly projects.

1.4.8 Nexus to Reclamation - Criteria H 4

1) BWD Contract with Reclamation

The Colorado River is the source of our water supply via the All – American Canal. The BWD approved diversion request is approximately 51,000 acre/feet per year and the Indian Unit's approved diversion request is approximately 49,000 acre/feet per year. Our USBR contract number is **19-XX-30-N0965**.

The Yuma Project is a Federal Reclamation Project. Work began on the distribution system of the Reservation Division in 1909 and the patented land was opened to settlers in 1910. With the construction of the Laguna Dam from 1905-1909, approximately 38,000-acre feet per year were provided to the non-Indian sections. The Bard Irrigation District was organized in 1927 to represent landowners in the Bard District. Water for the project was diverted from the Laguna Dam. Later after the construction of the Imperial Diversion Dam (1938), 5 miles upriver and the completion of the All-American Canal (1941), irrigation for the Reservation Division was diverted from 5 turnouts along the All-American Canal. This included the Siphon Drop Power Plant for the Indian Unit and the Yuma Main Canal for the Valley Division in located in Arizona.

1. Technical Proposal and Evaluation Criteria

1.4 Evaluation Criteria

1.4.8 Nexus to Reclamation - Criteria H 4

1) BWD Contract with Reclamation

On December 1, 1978, the Bard Irrigation District was renamed the Bard Water District. In March 1981, the Bard Water District entered into a contract with the U.S. Bureau of Reclamation (USBR) for the operation and maintenance of the Bard Unit. In January 1983, BWD entered into an additional contract to operate and maintain the Indian Unit facilities. The Bard water users originally contracted (beginning in 1909) with the USBR under Present Perfected Rights to provide water under this pre-existing agreement. Bard's consumption is based upon these farm units. The Yuma Project Reservation Division (YRPD) can divert all the water needed for crops; not to exceed 25,000 acres per year.

1) BWD maintains a continuous working relationship with the Bureau of Reclamation's office in Yuma (collaborating to update our Water Conservation Plan for 2020 as well as assisting with our new grants), USBR's Technical Service Center, as well as with the USDA, NCRS and the University of AZ, Yuma campus. A list of our previous, ongoing, and pending grants is provided on the following page.
2) BWD works diligently to maintain and repair our aging systems with very little funding and resources. In 2004, we received a North American Development Bank grant with 25% Tribal and 25% Bard Water District matching funds. 12 Miles of canals and ditches were lined with concrete or concrete piping and check structures were installed. Bard water users obtained this loan and pay $18.50 per acre per year until 2023 to cover the costs of this construction. All water saved may be used by a lower priority.

2) Benefit to Reclamation Project Area or Activity

Water conserved will go to lower priority users who are more effected by water shortages. USBR can use this water to aid other growers, municipalities or other nearby entities. This will be especially important in times of shortages and drought.

