Water Supply Reserve Account – Grant and Loan Program
Water Activity Summary Sheet
September 11-12, 2014
Agenda Item 13(c)

Applicant: Lower Arkansas Valley Water Conservancy District

Program Sponsor: Lower Arkansas Valley Water Enterprise Fund

Water Activity Name: FIRI Analysis and Tailwater Return Flow Study on Fort Lyon Canal

Water Activity Purpose: Agricultural Study

County: Bent

Drainage Basin: Arkansas

Water Source: Arkansas River

Total Amount Requested: $175,137

Source of Funds: $30,000 Arkansas Basin Account; $145,137 Statewide Account

Matching Funds: Basin Account Match ($30,000) = 17% of total grant request
Basin Account & Applicant Match ($80,000) = 45.7% of total grant request
Applicant Match ($50,000) = 22.2% of total study costs ($225,137)
(refer to *Funding Summary/Matching Funds*)

Staff Recommendation:
Staff recommends approval of up to $30,000 from the Arkansas Basin Account and $145,137 from the Statewide account to help fund the study titled: FIRI Analysis and Tailwater Return Flow Study on Fort Lyon Canal.

Water Activity Summary: The first phase of the study (for which the Applicant is currently seeking funding) will utilize the Farm Irrigation Rating Index (FIRI) method on a canal-wide basis to analyze irrigation efficiency. This analysis will involve extensive data collection and observation pertaining to irrigation management and systems with the goal of establishing more representative canal-wide irrigation efficiency. It will then select a limited number of farms on a single section of the Fort Lyon Canal to provide sufficient data on tailwater return flows.

The goal of the first phase of the Study will be to obtain high-quality data on farm efficiency, pursuant to a FIRI analysis, and on the actual amounts of tailwater return flows occurring from flood-irrigated farms on a subset of the Fort Lyon Canal. The FIRI Analysis and Tailwater Study will enable a better understanding of the farm irrigation efficiency and how tailwater return flows actually accrue to the Arkansas River as compared to the tailwater assumption, an irrigation efficiency factor, contained in the Irrigation System Analysis Model (ISAM). ISAM was developed to provide a standard methodology for performing evaluations as to whether irrigation system improvements result in a reduction or change in the timing or location of historical seepage losses or return flows in violation of Article IV-D of the Arkansas River Compact and to implement the "Compact Rules Governing Improvements to Surface Water Irrigation Systems in the Arkansas River Basin in Colorado" (the "Irrigation Improvements Rules").

ISAM is widely believed to be overly-conservative on water-short ditch systems such as the Fort Lyon Canal. Moreover, it did not consider whether tailwater run-off from one field may actually be utilized on another field within the same farm. A priority of all parties in developing the Irrigation Improvements Rules and the ISAM was to ensure that these rules would not create a disincentive to install irrigation system improvements. However, overly-conservative assumptions in the ISAM can have this effect and can also result in over-delivery of Colorado's water resources to Kansas. A lower tailwater assumption and increased maximum farm irrigation efficiency factor will also have the benefit of increasing the anticipated transferable yield associated with Fort Lyon shares in the context of other water transfers, such as rotational leasing-fallowing projects.

The Study is designed to conserve existing water resources and reduce pressure on existing water supplies, both of which would assist in meeting both the M&I and agricultural water gaps identified in the Arkansas River Basin Consumptive Needs Assessment: 2030 (June 2008). The potential water savings that may result from a lower, more accurate tailwater return flow assumption and increased maximum farm irrigation efficiency factor on the Fort Lyon Canal could reduce the amount of water supplies needed to meet Compact compliance requirements under the Irrigation Improvements Rules, leaving that water available to meet other needs, including M&I needs. Also, by decreasing the costs associated with Compact compliance for irrigation system improvements, the Study could promote further installation of irrigation system improvements and the resultant benefits of increased water efficiency, increased productivity, and improved water quality. Additional transferable yield will similarly be available from temporary (i.e., rotational leasing and fallowing programs) and/or permanent changes to Fort Lyon shares.

Discussion:
No further discussion is required

Issues/Additional Needs:
No issues or additional needs have been identified.

Threshold and Evaluation Criteria:
The application meets all four Threshold Criteria

Tier 1-3 Evaluation Criteria:

Tier 1: (a) The study will address agricultural irrigation efficiency and assist in determining the amount of water needed to meet Arkansas River Compact obligations.

(b) The Lower Ark District will work in close collaboration with Fort Lyon Canal farmers to undertake the first phase of the Study. The study will also involve cooperation and collaboration with the Fort Lyon Canal Company in undertaking the study and the Division 2 Engineer's Office of the Division of Water Resources.

(c) The Tailwater Study is designed to actively and measurably lead to the development of conserved water to meet both the M&I gap and the agricultural gap, as identified in the Arkansas River Basin Consumptive Needs Assessment: 2030 (June 2008).

Tier 2: (d) Without funding from the WSRA, this phase of the Tailwater Study will not be undertaken. Alternate means of funding have been explored but none appear to be available.

(e) The Lower Ark District has demonstrated a significant commitment to the Tailwater Study through matching funds of $50,000.

Tier 3: (f) The anticipated results of the Tailwater Study will help sustain agriculture by ensuring that Fort Lyon farmers continue to have incentives to invest in their operations and install irrigation system improvements. Such investments are needed to ensure the future health and vitality of agricultural communities. Moreover, these irrigation system investments could improve water quality and benefit both the environment and recreation on the Lower Arkansas River.

(g) The Tailwater Study will address problems related to compact-entitled water and compact compliance and promotes maximum utilization of state waters. One of the study's broad aims is to ensure that the accuracy of "return flow maintenance water" calculations pursuant to the Irrigation Improvements Rules such that a violation of the Arkansas River Compact is avoided. The Tailwater Study will provide the data needed to refine the H-I Model and the ISAM in a way that is anticipated to reduce the burdens of Compact compliance on farmers.

(h) n/a

(i) Though not easily quantified because the amount of water saved will ultimately depend on the results of the full study and the rate of sprinkler growth, the data and analysis generated from this phase of the Tailwater Study will provide a high level of benefit. The anticipated reduction in the tailwater assumption and an increase in the maximum farm irrigation efficiency factor on the Fort Lyon is likely to lead to encourage increasing water efficiency and agricultural productively through installation of sprinkler systems on irrigated lands and reductions in return flow obligations under the Arkansas River Compact.

(j) Most immediately, the data and analysis resulting from completion of the full Tailwater Study may be incorporated into the H-I Model and the ISAM and will further the CWCB goals of promoting more efficient use of water while ensuring Compact compliance. It also has the potential to generate data that may be relevant for the Arkansas decision support system.

Funding Summary/Matching Funds:

	Cash	**In-kind**	**Total**
WSRA Arkansas Basin Account	$30,000	n/a	$30,000
WSRA Statewide Account	$145,137	n/a	$145,137
Lower Arkansas Water Conservancy District	$50,000	$0	$50,000
Total Study Costs	**$225,137**	**$0**	**$225,137**

All products, data and information developed as a result of this grant must be provided to the CWCB in hard copy and electronic format as part of the project documentation. This information will in turn be made widely available to Basin Roundtables and the general public and will help promote the development of a common technical platform. In accordance with the revised WSRA Criteria and

Guidelines, staff would like to highlight additional reporting and final deliverable requirements. The specific requirements are provided below.

Reporting: The applicant shall provide the CWCB a progress report every 6 months, beginning from the date of the executed contract. The progress report shall describe the completion or partial completion of the tasks identified in the scope of work including a description of any major issues that have occurred and any corrective action taken to address these issues.

Final Deliverable: At completion of the project, the applicant shall provide the CWCB a final report that summarizes the project and documents how the project was completed. This report may contain photographs, summaries of meetings and engineering reports/designs.

Engineering: All engineering work (as defined in the Engineers Practice Act (§12-25-102(10) C.R.S.)) performed under this grant shall be performed by or under the responsible charge of professional engineer licensed by the State of Colorado to practice Engineering.

