Feasibility of Piping
the
Orchard Ranch Ditch

Sponsored by the
Orchard Ranch Ditch Company
in conjunction with
The Colorado Water Conservation Board
and
The United States Bureau of Reclamation

FEASIBILITY STUDY APPROVAL
Pursuant to Colorado Revised Statutes 37-60-121 &122, and in accordance with policies adopted by the Board, the CWCB staff has determined this Feasibility Study meets all applicable requirements for approval.

Signed

1/13/16
Date

November 2015

Table of Contents and list of Appendices

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BACKGROUND

Purpose

The proposed project will pipe an earthen canal and several laterals in conjunction with the U.S. Bureau of Reclamation Salinity Control program. Approximately 90% of the cost of will be provided by the U.S. Bureau of Reclamation. The Orchard Ranch Ditch Company is requesting a $150,000 loan from the CWCB to complete the funding package needed to carry out the project. This project is considered to be rehabilitation of existing facilities. The piping project will accomplish two main goals:

1) Decrease the amount of salt entering into the Colorado River by an estimated 1004 tons each year over the 50 year lifespan of the project.

2) Modernize the irrigation delivery system for the shareholders of the Orchard Ranch Ditch. The modernization will result in an increased opportunity for shareholders to implement water saving irrigation practices such as sprinkling. The project will also increase the amount of water available for irrigation because of a decrease in canal transit loss.

The project is needed to keep local agriculture viable as the farmers face pressures from increased housing development near to the ditch and increased demand for water from other users of water from Colorado River.

Study Area Description

The study area is located in Delta County near the town of Eckert. The largest nearby town is Delta which is located about 10 miles south of Eckert. The topography of the area is dominated my mesas and valleys. The piping project is on the Surface Creek mesa, a relatively flat mesa which has been farmed for well over 100 years. Currently about 350 acres served by the ditch are being farmed. In the past over 400 acres have been farmed and some of that land is expected to resume irrigation when new ownership takes place. The main crops are hay, pasture, and fruit. Typical alfalfa yields are 4 tons per acre per year. Typical apple yields are 600 bushels per acre. Cattle are the main livestock grazed on the pastures.

The main stream in the study area is Surface Creek which originates about 20 miles to the north on the Grand Mesa. The Gunnison River is located about 8 miles to the south of the study area. The Gunnison River drains the entire region.

The study area is historically an agricultural area with small towns serving the agriculture industry. Coal mining has taken place nearby, but is no longer active. Other important employers are education, health care, and government. No major industry is located in the study area. In the last 40 years, the mild climate and beauty of the area has made the area a popular location to retire. Some of the agricultural lands have been converted to residential developments which are populated mainly by older citizens. The population of the entire Delta County is currently about 30,000 people.

Appendix A contains maps showing the study area and proposed project.

Previous Studies

The NRCS conducted reconnaissance level studies in 1989-92 to modernize the Orchard Ranch Ditch 1989-92. Both underground piping and concrete lined ditch were considered. During that period one cost estimate for piping only the main canal was $281,000. For various funding reasons both on the part of the NRCS and the ditch company the project was not implemented.

In the U.S. Bureau of Reclamation's 2012 funding cycle the Orchard Ranch Ditch applied for funds to pipe the ditch and several laterals. The application was not funded because the project cost of $1,479,000 was not competitive with other applicants for the U.S. Bureau of Reclamation funds.

PROJECT SPONSOR

The sponsor of this project is the Orchard Ranch Ditch Company. The Company's ditch was dug in the late 1800's by a group of early settlers cooperating to get water to their new farms. The ditch has been in continuous operation since that time. The Orchard Ranch Ditch Company is a mutual ditch company incorporated in the State of Colorado on August 8, 1915. A copy of company's Articles of Incorporation and By-laws are found in Appendix B.

There are 17280 shares of stock in the Orchard Ranch Ditch Company. There are 34 shareholders, three of which are homeowners' associations. Natural stream flow water from the company's decrees is divided proportional to the number of shares owned by each shareholder.

Revenue for company comes almost entirely from assessments on shares of stock. A very small portion of the revenue comes from administrative fees charged to the shareholders.

The Orchard Ranch Ditch owns a concrete diversion in Surface Creek. It also owns, a concrete spillway, concrete headgate structure, and 2 Parshall flumes set in concrete. In the canal itself the ditch company owns 9 concrete division boxes for sending water into the laterals. The easement for the ditch is prescriptive. The ditch company does not own any rights of way.

WATER RIGHTS

Water Availability

The Orchard Ranch Ditch owns 3 decrees for natural stream flow water in Surface Creek. They are listed below:

Court Action 0038	adjudication of 06/17/1889, absolute, Decree #4	5.70 cfs
Court Action 0457	adjudication of 09/28/1907, absolute, Decree # 27	6.45 cfs
Court Action 4808	adjudication of 01/31/1964, absolute, Decree #K46	10.00 cfs

The number 4 decree typically runs April 1 – July 10

The number 27 decree typically runs May 1 – June 10
The number K46 decree typically runs May 10 – May 20, but in years of below normal snowpack on the Grand Mesa it may not run at all.

Many of the shareholders own storage water rights in private reservoirs on the Grand Mesa. The ditch delivers water from these reservoirs to the owners of the storage water in addition to their proportional rights to the natural stream flow decrees.

The annual amount of water the Orchard Ranch Ditch carries varies substantially depending on the snowpack on the Grand Mesa. A typical year is 2500-3000 acre feet of water with perhaps three quarters of that being natural stream flow water and one quarter being storage water.

Water Supply Demands

The availability and demand for water in the project area can be characterized as, "almost adequate if you do a good job irrigating." This is typical of the dry mesas of Delta County. A certain amount of the service area of the Orchard Ranch Ditch will probably be converted from agriculture to housing and small acreage farming over the 50 year lifespan of this project. However as the house owners and small acreages become owners of ditch company shares they typically use the water as fully as the farmer previously did. Currently about ¼ of the farmland is in conservation easement, so at a minimum this much acreage is expected to continue in production agriculture.

The project will provide a small increase in water availability – probably no more than 5% - from stopping the seepage out of the bottom of the earthen canal. However the project will go a long ways towards providing water security for the ditch's service area in a situation of increasing population in the service area and increasing demand for Colorado River water.

PROJECT DESCRIPTION

Analysis of Alternatives

The purpose of the project is to rehabilitate and improve existing facilities. Three alternatives were considered:
1) The no action alternative
2) Piping the ditch and portions of 4 laterals with Polyvinyl chloride plastic (PVC) pipe
3) Piping the ditch and portions of 4 laterals with High density polyethylene (HDPE) pipe

The alternatives were compared to each other using the evaluation factors suggested in the CWCB Water Project Loan Program Guidelines. In some cases the evaluation factors were applied in a non quantitative manner. However this technique was sufficient to highlight differences and choose a preferred alternative. Appendix C shows the analysis of alternatives.

The evaluation methodology used in choosing a preferred alternative consisted of reviewing the evaluation table in Appendix C while guided by the following goals:

1) The preferred alternative should **modernize** water delivery and provide the opportunity to shareholders to implement more efficient irrigation practices.
2) The preferred alternative should provide long term **security** of water availability to shareholders in the face of increased density of local population and increased demand on Colorado River water
3) The preferred alternative should choose a practice that has long term **reliability.** A lifespan of 50 years was considered.
4) The preferred alternative should have the **Shareholders**' portion of the **cost** not be excessive
5) The preferred alternative should be able to retain a construction grant from the U.S. Bureau of Reclamation. The grant focuses on **decreasing the salt load** in the Colorado River

Alternative 1 was ruled out because it did not achieve the ditch company's goal of modernizing the water delivery system. The alternative was also ruled out because it does not achieve the goals of decreasing salt in the Colorado River nor of improving the long term ability of the ditch company to deliver water to shareholders.

Alternative 2 was ruled out because our engineering company advised that HDPE would be a better material for our project.

Alternative 3 was chosen because it was only slightly more expensive that Alternative 2. This made the shareholders portion of the cost acceptable. In addition alternative 3 did the best job of achieving the other 4 goals.

Selected Alternative

Narrative Description

The project will replace approximately 8260 feet of earthen main canal and 2560 feet of earthen laterals with underground pipe. In some sections multiple pipes lying side by side will be used instead of a single pipe. This multiple pipe feature will better manage water distribution to shareholders. In all, approximately 16,660 feet of pipe will be laid. A new headgate and screening structure will be constructed at the inlet of the piping system. The existing diversion in the creek and spillway are functioning well, so no new diversion or spillway are planned.

The project will be operated much the same as at present. Namely the water will be divided among the shareholders in proportion to the number of shares they own. The ditch company will continue to employ a ditch rider to do this task.

Map

Map 3 in Appendix A shows existing and proposed components for the entire project.

Conceptual Plan/Cross-Section

A diagram of typical trench excavation, pipe bedding and back fill is found in Appendix D. A detailed survey has been done of the project. It is not yet available for

inclusion in this feasibility study. It will show profile and hydraulic gradeline.

Conceptual Design Features

The U.S. Bureau of Reclamation grant which the ditch company received for this project states that at a minimum all projects must meet NRCS construction standards. A sample standards sheet is found in Appendix E

Field Investigations

This project is to rehabilitate an existing facility. It is anticipated that minimal field investigations will be needed.

Right-of-Way/Land

A tabulation of land ownership and easement requirements is found in Appendix F.

Cost estimate

A detailed cost estimate for the project is found in Appendix G

Implementation Schedule

The project implementation schedule is found in Appendix H

Impacts

The terms of the ditch company's grant from the U.S. Bureau of Reclamation include requirements for compliance with NEPA, cultural resource regulations, and paleontological protection regulations. An environmental analysis will be conducted. A cultural study will be conducted to determine historical and paleontological impacts. A wildlife habit replacement plan will be implemented during the same time the piping project is being implemented.

The U.S. Bureau of Reclamation will be the lead Federal agency for NEPA compliance and will be responsible for evaluating technical information and ensuring that natural, and cultural, and socioeconomic concerns are appropriately addressed.

Impacts on local and/or regional plans for water resource development, land use, recreation, and economic development will likely be minimal since this project rehabilitates facilities that are already existing and in use. The ability to manage water quality will be greatly upgraded. The project will cause an estimated decrease of 1004 tons of salt entering the Colorado River every year for the next 50 years.

Two of the three decrees for natural stream flow water are pre 1922 decrees. The proposed project should help insure the continued use of those decrees and thus safeguard water rights for the state of Colorado.

Funds to study and mitigate impacts of the project are included in the detailed cost estimate shown in Appendix G.

Institutional Feasibility

The U.S. Bureau of Reclamation will oversee obtaining compliance with Federal and State agencies. Local permits for such things as road crossings will be obtained by the ditch company.

FINANCIAL FEASIBILITY ANALYSIS

Loan Amount

The project is expected to cost $1,430,720. The Orchard Ranch Ditch Company is requesting a loan of $150,000 from the CWCB with a 30 year term and a hybrid agricultural - municipal interest rate of 1.95%

Financing Sources

Grant currently being processed by U.S. Bureau of Reclamation	$1,280,720
Loan from CWCB	$ 150,000

Revenue and Expenditure Projections

The Orchard Ranch Ditch schedule of revenue and expenditures for the 30 year life of the loan is found in Appendix I. The schedule is built on the assumption that when the piping project is completed operation, maintenance, and replacement costs will be approximately 50% higher than they are a present.

Loan Repayment Sources

The funds for loan payment will come from shareholder assessments. Current assessments are $.40 per share plus $75 per shareholder. Increase in assessments for servicing the CWCB loan is expected to be approximately $0.39 per share for 30 years.

Financial Impacts

Currently the Orchard Ranch Company has no debt. The total assessment for operations, maintenance, replacement and debt repayment is expected to be about $1.15 per share before inflation during the 30 year life of the CWCB loan. It is unknown if any financial savings will result from this project.

TABOR

The Orchard Ranch Ditch is a private mutual ditch corporation. It has tax exempt status with the Internal Revenue Service. The Orchard Ranch Ditch Company is not subject to the provisions of TABOR

Collateral

The Orchard Ranch Ditch Company will provide the following collateral:
1) A pledge of assessment revenues backed by a rate covenant that guarantees the assessment rates will be adequate to cover all of debt obligations
2) A pledge of the company's water distribution facilities

Sponsor Creditworthiness

The 2015 assessment is $.40 per share and the administration fee is $75.00 per shareholder.

Copies of the three most recent annual financial statements are found in Appendix I.

CONCLUSIONS AND RECOMMENDATION

The Orchard Ranch Ditch piping project is a rehabilitation project that is technically feasible. Approximately 90% of the funding for the project is being provided by the U.S. Bureau of Reclamation. The funding from the U.S. Bureau of Reclamation makes the project financially feasible for the ditch company.

The project will help protect natural stream flow decrees that predate the 1922 Colorado River Compact.

COLORADO
Colorado Water Conservation Board
Department of Natural Resources

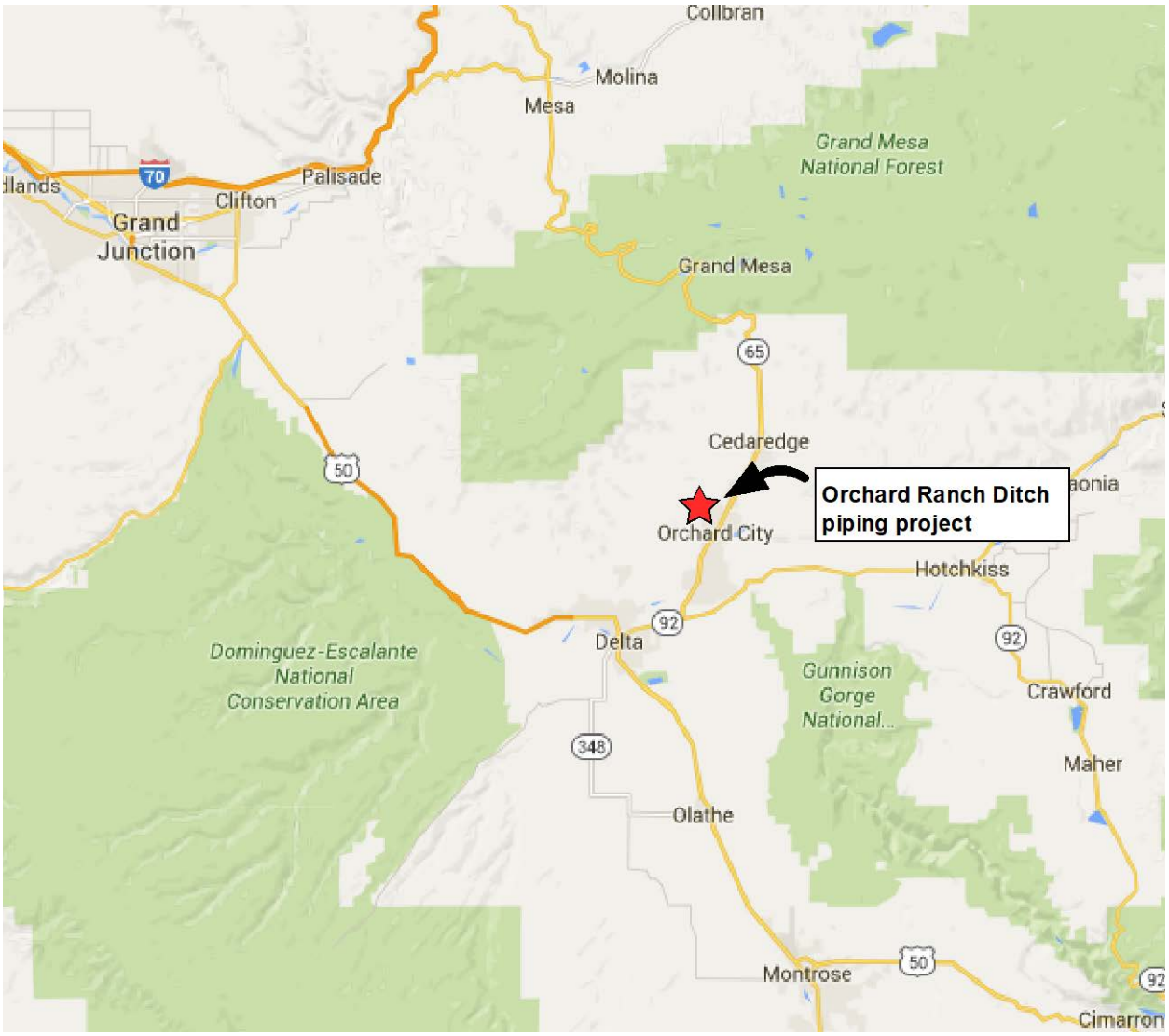
Water Project Loan Program

Application Type	
☐ Prequalification *(Attach 3 years of financial statements)* ☒ Loan Approval *(Attach Loan Feasibility Study)*	
Agency/Company Information	
Company / Borrower Name: Orchard Ranch Ditch Company	
Authorized Agent &Title: Paul Kehmeier, Vice president and manager of piping project	
Address: 20490 North Road, Eckert CO 81418	
Phone: (970) 835-3004, 779-0723	Email: Paul-Kehmeier@msn.com
Organization Type: ☒ Ditch Co, ☐ District, ☐ Municipality ☐ other:_____	Incorporated? ☒ YES ☐ NO
County: Delta	Number of Shares/Taps: 17280 shares
Water District: 40	Avg. Water Diverted/Yr__3000___ acre-feet
Number of Shareholders/Customers Served:	Curr Assess per Share $0.40 (+ $75 per shareholder)
34	Average monthly water bill $ _____ (Municipality)
Contact Information	
Project Representative: Paul Kehmeier	
Phone:970-835-3004, 779-0723 cel	Email: Paul-Kehmeier@msn.com
Engineer: J-U-B Engineers Inc., Tracy Allen	
Phone:801-547-0393, 726-5818 cel	Email: tla@jub.com
Attorney: none at this time	
Phone: ( )	Email:
Project Information	
Project Name: Orchard Ranch Ditch Pipe Project	
Brief Description of Project: (Attach separate sheets if needed)	
-- Please refer to page 2 of this application --	
General Location: (Attach Map of Area) -- Please refer to the map on page 3 of this application --	
Estimated Engineering Costs: $143,670	Estimated Construction Costs: $1,197,243
Other Costs (Describe Above): $89,807 (see pg 2)	Estimated Total Project Costs: $1,430,720
Requested Loan Amount: $150,000 (*Limit 90% of Total Project Costs*)	Project Start Date(s) Design: Jan., 2016 Construction: Sept 2016
Signature	
Paul Kehmeier ___Vice_President_____11/25/15 Signature / Title Date	Return to: Finance Section Attn: Anna Mauss 1313 Sherman St #718 Denver, CO 80203 Ph. 303/866.3449 e-mail: anna.mauss@state.co.us