1. Technical Proposal and Evaluation Criteria

1.4 Evaluation Criteria

1.4.8 Nexus to Reclamation - Criteria H 4

List of Previous, Ongoing and Pending Grants

Date Applied/Awarded	Title	Grant Source	Amount	Status
2018 Re-applied 2020	Cocopah Drop Leaf Gate Replacement Ute	*WATERSMART Small-Scale Water Efficiency Grant*	$33K	Declined Costs Increased
2019-2020	Demonstrating Conservation Technologies for Measurement Devices - Cocopah	*Water Conservation Field Services Program for Lower Colorado River*	$80K	Completed March 2021
2019-2020	Design and Engineering for the Five Gate Structure	*Water Conservation Field Services Program for Lower Colorado River*	$161k	Completed March 2021
2017-2019	Fallowing Yearly 2,400 Acres	*Third Funding for Two Year Voluntary Pilot System Water Conservation Program*	$295K	Completed Sept 2019
2019	Engineering/Design and Construction/Lining 1st half 4,250 LF of Acoma Lateral	*Two Small-Scale Water Efficiency Program (SWEP)*	$73K $74K	Completed April 2021
2019-2020	Engineering/Design 2nd half Acoma Lateral Lining and Appurtenances 5,550 LF	*Water Conservation Field Services Program Lower Colorado Region*	$89K	60% Complete Oct 2021
2019 Re-applied 2021	Engineering/Design Mohave Canal Lining and Appurtenances 2.78 Miles	Water Conservation Field Services Program Lower Colorado Region	$111K	**NOT AWARDED**
2019 Cancelled WEEG Awarded	Construction of Five Gate	*WaterSMART Drought Resiliency grant*	$641K	**NOT AWARDED**
2019-2020	Construction of Five Gate	*WaterSMART Water and Energy Efficiency*	$641K	Completed Sept 2021
2019-2020	Watershed Planning	*Cooperative Water Management Program Phase 1*	$100K	30% Complete Oct 2021
2020	RC Gate Replacement	*Small-Scale Water Efficiency Program (SWEP)*		**NOT AWARDED**
2020-2021	Cocopah Drop Leaf Gate Replacement Ute	*Small-Scale Water Efficiency Program (SWEP)*	$110K	**NOT AWARDED**
2019	Mohave Lining 1st Mile	***USDA** RCPP Grant*	$1,317K	**NOT AWARDED**
2020-2021	Mohave Lining 1st Mile	*Agriculture Water Users Efficiency Grant*	$1,317K	90% Complete Oct 2021
2020-2021	SOR	*Water Conservation Field Services Program Lower Colorado Region*	$115K	30% Complete Oct 2021
2020-2021	Lining 2nd Half Acoma Lateral	*WaterSMART Water and Energy Efficiency*	$2,236K	Post Award Review
2020-2021	Engineering/Design for Arnold Rd and Cocopah Canal Crossing	*Water Conservation Field Services Program Lower Colorado Region*	$42K	Just Awarded
2020-2021	Sioux Lateral Pipeline Project	*Small-Scale Water Efficiency Program (SWEP)*	$203K	Just Awarded
2020-2021	Engineering and Design Five Gates	*CA DWR Disadvantaged Communities Grant*	$20K	Completed March 2021

USDA EQIP Grants – Working with local farmers Fall 2019-Spring 2023
IRWM – State of CA – Matching Funds for USBR Grants and New Projects TBD.

1. Technical Proposal and Evaluation Criteria

1.4 Evaluation Criteria

1.4.8 Nexus to Reclamation - Criteria H 4

2) Benefit to Reclamation Project Area or Activity

Water conserved will go to lower priority users who are more effected by water shortages. USBR can use this water to aid other growers, municipalities or other nearby entities. This will be especially important in times of shortages and drought.

3) Is BWD a Tribe?

No, but 51.7% of the irrigated agricultural land in our district is on the Quechan Indian Reservation and the irrigation system is managed by us. The Bard Water District and Lands located in the Yuma Project includes the Reservation Division in California. The Reservation Division consists of approximately 14,700 irrigable acres of which 7,100 acres are in the Bard Unit (Bard Water District, mostly on the Eastern portion) and 7,600 acres in the Indian Unit (mostly on the Western portion). This proposed Mohave Canal project was originally constructed as part of the 1909 Yuma Project.

In January 1983, BWD entered into a contract to operate and maintain the Indian Unit facilities. The Indian Unit Water Users pay the Bureau of Indian Affairs (BIA) their O & M costs, then these funds pass through to the USBR and eventually BWD is compensated. The Fort Yuma Indian Reservation of California was established for the Quechan Indian Tribe by an Executive Order of January 9, 1884. These Indian lands are held in trust by the BIA for the individual Indian allottees in about 10-acre allotments. This acreage is pooled and leased to approximately 10 major farm operators in the area. The leases are administered by the Bureau of Indian Affairs. The Bard Unit contains patented lands held in private ownership. There are about 190 individual water user accounts in the Bard Water District and 10 in the Indian Unit.

1. Technical Proposal and Evaluation Criteria

2. Performance Measures

Pre-project Estimations of Baseline Data:

We have already completed the following tests that are included in our Water Conservation Plan.

Ponding Tests: Seepage and Evaporation

Inflow/Outflow Testing: Data is collected whenever water is released. This is incorporated into our data base. We can generate report for early and late seasons adding the ratio of acre-feet diverted to acre-feet received to calculate efficiency. Adjustments are made for evaporation (including season/ ambient temperatures).

Post-Project Methods for Quantifying the Benefits of Canal Lining:

Pre-project results will be compared with Post-project results to calculate water savings. We will compare ratio of acre-feet diverted to acre-feet received to calculate efficiency. These stats will be updated in our Water Conservation Plan. Much of this data will be provided during our SOR (February 2021-December 2022).