Arkansas Basin Roundtable

PLANNING OUR WATER FUTURE

Colorado Water Conservation Board
Attn: Mr. Craig Godbout
Program Manager, Water Supply Planning Section
1580 Logan Street, Suite 200
Denver CO 80203

August 18, 2014

Re: WSRA Grant Recommendation-Tailwater Return Flow Study on Fort Lyon Canal

Dear Mr. Godbout;

The Arkansas Basin Roundtable, on behalf of the Lower Arkansas Valley Water Conservancy District and Fort Lyon Rule 10 Association has approved the attached grant request for $175,137 ($30,000 in Basin Funds and $145,137 in Statewide funds*).*

The Tailwater Study will enable a better understanding of how tailwater return flows actually accrue to the Arkansas River as compared to the tailwater assumption contained in the Irrigation System Analysis Model (ISAM). ISAM was developed to provide a standard methodology for performing evaluations as to whether irrigation system improvements result in a reduction or change in the timing or location of historical seepage losses or return flows in violation of Article IV-D of the Arkansas River Compact and to implement the "Compact Rules Governing Improvements to Surface Water Irrigation Systems in the Arkansas River Basin in Colorado" (the "Irrigation Improvements Rules"). Specifically, Applicants will identify 5-8 representative and geographically-distributed farms along the Fort Lyon Canal. Equipment will be installed and Applicants will conduct measuring and monitoring for two or more irrigation seasons to gather data on tailwater return flows. The data will then be analyzed to determine **actual** tailwater return flows. These results will be validated to confirm the applicability of the results on a canal-wide basis. The methodologies and approaches used will be designed to provide a basis for a potential refinement to ISAM's tailwater assumption.

The Tailwater Study would positively enhance the current system of allocating water within Colorado through ensuring maximum utilization of available water supplies, encouraging water savings through improved irrigation efficiency, and reducing potential over-deliveries of Colorado's water resources to Kansas under the Irrigation Improvements Rules. The study would enhance and improve evaluations of current water use practices and would inform water resource management decisions. In addition to agricultural purposes, the Tailwater Return Flow Study on the Fort Lyon Canal (the "Tailwater Study") will also address ongoing Arkansas River Compact compliance issues and has the potential to benefit M& I users.

If you have any further questions regarding the Roundtable support, please don't hesitate to call me.

Regards,

E.L. Konarski, Chr. Arkansas Basin Roundtable

COLORADO WATER CONSERVATION BOARD

WATER SUPPLY RESERVE ACCOUNT APPLICATION FORM

Today's Date: July 11, 2014

FIRI Analysis and Tailwater Return Flow Study on Fort Lyon Canal

Name of Water Activity/Project

Lower Arkansas Valley Water Conservancy District

Name of Applicant

Arkansas Basin Roundtable

Amount from Statewide Account: 145,136

Amount from Basin Account(s): 30,000

Total WSRA Funds Requested: 175,136

Approving Basin Roundtable(s)
(If multiple basins specify amounts in parentheses.)

FEIN:

Application Content

Required Exhibits

A. Statement of Work, Budget, and Schedule
B. Project Map
C. As Needed (i.e. letters of support, photos, maps, etc.)

Appendices – Reference Material

1. Program Information
2. Insurance Requirements
3. WSRA Standard Contract Information (Required for Projects Over $100,000)
4. W-9 Form (Required for All Projects Prior to Contracting)

Instructions

To receive funding from the Water Supply Reserve Account (WSRA), a proposed water activity must be approved by the local Basin Roundtable **AND** the Colorado Water Conservation Board (CWCB). The process for Basin Roundtable consideration and approval is outlined in materials in Appendix 1.

Once approved by the local Basin Roundtable, the applicant should submit this application **with a detailed statement of work including budget and schedule as Exhibit A** to CWCB staff by the application deadline.

WSRA applications are due with the roundtable letter of support 60 calendar days prior to the bi-monthly Board meeting at which it will be considered. Board meetings are held in January, March, May, July, September, and November. Meeting details, including scheduled dates, agendas, etc. are posted on the CWCB website at: http://cwcb.state.co.us Applications to the WSRA Basin Account are considered at every board meeting, while applications to the WSRA Statewide Account are only considered at the March and September board meetings.

When completing this application, the applicant should refer to the WSRA Criteria and Guidelines available at: http://cwcb.state.co.us/LoansGrants/water-supply-reserve-account-grants/Documents/WSRACriteriaGuidelines.pdf

The application, statement of work, budget, and schedule **must be submitted in electronic format** (Microsoft Word or text-enabled PDF are preferred) and can be emailed or mailed on a disk to:

Craig Godbout - WSRA Application
Colorado Water Conservation Board
1580 Logan Street, Suite 200
Denver, CO 80203
Craig.godbout@state.co.us

If you have questions or need additional assistance, please contact Craig Godbout at: 303-866-3441 x3210 or craig.godbout@state.co.us.

Water Supply Reserve Account – Application Form
Revised October 2013

Part I. - Description of the Applicant (Project Sponsor or Owner);

1. Applicant Name(s): Lower Arkansas Valley Water Conservancy District & Fort Lyon Rule 10 Association

Mailing address: 801 Swink Ave.
Rocky Ford, CO 81067

FEIN #: 481298144

Primary Contact: Jay Winner Position/Title: General Manager

Email: jwinner@centurytel.net

Phone Numbers: Cell: 719-469-8935 Office: 719-254-5115

Alternate Contact: Peter D. Nichols Position/Title: Special Counsel

Email: pdn@bhgrlaw.com

Phone Numbers: Cell: 303-494-0278 Office: 303-402-1600

2. Eligible entities for WSRA funds include the following. What type of entity is the Applicant?

[ ] Public (Government) – municipalities, enterprises, counties, and State of Colorado agencies. Federal agencies are encouraged to work with local entities and the local entity should be the grant recipient. Federal agencies are eligible, but only if they can make a compelling case for why a local partner cannot be the grant recipient.

[x] Public (Districts) – authorities, Title 32/special districts, (conservancy, conservation, and irrigation districts), and water activity enterprises.

[ ] Private Incorporated – mutual ditch companies, homeowners associations, corporations.

[ ] Private individuals, partnerships, and sole proprietors are eligible for funding from the Basin Accounts but not for funding from the Statewide Account.

[ ] Non-governmental organizations – broadly defined as any organization that is not part of the government.

3. Provide a brief description of your organization

The Lower Arkansas Valley Water Conservancy District ("Lower Ark District") is a water conservancy district established in 2002 pursuant to Colorado law, C.R.S.§ 37-45-101 et seq. The Lower Ark District's mission is to acquire, retain and conserve water resources within the Lower Arkansas River; to encourage the use of such water for the socio-economic benefit of the District citizens; and to participate in water-related projects that will embody thoughtful conservation, responsible growth, and beneficial water usage within the Lower Arkansas Valley. As such, this includes promoting and protecting agriculture in the Lower Arkansas Basin. A critical aspect in preserving agriculture is to ensure agriculture's current and future economic viability. This can be achieved through increased irrigation efficiency and the associated maximum utilization of available water supplies. Currently, the vast majority of irrigation occurring in the Arkansas River Basin continues to employ surface (flood) irrigation. After participating in the development of the Irrigation Improvements Rules (discussed below), the Lower Ark District stepped forward to prepare and administer the only Rule 10 Compact compliance plans on behalf of irrigation system improvement owners.

4. If the Contracting Entity is different then the Applicant (Project Sponsor or Owner) please describe the Contracting Entity here.

The Lower Ark District formed a Water Activity Enterprise in 2003 to manage the District's water assets and provide services to the District on a reimbursable basis. The Lower Arkansas Valley Water Enterprise Fund would be the contracting entity for this project. This approach has successfully completed on four prior CWCB grants (two concerning the Super Ditch, including two WSRA grants, and two concerning the State Engineer's Irrigation Improvements Rules).

5. Successful applicants will have to execute a contract with the CWCB prior to beginning work on the portion of the project funded by the WSRA grant. In order to expedite the contracting process the CWCB has established a standard contract with provisions the applicant must adhere to. A link to this standard contract is included in Appendix 3. Please review this contract and check the appropriate box.

[x] The Applicant will be able to contract with the CWCB using the Standard Contract

[ ] The Applicant has reviewed the standard contract and has some questions/issues/concerns. Please be aware that any deviation from the standard contract could result in a significant delay between grant approval and the funds being available.

6. The Tax Payer Bill of Rights (TABOR) may limit the amount of grant money an entity can receive. Please describe any relevant TABOR issues that may affect the applicant.