The Orchard Ranch Ditch is located on the south side of Grand Mesa about 10 miles north of Delta Colorado. The ditch has natural stream flow decrees for 22.17 cfs from Surface Creek, a tributary of the Gunnison River. The ditch also delivers water which comes from privately owned reservoirs on Grand Mesa. The Orchard Ranch Ditch has been in continuous operation for approximately 120 years. The ditch currently serves about 400 acres of farmland and 3 subdivisions. The proposed project will pipe the 1.6 mile long main earthen canal and portions of 4 laterals. The project will be done in conjunction with the U.S. Bureau of Reclamation Salinity Control program. Approximately 90% of the cost of the project will be provided by the U.S. Bureau of Reclamation. Of the 30 or more ditches in the Surface Creek area, the Gunnison Roundtable has listed the Orchard Ranch Ditch as number 3 in priority for piping.

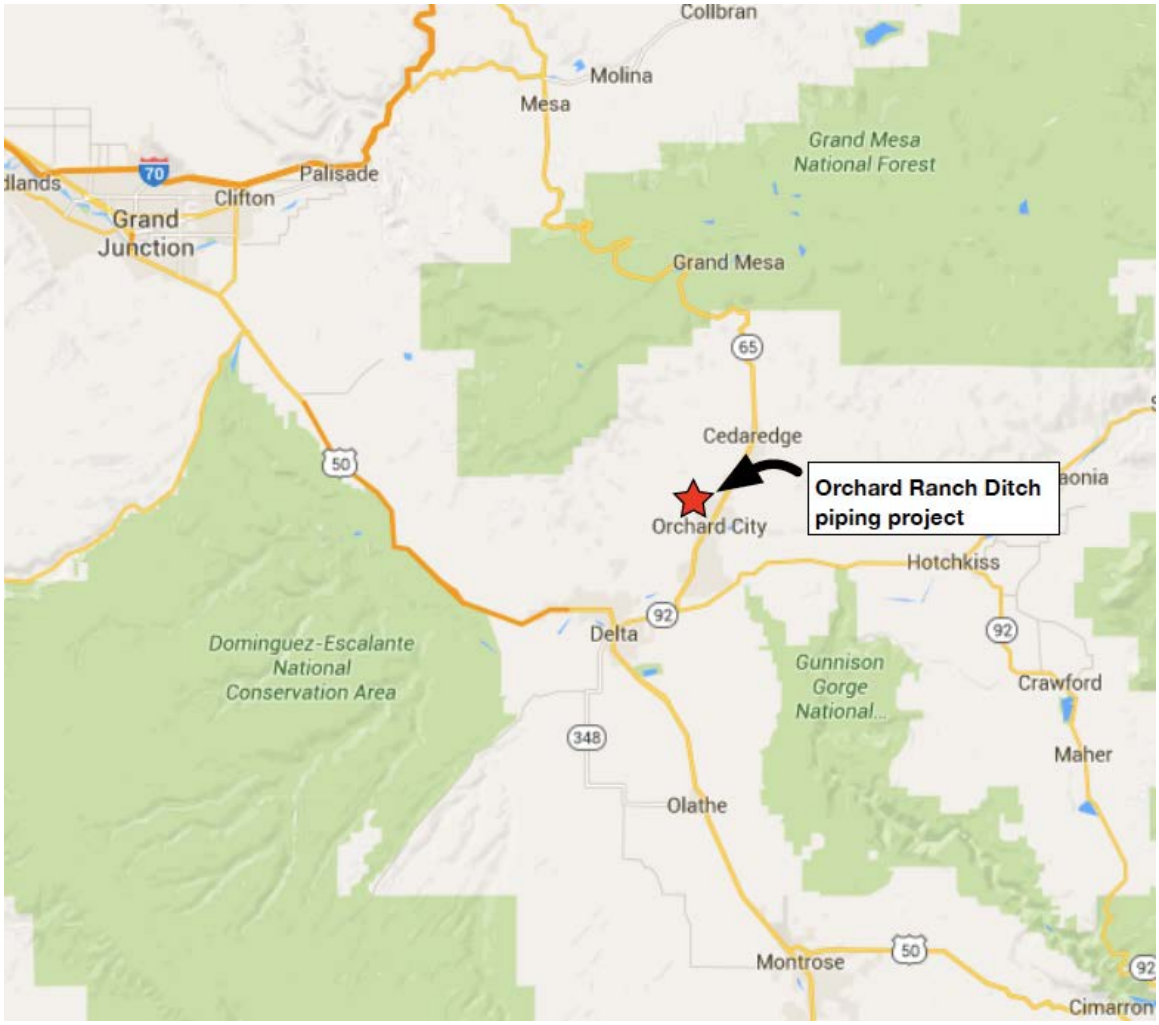
Description of Other Costs	
NEPA and Cultural compliance	$23,945
Implementation of habitat mitigation	$59,862
Required audits	$ 6,000
TOTAL	$89,807

General location of the proposed project



Appendix A – Maps

Map 1 – General area of project

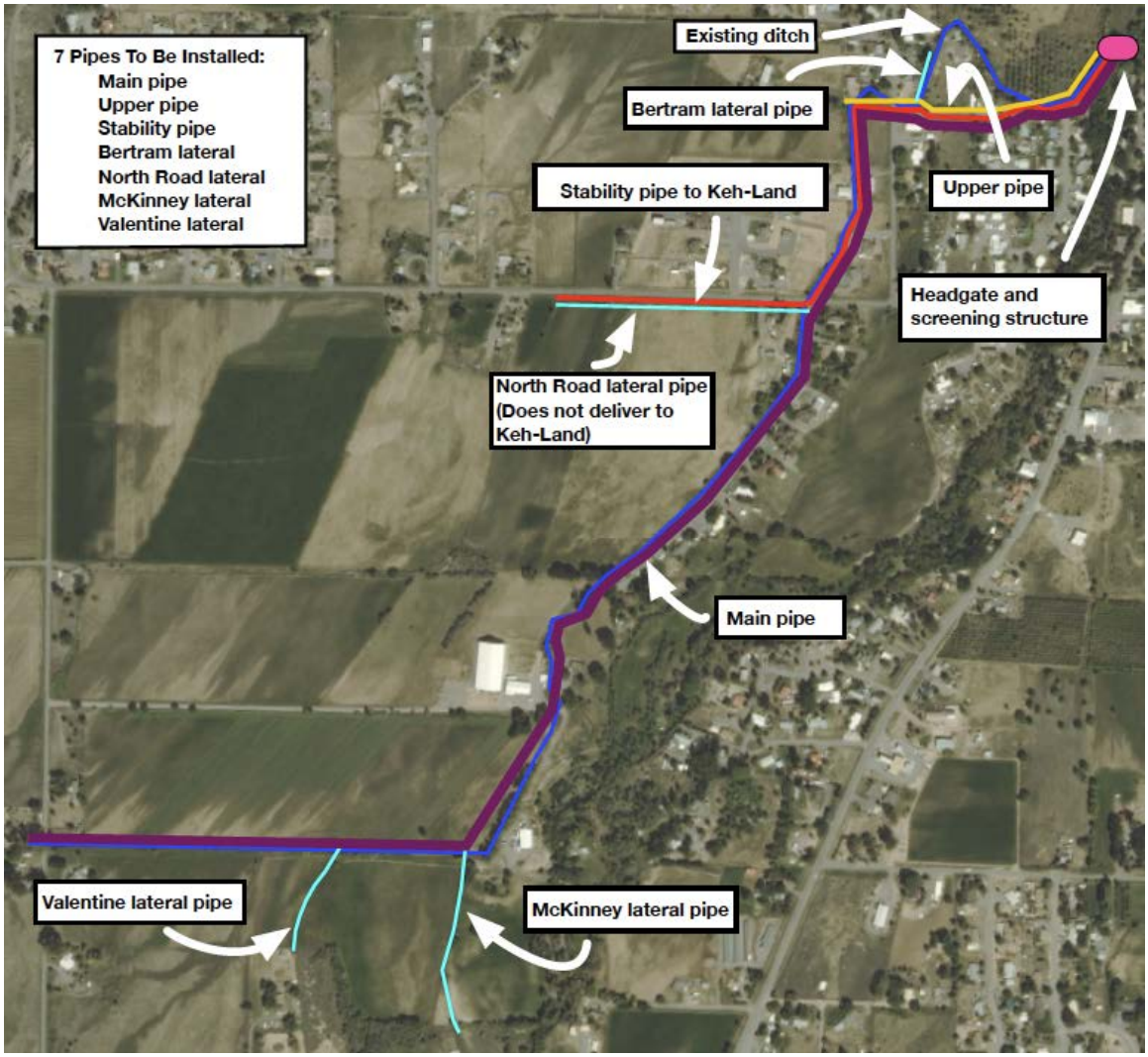


Appendix A – Maps

Map 2 – Land irrigated by the Orchard Ranch Ditch

Appendix A – Maps

Map 3 – Proposed Orchard Ranch Ditch Piping Project



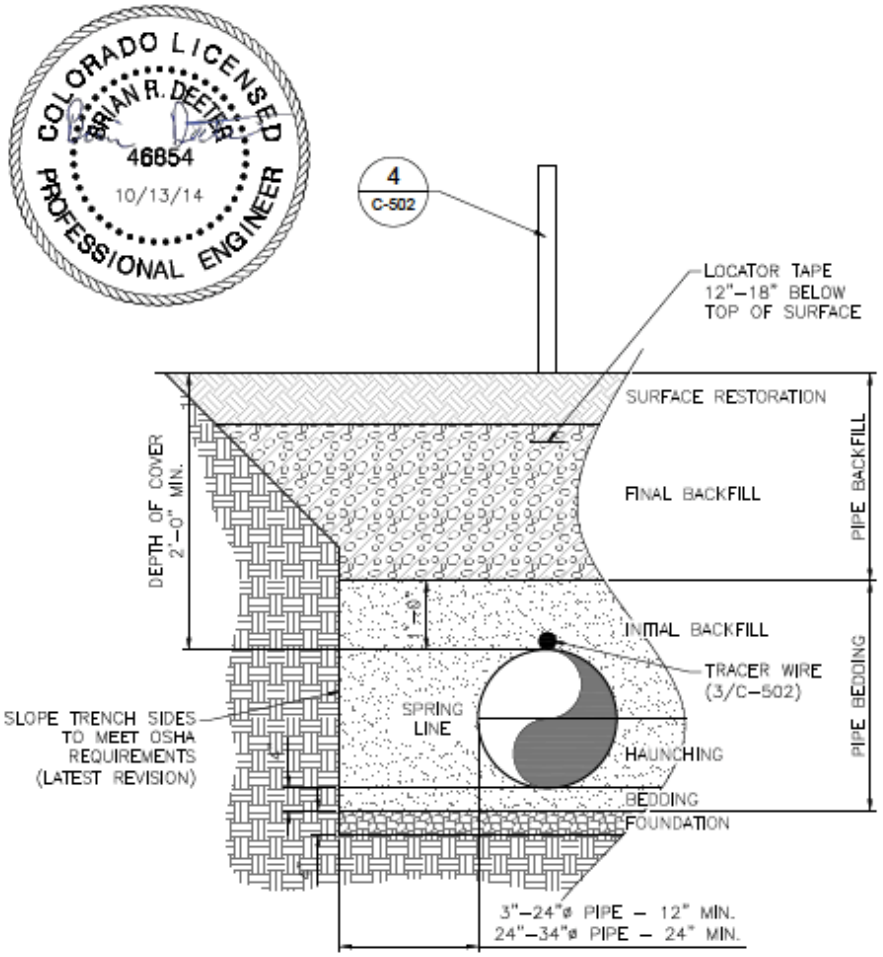
Appendix C - Analysis of alternatives

Analysis of Alernatives for the Orchard Ranch Ditch Improvement Project

	Evaluation Factors					
Alternative	**Change in water yield**	**Cost to shareholders**	**Impacts to man-made environment**	**Impacts to natural environment**	**Economic feasibility**	**Institutional requirements**
No action	0%	No change in cost in the short term. Assessments for maintenance of open canal may increase over time.	none	none	High in short term, in longterm may become costly to maintain open canal	none
Pipe ditch and portions of 4 laterals with PVC	5% increase	Total project cost is about 2.2% less with PVC compared to HDPE	Approximately 5 acres disturbed during construction. Few man made structures impacted. Disturbed fences will be rebuilt. Bridges across canal become unnecessary.	Approximatley 5 acres disturbed during construction. Disturbed lands will be reclaimed. Loss of wildlife habitat will be mitigated off site.	High due to Bureau of Reclamation cost share funds already allocated	Approximately 5 new easements and 3 adjustments of existing easements. 3 road crossing permits
Pipe ditch and portions of 4 laterals with HDPE	5% increase	Total project cost is about 2.2% less with PVC compared to HDPE	Approximately 5 acres disturbed during construction. Few man made structures impacted. Disturbed fences will be rebuilt. Bridges across canal become unnecessary.	Approximatley 5 acres disturbed during construction. Disturbed lands will be reclaimed. Loss of wildlife habitat will be mitigated off site.	High due to Bureau of Reclamation cost share funds already allocated	Approximately 5 new easements and 3 adjustments of existing easements. 3 road crossing permits

Appendix D – Conceptual plan and cross section

Trench evacuation and backfill



TRENCH BACKFILL NOTES:

1. SURFACE RESTORATION:
   A. REFER TO SURFACE RESTORATION IN TYPICAL SECTIONS 2, 3, 4, 5, AND 6 ON SHEET C–501.
2. FINAL BACKFILL:
   A. 85% TYPICAL
   B. 95% COMPACTION IN ROAD RIGHT–OF–WAY AND DRIVE WAYS.
   C. USE ASTM D 1557 MODIFIED PROCTOR FOR COUNTY ROADWAYS.
   D. USE ASTM D 695 STANDARD PROCTOR FOR ALL OTHER AREAS.
   E. SUBSOIL TYPE S1, ONSITE BACKFILL TYPE A2, IMPORTED GRANULAR FILL TYPE A1.
   F. INSTALL MAGNETIC LOCATOR TAPE 12"–18" BELOW FINISHED SURFACE. CENTER TAPE IN TRENCH.
3. BEDDING:
   A. ONSITE BEDDING TYPE A4, IMPORTED BEDDING TYPE A3. LIMIT PARTICLE SIZE TO 1".
   B. INITIAL BACKFILL:
      B.1. 90% COMPACTION
      B.2. FILL VOIDS BETWEEN PIPE AND TRENCH SIDES.
      B.3. USE HAND HELD OR WALK BEHIND COMPACTION EQUIPMENT TO PROTECT PIPE.
      B.4. LIFT THICKNESS: MAX. 8" UNCOMPACTED.
   C. HAUNCHING:
      C.1. 90% COMPACTION
      C.2. SHOVEL–SLICE AND MANUAL TAMP EMBEDMENT MATERIAL TO ASSURE ALL VOIDS BETWEEN THE PIPE AND THE TRENCH BOTTOM AND SIDES ARE FILLED.
      C.3. COMPACT MATERIAL TO PROVIDE COMPLETE CONTACT WITH PIPE BOTTOM.
   D. BEDDING:
      D.1. LEVEL EMBEDMENT MATERIAL TO PROVIDE CONTINUOUS FIRM SUPPORT ALONG FULL LENGTH OF PIPE. HIGH SPOTS SHOULD BE SHAVED OFF AND LOW SPOTS FILLED WITH WELL TAMPED SOIL. EXCAVATE A BELL HOLE, IF NECESSARY, TO ASSURE NO UNDUE WEIGHT IS PLACED ON BELL AND THAT THE PIPE BARREL IS SUPPORTED.
4. FOUNDATION:
   A. IMPORTED FOUNDATION TYPE A5.
   B. USE FOUNDATION MATERIAL AS REQUIRED TO PROVIDE STRUCTURAL SUPPORT FOR PIPE.