3. Project Budget

3.1 Funding Plan and Letters of Commitment

Summary of Non-Federal and Federal Funding Sources

USBR: $484,340 50%

BWD: $484,340 50%

Summary of Non-Federal and Federal Funding Sources

Funding Sources	Funding Amount
Non-Federal Entities (BWD)	
Labor and Fringe	**$84,011**
Fringe	**$45,834**
Equipment	**$155,600**
Materials	**$70,000**
	$355,445
Contractual (Engineering/Design and Testing) $587,500 (Total) - $484,340 (BOR) = $103, 160 (BWD)	**$103,160**
Direct Costs	**$458,605**
BWD: Indirect Costs De-Minimus 10% of $257,345 MTDC	**$25,735**
Non-Federal Subtotal (BWD) Labor, Fringe, Equipment, Materials, Indirect Costs and 18% Contractual	**$484,340**
Other Federal Entities	**$0.00**
Requested Reclamation Funding ***For Contractual 82% of Contractual***	**$484,340**
Total Project Funding	**$968,680**

3. Project Budget

3.2 Budget Proposal

BUDGET ITEM DESCRIPTION	COMPUTATION		Quantity Type	TOTAL COST
	$/Limit	Quantity		
Salaries and Wages				
Project Manager	$43.34	360	HRS	$15,602.40
Water Master	$27.56	360	HRS	$9,921.60
Equipment Operators (2)	$23.02	800	HRS	$18,416.00
Concrete Fabricator	$20.00	360	HRS	$7,200.00
Gate Fabricator	$19.69	360	HRS	7,088.40
Laborers (2)	$13.52	720	HRS	$9,734.40
Administrative Asst.	$24.54	120	HRS	$2,944.80
Contract & Grant Specialist	$36.40	360	HRS	$13,104.00
Subtotal Salaries and Wages				**$84,011.60**
Fringe Benefits				
Project Manager (41.45%)	$15,602.40	.4534	%	$7,074.13
Water Master (39.76%)	$9,921.60	.4383	%	$4,348.64
Equipment Operators - 2 (48.22%)	$18,416.00	.5891	%	$10,848.87
Concrete Fabricator	$7,200.00	.5605	%	$4,035.60
Gate Fabricator (50.82%)	7,088.40	.4997	%	$3,542.07
Laborers - 2 (61.60%)	$9,734.40	.5533	%	$5,386.04
Administrative Asst. (36.52%)	$2,944.80	.4694	%	$1,382.29
Contract & Grant Specialist (7.78%)	$13,104.00	.7033	%	$9,216.04
Subtotal Fringe				**$45,833.68**
Equipment (Bard Water District)				
Front End Loader CAT 938G	$100.00	160	HRS	$16,000.00
Rubber Tired Excavator CAT M318F	$100.00	120	HRS	$12,000.00
Excavator 330 C	$100.00	120	HRS	$12,000.00
Dump Truck -GMC	$100.00	160	HRS	$16,000.00
Dump Truck – Kenworth	$135.00	160	HRS	$21,600.00
Water Truck – GMC	$50.00	120	HRS	$6,000.00
12M3 Motor Grader	$150.00	160	HRS	$24,000.00
Mac/Cozad Lowboy	$150.00	120	HRS	$18,000.00
Flatbed/Tilt Bed	$75.00	120	HRS	$9,000.00
Service Truck 1 Ton 2000 Ford	$50.00	240	HRS	$12,000.00
Project Manager & Water Master Trucks (2)	$25.00	360	HRS	$9,000.00
Subtotal Equipment				**$155,600.00**
Supplies and Materials				
Fill Dirt	$10.00	7,000	CU YD	$70,000.00
Concrete included with Trencher	$0.00	600	CU YD	$ 0.00
Subtotal Supplies and Materials				**$70,000.00**

3. Project Budget

3.2 Budget Proposal (continued)

BUDGET ITEM DESCRIPTION	COMPUTATION		Quantity Type	TOTAL COST
	$/Limit	Quantity		
Contractual/Construction				
Construction Management Include On-site Engineering/Survey	$52,000.00	1	LS	$52,000.00
Concrete Testing	$15,000	0.5	Mile	$7,500.00
Trencher	$200.00	2,640	LF	$528,000.00
Subtotal Contractual/Construction				**$587,500.00**
Env. and Regulatory Compliance	$0.00	1	LS	$0.00
TOTAL DIRECT COSTS				**$942,945.28**
MTDC **$257,345**				
Indirect Costs De-Minimus	$257,345.28	0.1	%	**$25,734.53**
TOTAL ESTIMATED PROJECT COSTS				**$968,679.28**

3.3 Budget Narrative

Salaries and Wages:

Project Manager: Nick Bahr – Project Management

Key Personnel: Water Master – Shawn Weddle – Assist Project Manager
Equipment Operators – Site Earthwork and Installation
Laborers – Site Earthwork and Installation
Gate Fabricator – On-site Installation/Modifications
Administrative Asst – Payroll/Accounts Payable Tracking
Contracts & Grants Specialist – Arlene Kingery Documents, Changes, Reports, Tracking

The Bard Water District certifies that the labor rates included in the budget proposal represent the actual labor rates of the identified personnel.