The Lower Ark District's 1.5 mill property tax levy is exempt from TABOR pursuant to the election that formed the district in 2002.

Part II. - Description of the Water Activity/Project

1. What is the primary purpose of this grant application? (Please check only one)

	Nonconsumptive (Environmental or Recreational)
x	Agricultural
	Municipal/Industrial
	Needs Assessment
	Education
	Other Explain:

2. If you feel this project addresses multiple purposes please explain.

In addition to agricultural purposes, the Tailwater Return Flow Study on the Fort Lyon Canal (the "Tailwater Study") will also address ongoing Arkansas River Compact compliance issues and has the potential to benefit M& I users.

3. Is this project primarily a study or implementation of a water activity/project? (Please check only one)

x	Study		Implementation

4. To catalog measurable results achieved with WSRA funds can you provide any of the following numbers?

	New Storage Created (acre-feet)
>225	New Annual Water Supplies Developed, Consumptive or Nonconsumptive (acre-feet)
	Existing Storage Preserved or Enhanced (acre-feet)
	Length of Stream Restored or Protected (linear feet)
	Length of Pipe/Canal Built or Improved (linear feet)
	Efficiency Savings (acre-feet/year OR dollars/year – **circle one**)
	Area of Restored or Preserved Habitat (acres)
	Other -- Explain:

****NOTE: This identified 225 acre-feet in new annual water supplies is an estimated amount of water that could be saved annually upon completion of the Study, which is calculated based on the continued rate of growth of sprinkler installation that has occurred between 2012 to 2014. During that time, the number of sprinklers on the Fort Lyon Canal has more than doubled from 65 in 2012 to approximately 145 in 2014. Assuming this continues during the 2-year period of the first phase of the study, and the tailwater assumption is demonstrated to be reduced to 5% or less and the farm irrigation efficiency factor is similarly increased as a result of the completion of the Tailwater Study, this could "free-up" an estimated 225 acre-feet of new supplies resulting from reductions in projected 2017 demands. This savings would be realized upon acceptance of adjustments to the H-I model and the ISAM. The amount of water that could be saved in future years of Rule 10 operation would continue to increase as more sprinklers were installed.*

4. To help us map WSRA projects please include a map (Exhibit B) and provide the general coordinates below:
The coordinates for the Fort Lyon Diversion Dam are:

Latitude: 38°07′03″N Longitude: -103°48′33″W

5. Please provide an overview/summary of the proposed water activity (no more than one page). Include a description of the overall water activity and specifically what the WSRA funding will be used for. A full **Statement of Work** with a detailed budget and schedule is required as **Exhibit A** of this application.

The FIRI Analysis and Tailwater Study will enable a better understanding of the farm irrigation efficiency and how tailwater return flows actually accrue to the Arkansas River as compared to the tailwater assumption an irrigation efficiency factor contained in the Irrigation System Analysis Model (ISAM). ISAM was developed to provide a standard methodology for performing evaluations as to whether irrigation system improvements result in a reduction or change in the timing or location of historical seepage losses or return flows in violation of Article IV-D of the Arkansas River Compact and to implement the "Compact Rules Governing Improvements to Surface Water Irrigation Systems in the Arkansas River Basin in Colorado" (the "Irrigation Improvements Rules"). The ISAM incorporates certain assumptions and factors contained in the H-I Model. The ISAM assumes 10% of the supply to the farm headgate is returned to the river as tailwater. This is widely believed to be overly-conservative on water-short ditch systems such as the Fort Lyon Canal. Moreover, it did not consider whether tailwater run-off from one field may actually be utilized on another field within the same farm. The ISAM currently contains the H-I Model's 65% maximum farm irrigation efficiency factor. In the most recent litigation between Kansas and Colorado over the Arkansas River Compact, this maximum farm irrigation efficiency was the subject of dispute, and Colorado experts believed that the 65% factor was unreasonably low for the Arkansas River Basin.

A priority of all parties in developing the Irrigation Improvements Rules and the ISAM was to ensure that these rules would not create a disincentive to install irrigation system improvements. However, overly-conservative assumptions in the ISAM can have this effect and can also result in over-delivery of Colorado's water resources to Kansas. The high-quality data specifically measuring tailwater return flows and farm irrigation efficiency that would be obtained from the Tailwater Study could be used to correct these deficiencies. By reducing the deliveries required by Fort Lyon improvements in Compact

compliance plans, demands on water supplies to meet delivery obligations will similarly be lessened, and additional water sources will remain available for maximum utilization and beneficial use within Colorado. A lower tailwater assumption and increased maximum farm irrigation efficiency factor will also have the benefit of increasing the anticipated transferable yield associated with Fort Lyon shares in the context of other water transfers, such as rotational leasing-fallowing projects.

The first phase of the study (for which Applicant is currently seeking funding) will utilize the Farm Irrigation Rating Index (FIRI) method on canal-wide basis to analyze irrigation efficiency. This analysis will involve extensive data collection and observation pertaining to irrigation management and systems with the goal of establishing a more representative canal-wide irrigation efficiency. It will then select a limited number of farms on a single section of the Fort Lyon Canal to provide sufficient data on tailwater return flows. The goal of the first phase of the Study would be to obtain high-quality data on farm efficiency pursuant to a FIRI analysis and on the actual amounts of tailwater return flows occurring from flood-irrigated farms on a subset of the Fort Lyon Canal. The resultant data and analysis will then be used to assess whether broader, on-site field irrigation and tailwater evaluations would be beneficial and are justified for future phases. If undertaken, the more extensive, second phase would be conducted with the aim of adjusting the tailwater assumption and irrigation efficiency factor in the H-I Model and the ISAM to more accurately reflect actual conditions.

Part III. – Threshold and Evaluation Criteria

1. Describe how the water activity meets these **Threshold Criteria.** (Detailed in Part 3 of the Water Supply Reserve Account Criteria and Guidelines.)

   a) The water activity is consistent with Section 37-75-102 Colorado Revised Statutes.[1]

The Study would positively enhance the current system of allocating water within Colorado through ensuring maximum utilization of available water supplies, encouraging water savings through improved irrigation efficiency, and reducing potential over-deliveries of Colorado's water resources to Kansas

[1] 37-75-102. Water rights - protections. (1) It is the policy of the General Assembly that the current system of allocating water within Colorado shall not be superseded, abrogated, or otherwise impaired by this article. Nothing in this article shall be interpreted to repeal or in any manner amend the existing water rights adjudication system. The General Assembly affirms the state constitution's recognition of water rights as a private usufructuary property right, and this article is not intended to restrict the ability of the holder of a water right to use or to dispose of that water right in any manner permitted under Colorado law. (2) The General Assembly affirms the protections for contractual and property rights recognized by the contract and takings protections under the state constitution and related statutes. This article shall not be implemented in any way that would diminish, impair, or cause injury to any property or contractual right created by intergovernmental agreements, contracts, stipulations among parties to water cases, terms and conditions in water decrees, or any other similar document related to the allocation or use of water. This article shall not be construed to supersede, abrogate, or cause injury to vested water rights or decreed conditional water rights. The General Assembly affirms that this article does not impair, limit, or otherwise affect the rights of persons or entities to enter into agreements, contracts, or memoranda of understanding with other persons or entities relating to the appropriation, movement, or use of water under other provisions of law.

under the Irrigation Improvements Rules. The study would enhance and improve evaluations of current water use practices and would inform water resource management decisions. The grant would not be implemented in a way that would diminish, impair, or cause injury to any property or contractual right created by intergovernmental agreements, contracts, stipulations among parties to water cases, terms and conditions in water decree, or any other similar document related to the allocation or use of water.

b) The water activity underwent an evaluation and approval process and was approved by the Basin Roundtable (BRT) and the application includes a description of the results of the BRTs evaluation and approval of the activity. At a minimum, the description must include the level of agreement reached by the roundtable, including any minority opinion(s) if there was not general agreement for the activity. The description must also include reasons why general agreement was not reached (if it was not), including who opposed the activity and why they opposed it. Note- If this information is included in the letter from the roundtable chair simply reference that letter.

Roundtable Evaluation Pending

c) The water activity meets the provisions of Section 37-75-104(2), Colorado Revised Statutes.[2] The Basin Roundtable Chairs shall include in their approval letters for particular WSRA grant applications a description of how the water activity will assist in meeting the water supply needs identified in the basin roundtable's consumptive and/or non-consumptive needs assessments.