Appendix D – Conceptual plan and cross section

NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

IRRIGATION PIPELINE

(Ft.)

CODE 430

DEFINITION

A pipeline and appurtenances installed to convey water for storage or application, as part of an irrigation water system.

PURPOSE

This practice may be applied as part of a resource management system to achieve one or more of the following purposes:

- Conveyance of water from a source of supply to an irrigation system or storage reservoir.
- Reduce energy use.
- Develop renewable energy systems (i.e., in-pipe hydropower).

CONDITIONS WHERE PRACTICE APPLIES

This standard applies to water conveyance and distribution pipelines installed above or below ground.

This standard does not apply to multiple outlet irrigation system components (e.g., surface gated pipes, sprinkler lines, or micro irrigation tubing).

CRITERIA

General Criteria Applicable to All Purposes

The water supply, quality, and rate of irrigation delivery for the area served by the pipeline shall be sufficient to make irrigation practical and feasible, for the crops to be grown and the irrigation water application methods to be used.

Pipelines shall be placed only in soils and environmental conditions suitable for the material type being selected.

Pipelines shall be designed to meet all service requirements such that internal pressure, including hydraulic transients or static pressure at any point is less than the pressure rating of the pipe.

Capacity. Capacity shall be sufficient to convey the design delivery flow rate for the planned conservation practices.

Design capacity of the pipeline conveyance or distribution system for irrigation systems shall be sufficient to meet the requirements for efficient application based on one of the following:

- Adequate to meet the moisture demands of all crops to be irrigated in the design area.
- Sufficient to meet the requirements of selected irrigation events during critical crop growth periods when less than full irrigation is planned.
- For special-purpose irrigation systems, sufficient to apply a specified amount of water to the design area in a specified operating period.

In computing the above capacity requirements, allowance must be made for reasonable water losses during application or use.

Friction and Other Losses. For design purposes, head loss for hydraulic grade line computations shall be computed using one of the following equations: Manning's, Hazen-Williams, or Darcy-Weisbach.

Except where joints, connections, or condition of the pipe indicate that a more conservative value is required, the following equations and roughness coefficient are recommended:

Material	Equation	Recommended Roughness Coefficient	Source
PVC	Hazen Williams "C"	150	1
	Manning's "n"	.009 (clean water)	
Aluminum	Manning's "n"	0.010	2

Concrete	Manning's "n"	0.011 Gasket 0.012 Mortar 0.014 Cast in Place	3
Polyethylene	Hazen Williams "C"	150 Smooth wall	4
	Manning's "n"	0.009 0.012 Bell Ends	4
Corrugated/Profile Wall Plastic Pipe	Manning's "n"	See manufacturer's association recommended values;	
Steel, Smooth	Manning's "n"	0.010 Lined 0.012 Unlined	5
Steel, Corrugated	Manning's "n"	Varies w/diameter and/or shape of corrugation. See reference 6 or 7	

Reference Sources:

1. Unibell. 2001. Handbook of PVC Pipe Design and Construction, 4th Ed.. Unibell PVC Pipe Assn. Dallas, TX.
2. SCS. 1972. Practice Standard 430-A Underground Irrigation Tubing.
3. ACPA. 2000. Concrete Pipe Design Manual. American Concrete Pipe Association. Irving, TX.
4. PPI. Handbook of Polyethylene Pipe. Plastic Pipe Institute. **www.plasticpipe.org**
5. SCS. 1972. Practice Standard 430-F Irrigation Pipe, Steel. (AWWA M-11 recommends n = 0.011)
6. Brater, et.al.. 1996. Handbook of Hydraulics, 7th Ed. McGraw-Hill. New York, NY.
7. AISI. 1999. Handbook of Steel Drainage & Highway Construction Products, 4th ed. American Iron and Steel Institute. Washington, D.C.

Equation selection shall be based on the given flow conditions and the pipe materials used. Other head losses (also called minor losses) from change in velocity and direction of flow due to inlet type, valves, bends, enlargements or contractions can be significant and shall be evaluated as appropriate. For closed, pressurized systems, the hydraulic grade line for all pipelines shall be maintained above the top of the pipeline at all locations for all flows unless specifically designed for negative internal pressures.

Flexible Conduit Design. Flexible conduits such as plastic pipe, steel pipe, aluminum pipe, corrugated metal pipe, or ductile iron pipe, shall be designed using NRCS National Engineering Handbook (NEH) Part 636, Chapter 52, Structural Design of Flexible Conduits, and the following criteria:

Smooth Wall Plastic Pipe. When operating at design capacity, the full-pipe flow velocity should not exceed 5 feet per second in pipelines with valves or some other flow control appurtenances placed within the pipeline or at the downstream end. As a safety factor against surge, the working pressure at all locations and under all anticipated flow conditions should not exceed 72 percent of the pressure rating of the pipe. If either of these limits is exceeded, special design consideration must be given to the flow conditions, and measures must be taken to adequately protect the pipeline against transient pressures. In all cases, the effects of surge pressures should be considered in the design of the pipeline. Design considerations for PVC pipe are contained in the Handbook of PVC Pipe, and considerations for polyethylene (PE) and high density polyethylene (HDPE) pipe are outlined in the Handbook of PE Pipe.

Corrugated or Profile Wall Plastic Pipe. When operating at design capacity, the full-pipe flow velocity should not exceed 5 feet per second in pipelines with valves or some other flow control appurtenance placed within the pipeline or at the downstream end. As a safety factor against surge, the working pressure at any point should not exceed 72 percent of the pressure rating of the pipe. If the pipe is not pressure rated, the maximum allowable pressure shall be 25 feet of head, or the maximum pressure as specified by the manufacturer for the pipe and connecting joints used.

Smooth Wall Steel Pipe. The specified maximum allowable pressure shall be determined using the hoop stress formula, limiting the allowable tensile stress to 50 percent of the yield-point stress for the material selected. The hoop stress formula and design stresses for commonly used steel and steel pipe are shown in the NEH Part 636, Chapter 52.

The minimum wall thickness for steel pipe shall be as follows:

Nominal Diameter (inches)	Wall Thickness
4-12	14 ga.
14-18	12 ga.
20-24	10 ga.
26-36	3/16 inch
38-48	1/4 inch

Corrugated Metal Pipe. Maximum allowable pressure for the pipe shall be:

- 20 feet of head for annular and helical pipe with sealed seams and watertight coupling bands.
- 30 feet of head for helical pipe with welded seams, annular ends, and watertight couplings.

Smooth Wall Aluminum Pipe. The maximum allowable pressure of the pipe shall be determined using the hoop stress formula limiting the allowed tensile stress to 7,500 psi. Refer to the procedures shown in NEH Part 636, Chapter 52.

Rigid Conduit Design. Rigid conduits such as concrete pipe or plastic mortar pipe shall be designed using the following criteria:

Non-reinforced Concrete Pipe with Mortar Joints. The maximum allowable pressure for pipe with mortar joints shall not exceed one-fourth of the certified hydrostatic test pressure as determined by the test procedure described in ASTM C118. Nor shall they exceed the following:

Diameter (inches)	Maximum Allowable Pressure (feet)
6 through 8	40
10 and greater	35

Non-reinforced Concrete Pipe with Rubber Gasket Joints. The maximum allowable pressure for non-reinforced concrete pipe with rubber gasket joints shall not exceed one-third the certified hydrostatic test pressure as determined by the test procedure described in ASTM C505. Nor shall they exceed the following:

Diameter (inches)	Maximum Allowable Pressure (feet)
6 through 12	50
15 through 18	40
21 and greater	30

Cast-in-Place Concrete Pipe. Maximum working pressure for cast-in-place concrete pipe shall be 15 feet above the centerline of pipe. Cast–in-place concrete pipe shall be used only in stable soils that are capable of being used as the outside form for approximately the bottom half of the conduit.

Reinforced Concrete Pipe with Gasket Joints. The maximum allowable pressure for reinforced concrete pipe with rubber gasket joints shall not exceed the rated hydrostatic pressure for the specified pipe according to appropriate ASTM or AWWA standards.

Reinforced Plastic Mortar Pipe. The pipeline shall be designed to meet all service requirements without a static or working pressure at any point greater than the maximum allowable working pressure of the pipe used. The static or working pressure of pipelines open to the atmosphere shall include free board. The minimum acceptable pipe pressure rating shall be 50 psi.

Support of Pipe. Irrigation pipelines both below and above ground shall be supported, where needed, to provide stability against external and internal forces. Pipe support shall be designed using NEH Part 636, Chapter 52.

Joints and Connections. All connections shall be designed and constructed to withstand the pipeline working pressure without leakage and leave the inside of the pipeline free of any obstruction that would reduce capacity.

Permissible joint deflection shall be obtained from the manufacturer for the joint type and pipe material used.

For sloping steel pipe, expansion joints shall be placed adjacent to and downhill from anchors or thrust blocks.

For welded pipe joints, expansion joints shall be installed, as needed, to limit pipeline stresses to the allowable values.

For suspended pipelines, joints shall be designed for pipe loading including the water in the pipe, wind, ice, and the effects of thermal expansion and contraction.

Joints and connections for metal pipes should be of similar materials whenever possible. If dissimilar materials are used, the joints or connections shall be protected against galvanic corrosion.

Depth of Cover. Buried pipe shall be installed at sufficient depth below the ground surface to provide protection from hazards imposed by traffic loads, farming operations, freezing temperatures, or soil cracking, as applicable.

Pipelines shall have sufficient strength to withstand all external loads on the pipe for the given installation conditions. Appropriate live loads shall be used for the anticipated traffic conditions. Refer to NEH Part 636, Chapter 52 for procedures to analyze external loads on buried pipe.

Shallow buried or above ground pipe installations require special consideration for protection from physical and environmental hazards. Refer to NEH Part 636, Chapter 52 for guidance when the depth of cover is less than the minimums specified below.

The minimum depth of cover for pipe susceptible to any of these hazards shall be:

Diameter (inches)	Depth of Cover (inches)
½ through 2½	18
3 through 5	24
6 or more	30
All sizes in soils subject to cracking	36

In areas where pipe is not be susceptible to freezing, vehicular, or cultivation hazards, and the soils do not crack appreciably when dry, the minimum depth of cover may be reduced to:

Diameter (inches)	Depth of Cover (inches)
½ through 1½	6
2 through 5	12
4 through 6	18
6 or more	24

At low places on the ground surface, extra fill may be placed over the pipeline to provide the minimum depth of cover. The top width of the fill shall be no less than 10 feet and the side slopes no steeper than 6:1.

Where it is not possible to achieve sufficient cover or sufficient strength, a carrier (encasement) pipe or other mechanical measures shall be used.

Pressure Reduction. Pressure reduction shall be incorporated in circumstances such as head gain exceeding pressure loss by a significant amount, excessive line pressures for the type of irrigation system supplied, or excessive static pressures.

Inlets. Inlets shall be of adequate size for the type of entrance condition to ensure design flow capacity without excessive head losses.

Provision shall be made to prevent the inflow of trash or other materials into the pipeline if these materials would be detrimental to the pipe capacity or performance of the irrigation application system.

For gravity flow inlets with square-edged or gated orifices, the nappe created by inflow at the orifice entrance shall be vented.

Water control structures, stands, Z-pipes and dog-legs are all acceptable inlet devices. Water control structures are commonly used for gravity flow pipelines, but do not account for removal of entrained air. Therefore, pipelines using these inlets must also meet the requirements listed under Vents.

Check Valves and Backflow Prevention. A check valve shall be installed between the pump discharge and the pipeline if detrimental backflow may occur. Check valves can cause extreme internal pressures, due to water hammer; if they close too fast as flow reversal occurs. “Non slam” type check valves or solenoid operated valves may be required.

Approved backflow prevention devices (chemigation valves) shall be used on all pipelines in which fertilizer, liquid manure, waste water, pesticides, acids, or other chemicals are added to the water supply and where back flow may contaminate the source water supply or groundwater.

Valves and Other Appurtenances. Pressure ratings of valves and other appurtenances shall equal or exceed the pipeline working pressure. When lever operated valves are used, an analysis shall be performed to evaluate potential surge/water hammer assuming an instantaneous valve closure.

Stands Open to the Atmosphere. Stands shall be used when water enters the pipeline to avoid entrapment of air; to prevent surge pressures and collapse because of vacuum failure; and to prevent pressure from exceeding the design working stress of the pipe. The stand shall be designed to:

- Allow a minimum of 1 foot of freeboard. The maximum height of the stand above the centerline of the mainline pipeline must not

exceed the maximum working head of the pipe.

- Have the top of each stand at least 4 feet above the ground surface except for surface gravity inlets or where visibility is not a factor. Gravity inlets and stands shall be equipped with trash racks and covers.
- Have a downward water velocity in stands not in excess of 2 feet per second. The inside diameter of the stand shall not be less than the inside diameter of the pipeline.

The cross sectional area of stands may be reduced above a point 1 foot above the top of the upper inlet, but the reduced cross section shall not be such that it would produce an average velocity of more than 10 feet per second if the entire flow were discharging through it.

If the water velocity of an inlet pipe exceeds three times the velocity of the outlet, the centerline of the inlet shall have a minimum vertical offset from the centerline of the outlet at least equal to the sum of the diameters of the inlet and outlet pipes.

Stands shall be constructed of steel pipe or other approved material and be supported on a base adequate to support the stand and prevent movement or undue stress on the pipeline.

Sand traps, when combined with a stand, shall have a minimum inside dimension of 30 inches and shall be constructed so the bottom is at least 24 inches below the invert of the outlet pipeline. The downward velocity of flow of the water in a sand trap shall not exceed 0.25 feet per second. Suitable provisions shall be made for cleaning sand traps.

The dimensions of gate stands shall be adequate to accommodate the gate or gates required, and shall be large enough to make the gates accessible for repair.

The size of float valve stands shall be adequate to provide accessibility for maintenance.

Stands must be constructed in a manner to insure vibration from the pump discharge pipe is not carried to the stand.

Pressure-relief valves can be used as an alternative to stands open to the atmosphere. A pressure-relief valve shall serve the pressure-relief function of the open stand or vent for which it is an alternative.

Stands Closed to the Atmosphere. If pressure-relief valves and air-and-vacuum valves are used instead of open stands, all requirements detailed in “Stands Open to the Atmosphere” shall apply except as modified below.

The inside diameter of the closed stand shall be equal to or greater than that of the pipeline for at least 1 foot above the top of the uppermost inlet or outlet pipe. To facilitate attaching the pressure-relief valve and the air-and-vacuum valve, the stand may be capped at this point, or if additional height is required, the stand may be extended to the desired elevation by using the same inside diameter or a reduced cross section. If a reduced section is used, the cross-sectional area shall be such that it would produce an average velocity of no more than 10 feet per second if the entire flow were discharged though it. If no vertical offset is required between the pump discharge pipe and the outlet pipeline and the discharge pipe is “dog-legged” below ground, the stand shall extend at least 1 foot above the highest part of the pump discharge pipe.