Fringe: Fixed rate for each employee category for all work done by Bard Employees. See Budget Proposal on Page 42

Travel: No Travel Required

2. Project Budget

3.3 Budget Narrative (continued)

Equipment: Site preparation, Load and Transport Dirt, Earthwork, installation/rebuild new structures, and final cleanup. Dust Control
Vehicles used for project management and in support of Bard Crew on-site

Motor Grader 12M3
CAT 938G — CAT 420F Backhoe
Tracked Excavator 330C — Rubber Tired Excavator 318F
Dump Truck
International Water Truck
Mac/Cozad Lowboy — Flatbed/Tilt bed
Ford F150 PU Trucks (2)
Ford F150 – Crew Cab Truck — Ford XLT Super Crew

730 & 830 Capital Trapezoid Trencher w/Boat (slip form for concrete) provided by Crawford Associates **(Contractor)**

Used ad Needed
Lighting (Night)
TIG Welder — ARC Welder
Stihl Concrete Saw
Tamper — Roller
730 & 830 Capital Trapezoid Trencher w/Boat (slip form for concrete) provided by Crawford Associates **(Contractor)**

Materials and Supplies:
Concrete for Appurtenances (Aprons, Tie-Ends, Frame, Sidewalls, etc.)
Fill Dirt to bring to fill trapezoid at required slope/grade
Forms/Transverse Joints/Structures for Concrete work NC

Contractual:
Engineering and Design – George Cairo Engineering LLC
Trencher

Other:
Environmental Regulatory Compliance Costs: None HAER completed July 2021

Indirect Cost Rate: NO approved government rate so use De-Minimus on MTDC (Labor, Fringe, Materials, $25,000 of Each Contractual)

3. Project Budget (continued)

3.3 Budget Narrative (continued)

Materials and Supplies:
Safety: Barriers, Level D Personal Vests, glasses, hard hats, gloves; Drinking Water
Concrete for Appurtenances (Aprons, Tie-Ends, Frame, Sidewalls, etc.)
Fill Dirt to bring to fill trapezoid at required slope/grade
Forms/Transverse Joints/Structures for Concrete work

Contractual:
Engineering and Design – George Cairo Engineering LLC

Other:
Environmental Regulatory Compliance Costs: None HAER completed July 2021

Indirect Cost Rate: NO approved government rate so use De-Minimus on total Direct Costs

4. Required Permits or Approvals

There are **no** permits or approval required for this project.

5. Letters of Support

See Appendix for three letters of intent/support from our farmers/growers (On-Farm).

6. Official Board Resolution

Resolution **WILL BE PROVIDED** BY November 30, 2021,
A letter has been provided by our Board President in the Appendix

APPENDIX A

Background and History – Pages 58-60

Photographs of Each 0.5 Mile Start and Endpoint Pages 61-65

Letters of Intent/Support Pages 66-68

Resolution – will be provided by November 30, 2021
Letter from Board President Provided Page 69

Referenced Documents

USBR Reservation System Evaluation Project conducted in January 2017
Technical Memorandum No. 35-RDE-8150-STY-2016-02 – Hydrologic Report

Excerpts from Referenced Documents

Drought Contingency Plan 2019
Cover, Table of Contents and Mohave Canal Lining Reference - Page 14

Water Conservation Plan
Cover, Table of Contents and Mohave Canal Lining Reference - Page 17
Data and Information Inserted in Pages 12-22 Criteria Section to Facilitate Review

A HAER-Level
Historical and Field Documentation for the Canal Lining Project
Cover, Table of Contents and Table Identifying Start and Endpoints and Inclusive Structures - Pages 21-22
Photographs are in included in pages 61-65 of this Appendix

Conservation Implementation Strategy Bard, CA Imperial County, Irrigation Improvement Project, Steve Reddy – District Conservationist, NRCS Yuma.

Background and History of Bard Water District

The Yuma Project, initiated in 1909, is a Federal Reclamation Project and lies within the historical boundaries of the Fort Yuma Indian Reservation in Southeastern California (Imperial County) along the lower Colorado River near Yuma, Arizona. The Bard Water District and Lands located in the Yuma Project includes the Valley Division in Arizona and the Reservation Division in California. The Reservation Division consists of approximately 14,700 irrigable acres of which 7,100 acres are in the Bard Unit (Bard Water District, mostly on the Eastern portion) and 7,600 acres in the Indian Unit (mostly on the Western portion). This proposed Mohave Canal project was originally constructed as part of the 1909 Yuma Project.