The Study is designed to conserve existing water resources and reduce pressure on existing water supplies, both of which would assist in meeting both the M&I and agricultural water gaps identified in the Arkansas River Basin Consumptive Needs Assessment: 2030 (June 2008). The potential water savings that may result from a lower, more accurate tailwater return flow assumption and increased maximum farm irrigation efficiency factor on the Fort Lyon Canal could reduce the amount of water supplies needed to meet Compact compliance requirements under the Irrigation Improvements Rules, leaving that water available to meet other needs, including M&I needs. Also, by decreasing the costs associated with Compact compliance for irrigation system improvements, the Study could promote further installation of irrigation system improvements and the resultant benefits of increased water efficiency, increased productivity, and improved water quality. Additional transferable yield will similarly be available from temporary (i.e., rotational leasing and fallowing programs) and/or permanent changes to Fort Lyon shares. These outcomes will mean that less pressure is placed on

[2] 37-75-104 (2)(c). Using data and information from the Statewide Water Supply Initiative and other appropriate sources and in cooperation with the on-going Statewide Water Supply Initiative, develop a basin-wide consumptive and nonconsumptive water supply needs assessment, conduct an analysis of available unappropriated waters within the basin, and propose projects or methods, both structural and nonstructural, for meeting those needs and utilizing those unappropriated waters where appropriate. Basin Roundtables shall actively seek the input and advice of affected local governments, water providers, and other interested stakeholders and persons in establishing its needs assessment, and shall propose projects or methods for meeting those needs. Recommendations from this assessment shall be forwarded to the Interbasin Compact Committee and other basin roundtables for analysis and consideration after the General Assembly has approved the Interbasin Compact Charter.

existing water supplies and existing water supplies may be extended further. This will assist in filling the identified Arkansas Basin's 28,000 acre-foot M&I gap.

This information will also be addressed in the letter from the Arkansas Basin Roundtable chair.

d) Matching Requirement: For requests from the **Statewide Fund**, the applicants will be required to demonstrate a **25 percent** (or greater) match of the total grant request from the other sources, including by not limited to Basin Funds. A minimum match of 5% of the total grant amount shall be from Basin funds. A minimum match of 5% of the total grant amount must come from the applicant or 3rd party sources. Sources of matching funds include but are not limited to Basin Funds, in-kind services, funding from other sources, and/or direct cash match. Past expenditures directly related to the project may be considered as matching funds if the expenditures occurred within 9 months of the date the contract or purchase order between the applicant and the State of Colorado is executed. Please describe the source(s) of matching funds. (NOTE: These matching funds should also be reflected in your Detailed Budget in **Exhibit A** of this application)

17% ($30,000) matching funds from the Arkansas Basin Roundtable (requested)
29% ($50,000) matching funds from the Lower Ark District

2. For Applications that include a request for funds from the **Statewide Account**, describe how the water activity/project meets all applicable **Evaluation Criteria.** (Detailed in Part 3 of the Water Supply Reserve Account Criteria and Guidelines and repeated below.) Projects will be assessed on how well they meet the Evaluation Criteria. **Please attach additional pages as necessary.**

Evaluation Criteria – the following criteria will be utilized to further evaluate the merits of the water activity proposed for funding from the Statewide Account. In evaluation of proposed water activities, preference will be given to projects that meet one or more criteria from each of the three "tiers" or categories. Each "tier" is grouped in level of importance. For instance, projects that meet Tier 1 criteria will outweigh projects that only meet Tier 3 criteria. WSRA grant requests for projects that may qualify for loans through the CWCB loan program will receive preference in the Statewide Evaluation Criteria if the grant request is part of a CWCB loan/WSRA grant package. For these CWCB loan/WSRA grant packages, the applicant must have a CWCB loan/WSRA grant ratio of 1:1 or higher. Preference will be given to those with a higher loan/grant ratio.

Tier 1: Promoting Collaboration/Cooperation and Meeting Water Management Goals and Identified Water Needs

a. The water activity addresses multiple needs or issues, including consumptive and/or non-consumptive needs, or the needs and issues of multiple interests or multiple basins. This can be demonstrated by obtaining letters of support from other basin roundtables (in addition to an approval letter from the sponsoring basin).

The Study will address multiple needs and issues and address the needs and issues of multiple interests within the Arkansas River Basin. A key goal of the study is to encourage further water savings through continued installation of more efficient irrigation system improvements. Increases in irrigation

efficiency provide benefits to all Colorado water users. With agricultural water use accounting for over 80% of water use in the State, increases in irrigation efficiency are a crucial way to address water scarcity problems. Moreover, improved irrigation efficiency can lead to improved water quality by reducing irrigation runoff and seepage, may result in improved crop yields, and can reduce the need for hired labor, thereby supporting the agricultural economy. These benefits accrue not just to the State's agricultural communities, but can be felt Basin-wide.

By reducing the amount of water needed to meet Compact compliance obligations (which will encourage further investments in water-saving irrigation improvements) and increasing the transferrable yield of Fort Lyon Canal shares, the Study could also result in both direct water savings and a reduction in demands placed upon all basin water supplies. And in so doing, it has the potential to contribute to a reduction in the agricultural and M&I water gaps and serve multiple interests. Irrigation improvement owners on the Fort Lyon and municipal users interested in participating in leasing-fallowing with shareholders in the Fort Lyon Canal Company could all directly benefit. Moreover, all water users that compete for the limited water supplies available in the Arkansas River basin would benefit from an improved, more accurate H-I Model that reduces the pressure placed on limited supplies to meet Compact compliance obligations.

b. The number and types of entities represented in the application and the degree to which the activity will promote cooperation and collaboration among traditional consumptive water interests and/or non-consumptive interests, and if applicable, the degree to which the water activity is effective in addressing intrabasin or interbasin needs or issues.

The Lower Ark District will work in close collaboration with Fort Lyon Canal farmers to undertake the first phase of the Study. The study will also involve cooperation and collaboration with the Fort Lyon Canal Company in undertaking the study and the Division 2 Engineer's Office of the Division of Water Resources. After Completion of the first phase and in cooperation with interested parties, Applicant will evaluate whether the results justify pursuing the expanded second phase of the study. If justified, Applicant will work with the Division 2 Office in the expanded study's final design, implementation, and in the potential integration of the results of the completed Tailwater Study into the H-I Model and the ISAM.

Because the Tailwater Study has the potential to free-up existing water supplies, increase water supplies through irrigation efficiency, and increase the transferable yield of Fort Lyon shares in temporary and permanent transfers, the study could ultimately benefit all water users in the Arkansas River Basin. It therefore has the potential to promote cooperation amongst historically competing water interests. Moreover, the data that will be obtained from the study will contribute to a better understanding of Arkansas River Basin's water resources, which can lead to improved decision-making and reduced conflicts among historically competing users. Finally, by reducing one of the barriers associated with sprinkler installation (the amount and concomitant cost of calculated return flow maintenance under ISAM), the Tailwater Study could lead to increases in the installation of irrigation improvements which has the benefit of improving water quality and the environment.

c. The water activity helps implement projects and processes identified as helping meet Colorado's future water needs, and/or addresses the gap areas between available water supply and future need as identified in SWSI or a roundtable's basin-wide water needs assessment.

The Tailwater Study is designed to actively and measurably lead to the development of conserved water to meet both the M&I gap and the agricultural gap, as identified in the Arkansas River Basin Consumptive Needs Assessment: 2030 (June 2008). It also keeps with the vision of that Needs Assessment by sustaining agriculture through encouraging increasing water efficiency and agricultural productivity. The potential water savings that may result from the Tailwater Study will assist in reducing the agricultural and M&I water gaps by reducing the amount of water supplies needed to meet Compact compliance requirements under the Irrigation Improvements Rules, leaving that water available to meet other needs, including M&I needs.

The Tailwater Study also meets the needs of irrigators and agricultural communities, and rural economies by reducing the costs associated with improvements to irrigation. By promoting water conservation through irrigation improvements, potentially reducing Compact compliance requirements, and increasing the transferable yield associated with Fort Lyon shares, the study meets the broad-based water management goal of maximum utilization of water while ensuring compliance with Arkansas River Compact. Moreover, the proposed FIRI analysis has the potential to provide useful and meaningful data that could be incorporated into the Arkansas decision support system currently under development.