An acceptable alternative design for stands requiring no vertical inlet offset (when inlet velocity is less than three times that of the outletting pipeline) shall be:

- Construct the dog-leg section of the pump discharge pipe with the same nominal pipe diameter as that of the pipeline.
- Install the pressure-relief valve and the air-and-vacuum valve on top of the upper horizontal section of the dog-leg.

Pressure-relief and air-and-vacuum valves shall be installed on stands with the nominal size pipe required to fit the valves’ threaded inlets.

Surge Tanks and Air Chambers. If surge tanks and/or air chambers are required for control of hydraulic transients or water column separation, they shall have adequate size to ensure the water volume needs of the pipeline are met without the tank/chamber being emptied, and that the required flow into the pipeline for the calculated pressure drop is met.

Pressure Relief Valves. A pressure relief (PR) valve shall be installed between the pump discharge and the pipeline if excessive pressure can build up when all valves are closed. If needed to protect the pipeline against pressure reducing valve malfunction or failure, PR valves shall be installed downstream of pressure reducing valves. Pressure relief should be

provided upstream from valves and at the downstream end of pipeline sections as needed.

Manufacturers of PR valves marketed for use under this standard shall provide capacity tables that give the discharge capacities of the valves at the maximum permissible pressure and differential pressure settings. These tables shall be based on performance tests, and shall be the basis for acceptance of these valves and selection of the design pressure setting.

PR valves shall be set to open at a pressure as low as practical, but no greater than 5 psi above the pressure rating or maximum allowable pressure of the pipe. The valves shall have sufficient flow capacity to reduce the excessive pressures in the pipeline. In lieu, of a detailed surge/pressure analysis, the minimum size of PR valve shall be ¼ inch nominal valve size per inch of the nominal pipeline diameter.

The pressure at which the valves start to open shall be marked on each PR valve. Adjustable PR valves shall be sealed or otherwise altered to prevent changing the adjustment from that marked on the valve.

Air Release Valves. Five types of air vents/valves commonly used on irrigation pipelines are continuous acting air release valves (CAV), vacuum-relief valves (VR), air release and vacuum relief valves (AVR), combination air valves (COMB), and open vents. Open vents are described in the “Vents” section of this standard.

If accumulation of air during operation may occur CAV shall be used to release air from the filled pipeline while under pressure. Normal orifice venting diameter is 1/16 to 3/8 inch.

VR valves shall be used for relief of vacuum pressures (i.e., negative pressures) due to sudden gate or valve closure, pump shutoff, or drainage of the pipeline.

AVR valves may be used for the same requirements described for VR valves. These valves shall also be used to release air from the pipeline on filling prior to the pipe being pressurized. They shall be used to alleviate flow restrictions, air locks, and water surging due to the presence of air within pipelines.

COMB valves have the combined function of all three valves (CAV, VR, and AVR) in one body. COMB valves may be used for any of the conditions in which a CAV, VR, or AVR is required.

If needed to provide positive means for air escape during filling and air entry while emptying, an AVR, VR, or COMB valve shall be installed at all summits, upstream and downstream of all in-line valves as needed, at the entrance, and at the downstream end(s) of the pipelines. Such valves are needed at these locations if the pipeline is closed to the atmosphere. However, they may not be needed if other features of the pipe system, such as permanently located sprinkler nozzles or other unclosed service outlets, adequately vent the particular location during filling and emptying operations. The use of these system features must be analyzed for air flow rate and the proper use of such features described in the Operation and Maintenance plan. High points in the pipeline require a CAV unless an outlet is located at that point.

In addition to the locations described above, an AVR or COMB valve shall be located at changes of grade in downward direction of flow in excess of 10 degrees, to ensure adequate air release during filling. On long pipelines, additional AVR or COMB valves may be required to adequately vent the pipe during filling.

For air release, the AVR or COMB valve shall be sized to exhaust air from the pipeline at the rate needed to prevent operational problems with the pipeline, while maintaining the proper operation of the valve. For design purposes, the exhaust pressure differential shall be limited to 2 psi. Long pipelines may require CAV (in addition to AVR) or COMB valves spaced in the range of 1,200 to 3,000 feet. Without some site specific analysis a spacing of ¼ mile is recommended.

For vacuum relief, the AVR, VR, or COMB valves shall be sized for air entry into the pipeline, ensuring the pipeline does not collapse due to vacuum created during drainage of the pipeline. For design purposes, the vacuum pressure differential shall be limited to the computed pipe collapse pressure or 5 psi, whichever is smaller.

If the required vacuum relief orifice diameter is significantly larger than the required air release orifice diameter, separate valves may be required to help eliminate excessive water hammer caused when the air is released too fast from the pipeline.

CAV or COMB valves shall be used as needed to permit air to escape while the line is at working pressure. Small orifices of these valve types shall be sized according to the design working

pressure and venting requirements recommended by the valve manufacturer.

The location of the CAV or COMB valves shall be sufficient distance downstream from the introduction of air into the system (under pressure conditions) to allow the air to be collected at the top of the pipe. Under some circumstances (e.g., pumped system with low pressure or velocity) consideration should be given to installing vent chambers for CAV or COMB valves. The vent chamber should be constructed according to the requirements under the second criterion in the "Vents" section of this standard.

Air vent size shall be based on pipeline size, pipe slope towards drains, and filling requirements. For pipeline size up to 3-inch diameter, 1/2-inch valves are generally adequate for filling operations, or preventing a vacuum from forming during emptying. For other pipe sizes, guidance for sizing air valves may be found in various valve manufacturers' literature (e.g., Val-Matic Valve Corp. or Crispin Valve) or in Appendix B of the AgPipe User Manual.

In lieu of a detailed design, for the corresponding pipe material below, the following size air valves shall be used:

- For Plastic ≤ 50 psi - 0.22 x pipe diameter
- For Plastic > 50 psi - 0.10 x pipe diameter
- For Metal - 0.125 x pipe diameter
- For Concrete - 0.125 x pipe diameter
- For Aluminum: ≤ 6" Dia. Pipe - 2-inch dia.
  8" to 10" - 3-inch dia.
  12" - 4-inch dia.

Manufacturers of air valves marketed for use under this standard shall provide dimensional data or a capacity table based on performance tests, which shall be the basis for selection and acceptance of these valves.

Vents. Venting must be designed into systems open to the atmosphere to provide for the removal and entry of air and protection from surge. The following criteria shall apply:

- Vents shall have a minimum freeboard of 1 foot above the hydraulic gradeline at design capacity. The maximum height of the vent above the centerline of the pipeline must not exceed the maximum allowable working pressure of the pipe.
- A vent chamber shall be constructed to intercept and/or capture air within the pipeline. The chamber shall intercept the circumference arc of 75 degrees at the top of the pipe (i.e., a vent chamber diameter of 2/3 the diameter of the pipeline). The chamber shall extend vertically at least one pipeline diameter up from the centerline of the pipeline. Above this elevation, the vent chamber may be reduced to minimum diameter of 2 inches.
- When an AVR or COMB valve is used instead of a vent, the above requirements shall apply except that the reduced section shall be sized to meet the nominal pipe size required to fit the valve's threaded inlet. An acceptable alternative is to install the valve(s) in the side of a service outlet, provided that the service outlet riser is properly located and adequately sized. If both AVR and PR valves are required at the location, the 10 feet per second velocity criteria given under the "Stands Open to the Atmosphere" section of this standard, shall apply to the reduced section.
- Vent chambers shall be installed on all open vents and closed vents with air valves, when the normal operating pressure of the pipe is 10 psi or less.
- A vent shall be located at the downstream end of laterals, at summits in the line, and at points where the grade changes more than 10 degrees in a downward direction of flow.
- A study of irrigation pipeline venting observed that individual bubbles, in general, rise to the top of the pipe and are carried by flowing water until released by a vent. The distance for the bubbles to rise to the surface is a function of pipeline velocity and diameter. The following equation gives general guidance regarding the distance from a pipeline inlet to an air vent:

$$L = 1.76\ V\ D$$

Where: L = Distance from inlet to vent (ft)
V = Average velocity (ft/sec)
D = Inside diameter of pipe (ft)

Outlets. Appurtenances to deliver water from the pipe system to the field, ditch, reservoir, or surface pipe system, are known as outlets. Outlets shall have adequate capacity and pressure rating to deliver the required flow to:

- The hydraulic gradeline of a pipe or ditch,
- A point at least 6 inches above the field surface,
- The design surface elevation in a reservoir, or
- An individual sprinkler, lateral line, hydrant, or other device at the required operating pressure.

Outlets shall be designed to minimize erosion, physical damage, or deterioration due to exposure.

Filling. The pipe system shall have a means of controlling the filling of the pipeline to prevent entrapped air and excessive transient pressures.

Filling velocities greater than 1 foot per second in a closed-to-the-atmosphere pipe system (i.e., all outlets closed) requires special evaluation and provisions to remove entrapped air and prevent transient pressures.

If filling at a low flow rate is not possible, the system shall be open to the atmosphere (outlets open) prior to pressurizing. The valves to supplied irrigation system components (gated pipe, wheel line, pivot, etc.) should be opened to release entrapped air and minimize transient pressures in the system. The system shall be designed for air removal and excessive transient pressures that may develop at higher filling rates.

Flushing. If the sediment load in the water is significant, the pipeline shall have adequate velocity to ensure that sediment is moved through and flushed out of the pipeline.

If provisions are needed for flushing sediment or other foreign material, a suitable valve shall be installed at the downstream end(s) or low point(s) of the pipeline.

Draining. Provisions shall be made for the complete removal of water from the pipeline by gravity or other means when:

- Freezing temperatures are a hazard.
- Draining is required by the pipe manufacturer.
- Draining of the pipeline is otherwise specified.

The water drained from pipelines shall not cause water quality, soil erosion, or safety problems upon release.

Safe Discharge of Water. Provisions shall be made for water being discharged from valves, especially air valves and pressure relief valves. Such valves shall be located such that flows are directed away from system operators, livestock, electrical equipment, and other control valves or hook-ups.

Thrust Control. Abrupt changes in pipeline grade, horizontal alignment, tees, or reduction in pipe size, normally require an anchor or thrust blocks to absorb pipeline axial thrust. Thrust control is typically needed at the end of the pipeline, at in-line control valves, at reducers, and at wyes, tees, and elbows.

The pipe manufacturer's recommendations for thrust control shall be followed. In absence of manufacturer's data, thrust blocks shall be designed using NEH Part 636, Chapter 52.

Longitudinal Bending and Joint Deflection. For plastic pipe, the allowable longitudinal bending for the pipeline shall be based on material type and the pressure rating, and shall be in accordance with industry standards, or as described in NEH Part 636 Chapter 52.

Industry standards for PVC pipe generally recommend a maximum joint deflection of one degree for gasketed pipe joints only. For a 20 foot piece of pipe, this is a four inch offset per joint. The minimum radius of curvature for 20' joints is 1,146 feet. The following equation can be used to determine joint deflection angles or curve radii for various lengths of pipe.

$$\text{Joint Deflection Angle (degrees)} = \left(\frac{180}{\frac{R \times \pi}{L}} \right)$$

Where:

R = Curve Radius in ft.
π = 3.1416
L = Pipe Length in ft.

Thermal Effects. For plastic pipe, thermal effects must be properly factored into system design. Pressure ratings for pipes are normally based on a pipe temperature of 73.4ºF. When operating temperature is higher the effective pressure rating of the pipe shall be reduced accordingly.

Values and procedures for pressure rating reduction shall follow information described in the NEH Part 636, Chapter 52.

The pipe pressure rating shall be reduced where the pipe environment or fluid temperatures exceed 73.4° F using the factors in the following table, or factors obtained from the manufacturer.

Strength Reduction Factors for High Temperatures		
Temperature, ºF	Buried PVC Pipe	PE Pipe
≤ 73.4	1.0	1.0
80	0.88	0.92
90	0.75	0.81
100	0.62	0.72
110	0.50	0.63
120	0.40	0.60
130	0.30	0.55
140	0.22	0.50

Physical Protection. Steel pipe installed above ground shall be galvanized or shall be protected with a suitable protective paint coating, including a primer coat and a minimum of two final coats.

Plastic pipe installed above ground shall be resistant to ultraviolet light throughout the intended life of the pipe or measures taken to protect the pipe from damage due to ultraviolet light. PVC pipe and fittings installed above ground shall be protected from ultraviolet oxidation by painting with a heavy pigmented, exterior water-based latex paint.

All pipes shall be protected from hazards presented by traffic loads, farm operations, freezing temperatures, fire, thermal expansion and contraction. Reasonable measures shall be taken to protect the pipe from potential vandalism.

Corrosion Protection. All metal to metal fittings, such as risers, bends, tees, and reducers, should be of similar metals. If dissimilar metals are used, the fittings shall be protected against galvanic corrosion (e.g., separate dissimilar metals with rubber or plastic insulator).

Bolts used to join galvanized steel shall be galvanized; plastic coated, stainless steel, or otherwise protected to prevent galvanic corrosion. Bolts used to join aluminum, other than aluminum alloy bolts, must be plastic coated or otherwise protected to prevent galvanic corrosion.

Interior Linings. Interior protective lining shall be provided when the pH of the water falls outside the ranges shown in the following table.

Material	Water pH
Aluminized Steel	Less than 5 or greater than 9
Galvanized Steel	Less than 6 or greater than 10
Aluminum Alloy	Less than 4 or greater than 10

Unlined steel pipelines can experience corrosion from very pure water (e.g., snow melt). If the Langelier Saturation Index (LSI) is less than -1.0, interior corrosion protection shall be provided. LSI values less than 0 indicate corrosive conditions. An LSI number equal to zero indicates a balanced condition. Calcium Carbonate will tend to form with LSI numbers greater than 0.

To calculate the LSI, it is necessary to know the alkalinity (mg/l as CaCO3), the calcium hardness (mg/l Ca+2 as CaCO3), the total dissolved solids (mg/l TDS), the actual pH, and the temperature of the water (°C). These values are used in the following equations:

$LSI = pH - pH_s$

$pH_s = (9.3 + A + B) - (C + D)$

Where:

$A = (Log10\ [TDS] - 1) / 10$

$B = -13.12 \times Log10\ (°C + 273) + 34.55$

$C = Log10\ [Ca^{+2}\ as\ CaCO_3] - 0.4$

$D = Log10\ [alkalinity\ as\ CaCO_3]$

Interior pipe coatings can be selected from one of the following methods if the applied coating meets the requirements of the applicable reference specification:

Accepted Interior Coating	Reference Specification
Coal Tar Enamel Coating	AWWA C203
Cement Mortar Lining	AWWA C205
Liquid Epoxy	AWWA C210

Exterior Protective Coatings. All buried steel pipelines shall have a Class A or Class B Coating as follows: (1). A Class A coating shall be provided if the Resistivity Survey shows that either (a) 20 percent or more of the total surface area of the pipeline will be in soil having a resistivity of 1,500 ohm-cm or less or (b) 10 percent or more of the total surface area of the pipeline will be in soil having a resistivity of 750 ohm-cm or less; (2) A Class B coating shall be provided for pipe to be installed in uniform soils having a resistivity greater than 1,500 ohm-cm.

A Class A coating method shall be selected based on consideration of the on-site physical, chemical, and biological conditions that may contribute to exterior corrosion of the pipeline, using procedures described in one or more of the design references listed in the Reference Section of this standard.

A Class A Coating can be selected from one of the following methods if the applied coating meets the requirements of the applicable reference specification:

Accepted Type A Coating	Reference Specification
Coal Tar Enamel Coating (Including asbestos felt or inert outer wrap)	AWWA C203
Tape Coating System (80 mil min. thickness)	AWWA C214
Polyurethane Coating (25 mil min. thickness)	AWWA C222

A Class B Coating can be selected from one of the following methods if the applied coating meets the requirements of the applicable reference specification: (Note: Class A coatings are also acceptable for Class B)

Accepted Type B Coating	Reference Specification
Coal Tar Enamel Coating (Excluding asbestos felt or inert outer wrap)	AWWA C203
Epoxy Coating (16 mil min. thickness)	AWWA C210 or 213
Tape Coating System (50 mil min. thickness)	AWWA C214
Prefabricated Tape Coating, 20 mil min.	AWWA C209

Coatings on all fittings shall provide equal protection to the specified coating.

Supplementary cathodic protection shall be provided if the soil resistivity survey shows that any part of the pipeline will be in soil whose resistivity is less than 10,000 ohm-cm unless galvanized pipe is used. Pipe to soil potential shall be not less than 0.85 V negative, referred to as a copper/copper sulfate reference electrode, with the cathodic protection installed. The initial anode installation shall be sufficient to provide protection for a minimum of 15 years.