On December 1, 1978, the Bard Irrigation District was renamed the Bard Water District. In March 1981, the Bard Water District entered a contract with the U.S. Bureau of Reclamation (USBR) for the operation and maintenance of the Bard Unit, In January 1983, BWD entered an additional contract to operate and maintain the Indian Unit facilities. The Indian Unit Water Users pay the Bureau of Indian Affairs (BIA) their O & M costs, then these funds pass through to the USBR and eventually BWD is compensated. *The overall condition of the delivery and drainage systems is relatively poor due to aging infrastructure , flood damage, maintenance challenges and other causes,* USBR TM 86-68210-2016-07, Evaluation of O & M Costs Allocation, July 2016.

The Fort Yuma Indian Reservation of California was established for the Quechan Indian Tribe by an Executive Order of January 9, 1884. These Indian lands are held in trust by the BIA for the individual Indian allottees in about 10-acre allotments. This acreage is pooled and leased to approximately 10 major farm operators in the area. The leases are administered by the Bureau of Indian Affairs. The Bard Unit contains patented lands held in private ownership. There are about 190 individual water user accounts in the Bard Water District and 10 in the Indian Unit.

Work began on the distribution system of the Reservation Division in 1909 and the patented land was opened to settlers in 1910. With the construction of the Laguna Dam from 1905-1909, approximately 38,000-acre feet per year were provided to the non-Indian sections. The Bard Irrigation District was organized in 1927 to represent landowners in the Bard District. Water for the project was diverted from the Laguna Dam.

Later after the construction of the Imperial Diversion Dam (1938), 5 miles upriver and the completion of the All-American Canal (1941), irrigation for the Reservation Division was diverted from 5 turnouts along the All-American Canal. This included the Siphon Drop Power Plant for additional turnouts off the Yuma Main Canal for the Valley Division located in Arizona.

The Bard water users originally contracted (beginning in 1909) with the Bureau of Reclamation under Present Perfected Rights to provide water under this pre-existing agreement. Bard's consumption is based upon these farm units. The Yuma Project Reservation District (YRPD) can divert all the water needed for crops; not to exceed 25,000 acres per year. The Bard Water District is just below the Laguna Dam, the first dam built on the Colorado River to divert water for the Yuma Project. The Bard Unit is part of the Yuma Project Reservation Division and has 2nd Priority Water under the California Seven Party Agreement. Return water flows back into the Colorado

Background and History of Bard Water District (continued)

River and continues to Mexico as specified by the International Agreement. The most important crops grown in the Bard Water District are produce, Medjool dates, citrus, cotton, alfalfa hay, and wheat. Crops can be grown year-round in this warm dry climate with little need for frost protection.

The Bard water users originally contracted (beginning in 1909) with the Bureau of Reclamation under Present Perfected Rights to provide water under this pre-existing agreement. Bard's consumption is based upon these farm units. The Yuma Project Reservation District (YRPD) can divert all the water needed for crops; not to exceed 25,000 acres per year. The Bard Water District is just below the Laguna Dam, the first dam built on the Colorado River to divert water for the Yuma Project. The Bard Unit is part of the Yuma Project Reservation Division and has 2nd Priority Water under the California Seven Party Agreement. Return water flows back into the Colorado River and continues to Mexico as specified by the International Agreement. The most important crops grown in the Bard Water District are produce, Medjool dates, citrus, cotton, alfalfa hay, and wheat. Crops can be grown year-round in this warm dry climate with little need for frost protection.

Currently, the Bard Water District operates and maintains 67 miles (353,760 Linear Feet) of irrigation ditches and canals; only 30% are lined with concrete or concrete piping. There are 465 (Check Gates and Delivery Gates) and YPRD diverts approximately 90,000-acre feet per year to irrigate approximately 15,000 acres. Efforts to conserve water are challenging in Bard's rapidly aging system, but Bard works closely with the USBR to be pro-active in addressing these issues. This proposed Design/Engineering Project for the Mohave Canal was originally constructed as part of the 1909 Yuma Project. Our contract number with the USBR is **19-XX-30-N0965**.