The benefits from a potentially reduced tailwater assumption and increased farm irrigation efficiency factor on the Fort Lyon Canal will continue to grow and multiply over time. As more sprinklers are installed, the amount of water saved through these corrections will continue to increase. And by reducing the costs associated with installation of sprinklers, the study will encourage continued sprinkler installation and the associated water conservation savings. As the largest canal in Colorado, water savings on the Fort Lyon Canal will be significant.

Tier 2: Facilitating Water Activity Implementation

d. Funding from this Account will reduce the uncertainty that the water activity will be implemented.

Funding from the WSRA will reduce the uncertainty that this first phase of the Tailwater Study will be implemented. The Lower Ark District and Division 2 Engineer's Office have discussed the concept of this Tailwater Study and its potential benefits since the original development of the ISAM. Without funding from the WSRA, this phase of the Tailwater Study will not be undertaken. Alternate means of funding have been explored but none appear to be available.

e. The amount of matching funds provided by the applicant via direct contributions, demonstrable in-kind contributions, and/or other sources demonstrates a significant and appropriate commitment to the project.

The Lower Ark District has demonstrated a significant commitment to the Tailwater Study through matching funds of $50,000. Moreover, the Lower Ark District has consistently demonstrated its commitment to implementation of the Irrigation Improvements Rules through its in-kind efforts in operating and administering the only Compact compliance plans since the adoption of the rules. The District has worked closely with the Division 2 Engineer's Office and the CWCB to improve and refine the Compact compliance process and the ISAM.

Tier 3: The Water Activity Addresses Other Issues of Statewide Value and Maximizes Benefits

f. The water activity helps sustain agriculture and open space, or meets environmental or recreational needs.

The anticipated results of the Tailwater Study will help sustain agriculture by ensuring that Fort Lyon farmers continue to have incentives to invest in their operations and install irrigation system improvements. Such investments are needed to ensure the future health and vitality of agricultural communities. Moreover, these irrigation system investments could improve water quality and benefit both the environment and recreation on the Lower Arkansas River.

g. The water activity assists in the administration of compact-entitled waters or addresses problems related to compact entitled waters and compact compliance and the degree to which the activity promotes maximum utilization of state waters.

The Tailwater Study will address problems related to compact-entitled water and compact compliance and promotes maximum utilization of state waters. One of the study's broad aims is to ensure that the accuracy of "return flow maintenance water" calculations pursuant to the Irrigation Improvements Rules such that a violation of the Arkansas River Compact is avoided. Colorado's experts in the Kansas v. Colorado litigation took issue with what was viewed as an unreasonably low 65% maximum farm irrigation efficiency factor that is currently used in the H-I Model. The Tailwater Study will provide the data needed to refine the H-I Model and the ISAM in a way that is anticipated to reduce the burdens of Compact compliance on farmers. By reducing Compact compliance obligations (which, in turn, preserves existing water supplies and could lead to future water savings), the results of the study will promote maximum utilization of state waters to a high degree.

h. The water activity assists in the recovery of threatened and endangered wildlife species or Colorado State species of concern.

While the Tailwater Study does not directly assist in the recovery of threatened or endangered wildlife, it will provide important information that can be integrated into water management decisions. With better information, decisions regarding water resource management can more carefully balance the needs of consumptive water users with those of threatened and endangered species and the environment. Moreover, if the Tailwater Study has the intended effect of continuing to encourage irrigation efficiency improvements, the associated water quality benefits would accrue to the Lower

Arkansas River ecosystem. Such ecosystem improvements could contribute to the overall recovery of threatened and endangered wildlife species.

i. The water activity provides a high level of benefit to Colorado in relationship to the amount of funds requested.

The first phase of the Tailwater Study provides a high level of benefit in relationship to the amount of funds requested. Though not easily quantified because the amount of water saved will ultimately depend on the results of the full study and the rate of sprinkler growth, the data and analysis generated from this phase of the Tailwater Study will provide a high level of benefit.

The anticipated reduction in the tailwater assumption and an increase in the maximum farm irrigation efficiency factor on the Fort Lyon is likely to lead to encourage increasing water efficiency and agricultural productively through installation of sprinkler systems on irrigated lands and reductions in return flow obligations under the Arkansas River Compact. This would result in less pressure on other Arkansas basin water supplies. It could similarly increase the potential transferable yield of Fort Lyon shares in, for example, a rotational municipal leasing - land fallowing program, which will benefit farmers and municipalities alike. Additionally, the data gathered and results obtained from the FIRI analysis have the potential to contribute to development of the Arkansas decision support system.

Just in the period between 2012 and 2014, the Fort Lyon Canal has seen more than a doubling of sprinklers operating under it and included in a Compact compliance plan. In 2012, there were 65 sprinklers on the Fort Lyon covered by a Compact compliance plan. In 2014, this number has increased to approximately 145 sprinklers. In 2014, these Compact compliance plans will provide for approximately 2000 acre-feet of "return flow maintenance water." If the rate of sprinkler installation continues during the first phase of the Tailwater Study, up to approximately 325 sprinklers on the Fort Lyon could be covered by Compact compliance plans. Extrapolating from the current "return flow maintenance requirements," this could mean more than a doubling in the amount of water needed for operation of those plans to approximately 4,500 acre-feet. If the Tailwater Study would result in a reduction of the tailwater assumption by 5% and an associated increase in farm irrigation efficiency factor by 5%, this could potentially result in 225 acre-feet of new water made available based on the number of anticipated sprinklers in 2017. A greater reduction in the tailwater assumption and associated increase in the farm irrigation efficiency would similarly result in even greater annual savings, and the savings would increase each year as more sprinklers are added. This is a significant amount of water and reflects a high degree of benefit from the funds requested for the Tailwater Study.

j. The water activity is complimentary to or assists in the implementation of other CWCB programs.

The Project both compliments and assists in the implementation of other CWCB programs. Most immediately, this data and analysis resulting from completion of the full Tailwater Study may be incorporated into the H-I Model and the ISAM and will further the CWCB goals of promoting more efficient use of water while ensuring Compact compliance, C.R.S. § 37-60-106(1)(i) and (r). It also has the potential to generate data that may be relevant for the Arkansas decision support system. Consistent

with these goals, the CWCB has previously provided financial assistance to the Lower Ark District formulate and implement cost-effective means to comply with the Irrigation Improvements Rules to avoid potential Compact violations. See e.g. S.B. 09-125.

Part IV. – Required Supporting Material

1. **Water Rights, Availability, and Sustainability** – This information is needed to assess the viability of the water project or activity. Please provide a description of the water supply source to be utilized, or the water body to be affected by, the water activity. This should include a description of applicable water rights, and water rights issues, and the name/location of water bodies affected by the water activity.

The Tailwater Study will facilitate more complete use of the water available to shareholders of the Fort Lyon Canal. The study will accordingly lead to better utilization of available water supplies within the Arkansas River basin. The results of the Tailwater Study are expected to positively affect all Fort Lyon Canal water rights by allowing the maximum utilization of those rights. Additionally, the results of the Tailwater Study are anticipated to have reduced pressure on water supplies currently being used to meet what are believed to be excessive return flow maintenance requirements. The Arkansas River as a whole may be positively affected by the results of the study.

2. Please provide a brief narrative of any related studies or permitting issues.

The Tailwater Study builds upon work previously conducted by Colorado State University in the Lower Arkansas River Basin regarding irrigation practices, water consumption, and return flows pursuant to a number of CWCB and other grants. As discussed above, it specifically seeks to refine the generalized 10% tailwater assumption that came out of that work.

The Tailwater Study also relates to prior work done by the Division 2 Engineer's Office in developing and refining ISAM, including the pond seepage study. Finally, it is anticipated that data and analysis from this study would be utilized in the anticipated Arkansas Decision Support System currently in development by the CWCB.

It is not currently anticipated that the first phase of the Tailwater Study would require any permits or approvals. Participation in the study would be voluntary and installation of equipment is anticipated to be on-farm only. However, if it is determined that any permits or approvals are required, Applicant will commit to obtaining such approvals.

