COLORADO
Colorado Water Conservation Board
Department of Natural Resources

1313 Sherman Street, Room 718
Denver, CO 80203

March 23, 2015

Mr. Perry Cabot, PhD., P.E. Water Resource Specialist
Colorado State University
2002 Campus Delivery
Fort Collins, CO 80533-2002

RE: Notice to Proceed - ATM Grant – Colorado Water Bank – CTGG1 2015-3032

Dear Perry,

This letter is to inform you that the contract to assist in the above ATM grant project was signed on March 20, 2015. The original contract will be mailed to you.

With the executed contract, you are now able to proceed with the project and invoice the State of Colorado for costs incurred through December 31, 2017. Please provide the project name, contract or purchase order number, when corresponding with or invoicing the State of Colorado for your project. Upon receipt of your invoice(s), the State of Colorado will provide payment no later than 45 days after review and signed approval by the project manager. I wish you much success in your project.

If you have any questions or concerns regarding the project, please contact me.

Sincerely,

//s//

Michelle Garrison
Water Resource Specialist
O 303-866-3441 x3213| F 303-866-4474
1313 Sherman St., Rm. 721, Denver, CO 80203
michelle.garrison@state.co.us | www.cwcb.state.co.u

Attachments

CMS# 75831

STATE OF COLORADO
Colorado Water Conservation Board
INTERAGENCY AGREEMENT
with
Board of Governors of the Colorado State University System acting by and through Colorado State University
Contract Number CTGG1 2015-3032

1. PARTIES

This Interagency Agreement (hereinafter called "Agreement") is entered into by and between the Colorado Water Conservation Board (hereinafter called "Payor"), and the Board of Governors of the Colorado State University System acting by and through Colorado State University (hereinafter called "Payee"), who may collectively be called the "Parties" and individually a "Party", both of which are agencies or higher education institutions of the STATE OF COLORADO, hereinafter called the "State".

2. EFFECTIVE DATE AND NOTICE OF NONLIABILITY.

This Agreement shall not be effective or enforceable until it is approved and signed by the Colorado State Controller or designee (hereinafter called the "Effective Date"), but shall be effective and enforceable thereafter in accordance with its provisions.

3. RECITALS

A. Authority, Appropriation, And Approval

Authority to enter into this Agreement exists pursuant to State Fiscal Rule 3-3 and funds have been budgeted, appropriated and otherwise made available pursuant to Colorado Revised Statutes (CRS) 37-60-106 and 37-60-121, and Senate Bill 09-125 adopted by the 2009 General Assembly and a sufficient unencumbered balance thereof remains available for payment. Required approvals, clearance and coordination have been accomplished from and with appropriate agencies.

B. Purpose

This project seeks to expand current agronomic feasibility assessments of partial and full season reductions to irrigated alfalfa and grass hay, as part of a Colorado Water Bank. By expanding the current study on alfalfa and grass hayfields, the project will help agricultural producers and the Water Bank Workgroup understand opportunities to save water through reduced irrigation, without adversely affecting long-term agronomic sustainability. The other purpose is to measure the irrigation water management (IWM) on project fields to calculate the amount of applied water (e.g., irrigations) and saved consumptive use (CU), for comparison with similar fields across their respective regions.

4. TERM AND EARLY TERMINATION

A. Term-Work Commencement

The Parties respective performances under this Agreement shall commence on the later of either the Effective Date or February 27, 2015. This Agreement shall terminate on December 31, 2017 unless sooner terminated or further extended as specified elsewhere herein. Either Party may terminate this Agreement by giving the other Party 30 days prior written notice setting forth the date of termination. Upon termination the liabilities of the Parties for future performance hereunder shall cease, but the Parties shall perform their respective obligations up to the date of termination.

5. STATEMENT OF WORK

A. Work

Payee shall complete the Work and its other obligations as described herein and in **Exhibit A** on or before December 31, 2017.

B. Goods and Services

Payee shall procure goods and services necessary to complete its obligations. Such procurement shall be accomplished using Agreement Funds and shall not increase the maximum amount payable hereunder by Payor.

6. PAYMENTS-MAXIUMUM AMOUNT

The maximum amount payable under this Agreement to Payee by Payor is $180,000. Payor shall make payment for purchases of goods and services within 45 days after receipt of valid invoices from Payee. Payments shall be made by an interagency transfer in lieu of a State warrant whenever possible. The maximum amount payable by Payor to Payee during each State fiscal year of this Agreement shall be:

$180,000 in FY2015
$180,000 in FY2016, minus any funds expended in FY2015
$180,000 in FY2017, minus any funds expended in FY2015 and FY2016
$180,000 in FY2018, minus any funds expended in FY2015, FY2016 and FY2017

7. RECORDS-MAINTENANCE AND INSPECTION

A. Maintenance

During the term of this Agreement and for a period terminating upon the later of **(i)** the five year anniversary of the final payment under this Agreement or **(ii)** the resolution of any pending Agreement matters (the "Record Retention Period"), each Party shall maintain, and allow inspection and monitoring by the other Party, and any other duly authorized agent of a governmental agency, of a complete file of all records, documents, communications, notes and other written materials, electronic media files, and communications, pertaining in any manner to the work or the delivery of services or goods hereunder.