Galvanized steel pipe may be used when the soil resistivity is greater than 4000 ohm-cm.

Hot-dipped asphalt or polymeric-coated, galvanized steel pipe shall be provided if the soil resistivity along any part of the pipeline is between 3000 and 4000 ohm-cm. In addition to the above coatings, cathodic protection shall be provided for galvanized steel pipe if the soil resistivity is less than 3000 ohm-cm.

Aluminized steel pipe may be used when the soil resistivity is greater than 1500 ohm-cm and the soil pH is between 5 and 9.

Aluminum alloy pipe may be used when the soil resistivity is greater than 500 ohm-cm and the soil pH is between 4 and 10.

When cathodic protection is required, joints and connecting bands shall be electrically bridged to ensure continuous flow of current. A dielectric connection shall be placed between the pump and the pipeline and between pipes with different coatings.

The total current required, kind and number of anodes needed, and life expectancy for the cathodic protection shall be designed in accordance with NRCS Design Note 12, Control of Underground Corrosion.

Resistivity Measurement Requirements for Metal Pipe. If risk of corrosion is “high” based on the Cooperative Soil Survey’s Soil Features Report, soil-resistivity measurements shall be conducted to determine corrosion protection requirements. For this purpose, field resistivity measurements shall be made or samples for laboratory analysis shall be taken at least every 400 feet along the proposed pipeline and at points where a visible change in soil characteristics occurs. If adjacent readings differ markedly, additional measurements shall be taken to locate the point of change. Resistivity determinations shall be made at two or more

depths in the soil profile at each sampling station; with the lowest depth at the stratum in which the pipe will be laid. The lowest value of soil resistivity found at each sampling station shall be used as the design value for that station.

After the pipe trench is excavated, a detailed soil resistivity survey shall be made as a verification of the final required cathodic protection. At this time, resistivity measurements shall be made in each exposed soil horizon at intervals not exceeding 200 feet. The lowest value of soil resistivity found at each sampling station shall be used as the design value for that station. If design values for adjacent stations differ significantly, additional intermediate measurements shall be made.

Electric Fields. An electric field can develop where a metal pipeline is installed adjacent to an existing metal pipeline. This situation can adversely affect the new pipeline. The new pipeline shall be adequately protected from this condition.

Environmental Constraints for Aluminum Pipe. Water quality shall be considered for aluminum pipeline installations. A copper content in excess of 0.02 ppm produces nodular pitting and rapid deterioration of the pipe if water is allowed to become stagnant. When the copper content exceeds this limit, the pipeline shall be designed to allow draining after each use.

Protection from corrosion shall be provided for aluminum pipe installed in contact with concrete.

Environmental Constraints for Concrete Pipe. Concrete pipelines shall not be installed on sites where the sulfate-salt concentration in the soil or soil water exceeds 1.0 percent. On sites where the sulfate concentration is more than 0.1 percent but not more than 1.0 percent, concrete pipe may be used only if the pipe is made with Type V or Type II cement, with tricalcium aluminate content not exceeding 5.5 percent.

Additional Criteria Applicable to Reduce Energy Use

Provide analysis to demonstrate reduction of energy use from practice implementation.

Reduction of energy use is calculated as average annual or seasonal energy reduction compared to previous operating conditions.

Additional Criteria Applicable to Develop Renewable Energy Systems

Renewable energy systems shall meet applicable design criteria in NRCS and/or industry standards, and shall be in accordance with manufacturer's recommendations. Hydropower systems shall be designed, operated, and maintained in accordance with the Microhydropower Handbook, Sections 4 and 5, as appropriate.

CONSIDERATIONS

General. Limiting the working pressure of pipelines to 72% of the pressure rating of the pipe or limiting the velocity to 5 feet per second does not necessarily eliminate the need to evaluate the effects of surge pressure. The effects of surge pressure on the pipeline should be evaluated in all situations.

Careful consideration should be given to determining the "working pressure" of pipelines. For example, for pipelines with downstream controls or in-line valves, consider the working pressure to be the static head on the pipeline at that point, rather than the pressure in the pipe under flowing conditions. Consider, also, the possibility of in-line valves being installed in open-flow pipelines in the future. For gravity flow, static head could be defined as the pressure in the pipeline based on the distance between the static water level and the pipe centerline. For pumped systems, the static head could be determined by the distance between the centerline of the pipe and the hydraulic grade line created by the pump "shutoff head".

Pump shutoff head data can be obtained from the pump manufacturer. If this data is not available, the shutoff head for centrifugal pumps can be estimated by using the formula:

$$P_S = (d\ n\ /1840)^2$$

Where:

P_S = shutoff head in feet of water
d = pump impeller diameter in inches
n = speed of impeller, rpm

Hydraulic transients (surge pressures) due to valve closures can be minimized by closing the valve slowly. Consider the following:

- Avoid the use of quick closing, quarter-turn valves such as lever-operated butterfly valves, if possible.

- Specify slow closing valves, geared valve operators, “anti-slam” air valves, or other similar devices.

Safety. Pipelines may present a threat to the safety of people and property, during both installation and operation. Consider safety as follows:

- Address trench safety in design and during construction.
- Provide protection for people from inlets of pipelines and open stands.
- Provide protection for people from water blowing from pressure-relief, air-release, and other valves.
- Determine the existence or non-existence of underground utilities prior to construction.

Protection of Pipeline and Appurtenances. Consider protection of the pipeline and all appurtenances from potential damage:

- Locate the pipeline and above-ground appurtenances and control structures to minimize potential damage from equipment and tillage practices.

Protect all above-ground appurtenances and control structures from possible damage by livestock and wildlife.

Economic. Economics can be a major factor in pipeline design, as follows:

- Select pipe based on lifetime energy requirements, as well as initial costs of materials.
- Select pipe material based upon expected life of practice.
- Consider hydropower applications as alternatives to use of pressure reduction valves or reduced pipe diameter to induce friction loss.

Water Quality and Quantity. The effects of an irrigation pipeline on water quality and quantity should be considered when designing an irrigation pipeline. Consider the effects:

- On the water budget, especially on infiltration and evaporation,
- On downstream flows or aquifers that would affect other water uses or users,
- On potential use for irrigation management,
- Of installing a pipeline in vegetation that may have been located next to the original conveyance,
- Of installing the pipeline (replacing other types of conveyance) on channel erosion or the movement of sediment and soluble and sediment-attached substances carried by water,
- On the movement of dissolved substances into the soil and on percolation below the root zone or to ground water recharge,
- Of controlled water delivery on the temperatures of water resources that could cause undesirable effects on aquatic and wildlife communities,
- On wetlands or water-related wildlife habitats, and
- On the visual quality of water resources.

Environment. Base pipe material selection on exposure considerations (such as soil resistivity, pH, sunlight, and traffic). Soil texture, resistivity, pH, moisture content, redox potential and depth are important soil properties to be aware of for pipelines and in reducing soil limitations related to corrosivity, or packing of soil material. Refer to soil survey information of the area and on-site soil investigations should be considered during planning and design processes.

The Langelier Saturation Index and related indices may be a factor in determining type of material to use for a pipeline.

Pipelines installed below the ground surface should have a soil plan describing soil reconstruction of disturbed soil during and after pipeline installation so original soil productivity is restored after pipeline installation. Appropriate vegetation should be established to stabilize disturbed areas that will not be cropped.

Follow State and Federal laws and regulations regarding cultural resources.

PLANS AND SPECIFICATIONS

Prepare plans and specifications for irrigation pipelines that describe the requirements for applying the practice according to this standard. As a minimum the plans and specifications shall include:

- A plan view of the layout of the pipeline.
- Profile of the irrigation pipeline.

- Pipe material and sizes.
- Pipe joint requirements.
- Locations and details for all appurtenances and control structures.
- Locations and specifications for all thrust blocks.
- Site specific construction specifications that describe in writing the installation of the irrigation pipeline. Include the specification for pressure testing of the irrigation pipeline.
- Depth of cover and backfill requirements.
- Disposal requirements for excess soil material.
- Vegetative establishment requirements.

OPERATION AND MAINTENANCE

An Operation and Maintenance (O&M) Plan shall be developed for each pipeline system installed. The plan should document needed actions to ensure that practices perform adequately throughout their expected life.

O&M requirements shall be included as an identifiable part of the design. Depending on the scope of the project, this may be accomplished by brief statements in the plans and specifications, the conservation plan narrative, or as a separate O&M Plan.

Other aspects of O&M, such as draining procedures for the pipeline and all valves and appurtenances, marking crossing locations, valve operation to prevent pipe or appurtenant damage, appurtenance or pipe maintenance, and recommended operating procedures, should be described as needed within the O&M Plan.

Monitoring of any cathodic protection systems shall be performed as specified in the O&M Plan.

A filling procedure shall be developed, which details allowable flow rates and appurtenance operation at the various phases of the filling process, required to assure safe filling of the pipeline. Flow measuring appurtenances such as flow meters or weirs, or other means (e.g., number of turns of a gate valve) should be used to determine the rate of flow into the pipeline system. This information shall be provided to the operator, and shall be incorporated into the Operation and Management Plan as appropriate.

REFERENCES

AgPipe Serial Pipeline Design Program – User Manual

ANSI/ASAE Standard S376.2, Design, Installation and Performance of Underground, Thermoplastic Irrigation Pipelines. American Society of Agricultural and Biological Engineers, St. Joseph, MI, 2004. (http://www.asabe.org/ [as of 2/22/2010])

ASTM C118, Standard Specification for Irrigation Pipe for Irrigation or Drainage.

ASTM C505, Standard Specification for Nonreinforced Concrete Irrigation Pipe with Rubber Gasket Joints.

Crispin Valve, http://www.crispinvalve.com/Home.htm

Handbook of PE Pipe, Second Edition, Plastics Pipe Institute, Irving, TX 75062. (http://www.plasticpipe.org/publications/pe_handbook.html [as of 2/22/2010])

Handbook of PVC Pipe: Design and Construction, Fourth Edition. Uni-Bell PVC Pipe Association, Dallas, TX 75234. (http://www.watermainbreakclock.com/handbook/ [as of 2/22/2010]).

Handbook of Steel Drainage & Highway Construction Products, AISI

McKinney, J.D., et al. Microhydropower Handbook, IDO-10107, Volumes 1 & 2. U.S. Department of Energy, Idaho Operations Office.

Seipt, W.R. 1974. Waterhammer Considerations for PVC Pipeline in Irrigation Systems. Transactions of the ASAE 17(3): 417-423.

Steel Pipe – A Guide for Design and Installation, AWWA M11

USDA-NRCS, National Engineering Handbook, Part 636, Chapter 52, Structural Design of Flexible Conduits.

USDA-NRCS, Engineering Design Note 12, Control of Underground Corrosion.

Appendix G – Cost estimate

DETAILED COST ESTIMATE
Orchard Ranch Ditch Piping Project

	Units	Number of Units	Cost	Number of Units * Cost	Salinity Program Funding	Other Funding	Basis of Cost Estimates
PROJECT DESIGN				$ 95,779.53	$ 95,779.53		8% of Construction
NEPA COMPLIANCE AND CULTURAL RESOURCES				$ 23,944.88	$ 23,944.88		2% of Construction
OWNER ADMINISTRATION				$ -	$ -		Basis = Eden Valley Irrigation & Drainage District - 2012 Lower West Side Piping Project (R09AP40880)
SUBTOTAL				**$ 119,724.41**	**$ 119,724.41**	**$ -**	
Mobilization	LS	1	$ 50,000.00	$ 50,000.00	$ 50,000.00		6% of Construction - Basis = Eden Valley Irrigation & Drainage District - 2012 Lower West Side Piping Project (R09AP40880)
Screening Structure	LS	1	$100,000.00	$ 100,000.00	$ 100,000.00		Average Bid - 2014 Forked Tongue Piping Project + Inflation 3% to 2017
24" HDPE DR 41 PIPE	LF	4220	$ 51.45	$ 217,138.69	$ 217,138.69		Average Bid - Sheep Creek South Valley Piping Project (R13AC40015) + Inflation 3% to 2017
18" HDPE DR 32.5 PIPE	LF	2100	$ 41.96	$ 88,105.92	$ 88,105.92		Average Bid - 2014 Roger's Mesa Water Distribution Association - Slack Piping Project (R13AC40003) + Inflation 3% to 2017
16" HDPE DR 32.5 PIPE	LF	5020	$ 40.11	$ 201,338.14	$ 201,338.14		Average Bid - 2014 Roger's Mesa Water Distribution Association - Patterson Piping Project (R13AC40003) + Inflation 3% to 2017
14" HDPE DR 32.5 PIPE	LF	1860	$ 32.99	$ 61,354.21	$ 61,354.21		Average Bid - 2014 Roger's Mesa Water Distribution Association - Patterson Piping Project (R13AC40003) + Inflation 3% to 2017
12" HDPE DR 32.5 PIPE	LF	1820	$ 28.34	$ 51,576.13	$ 51,576.13		Average Bid - 2014 Roger's Mesa Water Distribution Association - Slack Piping Project (R13AC40003) + Inflation 3% to 2017
6" HDPE DR 32.5 PIPE	LF	1350	$ 14.86	$ 20,061.00	$ 20,061.00		Average Bid - 2014 Roger's Mesa Water Distribution Association - Slack Piping Project (R13AC40003) + Inflation 3% to 2017
Fittings	LS	1	$ 60,000.00	$ 60,000.00	$ 60,000.00		10% of Pipe Costs
Meters	EA	11	$ 7,000.00	$ 77,000.00	$ 77,000.00		Average Bid - 2014 Forked Tongue Piping Project + Inflation 3% to 2017
Turnouts	EA	11	$ 12,000.00	$ 132,000.00	$ 132,000.00		Average Bid - 2014 Forked Tongue Piping Project + Inflation 3% to 2017
Easements	LS	1	$ 10,000.00	$ 10,000.00	$ 10,000.00		Average Bid - 2012 Sheep Creek Cedar Hollow Piping Project + Inflation 3% to 2017
Fill Ditch	LF	16370	$ 2.00	$ 32,740.00	$ 32,740.00		Average Bid - 2012 Sheep Creek Cedar Hollow Piping Project + Inflation 3% to 2017
Remove and Replace Fencing	LF	200	$ 7.00	$ 1,400.00	$ 1,400.00		Average Bid - 2012 Sheep Creek Cedar Hollow Piping Project + Inflation 3% to 2017
Imported Fill	CY	4900	$ 15.00	$ 73,500.00	$ 44,781.97	$ 28,718.03	Average Bid - 2014 Roger's Mesa Water Distribution Association - Patterson Piping Project (R13AC40003) + Inflation 3% to 2017
Reseeding	LF	13530	$ 1.00	$ 13,530.00		$ 13,530.00	Average Bid - 2012 Sheep Creek Cedar Hollow Piping Project + Inflation 3% to 2017
Road Crossings	LF	150	$ 50.00	$ 7,500.00	$ 7,500.00		Average Bid - 2012 Sheep Creek Cedar Hollow Piping Project + Inflation 3% to 2017
SUBTOTAL				**$ 1,197,244.09**	**$ 1,154,996.06**	**$ 42,248.03**	
CONSTRUCTION MANAGEMENT				$ 47,889.76		$ 47,889.76	4% of Construction
SUBTOTAL				**$ 47,889.76**	**$ -**	**$ 47,889.76**	
HABITAT REPLACEMENT				$ 59,862.20		$ 59,862.20	5% of Construction
A-133 AUDIT	EA	3	$ 2,000.00	$ 6,000.00	$ 6,000.00		Eden Valley Irrigation & Drainage District - (R09AP40880)
SUBTOTAL				**$ 65,862.20**	**$ 6,000.00**	**$ 59,862.20**	
TOTAL				**$ 1,430,720.47**	**$ 1,280,720.47**	**$ 150,000.00**	

Notes:

1) This cost estimate was submitted to the U.S. Bureau of Reclamation in the ditch company's successful grant application.

2) The "other funding" column currently shows where the $150,000 CWCB loan will be used, however in practice the loan may be used to pay a percentage (10.5%) of each line item.

3) The cost of financing is estimated to be $1,500 (1% of $150,000) loan. This cost is not included in the document above.

4) The line for 6" HDPE pipe is no longer current and should include an additional 290 feet. The affect of this addition on the overall budget is considered negligible.