3. Statement of Work, Detailed Budget, and Project Schedule

The statement of work will form the basis for the contract between the Applicant and the State of Colorado. In short, the Applicant is agreeing to undertake the work for the compensation outlined in the statement of work and budget, and in return, the State of Colorado is receiving the deliverables/products specified. **Please note that costs incurred prior to execution of a contract or purchase order are not subject to reimbursement**. All WSRA funds are disbursed on a reimbursement basis after review invoices and appropriate backup material.

See Exhibit A. *Additionally, maps depicting the irrigated acres under the Fort Lyon Canal and those parcels covered by a Lower Ark District-operated Rule 10 Compact compliance plan are attached hereto.*

REPORTING AND FINAL DELIVERABLE

Reporting: The applicant shall provide the CWCB a progress report every 6 months, beginning from the date of the executed contract. The progress report shall describe the completion or partial completion of the tasks identified in the statement of work including a description of any major issues that have occurred and any corrective action taken to address these issues.

Final Deliverable: At completion of the project, the applicant shall provide the CWCB a final report that summarizes the project and documents how the project was completed. This report may contain photographs, summaries of meetings and engineering reports/designs.

PAYMENT

Payment will be made based on actual expenditures and invoicing by the applicant. Invoices from any other entity (i.e. subcontractors) cannot be processed by the State. The request for payment must include a description of the work accomplished by major task, and estimate of the percent completion for individual tasks and the entire water activity in relation to the percentage of budget spent, identification of any major issues and proposed or implemented corrective actions. The last 10 percent of the entire water activity budget will be withheld until final project/water activity documentation is completed. All products, data and information developed as a result of this grant must be provided to the CWCB in hard copy and electronic format as part of the project documentation. This information will in turn be made widely available to Basin Roundtables and the general public and help promote the development of a common technical platform.

The above statements are true to the best of my knowledge:

Signature of Applicant: 

Print Applicant's Name: JAY WINNER, LOWER ARKANSAS VALLEY WATER CONSERVANCY DISTRICT

Project Title: FIRI ANALYSIS + TAILWATER STUDY ON THE FORT LYON CANAL

Date: JULY 11, 2014

Return an electronic version (hardcopy may also be submitted) of this application to:

Craig Godbout – WSRA Application
Colorado Water Conservation Board
1580 Logan Street, Suite 200
Denver, CO 80203
303-866-3441, ext. 3210 (office)
303-547-8061 (cell)
craig.godbout@state.co.us

Statement of Work

WATER ACTIVITY NAME – FIRI Analysis and Tailwater Return Flow Study on Fort Lyon Canal

GRANT RECIPIENT – Lower Arkansas Valley Water Conservancy District

FUNDING SOURCE – Water Supply Reserve Account (Statewide and Arkansas Basin)

INTRODUCTION AND BACKGROUND

The Lower Arkansas Valley Water Conservancy District ("Lower Ark") is committed to preserving agriculture in the Lower Arkansas River Basin. In the face of competing demands on limited water resources, encouraging improvements in irrigation efficiency and agricultural productivity is critical in preserving the agricultural economy and supporting rural communities. However, this must be achieved in a manner that ensures compliance with the Arkansas River Compact. Since adoption of the "Compact Rules Governing Improvements to Surface Water Irrigation Systems in the Arkansas River Basin in Colorado" (the "Irrigation Improvements Rules") in 2011, Lower Ark has stepped forward to prepare and administer the only Rule 10 Compact compliance plans on behalf of irrigation system improvement owners.

After operating a single Rule 10 Plan for the first two years, Lower Ark recognized the unique needs of the Fort Lyon Canal Company Rule 10 plan members and determined that these needs would be better addressed under a separate Rule 10 Plan. The Fort Lyon Canal, at over 113 miles long and irrigating approximately 94,000 acres, is the largest irrigation canal in Colorado. The Fort Lyon Canal is typically a water-short system, and Fort Lyon shareholders also make up approximately 2/3 of the irrigated acreage covered by Compact compliance plans. In the fall of 2013, a Fort Lyon Rule 10 Association (FLR10) was formed and was recently incorporated in order to establish a cooperative, self-sustaining entity for Fort Lyon Canal shareholders who face compact compliance obligations under the Irrigation Improvements Rules.

The FIRI Analysis and Tailwater Return Flow Study on the Fort Lyon Canal (the "Project") will first follow the Farm Irrigation Rating Index (FIRI) method to evaluate irrigation efficiency on the Fort Lyon Canal. Those results will be cross-checked by conducting a small-scale investigation of on-farm tailwater return flows. The Project will enable a better understanding of both canal-wide farm irrigation efficiency and how and in what amount tailwater return flows actually accrue to the Arkansas River for use in a variety of contexts. With respect to Compact compliance issues, the results of the study will be compared to the irrigation efficiency factor and tailwater assumption contained in the Irrigation System Analysis Model (the "ISAM"), as derived from the H-I Model.

The ISAM was developed to provide a standard means for evaluating whether a specific irrigation system improvement results in a reduction or change in the amount, timing, or location of historical seepage losses or return flows in violation of Article IV-D of the Arkansas River Compact and to implement the Irrigation Improvements Rules. The ISAM allows for a comparison of seepage losses and computed return flows between the pre-improvement and post-improvement conditions. In making this comparison, the ISAM assumes a standard 10% of farm headgate deliveries are returned to the river as tailwater under flood-irrigation (pre-improvement) conditions and a 65% maximum irrigation efficiency factor for flood irrigation. The

tailwater assumption and irrigation efficiency factor are widely believed to be overly-conservative, particularly on the water-short Fort Lyon Canal where most of the tailwater from one field is likely beneficially used by crops on other fields and does not reach the stream system. If the irrigation efficiency factor and tailwater assumption in the ISAM are, in fact, overly-conservative (i.e., there is less than 10% of tailwater return flows from flood-irrigated farms) and the percentage of crop consumption (irrigation efficiency) is greater, then return flow maintenance deliveries are being made pursuant to Compact compliance plans in excess of actual changes to return flows associated with the installation and use of irrigation system improvements under the Irrigation Improvements Rules.

Given the extensive physical size of the Fort Lyon Canal, the Project will be pursued in a phased approach. The first phase for which Applicant is currently seeking funding, will involve two parts. First, it will utilize the Farm Irrigation Rating Index (FIRI) method on canal-wide basis to analyze irrigation efficiency. This analysis will involve extensive data collection and observation pertaining to irrigation management and systems with the goal of establishing a representative canal-wide irrigation efficiency. Applicant will then select a limited number of farms on a single section of the Fort Lyon Canal to provide sufficient data on tailwater return flows to evaluate whether the initial results support pursuing a more broad-based, geographically extensive study on a canal-wide basis.

The goal of Phase One of the Project would be to obtain high quality data on farm efficiency pursuant to a FIRI analysis and on the actual amounts of tailwater return flows occurring from flood-irrigated farms on a subset of the Fort Lyon Canal. This data and analysis could then be used to assess whether broader on-site field irrigation evaluations would be beneficial and are justified for future phases. If undertaken, the more extensive, second phase would be conducted with the aim of adjusting the tailwater assumption and irrigation efficiency factor in the H-I Model and the ISAM to more accurately reflect actual conditions. By reducing the return flow maintenance deliveries required by Compact compliance plans operating under the Irrigation Improvements Rules, pressure on limited water supplies to meet these delivery obligations will similarly be lessened and additional water sources will remain available for beneficial use to meet other demands within the Arkansas River Basin. Additionally, the transferrable yield associated with Fort Lyon shares in both temporary and permanent changes could be increased as a result of reductions in assumed tailwater return flows and increases in irrigation efficiency. The Project's data could also be incorporated into the anticipated Arkansas Decision Support System and similar water management tools providing high-quality information to assist in Basin-wide water management decisions. Each of these potential Project outcomes could directly lead to reductions in the agricultural and M&I gap identified in the Arkansas Basin Consumptive Needs Assessment: 2030 (2008).

OBJECTIVES

The objectives are as follows:

- Objective 1 – Collect and Analyze High-Quality Data on Farm Irrigation Efficiency: Applicant will collect irrigation management and system data and make necessary field observations required by the Farm Irrigation Rating Index (FIRI) method to allow for determination of the six water management factors and the nine system factors. A potential irrigation efficiency will be established utilizing published technical data. Data gathered will be studied and considered to determine the appropriate management and

system factors used in the FIRI analysis that have positive and negative impacts on efficiency to arrive at an average, canal-wide irrigation efficiency.