B. Inspection

Payor shall have the right to inspect Payee's performance at all reasonable times and places during the term of this Agreement. Payee shall permit Payor, and any other duly authorized agent of a governmental agency having jurisdiction to monitor all activities conducted pursuant to this Agreement, to audit, inspect, examine, excerpt, copy and/or transcribe Payee's records related to this Agreement during the Record Retention Period to assure compliance with the terms hereof or to evaluate performance hereunder. Monitoring activities controlled by Payor shall not unduly interfere with Payee's performance hereunder.

8. CONFIDENTIAL INFORMATION-STATE RECORDS

Each Party shall treat the confidential information of the other Party with the same degree of care and protection it affords to its own confidential information, unless a different standard is set forth in this Agreement. Each Party shall notify the other Party immediately if it receives a request or demand from a third party for records or information of the other Party.

9. FAILURE TO PERFORM-DISPUTES

The failure of a Party to perform its respective obligations in accordance with the provisions of this Agreement is a breach of this Agreement. In the event of disputes concerning performance hereunder or otherwise related to this Agreement, the Parties shall attempt to resolve them at the divisional level. If this fails, disputes shall be referred to senior departmental management staff designated by each Party. If this fails, the executive director of each Party shall meet and attempt resolution. If this fails, the matter shall be submitted in writing by both Parties, or either of them, to the State Controller, whose decision shall be final.

10. NOTICE AND REPRESENTATIVES

Each individual identified below is the principal representative of the designating Party. All notices required to be given hereunder shall be hand delivered with receipt required or sent by certified or registered mail to such Party's principal representative at the address set forth below. In addition to, but not in lieu of a hard-copy notice, notice also may be sent by e-mail to the e-mail addresses, if any, set forth below. Either Party may from time to time designate by written notice substitute addresses or persons to whom such notices shall be sent. Unless otherwise provided herein, all notices shall be effective upon receipt.

Payor:

Michelle Garrison, Program Manager Water Resources Specialist
Colorado Water Conservation Board
1313 Sherman Street, Rm. 718
Denver, CO 80203
Michelle.garrison@state.co.us

Payee:

Perry Cabot, PhD., P.E.,Water Resources Specialist
CSU, CWI
3168 B ½ Rd.
Grand Junction, CO 81503
Perry.cabot@colostate.edu

11. GENERAL PROVISIONS

A. Assignment

The rights and obligations of each Party hereunder are personal to such Party and may not be transferred, assigned or subcontracted without the prior, written consent of the other Party.

B. Order of Precedence

In the event of conflicts or inconsistencies between this Agreement and its exhibits and attachments, such conflicts or inconsistencies shall be resolved by reference to the documents in the order of priority: exhibits and attachments first; this Agreement second.

C. Third Party Beneficiaries-Negation

Enforcement of all rights and obligations hereunder are reserved solely to the Parties. Any services or benefits which third parties receive as a result of this Agreement are incidental and do not create any rights for such third parties.

CTGG1 2015-3032
CMS#~~77091~~ 75831

12. SIGNATURE PAGE

THE PARTIES HERETO HAVE EXECUTED THIS INTERAGENCY AGREEMENT

*** Persons signing for Parties hereby swear and affirm that they are authorized to act on behalf of their respective Party and acknowledge that the other Party is relying on their representations to that effect.**

STATE OF COLORADO
John W. Hickenlooper, Governor

Board of Governors of the Colorado State University System acting by and through Colorado State University

Signature
By: David B Doty, Associate Director
Title: Sponsored Programs

Date: 2/11/15

Department of Natural Resources
Mike King, Executive Director

Rebecca mitchell

By: Rebecca Mitchell Chief,
Water Supply Planning Section, CWCB
Signatory avers to the State Controller or delegate that Grantee has not begun performance or that a Statutory Violation waiver has been requested under Fiscal Rules

Date: 2-25-15

ALL CONTRACTS REQUIRE APPROVAL BY THE STATE CONTROLLER

STATE CONTROLLER
Robert Jaros, CPA, MBA, JD

By: Susan Bovey

Date: 3/20/15

Exhibit A: Scope of Work

Monitoring Consumptive Use and Agronomic Sustainability for Split-Season Irrigation of Alfalfa and Grass Hayfields under the Auspices of a Western Slope Water Bank

Phase IIC Feasibility Study

Collaborating Investigators:

Dr. Joe Brummer, CSU, Soil and Crop Sciences
Dr. Perry Cabot, CSU, Colorado Water Institute, Extension, Agricultural Experiment Station
Dr. José Chávez, CSU, Civil and Environmental Engineering