Appendix G – Cost estimate

Appendix H – Orchard Ranch Ditch piping project Implementation Schedule

Orchard Ranch Ditch Piping Project

Construction & Funding Schedule

Milestone	Required Funding	2016 Q1	2016 Q2	2016 Q3	2016 Q4	2017 Q1	2017 Q2
FY 2016 Salinity Program Funding	$ 155,412.07						
FY 2016 Colorado Water Conservation Board Funding	$ 18,202.11						
Cooperatvie Agreement Signed							
Engineering Design							
NEPA/Cultural Resource Processes/Habitat Replacement							
50% Design Review w/USBR							
NEPA Report submitted to USBR							
Cultural Resource Report to USBR							
90% Design Review w/USBR							
Cultural Resources Report to SHPO							
Environmental Clearances							
Habitat Replacement Plan Adopted							
Design Complete/Advertise Project							
Bidding & Selection of Contractor							
Habitat Replacement Plan Implemention							
FY 2017 Funding	$ 1,125,308.40						
FY 2017 Colorado Water Conservation Board Funding	$ 131,797.89						
Construction							
Substantial Completion of Construction							
Habitat Replacement Plan Implemented							

DIV	WD	ID	Water Right Name	Water Source	Q10	Q40	Q160
4	40	774	ORCHARD RANCH DITCH	SURFACE CREEK	NE	SE	SW
4	40	774	ORCHARD RANCH DITCH	SURFACE CREEK	NE	SE	SW
4	40	774	ORCHARD RANCH DITCH	SURFACE CREEK	NE	SE	SW
4	40	774	ORCHARD RANCH DITCH	SURFACE CREEK	NE	SE	SW
4	40	774	ORCHARD RANCH DITCH	SURFACE CREEK	NE	SE	SW

Sect	Twshp	Range	PM	County	Adj Date	Padj Date	Appr Date	Admin No	Priority # (decree?)
12	14S	95W	S	DEL	6/17/1889		5/9/1883	12182.00000	4
12	14S	95W	S	DEL	9/28/1907	2/17/1906	6/17/1889	20501.14413	27
12	14S	95W	S	DEL	1/31/1964	3/20/1954	6/1/1920	38064.25719	K46
12	14S	95W	S	DEL	6/17/1889		5/9/1883	12182.00000	4
12	14S	95W	S	DEL	6/17/1889		5/9/1883	12182.00000	4

Rate Amount (CFS)	Volume Amount (ACFT)	Case No	Action Comment	Action Update	
5.7		CA0038	P30	1/1/1986	1
6.45		CA0457	NO LOC IN DECREE P582	1/1/1986	2
10		CA4808	SEE STIP IN DECREE. P2571	11/15/1989	3
19.3		CA0038	P30	1/1/1986	
19.3		75CW0059	19.30CFS ABANDONED BY CW \74'59 03/05/	1/1/1986	

RECLAMATION

Managing Water in the West

Bureau of Reclamation
Colorado River
Basinwide & Basin States
Salinity Control Program

2012 FOA Project Proposal
FOA No. R12SF40034

Forked Tongue/Holman Ditch Piping Project

Eckert, Colorado

Forked Tongue/Holman Ditch Company

November 16, 2012

TABLE OF CONTENTS

PART I -- PROJECT SUMMARY

All information must be entered into the response boxes provided. Where information requested in not applicable enter "NA".

A **APPLICANT/ENTITY NAME:**
City/town, State

Response:
Forked Tongue/Holman Ditch Co.
Eckert, Colorado

B **PROJECT PROPOSAL NAME:**

Response:
Forked Tongue/Holman Ditch Piping Project

C **PROJECT PROPOSAL PREPARED BY:**

Response:
Brian Deeter, P.E.
J-U-B Engineers, Inc.

D **FUNDING REQUEST SUMMARY:** *[Use * to denote an in-kind contribution]*

FUNDING SOURCE	FUNDING AMOUNT
Basinwide/Basin States Program:	$650,192.50
Other Federal (list each source):	
Other (list each source):	
TOTAL PROJECT FUNDING:	$650,192.50

E **ABBREVIATED PROJECT SUMMARY:** If the project is irrigation related, include name and length of canals and laterals to be improved by piping or lining.

Response:
The Forked Tongue/Holman Ditch is presently an earthen canal. It will be completely piped from the diversion point to the end of last user's field. The pipe will allow a change in point of take out for one of the users. As a result there will be approximately 1.47 miles of multiple user pipe and 0.42 miles of single user pipe for a total of 1.89 miles of pipe. The pipe eliminates approximately 2.08 miles of earthen ditch and earthen laterals.

The pipe will run along the top of the fields, and the takeout system from the pipe is designed to serve wheel line sprinklers on all of the farmland if the landowners wish to convert to sprinklers at a future date. The route of the pipe eliminates the need for any laterals except for one new lateral which will serve the habitat mitigation area. This lateral will be approximately 0.10 mile long and will be piped.

The loss of habitat caused by the project is planned to be mitigated by plantings at the county landfill which is adjacent to the pipe. Water for the plantings will be provided from the pipe and water rights have been secured for that purpose.

F **ESTIMATED SALT LOAD REDUCTION:** (See FOA Section IV.A)

IN ORDER TO OBTAIN SALT LOAD REDUCTION ESTIMATES, THE SALT LOAD REDUCTION

	WORKSHEET MUST BE SUBMITTED TO THE PROGRAM MANAGER WITH A COPY TO THE APPROPRIATE RECLAMATION TECHNICAL CONTACT. FINAL SUBMISSIONS MUST BE RECEIVED NO LATER THAN OCTOBER 1, 2012.
	Response: 412 tons per year
G	**ESTIMATED COST EFFECTIVENESS VALUE:**
	Response: $73.46/ton/year
H	**CONTRACTING ENTITY MANAGER CONTACT INFORMATION:**

Name:	Paul Kehmeier
Title:	Ditch company president
Address:	20490 North Road, Eckert, CO 81418
Telephone:	970 835-3004 970 779-0723 (cell)
Fax:	None
E-mail:	Paul-Kehmeier@msn.com

I **PROJECT MANAGER CONTACT INFORMATION:**

Name:	Brian Deeter
Title:	Project Manager
Address:	466 North 900 West, Kaysville, UT 84037
Telephone:	(801)547-0393
Fax:	(801)547-0397
E-mail:	brd@jub.com

J **ACKNOWLEDGEMENT OF FOA AMENDMENTS:** Applicants shall acknowledge receipt of any amendment to this Funding Opportunity Announcement by identifying the amendment number and date.

List Amendment No. and Date:
Amendment No. 1 – August 18, 2012
Amendment No. 2 – October 1, 2012

PART II - PROJECT PROPOSED FOR FUNDING

Provide a brief narrative or tabular data responding to each of the following sections that apply to the proposed salinity control project. All information must be entered into the response boxes provided in the application, with the exception of maps or data tables which may be inserted in the appropriate appendix..

A. BACKGROUND & DESCRIPTION OF PROJECT AREA: Describe project setting and geographic location. For irrigation-related applications, include general hydrology, geology, soils, climate (average rainfall, temperature, and growing season), water storage facilities, existing irrigation facilities (total mileage of canals & laterals and number of users), irrigated acreage, types of crops, etc.

Response:

This project is located on the south side of Grand Mesa about 10 miles north of Delta Colorado. The ditch is fed by Tongue Creek, a tributary of the Gunnison river.

The ditch and the land it irrigates are located in an ancient ocean bed. The narrow valley where the project is located is quite level and flat. The soils are adobe clay derived from Mancos Shale. About 90% of the project area soils are classified as Billings silty clay loam (NRCS.) Maps of selenium occurrence indicate that the ditch is in an area of concern for selenium loading.

The average precipitation is 8 inches per year. Average maximum temperature is about 67 degrees, and average minimum is about 34 degrees. The growing season is from about April 1 to October 1.

There are no water storage facilities on the project area. Currently all irrigation is done by flood irrigation. Most of the fields have furrows to help with the flood irrigation.

There is one main canal. It is about 2.0 miles long including the single user portion of the canal. About 170 acres are irrigated from the canal. There are 4 short, one user laterals which have a combined length of about 0.1 mile. There are 4 users of the ditch, one of which is the county of Delta County. The main crops grown are hay, pasture, and small grains.

B. PROJECT MAPS: Attach, as Appendix A, detailed maps showing existing facilities and proposed improvements as described in Parts B.1 and B.2 below. Printed maps shall be no larger than 11x17.

B.1 MAP(S) OF EXISTING FACILITIES: Attach a detailed map(s) scaled appropriately to easily identify the project area, existing facilities, and major geographic features including roads, streams, reservoirs, towns, etc. If the proposed project is irrigation related, the map should show locations of canals, laterals, and irrigated lands. Those canals or laterals proposed for improvement or abandonment under this application should be clearly identified.

B.2 MAP(S) OF PROPOSED IMPROVEMENTS: Attach a detailed map(s) scaled appropriately which clearly identifies improvements that would be constructed under this application. If irrigation related, display new pipeline alignments and/or canal segments to be lined. Indicate in the color blue, the portion of the delivery system facilities to be funded in whole or part by Reclamation and, in the color red, any portion to be funded by other sources. Those funding sources should be identified in Part III, B.

C. WATER RIGHTS AND SUPPLY: Describe the water rights for both diversion and storage. Describe irrigation water supply and water shortages.

Response:

The Forked Tongue/Holman ditch has 3 decrees out of Tongue Creek. For a total of 6.97 cfs. The decrees are listed below with the highest priority decree first.
#5 (renumbered to #13) – 4.60 cfs
#G-77 – 1.00 cfs
#H-9 – 1.37 cfs

All the water run in the ditch comes from these 3 decrees. No stored water from mountain reservoirs is run in the Forked Tongue/Holman Ditch. There are no rights for storage of water on

PART II - PROJECT PROPOSED FOR FUNDING

the project area itself.

The 3 decrees normally supply adequate water for irrigation. Occasionally there is a mild shortage of water in late summer. Most years the creek is not even put on call for the decrees.

D. DETAILED DESCRIPTION OF PROPOSED PROJECT: Describe the project in detail including the proposed salinity control process.

EXISTING IRRIGATION DELIVERY SYSTEM (CANALS, LATERALS, DITCHES, ETC.): Describe the specific existing facilities (canals, laterals, ditches) that are to be improved or replaced. Details should include names of each canal, lateral or ditch and existing lengths and flow capacities. Additional information concerning these existing facilities should be provided in Appendix B.

Response:
The entire main canal of the Forked Tongue/Holman Ditch is presently an earthen canal. This includes 1.32 miles as a multiple user canal, and 0.65 miles as a single user canal. There are 4 short, 1 user laterals that come off the main canal. In appendix B they are named as laterals A,B,C, and D. The combined length of all the laterals is 0.11 mile. The laterals are presently either earthen or piped using culverts and other non-standard methods. The maximum flow capacity of the main canal has rarely if ever been tested, but the capacity is in excess of 10 cfs. The flow capacities of each of the short laterals is about 2cfs.

D.1.b PROPOSED IRRIGATION DELIVERY SYSTEM IMPROVEMENTS: Identify the canal system or individual canals and laterals and describe in detail the proposed lining or piping of those facilities. Include pipe/lining types, sizes, lengths, etc. If the proposed project requires acquisition of water or water rights, describe the acquisition plan and required contracts. Describe plans for abandoning any facilities including obliterating abandoned canal/ditch prisms.

Response:
The proposed project involves the following components:

- Construction of a screening structure at the head of the pipeline to remove debris from entering the pipeline.
- Placing the entire canal in pipe from the screening structure to the last user. A little more than half of the distance will be along a new right of way so as to shorten distances and to provide for irrigation efficiencies.
- General pipe sizes and quantities of 80 psi PIP Pipe are as follows:
  - 1700' of 21"
  - 2640' of 18"
  - 2440' of 15"
  - 3180' of 12"
- Turnout structures will be 8 inch alfalfa valves with a bonnet that will tie on to new and existing gated pipe and may be connected in the future to wheel lines.
- A new flume and meters will be installed to help monitor flows.
- Three drains will be provided for flushing sediment and draining the system.
- The existing canal will be abandoned and covered as the pipeline is installed.

D.2 OTHER TYPES OF SALINITY CONTROL (NON-IRRIGATION RELATED): For desalinization, evaporation or other salinity control measures, clearly identify the salinity sources and quantify the salt (in tons/year) that will be controlled or eliminated. Include data that defines the salt loading and control in tabular format in Appendix C. Also see FOA Section IV.E.3.

PART II - PROJECT PROPOSED FOR FUNDING	
	Response: N/A
D.3	**NEW WATER IMPOUNDMENT STRUCTURES:** If new ponds, reservoirs, settling basins, or other water impoundment structures are to be constructed or existing structures enlarged for any purpose (e.g., re-regulation, evaporation, etc.) as part of this application, address the requirements listed in FOA Section IV.E.1.b and identify the type and thickness of the liner, the average seepage rate expected over the project life, construction methods, and quality control program. If the size of a proposed or existing water impoundment structure increases later a new salt load calculation will be developed and funding may be reduced and/or the application ranking may change.
	Response: N/A
D.4	**DESCRIPTION OF ON-FARM OPPORTUNITIES:** If new irrigation pipelines will provide sufficient water pressure and volume to promote new high efficiency irrigation improvements (sprinklers) on individual farm properties, complete the Enable On-Farm Worksheet and submit required mapping in accordance with FOA Section IV.E.2. Attach the completed worksheet as Appendix D. Summarize below the number of eligible deliveries and "Claimable Acres" for each canal/lateral/ditch. Additionally, identify the percentage of landowners that have demonstrated their intent by signing the page 2 table of the worksheet, and list the total acreage represented by those landowners.
	Response: N/A
E.	**ENVIRONMENTAL CONSIDERATIONS:**
E.1	**NEPA COMPLIANCE:** Describe existing environmental compliance documents for the project area and new environmental documents (e.g., environmental assessments) required to implement the proposed project. Identify responsible parties and estimated costs.
	Response: There are no known environmental compliance documents for the project area. It is anticipated that the proposed project would require the preparation of an Environmental Assessment. The preparation of the environmental document would be fully coordinated with Reclamation, and would be prepared by the Forked Tongue/Holman Ditch Company through the services of J-U-B ENGINEERS, Inc. The estimated cost for NEPA compliance is included in Appendix E: Detailed Cost Estimate.
E.2	**OTHER BENEFITS:** Describe any additional environmental benefits of the proposed project including selenium-loading reduction.
	Response: Water-quality Benefits: The proposed project is located in an area dominated by Mancos shale. It is located in the Tongue Creek sub-basin and more specifically in the two sub watersheds designated by Hydrologic Unit Codes 140200050110 and 140200050112. The Gunnison Basin Selenium Task Force (STF) and the Selenium Management Program Formulation Document (Reclamation, 2011) identified open, earthen irrigation delivery system laterals in Mancos shale soils as a source of deep percolation of irrigation water and selenium loading. The piping of irrigation laterals has been demonstrated to be an effective means reducing selenium and salt loading (Butler, 2001). Numerous stream segments within the Tongue Creek sub-basin are on the State of Colorado's Clean Water Act Section 303(d) List for selenium impairment or on the State's Monitoring and Evaluation List for further study (Water Quality Control Division, Regulation #93 amended 02-13-12) and eventual Total Maximum Daily Load development. The STF has ranked soils in the North Fork area according to their selenium mobilization potential (low, moderate,

PART II - PROJECT PROPOSED FOR FUNDING

high, and very high). The Forked Tongue lateral is within an area identified as having soils split between low to very high selenium mobilization potential. The piping of the proposed irrigation lateral is therefore likely to reduce selenium loading from the delivery system.

The proposed project would increase the efficiency of the existing system and conserve water that is currently lost through the open canals and laterals. Improvements to the existing facility would allow operators to better control the allocation of water along the system.

E.3 **ENDANGERED SPECIES CONCERNS:** Identify any known endangered or threatened species in the project area and assess the possibilities they may be affected by activities associated with the proposed project.

Response:
The following species are on the US Fish & Wildlife Services Threatened, Endangered and Candidate Species List for Delta County, Colorado (list dated October 2012):

Species Name	Status
Yellow-billed cuckoo (*Coccyzus americanus*)	Candidate
Gunnison sage-grouse (*Centrocercus minimus*)	Candidate
Colorado pikeminnow (*Ptychocheilus lucius*)	Endangered
Greenback cutthroat trout (*Oncorhynchus clarki stomias*)	Threatened
Razorback sucker (*Xyrauchen texanus*)	Endangered
Colorado hookless cactus (*Sclerocactus glaucus*)	Threatened
Clay-loving wild buckwheat (*Eriogonum pelinophilum*)	Endangered
Black-footed ferret (*Mustela nigripes*)	Experimental Population, Non-Esse
Canada lynx (*Lynx canadensis*)	Threatened
North American wolverine (*Gulo gulo luscus*)	Candidate

There are no known occurrences of any federally listed species in the proposed project area. A Biological Assessment would be conducted as part of the NEPA compliance for the proposed project. The Biological Assessment would include an evaluation of all federally listed, state sensitive and special status species and habitat that may occur in the proposed project area.