- Objective 2 – Collect High-Quality Data on Tailwater Return Flows from Flood-Irrigated Farms: Applicant will identify 3-5 representative farms within a single section of the Fort Lyon Canal and will conduct measuring and monitoring for one or two irrigation seasons to gather data on irrigation efficiency tailwater return flows.

- Objective 3 – Analyze Data and Verify Tailwater Results: Data gathered will be analyzed to determine actual tailwater return flows and compare those to the factors obtained from the FIRI analysis.

- Objective 4 – Evaluate Potential for Phase Two in Support Possible Integration of Results into the H-I Model and the ISAM: After completion of Phase One of the Project, Applicant will evaluate, in coordination with interested parties and the Division 2 Engineer's Office, whether the results justify and support a broader, more extensive study to perform field-specific evaluations on a canal-wide basis. The methodologies and approaches used in conducting the both this Phase One and a potential Phase Two of the Project will be designed to provide a basis for any potential adjustment to the H-I Model's and ISAM's tailwater and farm efficiency assumption pursuant to the Irrigation Improvements Rules.

TASKS

TASK 1 – Conduct Farm Irrigation Rating Index Analysis

Description of Task
This task will determine locations of flood-irrigated farms under the Fort Lyon and identify and contact their land owners to obtain permission for inclusion in the Project. This task will include site visits and tours along the Fort Lyon Canal to observe and document irrigation practices, type of irrigation method used and farmer interviews to determine management and system arrangements. This evidence will be used to determine potential irrigation efficiencies and the factors used in the FIRI method analysis and to perform the FIRI method analysis on a farm-by-farm basis for participating farms. These values will be used to determine an average canal-wide irrigation efficiency.

Method/Procedure
Farms will be identified through review of Division 2 Office GIS mapping, site visits, and meetings with persons knowledgeable about farms located on the Fort Lyon Canal, including the Division 2 Engineer's Office and the Fort Lyon Canal Company. Owners of suitable farms for inclusion in the Project will be contacted to determine whether and to what level the owner is willing to participate. If the level of participation exceeds the budget or schedule limitations of the proposed study, farms will be chosen in a manner that produces a representative dataset of the characteristics found under canal.

Applicant will then observe and document, on a canal-wide basis, the range of irrigation management practices and methods used and document system infrastructure. Management documentation will include, among others, ability to measure water and soil moisture, irrigation expertise, level of irrigation system maintenance, and ability to control water deliveries. System

documentation will include, among others, ability to distribute water efficiently and apply uniformly, slopes and length of fields, ability to reuse tailwater, and flexibility and maintenance level of irrigation equipment. Other canal-wide data needed for the FIRI method analysis will also be collected and individual interviews and farm site visits will be held with owners of participating farms to document specific management practices employed and to evaluate their irrigation system for efficiencies.

Applicant will then conduct the FIRI method analysis. This begins with an analysis of potential efficiency for different types of irrigation systems and then considers numerous management and system factors that have positive and negative impacts on efficiency to arrive at an actual farm irrigation efficiency for the farm being analyzed. Once potential efficiencies are selected, irrigation efficiencies will be determined using the FIRI method on a farm-by-farm basis for participating farms. These results will be weighted and compared to general canal-wide observations to determine an average canal-wide irrigation efficiency.

Deliverable

This task deliverable will include: maps and legal descriptions of the selected farms; documentation of management and system observations for participating farms and general descriptions of the same for the Fort Lyon Canal as a whole; and a report that describes the methods and procedures used during the study and summarizes the FIRI analysis results and conclusions.

TASK 2 – Farm Identification for Tailwater Study

Description of Task

This task will identify three to five flood-irrigated farms located within a single section of the Fort Lyon Canal that represent a broad range of characteristics under the Fort Lyon Canal, including farm size (individual field sizes and overall farm size), terrain, type of irrigation delivery system (earthen ditch, concrete ditch, gated pipe, etc.), and feasibility of monitoring of tailwater return flows.

Method/Procedure

Farms with the necessary characteristics will be identified through review of maps, aerial photographs, crop records, and meetings with persons knowledgeable about farms located on the Fort Lyon Canal. Owners of suitable farms for inclusion in the study will be contacted to determine whether the owner is willing to participate in the study. Meeting(s) with Division 2 Engineering personnel will take place to discuss potential farms for inclusion and obtain input as to preferred farm locations. Meetings will also take place with the Fort Lyon Canal Company board and superintendent to explain the purpose and operations plan of the study and address any questions or concerns they may have.

Deliverable

This task deliverable will be maps and legal descriptions of the selected farms, the locations and types of equipment to be installed on each farm, and description as to the basis for inclusion in the study.

TASK 3 – Purchase and Installation of Measuring and Monitoring Equipment

Description of Task

This task will carefully consider and determine locations of flow measurement equipment and determine the appropriate type and size of measuring and recording equipment for each farm.

Applicant will then purchase and properly install the equipment.

Method/Procedure
Applicant will work with the Owners of the participating farms to determine proper locations for flow measurement/recording equipment installation to ensure accurate and reliable data can be taken. This task will also require research and conversations with irrigation measurement/recording device companies to determine the proper equipment for each farm in the study. Applicant will confirm with Division 2 Engineering personnel that the selected equipment is acceptable and standard for irrigation flow measurement and measurement of crop consumption.

Each farm will be assessed individually to determine the appropriate type of measurement equipment, but in general, Parshall, trapezoidal and cutthroat flumes, as well as sharp-crested weirs will be used, all equipped with stilling wells and automatic water-level data loggers, to measure applied volume flowing onto a farm and tailwater volume flowing off of a farm. Permanent measurement structures owned by study participants or the Fort Lyon Canal Company will also be used when feasible. Once selected, equipment will be installed using standard installation procedures and Applicant will provide an opportunity to Division 2 Engineering personnel to inspect the equipment.

Deliverable
This task will be completed with documentation of the equipment purchased and a brief narrative and/or photographs showing the sites where the measuring and monitoring equipment was installed.

TASK 4 – Site Monitoring and Data Collection

Description of Task
This task will be to monitor and collect flow data from all equipment within the study and ensure each remains properly installed.

Method/Procedure
When possible, each farm will be visited before an irrigation run serving the farms in the selected section begins to ensure all equipment remains in good working condition. With the long length of the Fort Lyon Canal and the large number of headgates it serves in relation to its relatively small capacity, it is operated in numerous sections. Therefore, only farmers in the currently-active section are allowed to receive water at one time. This period of time when water can be received is called a “run”. Typically, farmers are given at least 12 hours of notice prior to receiving water and each run is normally 48 hours in length. This method of operation will facilitate monitoring and data collection activities. After each run is complete, study personnel will return to each irrigated farm and download all flow data from both of the farm’s data recorders and save it to a laptop computer. Data will be given a preliminary review to ensure it is reasonable and representative of the flows and volumes expected for that field.

Deliverable
The deliverable for this task item will be the data log sheets for each of the farms included in the study and any summaries of such data.

TASK 5 – Data Processing and Analysis

Description of Task
Once all above tasks have been completed, study personnel will analyze the flow data to determine the amount of tailwater return flow volume lost from each farm as a total volume and as a percentage of volume applied to the farm.

Method/Procedure
Tailwater measured from each farm will be analyzed as a total volume and as a percentage of supply delivered to the farm. Precipitation data will be downloaded from the CoAgMet website to determine precipitation occurring at stations closest to each farm. The tailwater volume will be reduced by the volume of precipitation occurring during an irrigation event at a specific farm. This analysis will be done for each farm on: a per irrigation run basis, a per year basis, and as a canal-wide per year basis. A range and an average will be determined and compared to CSU's study reported in "Irrigation Practices, Water Consumption, & Return Flows in Colorado's Lower Arkansas River Valley."

Deliverable
The deliverable for this task item will be a report that: (1) describes the methods and procedures used during the study and (2) summarizes the study results and conclusions.

TASK 6 – Evaluation of Potential Phase II of Project

Description of Task
The results of this Project will be carefully evaluated by Applicant, in cooperation with other interested parties including the Division 2 Engineer, to determine whether the results justify pursuing a second phase of the Project that would be a more detailed and measurement-intensive field and return flow evaluation. Phase Two of the Study could potentially support a modification to the H-I Model and the ISAM.