Mohave Canal Characteristics:

Mohave Canal (Head to Lower portion is 2.78 Miles)

The Mohave Canal is in **Area F** and receives water from the Colorado River via the All-American Canal, via the Reservation Main Canal. The BWD approved diversion request is approximately 51,000 acre/feet per year. The Indian Unit's approved diversion request is approximately 49,000 acre/feet per year.

Laterals that run off the Mohave Canal include: Vomical, Maricopa, Klamath, Kawai, Hopi, Hoopa.

Length for Phase 2 Engineering and Design: 1.78 Miles or 9,398 LF (Total 2.78 Miles or 14,678 LF)

Widths: Top	12 Ft	Bottom 4 Ft	Height:	7 Ft
Water Depth:	6 Ft		Slope:	1 to 1.5 Ft
Acres Served:	1,804 Acres			
Soil Type:	Clay Loam			

Water Delivered Approximately 1,471 acre-feet/year. Additional 7,000 acre-feet/year pass through Mohave to the other six laterals listed above and then to the growers' fields/ditches.

Background and History of Bard Water District (continued)

Source of Water: Colorado River- All American Canal **Water Rights Involved:** 2nd Priority

Total Quantity of Water Supplied: Bard Unit: 50,000 acre ft/yr Indian Unit: 49,000 acre ft/yr

Current Users and Number Served: Agricultural 150

Major Crops: Wheat, Sudan Grass, Produce and Cotton (Listed by water demand: High ➡ Low)

Total Acres Served: Bard Unit 7,100 Indian Unit 7,600

Estimated Water Loss Reduction if Conveyance modernized:

Approximately 1,940 acre feet/year or 23.4% of water delivered to this area.

Potential Shortfalls in Water Supply: If drought continues, quantities could be reduced. Increased demand from new users. Water conservation measures are critical. In our Drought Plan voluntary actions are taken by farmers such as seasonal fallowing, drip irrigation methods, sprinkler systems to germinate seeds, elimination of crops that require large quantities of water.

Bard Water District Water Delivery or Distribution System: Agricultural Use only. Nearby ground water wells used for tribal, residential and commercial use.

Type and Approximate Total Lengths of Canals, Laterals and Pipes: 67 Miles 353,760 LF

Concrete Lined/Pipe: 27 Miles 142,560 LF (40%) **Unlined:** 40 Miles or 211,200 LF (60%)

Type and Approximate Total Lengths of Canals:	13 Miles	36,640 LF		
Concrete Lined: 8 Miles	42,240 LF	**Unlined:**	5 Miles	26,400 LF
Type and Approximate Total Lengths of Laterals:	50 Miles	264,000 LF		
Concrete Lined: 13 Miles	68,640 LF	**Unlined:**	37 Miles	195,360 LF
Fragmented/Deteriorated Concrete Lined Lateral:	1 Mile	5,280 LF		
Type and Approximate Total Lengths of Pipes:	3 Miles	15,840 LF		

Number of Irrigation Turnouts: 450

Significant Irrigation Improvements: Remote Monitoring Devices: 5 and 2 (2020/2021)

NRCS Projects: 2 (2019) and 22 (proposed)

Photographs

Four Structures (Check and Turnout) – Start and End of Each 0.5 Miles Section

Photo 1
Beginning of Mohave Canal and Head Gate
Failed and Replaced (2000-2005)
Facing South/Downstream
ASM Feature No. 4-IMP-6821 (YIP Y11)
(Already received Cultural Clearance with Five Gate Project)

Two Adjacent Metal Slide Gates with Hand Wheel Lifting Devices Type A Rectangular Headwalls

Photo 2
New Mohave Head Gate and Mohave Canal (2000-2005)
Facing South/Downstream
32°48'28.28"N 114°31'42.07"W
ASM Feature No. 4-IMP-6821 (YIP Y11) and . 4-IMP-6811 (YIP Y01)
(Already received Cultural Clearance with Five Gate Project)

Photographs

Four Structures (Check and Turnout) – Start and End of Each 0.5 Miles Section

Metal Slide Gate with Hand Wheel Lifting Device
Type A Rectangular Angled Sidewalls.
Road Crossing sidewall connects to structure.
Eyelet Hooks for Installation

Photo 6
Hoopa Lateral Head Gate/Turnout
Accidently Destroyed/Replaced (2010)
West side of Canal – Facing West
32°48'14.61"N 114°31'56.07"W
ASM Feature No. 4-IMP-6819 (YIP Y9)

Two Adjacent Wooden Gates with Jacklift Device
Type B Flat Metal Grate for Pedestrian Walkway