E.4 **CULTURAL RESOURCES:** Identify any known archeological sites in the area of the proposed project and assess the possibilities they may be affected by activities associated with the proposed project.

Response:
There are no known cultural resources in the project area. In compliance with 36 CFR 800.4(d)(1) and 36 CFR 800.11(d), a cultural resource inventory report would be prepared and submitted to Reclamation's Archaeologist for consultation with the Colorado Office of Archaeology and Historic Preservation.

F. **HABITAT REPLACEMENT PLAN:** If known, describe wetlands that may be affected by the proposed project and whether they have been previously inventoried. Identify existing Habitat Replacement Plans or new evaluations and analysis needed to develop a plan. Identify costs for studies and implementation of the plan. Justification must be provided if estimated costs are less than 5% of the Total Construction Cost. See FOA Section IV.E.4 for further information.

Response:
Habitat, including wetlands and riparian areas, in the proposed project area has not been recently inventoried. A review of the National Wetland Inventory Maps indicates that there are areas that may contain wetlands within the general vicinity of the project area. Wetlands that are most likely

PART II - PROJECT PROPOSED FOR FUNDING	
	to be impacted by the proposed project are those associated with the irrigation canals and laterals. The proposed project would pipe open ditches; and therefore, may eliminate the primary hydrologic element necessary for some of these areas to function as habitat. All habitat, including wetlands and riparian areas, would be inventoried during the NEPA process. A Habitat Replacement Plan would be approved by Reclamation prior to construction of the proposed project. The estimated cost of the Habitat Replacement Plan is 5% of the total construction cost and is included in Appendix E: Detailed Cost Estimate.
G.	**OPERATION, MAINTENANCE AND MANAGEMENT PLAN:** Describe the proposed operation, maintenance, and management plan that will assure the project achieves the proposed salinity control over the project life. If the proposed project is an industrial process or an irrigation related project that relies extensively on water management to achieve benefits, a detailed description of the plan and funding source should be included. O&M of water impoundment structures should be described as specified in FOA Section IV.E.1.b.
	Response: Forked Tongue/Holman Ditch Co presently operates the canal and would continue to operate and maintain the pipeline in the future. They are well equipped and staffed for this responsibility. Operation of the Forked Tongue/Holman ditch once piped will remain essentially unchanged, and maintenance would be reduced significantly as a result. The pipeline system is simple to operate and will require no special training or skill level on the part of the water users. The pipeline will be drained at the end of each irrigation season and re-filled the following spring. The screening structure will require some periodic maintenance and cleaning. One advantage of the piped canal system is that the annual cleaning of sediment from the canal will be virtually eliminated. Most sediment that enters the pipeline will remain suspended in the water and will exit the pipe at the irrigation turnouts. Minor amounts of sediment will be flushed from the pipe when it is drained at the end of each irrigation season.
H.	**EXPERIENCE IN IMPLEMENTING PROJECTS:** Identify past salinity control projects or projects of similar nature completed or underway by your organization (entity and consultant); include construction dates, brief description, and status.
	Response: The proposed piping of the Forked Tongue/Holman ditch is the first salinity project undertaken by the Forked Tongue/Holman Ditch Co, as it is the only canal owned by the Company. J-U-B Engineers have significant experience completing all sizes and types of projects. In particular, J-U-B Engineers have assisted multiple clients in the implementation of salinity reduction projects over recent years. Those include projects for: - Huntington Cleveland Irrigation Company (Huntington, Utah) 2004 to present - Dry Gulch Irrigation Company (Dry Gulch, Utah) 2010 to Present - Montezuma Valley Irrigation Company (Cortez, Colorado) 2006-2008 - Farson/Eden pipeline project(Farson, Wyoming) 2005-Present

PART III – PROJECT COSTS AND FUNDING PLAN

A. DETAILED COST ESTIMATE: Using the table in Appendix E provide a detailed cost estimate for materials and construction (provisions for contingencies must be shown as a separate line item and not included in the unit or total cost for other cost elements). The Habitat Replacement Plan, design, NEPA, and other similar costs must be shown as direct costs. Indirect costs such overhead are to be included in the cost estimate as well. All quantities, materials, sizes, etc. must agree with those provided in the detailed project description in Part II.D.

B. FUNDING PLAN: Describe the funding plan for construction, operation, and maintenance of the project. If funding from sources other than the Basinwide or Basin States Programs is anticipated, the funding partner should be identified and a letter of commitment attached. Proposed in-kind contributions should be identified.

Response:
It is proposed that the entire Forked Tongue/Holman Ditch Piping Project utilize Reclamation Salinity Control Funds. No private or other funds are required. The entire project will be completed using the funds requested herein ($650,192.50).

C. COST EFFECTIVENESS:

C.1 ESTIMATED PROJECT LIFE: State estimated life of project components. This is 50 years for all irrigation-related improvements.

Response:
The estimated life of the Forked Tongue/Holman Ditch Piping Project is 50 years.

C.2 TOTAL & AMORTIZED RECLAMATION COSTS:

Total Basinwide / Basin States Program cost:	$650,192.50	Amortized Basinwide / Basin States Program cost:	$30,266.59

(In the table provided, enter the total and amortized Basinwide Program or BSP costs. The amortized cost can be determined by applying the amortization factor of 0.04655 to the Basinwide or BSP costs. The amortization factor is based on the FY 2012 Federal planning interest rate of 4 percent and a project life of 50 years.)

C.3 ESTIMATE OF SALT LOAD REDUCTION: Include written response from Reclamation providing salt load reduction estimate in Appendix F

Off-farm: 354 tons/year
On-farm: 58 tons/year
Total: 412 tons/year

C.4 COST EFFECTIVENESS VALUE: Divide the Amortized Basinwide/Basin States Program cost by the total annual salt load reduction estimate.

$73.46/ton/year

D. CONSTRUCTION & FUNDING SCHEDULE: Include a detailed schedule displaying anticipated major work items and funding requirements (including cost share and in-kind services) on a Federal fiscal year basis (October 1 – September 30) for each year of the project.

Response:

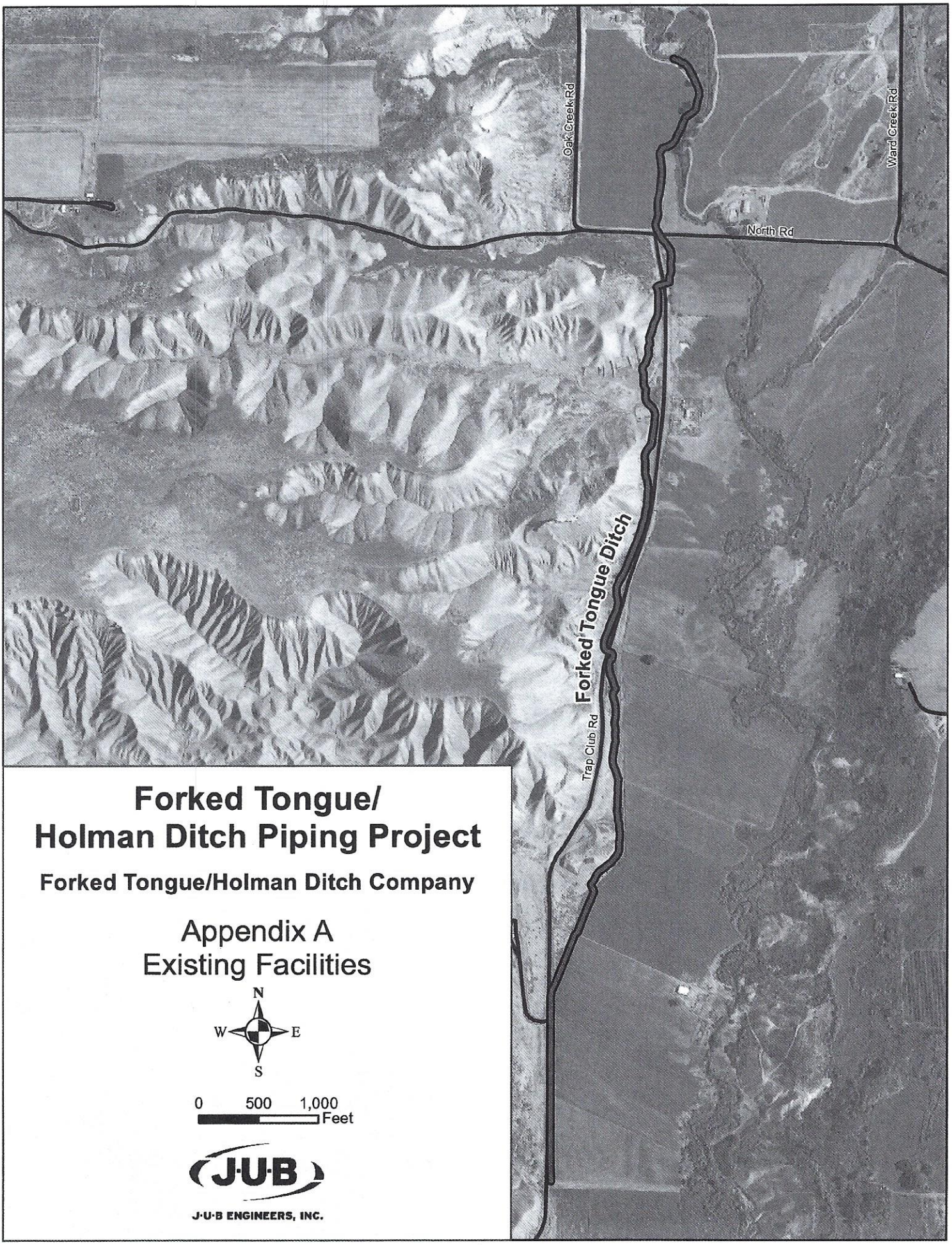
PART III – PROJECT COSTS AND FUNDING PLAN

Milestone	Date	Required Funding
Cooperative Agreement Signed	May-13	
Engineering Contract Executed/Begin Design	May-13	
Begin NEPA/Cultural Resource Processes/Habitat Replacement	May-13	
50% Design Review w/USBR	Jul-13	
NEPA Report submitted to USBR	Sep-13	
Cultural Resource Report to USBR	Sep-13	
90% Design Review w/USBR	Sep-13	
Purchase Some Pipe	Sep-13	
FY 2013 Funding		$ 100,000
Cultural Resources Report to SHPO	Oct-13	
Environmental Clearances	Nov-13	
Habitat Replacement Plan Adopted	Nov-13	
Design Complete/Advertise Project	Nov-13	
Bidding & Selection of Contractor	Nov-13	
Habitat Replacement Plan Implementation	Dec-13	
Begin Construction	Dec-13	
Substantial Completion of Construction	Jun-14	
FY 2014 Funding		$ 550,192.50

RECLAMATION

Managing Water in the West

APPENDIX A: PROJECT MAPS



Forked Tongue/ Holman Ditch Piping Project

Forked Tongue/Holman Ditch Company

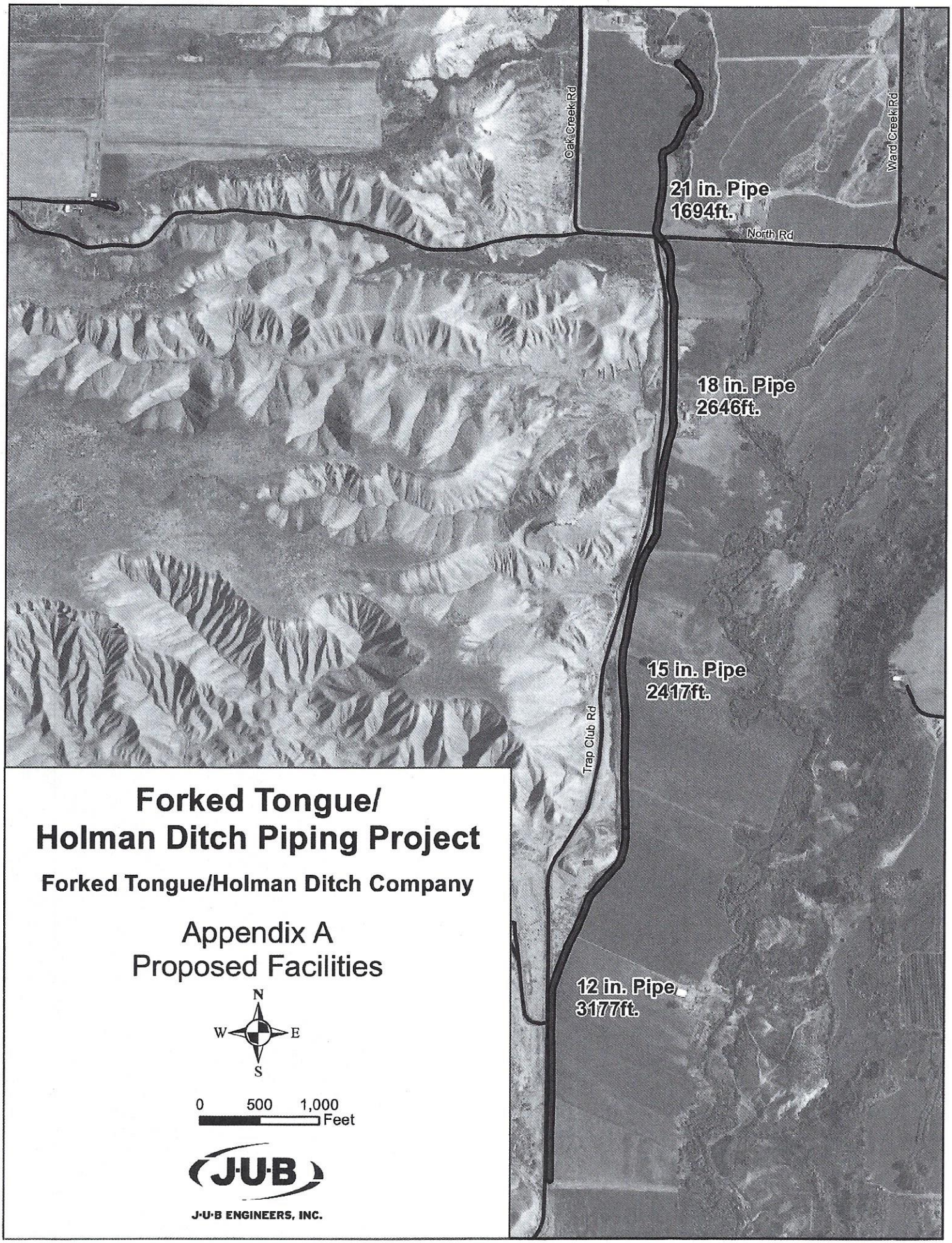
Appendix A
Existing Facilities

N
W E
S

0 500 1,000 Feet

J·U·B

J·U·B ENGINEERS, INC.



Forked Tongue/ Holman Ditch Piping Project

Forked Tongue/Holman Ditch Company

Appendix A
Proposed Facilities

N
W E
S

0 500 1,000
Feet

J·U·B

J·U·B ENGINEERS, INC.