Method/Procedure
Study personnel will meet with Division 2 personnel and other appropriate State water officials to present the results of this first phase of the Project. Applicant will also meet with other interested parties, such as the Fort Lyon Canal Board, to discuss the results of Phase One. Taking into account the meeting, Applicant will determine whether the results of the FIRI and initial tailwater study are sufficient to justify pursuing a second phase of the study that would involve a more detailed irrigation efficiency examination of a sufficient farms geographically dispersed along the Fort Lyon Canal to support a potential modification to the H-I Model and the ISAM pursuant to the procedure set forth in the Irrigation Improvements Rules.

Deliverable
Applicant will prepare a recommendation as to whether a second phase of the Project should be pursued, which will include the various considerations upon which such recommendation is based and whether the recommendation is supported by the Division 2 Engineer's Office and other interested parties.

REPORTING AND FINAL DELIVERABLE

Reporting
The Applicant shall provide the CWCB a progress report every 6 months, beginning from the date of the executed contract. The progress report shall describe the completion or partial

completion of the tasks identified in the statement of work including a description of any major issues that have occurred and any corrective action taken to address these issues.

Final Deliverable

At completion of the Project, the Applicant shall provide the CWCB a final report that summarizes the results of the project and documents how the project was completed. This report may contain maps, photographs, summaries of meetings and engineering reports/designs.

BUDGET

Anticipated budget tables for the Project are provided below. These tasks correspond to those identified above.

	Equipment/ Direct Costs	Labor	Total Project Costs
Task 1 – Conduct FIRI Analysis	$ 20,040	$ 84,430	$ 104,470
Task 2 – Farm Identification	$ 974	$ 6,915	$ 7,889
Task 3 – Purchase and Installation of Equipment	$ 26,798	$ 9,900	$ 36,698
Task 4 – Site Monitoring and Data Collection	$ 1,680	$ 36,025	$ 37,705
Task 5 – Data Processing and Analysis	$ 224	$ 21,120	$ 21,344
Task 6 – Evaluate Phase 2	$ 280	$ 16,750	$ 17,030
Total Costs	$ 49,996	$ 175,140	$ 225,136
Matching Funds			$ 50,000
Total Grant Request (Basin and Statewide)			$ 175,136

Hours:

	Project Manager/ Engineer	Staff Engineer	Engineering Technician	Legal	Total
Billing Rate	$150	$55	$50	$240	
Task 1 – Conduct FIRI Analysis	195	490	507	12	$ 84,430
Task 2 – Farm Identification	20	45		6	$ 6,915
Task 3 – Purchase and Installation of Equipment	10	80	80		$ 9,900
Task 4 – Site Monitoring and Data Collection	27	340	300		$ 36,025
Task 5 – Data Processing and Analysis	80	120	12	8	$ 21,120
Task 6 – Evaluate Phase 2	60	10		30	$ 16,750
Total Cost					$ 175,140

Other Direct Costs:

Item:	Mileage	Materials	In-Kind Contributions	Total
Task 1 – FIRI Analysis	9,000	$ 15,000		$ 20,040
Task 2 – Farm Identification	400	$ 750		$ 974
Task 3 – Purchase and Installation of Equipment	800	$ 26,350		$ 26,798
Task 4 – Site Monitoring and Data Collection	3,000			$ 1,680
Task 5 – Data Processing and Analysis	400			$ 224
Task 6 – Evaluate Phase 2	500			$ 280
Total Cost				$ 49,996

SCHEDULE

A project schedule including key milestones for each task and the completion dates or time period from the Notice to Proceed (NTP) is as follows:

Task	**Months**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Task 2 – FIRI Analysis												
Task 2 – Farm Identification												
Task 3 - Equipment												
Task 4 – Site Monitoring and Data Collection												
Task 5 – Data Processing and Analysis												
Task 6-Evaluate Phase Two												

Task	**Month**															
	13	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**
Task 1																
Task 2																
Task 3																
Task 4																
Task 5																
Task 6																

ID# 133
ID# 110
ID# 54
ID# 174
ID# 175
ID# 115
ID# 60
ID# 76
ID# 177
ID# 113
ID# 116
ID# 153
ID# 83
ID# 73
ID# 57
ID# 166
ID# 77
ID# 85
LAS ANIMAS
LAMAR
Arkansas River

COLORADO
Division of Water Resources
Department of Natural Resources

Projection: Universal Transverse Mercator, Zone 13, North American Datum 1983, Meters
2013 NAIP Aerial Photos

Div. of Water Resources, Div. 2

Division Of Water Resources
State Of Colorado

LAVWCD Irrigation Improvement Farms Under The Ft Lyon - 2014 (Not on Major Drains)

Miles
0 0.5 1 2 3
1:160,000

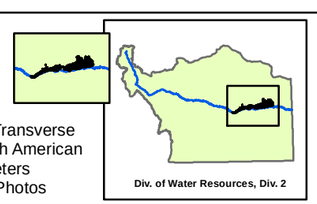
N

Fields in LAVWCD Rule 10 Plan
Fields under the Ft Lyon Canal
Other Fields

ID# 159
ID# 84
ID# 176, approximate location of pivot
ID# 117
ID# 58
ID# 134
ID# 146
ID# 156
ID# 59
ID# 108
ID# 168
ID# 172
ID# 56
ID# 109
ID# 123
ID# 158
ID# 124
ID# 125
ID# 88
ID# 102
ID# 121
ID# 169
ID# 74
ID# 165
ID# 72
Arkansas River

COLORADO
Division of Water Resources
Department of Natural Resources

Projection: Universal Transverse Mercator, Zone 13, North American Datum 1983, Meters
2013 NAIP Aerial Photos



Division Of Water Resources
State Of Colorado

LAVWCD Irrigation Improvement
Farms Under The Ft Lyon - 2014
(Wiley Drain)

N

Miles
0 0.275 0.55 1.1 1.65
1:70,000

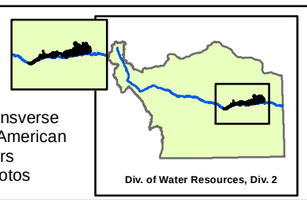
Fields in LAVWCD Rule 10 Plan
Fields under the Ft Lyon Canal
Other Fields

STATE OF COLORADO 1876

ID# 98
ID# 100
ID# 105
ID# 103
ID# 90
ID# 87
ID# 160
ID# 167
ID# 89
ID# 71
ID# 104
ID# 92
ID# 135
ID# 138
ID# 80
ID# 70
Arkansas River
LAMAR

COLORADO
Division of Water Resources
Department of Natural Resources

Projection: Universal Transverse Mercator, Zone 13, North American Datum 1983, Meters
2013 NAIP Aerial Photos



Division Of Water Resources
State Of Colorado

LAVWCD Irrigation Improvement
Farms Under The Ft Lyon - 2014
(Pleasant Valley Drain)

N

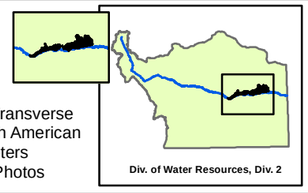
Miles
0 0.275 0.55 1.1 1.65
1:70,000

- Fields in LAVWCD Rule 10 Plan
- Fields under the Ft Lyon Canal
- Other Fields

ID# 63
ID# 164
ID# 64
ID# 173
ID# 67
ID# 69
ID# 99
ID# 97
ID# 95
ID# 78
ID# 106
ID# 68
ID# 122
ID# 79
ID# 163
ID# 151
ID# 65
ID# 157
ID# 132
ID# 81
ID# 107
Arkansas River
Arkansas River

COLORADO
Division of Water Resources
Department of Natural Resources

Projection: Universal Transverse Mercator, Zone 13, North American Datum 1983, Meters
2013 NAIP Aerial Photos



Division Of Water Resources
State Of Colorado

LAVWCD Irrigation Improvement
Farms Under The Ft Lyon - 2014
(May Valley Drain)

Miles
0 0.3 0.6 1.2 1.8
1:70,000

N

Fields in LAVWCD Rule 10 Plan
Fields under the Ft Lyon Canal
Other Fields