Photo 7
Hoopa Check Structure
Rebuilt (Post 1956 - YIP states only abutments present)
Facing Southwest/Downstream
32°48'9.66"N 114°31'59.10"W

Photographs

Four Structures (Check and Turnout) – Start and End of Each 0.5 Miles Section

Metal Slide Gate with Jacklift Device Type A Rectangular Angled Sidewalls. Sidewall connects to Check Structure downstream. Eyelet Hooks for Installation (Post 1990)

Photo 12
Farm Turnout 198
Replaced (Post 1990)
West side of Canal – Facing West
32°47'47.00"N 114°32'3.56"W

Two Adjacent Metal Slide Gates with Jacklift Device Type B Flat Concrete sidewalls extend on East and West sides of canal. Metal Grate Pedestrian

198 Farm Turnout

Photo 13
Hopi Check Structure (1949-1950)
Facing Southwest/Downstream
32°47'46.88"N 114°32'3.39"W
ASM Feature No. 4–IMP-6818 (YIP Y8)

Photographs

Four Structures (Check and Turnout) – Start and End of Each 0.5 Miles Section

Metal Slide Gate with Jacklift Device
Type C Curved. Road Crossing sidewall connects to structure.

Photo 11
Hopi Lateral Main Gate/Turnout (1949-1950)
Tie-End Head Walls with Colby Road Crossing Project
West side of Canal – Facing West
32°47'47.35"N 114°32'3.55"W

NOTE: Canal begins to narrow!

Photographs

Four Structures (Check and Turnout) – Start and End of Each 0.5 Miles Section

Metal Slide Gate with Jacklift Device
Type A Rectangular Sidewall connects to Road Crossing upstream and Check Structure downstream.
Proposed to be replaced with road crossing.

Photo 16
Kawai Lateral Head Gate/Turnout
Wooden Slide Gate, Lever and Headwall Replaced (Post 1992)
West side of Canal – Facing West
32°47'21.12"N 114°32'3.42"W
ASM Feature No.4-IMP-6816 (YIP Y6)

Kawai Head Gate

Two Adjacent Wooden Slide Gates with narrow wooden handles for lifting.
Type B Flat Concrete sidewalls extend on East and West sides of canal.
Metal Grate Pedestrian Walkway
Proposed to be replaced with turnout and road

Photo 17
Kawai Check Structure (1949-1950)
Facing South/Downstream
32°47'21.04"N 114°32'3.34"W

11/01/21

Arlene Kingery
Contracts & Grants Specialist
Bard Water District
1473 Ross Road
Winterhaven, CA 92283

Subject: Letter of support for Bard Water District's WaterSMART Water Energy Efficiency Grant Application FY2021-2022 to Finish Lining 0.5 Mile (1/3) of the Remaining 1.5 Mile Upper Section of the Mohave Canal

Dear Arlene,
We are pleased to provide this letter of support to Bard Water District for this grant application. We supported Bard Water during Project 1: Concrete lining 1.28 Miles of the lower portion of this canal by fallowing our fields to allow for construction. This project is 90% completed as of August 2021; Project 2 (WCFS Grant, submitted October 2021) will help us complete the Engineering and Design for this final 1.50 Mile section. Project 3 (AWUE Grant submitted October 2021) will help us to line a 0.5 Mile section and finally **Project 4 to line another 0.5 Mile section** the next step in our efforts to modernize and improve the Mohave Canal's 2.78 Mile delivery system. We realize that modernization of infrastructure (concrete lining) will provide us new opportunities for us to adapt and improve our irrigation systems also. NCRS has already contacted us about potential project and funding. These project improvements would help us optimize efficiency, reliability, and safety of our water delivery systems, subsequently improving water management and conservation. This will also reduce the spread of noxious/invasive plants. The Mohave Canal currently irrigates 682.4 acres of our agricultural fields. We are very pleased with the concrete lining of almost half of the canal and will continue to support Bard in their efforts to improve our water delivery systems.