APPENDIX B: EXISTING IRRIGATION DELIVERY FACILITIES DATA SHEET

Bureau of Reclamation
Colorado River Basinwide and Basin States Salinity Control Programs
Salt Load Reduction Worksheet

(Use required format provided below)

Item	Units	Identify individual canal, lateral, or ditch				
		Forked Tongue Ditch main canal FTDA (mile 0.000-1.776) **irrigation portion** (mile 1.319-1.776 is single user canal)	Forked Tongue Ditch main canal (mile 1.776-1.968) **Return portion** (all single user canal	Forked Tongue Ditch lateral A (FTDAA) (single user lateral)	Forked Tongue Ditch lateral B (FTDAB) (single user lateral)	Forked Tongue Ditch lateral C (FTDAC) (single user lateral)
Length of existing canal/lateral/ditch	feet	9377	1014	290	63	143
Irrigated acreage served	acres	170	0	21	18	27
Irrigation season						
Average daily diversion	cfs	3.041	0	.304	.304	.304
Average seasonal diversion	ac-ft	1101	0	110	110	110
Average no. of days water carried	days	181	0	181	181	181
Non-irrigation season (stockwater)						
Average daily diversion	cfs	0	0	0	0	0
Average seasonal diversion	ac-ft	0	0	0	0	0
Average no. of days water carried	days	0	0	0	0	0
Length of ditch carrying winter water	feet	N.A.	N.A.	N.A.	N.A.	N.A.
Describe EXISTING lined or piped sections						
Lined length	feet	0	0	0	0	0
Liner type (concrete, earth, etc)	See Note 1	N.A.	N.A.	N.A.	N.A.	N.A.
Year installed	year	N.A.	N.A.	N.A.	N.A.	N.A.
Liner condition	See Note 2	N.A.	N.A.	N.A.	N.A.	N.A.
Piped length (see Note 3)	feet	0	0	0	0	0
Remaining unlined/unpiped length	feet	9377	1014	290	63	143
Length to be replaced/improved	feet	9377	1014	290	63	143
Proposed replacement material	pipe or liner	Pipe	Pipe	Pipe	Pipe	Pipe

Notes: 1. Type of liner may be concrete, earth (clay), membrane or other (please specify).
2. Condition of liner should be rated as poor, satisfactory, good.
3. Disregard dispersed pipe segments with individual lengths of less than 100 feet.

Item	Units	Identify individual canal, lateral, or ditch				
		Forked Tongue Ditch lateral D (FTDAD) (single user lateral)				
Length of existing canal/lateral/ditch	feet	95				
Irrigated acreage served	acres	15				
Irrigation season						
Average daily diversion	cfs	.304				
Average seasonal diversion	ac-ft	110				
Average no. of days water carried	days	181				
Non-irrigation season (stockwater)						
Average daily diversion	cfs	0				
Average seasonal diversion	ac-ft	N.A.				
Average no. of days water carried	days	N.A.				
Length of ditch carrying winter water	feet	N.A.				
Describe EXISTING lined or piped sections						
Lined length	feet	0				
Liner type (concrete, earth, etc)	See Note 1	N.A.				
Year installed	year	N.A.				
Liner condition	See Note 2	N.A.				
Piped length (see Note 3)	feet	N.A.				
Remaining unlined/unpiped length	feet	95				
Length to be replaced/improved	feet	95				
Proposed replacement material	pipe or liner	Pipe				

Notes: 1. Type of liner may be concrete, earth (clay), membrane or other (please specify).
2. Condition of liner should be rated as poor, satisfactory, good.
3. Disregard dispersed pipe segments with individual lengths of less than 100 feet.

APPENDIX C: SUPPLEMENTAL DATA TABLES AND/OR DATA FOR OTHER TYPES OF SALINITY CONTROL (NON IRRIGATION RELATED)

APPENDIX D – ESTIMATE OF ENABLED ON-FARM ACREAGE

The Page 1 and Page 2 tables for Appendix D can be downloaded from the website http://www.usbr.gov/uc/progact/salinity as an Excel spreadsheet. Instructions for completing Appendix D are contained in the spreadsheet file. Include the completed tables with the final application as Appendix D and submit the completed Excel spreadsheet electronically.

APPENDIX E: DETAILED COST ESTIMATE

1) Listed items should be shown in sufficient detail to evaluate the reasonableness of the cost, for example, show different pipe diameters, farm turnouts, road crossings, air vents, pressure reducing valves, fittings, isolations valves, diversion structures, trash cleaners, mechanical equipment, metalwork, earthwork, lining materials, concrete structures, canal obliteration, structure removal, re-vegetation, and right-of-way acquisition. The line item should show quantities and appropriate pricing either in unit prices or materials and installation.
2) All entries must precisely match values and descriptions in the responses to Part II, Project Proposed for Funding
3) Unless justification is provided in Part III D of the project proposal for a different value, the Habitat Replacement Plan should be 5% of the Total Construction Cost. For further information, see FOA Section IV.E.4. The applicant is responsible for the full cost of the Habitat Replacement Plan even if it exceeds the 5% value.
4) Costs must be included for NEPA compliance and compliance with cultural resource laws. The applicant is responsible for any costs of mitigation of cultural resource impacts and should include sufficient allowances.
5) Provisions for contingencies should be noted in the text and included in unit prices; do not show as a separate line item.
6) For further guidance please refer to the *Budget Pricing Guide* document which can be downloaded from http://www.usbr.gov/uc/progact/salinity

Bureau of Reclamation
Colorado River Basinwide and Basin States Salinity Control Programs
Salt Load Reduction Worksheet

ITEM DESCRIPTION *(add more lines as needed)*	QUANTITY	UNIT	$/UNIT	TOTAL COST	RECLAMATION FUNDING	RECIPIENT OR OTHER FUNDING
Mobilization	LS	1	$ 25,000.00	$ 25,000.00	$ 25,000.00	$ -
Inlet Structure, Head Gate, Headwall and Spillway	LS	1	$ 55,000.00	$ 55,000.00	$ 55,000.00	$ -
Furnish and Install 21" 80 psi PIP	LF	1700	$ 37.00	$ 62,900.00	$ 62,900.00	$ -
Furnish and Install 18" 80 psi PIP	LF	2640	$ 31.00	$ 81,840.00	$ 81,840.00	$ -
Furnish and Install 15" 80 psi PIP	LF	2440	$ 22.50	$ 54,900.00	$ 54,900.00	$ -
Furnish and Install 12" 80 psi PIP	LF	3180	$ 17.00	$ 54,060.00	$ 54,060.00	$ -
Furnish and Install 6" 80 psi PIP	LF	100	$ 10.00	$ 1,000.00	$ 1,000.00	$ -
Airvents	EA	8	$ 2,350.00	$ 18,800.00	$ 18,800.00	$ -
Drains	EA	3	$ 3,000.00	$ 9,000.00	$ 9,000.00	$ -
Meters	EA	3	$ 3,000.00	$ 9,000.00	$ 9,000.00	$ -
15" Valve	EA	2	$ 2,400.00	$ 4,800.00	$ 4,800.00	$ -
12" Valve	EA	1	$ 1,350.00	$ 1,350.00	$ 1,350.00	$ -
6" Valve	EA	1	$ 750.00	$ 750.00	$ 750.00	$ -
Flume	LS	1	$ 15,000.00	$ 15,000.00	$ 15,000.00	$ -
18" Main Risers	EA	21	$ 1,250.00	$ 26,250.00	$ 26,250.00	$ -
15" Main Risers	EA	21	$ 1,150.00	$ 24,150.00	$ 24,150.00	$ -
12" Main Risers	EA	26	$ 1,100.00	$ 28,600.00	$ 28,600.00	$ -
Remove and Replace Existing Fence	LF	200	$ 7.00	$ 1,400.00	$ 1,400.00	$ -
Remove Structures	LS	3	$ 1,000.00	$ 3,000.00	$ 3,000.00	$ -
Furnish Imported Trench Backfill Type A1	TON	200	$ 20.00	$ 4,000.00	$ 4,000.00	$ -
Furnish Foundation Type A5	TON	10	$ 20.00	$ 200.00	$ 200.00	$ -
Furnish 3/4" Rock Type A6	TON	30	$ 25.00	$ 750.00	$ 750.00	$ -
Furnish Untreated Base Course Type A7	TON	30	$ 25.00	$ 750.00	$ 750.00	$ -
Furnish Imported D50=8" Riprap	TON	50	$ 55.00	$ 2,750.00	$ 2,750.00	$ -
Reseeding	LS	1	$ 2,000.00	$ 2,000.00	$ 2,000.00	$ -
Fill Existing Canals	LF	6100	$ 2.00	$ 12,200.00	$ 12,200.00	$ -
Road Crossing	EA	3	$ 2,000.00	$ 6,000.00	$ 6,000.00	$ -
Deep Trench Excavation	LF	700	$ 2.00	$ 1,400.00	$ 1,400.00	$ -
TOTAL CONSTRUCTION COSTS				$ 506,850.00	$ 506,850.00	$ -
OTHER DIRECT COSTS						
Design				$ 43,000.00	$ 43,000.00	$ -
NEPA Compliance				$ 16,000.00	$ 16,000.00	$ -
Cultural Resources				$ 5,000.00	$ 5,000.00	$ -
Construction Management				$ 43,000.00	$ 43,000.00	$ -
Habitat Replacement Plan Implementation (see FOA Section IV.E.4)				$ 25,342.50	$ 25,342.50	$ -
Contingency						
Other (Specify)						
TOTAL DIRECT COSTS				$ 639,192.50	$ 639,192.50	$ -
INDIRECT COSTS						
Overhead				$ 11,000.00	$ 11,000.00	$ -
Other (Specify)					$ -	
TOTAL PROJECT COSTS				**$ 650,192.50**	$ 650,192.50	$ -

FOA NUMBER: R12SF40034

APPENDIX F: SALT LOAD REDUCTION ESTIMATE(S)

Include the response letter from Reclamation providing the salt load reduction estimate.

United States Department of the Interior

BUREAU OF RECLAMATION
Upper Colorado Regional Office
125 South State Street. Room 6107
Salt Lake City. UT 84138-1102

IN REPLY REFER TO

OCT 19 2012

UC-240
ADM-13.00

Paul Kehmeier, Ditch Company President
Forked Tongue/Holman Ditch Co.
20490 North Road
Eckert, CO 81418

Subject: Funding Opportunity Announcement (FOA) No. R12-SF-40-034 – Colorado River Basinwide & Basin States Salinity Control Programs – Salt Load Reduction Estimate for the Forked Tongue/Holman Ditch Piping Project

Dear Mr. Kehmeier:

Thank you for submitting the Salt Load Reduction Worksheet and the relevant appendices. We understand your project will involve piping approximately 9,968 feet of the Forked Tongue/Holman Ditch, and selected laterals, near Eckert, Colorado. No new water storage facilities are included in the project proposal. Based on the accepted salinity studies in the Lower Gunnison River basin area, the annual salt load reduction estimate for your proposed irrigation delivery system improvements is 412 tons/year. Salt load reduction estimates for the individual components of the proposed project are listed in the enclosed table.

The salt load reduction estimates provided in this letter are based on the best and current available information. In many areas of the Colorado River basin, salinity studies are continually being updated and re-interpreted and thus these estimates may change. If these estimates change after receipt of this letter, you will be notified by a similar letter by no later than October 31, 2012. The salt load estimates provided during this FOA are only valid for this FOA. In future FOAs, current salt load estimates will need to be requested.

The salt load reduction estimate must be reported in the project proposal as the off-farm estimated salt load reduction in Part III, item C.3 and Part I, item F. It must also be used to calculate the cost effectiveness of the project in Part III, item C.4; the cost effectiveness also must be reported in Part I, item G. This letter and the enclosed table must be attached to the project proposal as Appendix F.

As stated in Section IV.B of the FOA, your final application must be received by 3:00 p.m. MST, November 16, 2012. It is important that the requested information be provided for all applicable sections of the required project proposal format in a brief and concise manner in the spaces

provided for responses. The required electronic format for the project proposal can be downloaded from the website: www.usbr.gov/uc/progact/salinity.

We strongly encourage you to read the Office of Management and Budget (OMB) Circulars that apply to your organization. The circulars can be found at http://www.whitehouse.gov/omb/grants/grants_circulars.html.

Prior to submitting your application please pay attention to the following items:

1. Reclamation recommends that your organization have your Project Proposal reviewed by the Colorado Water Conservation Board. This is not a requirement, but by doing so you will be able to obtain a State Representative Review Letter. This letter will help reduce risk in the Application Review Committee (ARC) review of your project. Please contact Mr. Steve Miller at 303-866-3441, ext. 3228 or steve.miller@state.co.us to obtain a review letter for your project proposal or if you have any questions.

2. REQUIRED - Your calculated salt load reduction estimate is between 300 and 1000 tons and will be considered under the Basin States Program (BSP). As a requirement of the BSP you will need to obtain a project review and concurrence letter from the Colorado Department of Agriculture, State Conservation Board. To obtain this review and letter of concurrence, please contact Mr. Jim Currier at 970-243-5068, ext. 116 or james.currier@co.nacdnet.net

The awarded funding agreement will require, among other things, that:

1. Your organization utilizes competitive processes for the acquisition of materials and construction subcontracts.

2. Allowable costs are governed by OMB Circulars A-87, A-110, and A-122, depending upon the type of organization.

3. Your organization will be reimbursed the actual allowable costs you incur to complete the project, up to the amount of the award. Any cost incurred for the project in excess of the agreement amount is the responsibility of your organization.

4. For the replacement of the delivery systems, all facilities (i.e., earthen canals and laterals and diversion structures) being replaced, shall be rendered unusable and incapable of retaining water by removal of structures and refilling the prisms. This is to assure that the proposed salt load reduction occurs. Costs for removing structures and refilling the prisms should be included in the cost of the salinity project.

False claims or mistakes made in the application discovered during the agreement award process will require that the application be re-rated, re-ranked, and could result in the application not being awarded or termination of the agreement award.

If you have any questions, please contact me at 801-524-3753, Mr. Brad Parry at 801-524-3723, or Mr. John Sottilare at 970-248-0640.

Sincerely,

Kib Jacobson

Kib Jacobson
Program Manager, Salinity Control Program

Enclosure

Letter prepared 10/18/2012

Forked Tongue/Holman Ditch and Laterals-pg 1/2
Salt Load Reduction Basis & Estimate

Item	Units	Off-farm Components		On-farm Components	
		Forked Tongue Main Ditch FTDA (mile 0.000 – 1.319)		Forked Tongue Main Ditch FTDA- one user (mile 1.319 – 1.776)	
Length of existing canal/lateral/ditch	feet	6,964		2,413	
Irrigated acreage served	acres				
Irrigation season					
Average daily diversion	cfs	3.041		1.186	
Average seasonal diversion	ac-ft	1101		425	
Average no. of days water carried	days	181		181	
Non-irrigation season (winter water)					
Average daily diversion	cfs	0		0	
Average seasonal diversion	ac-ft	0		0	
Average no. of days water carried	days	0		0	
Length of ditch carrying winter water	feet	N/A		N/A	
Describe EXISTING lined or piped sections					
Lined length	feet	0		0	
Liner type (concrete, earth, etc)	See Note 1	N/A		N/A	
Year installed	year	N/A		N/A	
Liner condition	See Note 2	N/A		N/A	
Piped length (see Note 3)	feet	0		0	
Remaining unlined/unpiped length	feet	6,964		2,413	
Length to be replaced/improved	feet	6,964		2,413	
Proposed replacement material	pipe or liner	Pipe		Pipe	
Estimated Salt Reduction	Tons/yr	354		50.3	

Notes: 1. Type of liner may be concrete, earth (clay), membrane or other (please specify).
2. Condition of liner should be rated as poor, satisfactory, good.
3. Disregard dispersed pipe segments with individual lengths of less than 100 feet.

Forked Tongue/Holman Ditch and Laterals-pg 2/2
Salt Load Reduction Basis & Estimate

Item	Units	On-farm Components				Total
		Lateral A FTDAA	Lateral B FTDAB	Lateral C FTDAC	Lateral D FTDAD	
Length of existing canal/lateral/ditch	feet	290	63	143	95	9,968
Irrigated acreage served	acres	21	18	27	15	
Irrigation season						
Average daily diversion	cfs	0.304	0.304	0.304	0.304	
Average seasonal diversion	ac-ft	110	110	110	110	
Average no. of days water carried	days	181	181	181	181	
Non-irrigation season (winter water)						
Average daily diversion	cfs	0	0	0	0	0
Average seasonal diversion	ac-ft	0	0	0	0	0
Average no. of days water carried	days	0	0	0	0	0
Length of ditch carrying winter water	feet	N/A	N/A	N/A	N/A	N/A
Describe EXISTING lined or piped sections						
Lined length	feet	0	0	0	0	0
Liner type (concrete, earth, etc)	See Note 1	N/A	N/A	N/A	N/A	N/A
Year installed	year	N/A	N/A	N/A	N/A	N/A
Liner condition	See Note 2	N/A	N/A	N/A	N/A	N/A
Piped length (see Note 3)	feet	0	0	0	0	0
Remaining unlined/unpiped length	feet	290	63	143	95	9,968
Length to be replaced/improved	feet	290	63	143	95	9,968
Proposed replacement material	pipe or liner	Pipe	Pipe	Pipe	Pipe	
Estimated Salt Reduction	Tons/yr	3.6	0.8	1.8	1.2	412

Notes: 1. Type of liner may be concrete, earth (clay), membrane or other (please specify).
2. Condition of liner should be rated as poor, satisfactory, good.
3. Disregard dispersed pipe segments with individual lengths of less than 100 feet.