Sincerely,

William Harrison

Harrison Family Farms Partnership

6445 East County 3rd Street | Yuma, AZ 85365 | Phone 928-344-0885 | Fax 928-726-1176 | abrooks@harrisonfarmsinc.com

11/01/2021

Arlene Kingery
Contracts & Grants Specialist
Bard Water District
1473 Ross Road
Winterhaven, CA 92283

Subject: Letter of support for Bard Water District's WaterSMART Water Energy Efficiency Grant Application FY2021-2022 to Finish Lining 0.5 Mile (1/3) of the Remaining 1.5 Mile Upper Section of the Mohave Canal

Dear Arlene,

We are pleased to provide this letter of support to Bard Water District for this grant application. We supported Bard Water during Project 1: Concrete lining 1.28 Miles of the lower portion of this canal section by fallowing our fields that receive water from the Mohave Canal This project i s 90% completed as of August 2021; Project 2 (WCFS Grant, submitted October 2021) will help us complete the Engineering and Design for this final 1.50 Mile section. Project 3 (AWUE Grant submitted October 2021) will help us to line a 0.5 Mile section and finally **Project 4 to line another 0.5 Mile section,** the next step in our efforts to modernize and improve the Mohave Canal's 2.78 Mile delivery system. The concrete lining of the Mohave Canal will create new opportunities for us to adapt and improve our own irrigation systems. NCRS has already contacted us about potential project and funding. These project improvements would help us optimize efficiency, reliability, and safety of our water delivery systems, subsequently improving water management and conservation. This will also reduce the risk of bacterial contamination from the sludge on the bottom of the existing earthen canal sections of the Mohave Canal and reduce noxious/invasive plants. The Mohave Canal currently irrigates 221.73 acres of our agricultural fields. We are very pleased with the concrete lining of almost half of the canal and will continue to support Bard in their efforts to improve our water delivery systems.

Sincerely,

Craig Alameda
Treasurer, Top Flavor Farms

11/01/2021

Arlene Kingery
Contracts & Grants Specialist
Bard Water District
1473 Ross Road
Winterhaven, CA 92283

Subject: Letter of support for Bard Water District's WaterSMART Water Energy Efficiency Grant Application FY2021-2022 to Finish Lining 0.5 Mile (1/3) of the Remaining 1.5 Mile Upper Section of the Mohave Canal

Dear Arlene,

We are pleased to provide this letter of support to Bard Water District for this grant application. We supported Bard Water during Project 1: Concrete lining 1.28 Miles of the lower portion of this canal by fallowing our fields to allow for construction. This project is 90% completed as of August 2021; Project 2 (WCFS Grant, submitted October 2021) will help us complete the Engineering and Design for this final 1.50 Mile section. Project 3 (AWUE Grant submitted October 2021) will help us to line a 0.5 Mile section and finally **Project 4 to line another 0.5 Mile section** the next step in our efforts to modernize and improve the Mohave Canal's 2.78 Mile delivery system. We realize that improvements to the Mohave Canal delivery system will provide us opportunities for us to adapt and improve our irrigation systems also. We intend to work with NRCS to identify potential improvement projects. These project improvements would help us optimize efficiency, reliability, and safety of our water delivery systems, subsequently improving water management and conservation. This will also reduce the spread of noxious/invasive plants. The Mohave Canal currently irrigates 313 acres of our agricultural fields. We are very pleased with the concrete lining of almost half of the canal and will continue to support Bard in their efforts to improve our water delivery systems.

Sincerely,

Mark Stover
Tanimura & Antle

BARD WATER DISTRICT

1473 Ross Road, Winterhaven, CA 92283-9715

Tele: 760-356-0714

Email: bardwater@outlook.com

November 1, 2021

Mr. Nick Bahr
General Manager
Bard Water District
1473 Ross Road
Winterhaven, CA 92283-9715

Subject: Letter of support for Bard Water District's WaterSMART: Water Energy Efficiency Grant Application FY2021-2022 for Project 4: Finish Lining 0.5 Mile (1/3) of the Remaining 1.5 Mile Upper Section of the Mohave Canal

Dear Nick,

We are pleased to provide this Letter of Support for this grant application. As farmers/ landowners, we are very familiar with the unique problems facing small rural agricultural communities, especially with aging irrigation structures (gates, turnouts, earthen canals and laterals) as well as food safety challenges, and increasing costs. Other environmental factors in Arizona and other Western states include climate change and drought. Project 1: Concrete lining 1.28 Miles of the lower portion of this canal is 90% completed as of August 2021; Project 2 (WCFS Grant, submitted October 2021) will help us complete the Engineering and Design for this final 1.50 Mile section. Project 3 (AWUE Grant) submitted October 2021 will help us to line a 0.5 Mile section and finally **Project 4 to line another 0.5 Mile section** the next step in our efforts to modernize and improve the Mohave Canal's 2.78 Mile delivery system. This is part of the five projects required to complete this project. If you are successful in receiving this funding, we look forward to our continued relationship to modernize and upgrade our water district's structures. This project (strategies/steps/funding) has been discussed and supported by our board members. A resolution will be prepared during our next board meeting in November.

Sincerely,

Ray Face
BWD Board President