The following will also be available for consultation during the project:
Dr. Abdel Berrada, CSU, Agricultural Experiment Station – Yellow Jacket
Dr. Greg Litus, CSU, Agricultural Experiment Station – Orchard Mesa (available for consultation)
Dr. Reagan Waskom, CSU, Director, Colorado Water Institute
Mr. Eric McPhail, County Director, CSU Extension-Gunnison.
Mr. John Rizza, CSU, Extension Specialist, Range and Small Acreage
Ms. Wendy Ryan, CSU, Colorado Climate Center

Introduction & Background:

The Water Bank Workgroup (WBWG) is a representative group of stakeholders that is exploring the use of a voluntary and compensated market approach to temporarily reduce consumptive uses in the Colorado River Basin in Colorado. The WBWG wants to develop solutions that strike a balance between urban, agricultural and environmental needs. The group, which was formed in 2009, consists of the Colorado River District, Southwestern Water Conservation District, The Nature Conservancy, the Front Range Council, and the State of Colorado. We regularly consult with agricultural representatives, Native American tribes, and the Bureau of Reclamation. The WBWG's effort is aimed at avoiding long-term agricultural dry up and water supply disruption on the West Slope while minimizing risk for all water Colorado River users. As the Water Bank Workgroup continues to define the operational aspects of the program, there exists a need to develop approaches to reduce or curtail irrigation for a portion of the growing season, without adversely affecting long-term agronomic sustainability. This proposal will examine reduced irrigation on six study field on the West Slope to better understand agronomic impacts, recovery time, and the amount of saved water that could be available to the water bank.

Goals:

1. Continue and expand the agronomic evaluations conducted by the WBWG in Phases 1, 2A, and 2B to investigate the feasibility of partial and full season irrigation reduction of grass and alfalfa on the west slope. This project will produce on-farm, real life, information for agricultural producers and the WBWG to understand consumptive use savings through reduced irrigation and whether long-term agronomic sustainability is affected.
2. Measure the irrigation water management (IWM) on project fields to calculate saved applied water (e.g., irrigations) and saved CU, for the larger purpose of estimating these parameters on comparable fields across their respective regions.

Objectives:

1. Understand the recovery period associated with bringing grass pastures and alfalfa fields back into production, after multiple (1, 2 and 3) years of reduced irrigation.
2. Determine the impacts to forage yield and quality on alfalfa and grass hayfields, after multiple years of reduced irrigation.
3. Derive estimates of saved applied water (e.g., irrigations) and saved CU that may be credited to alfalfa and grass hayfields where split-season irrigation is practiced under structured guidelines.

TASKS

TASK 1 (GRAD STUDENTS) – Graduate student and intern interviews and selection.

Description:
There will be one (1) Masters-Level graduate student and one (1) summer intern required for the project. The graduate student will commence their degree program in Spring 2015 and complete their thesis defense in Spring 2017. Along this schedule, the grad student will complete four semesters of coursework (in-state tuition) and have an additional semester of 1.0 research credit to complete their thesis. The graduate student will be expected to relocate to Grand Junction during the summer months. The CSU Orchard Mesa Agricultural Experiment Station (AES) will provide housing free of charge. By relocating them to Grand Junction, the amount of travel time and complication of logistics will be greatly minimized.

Additionally, the first year of the project (2015) will be heavily involved in field work to establish and instrument the research sites. The budget also includes funding for an intern to be hired locally for 3.5 months. This in turn is budgeted as a non-student hourly because they may originate from a non-CSU University. Dr. Cabot is familiar with several potential intern candidates locally from his 2014 Summer field season.

All of the Principal Investigators as well as members of the WBWG will be involved in the selection of the graduate students and interns. Graduate students will assume their Masters Degrees from the Department of Soil and Crop Sciences (Prof. Joe Brummer), or from the Department of Civil and Environmental Engineering (Prof. José Chavez). The graduate committee for the students would likely consist of Prof. Joe Brummer, Prof. José Chavez and Dr. Perry Cabot, with an outside member from the Water Bank Workgroup. Members of the graduate committee will supervise the students and interns during the course of the project; therefore some faculty time has been budgeted for the summer salaries.

Deliverables:

• Selection of graduate student by Spring 2015 and supervision through Spring 2017.
• Selection and supervision of a field intern for Summer 2015.

TASK 2 (SITE DEVELOPMENT) – Construction of research sites and deployment of monitoring equipment

Description:
In Year 1 (2015), the research sites will be established and instrumented. A reference plot on which a "typical" irrigation regimen (i.e., irrigating on the basis of time, availability, and/or visual cues) is practiced will also be established and instrumented. The reference plots will be irrigated to reflect a condition that would occur on fields that do not participate in the water bank. The experimental concept, therefore, is to determine the agronomic and biophysical impacts of reduced irrigation versus irrigation to maximize yield or irrigation to fully utilize water rights throughout the season (i.e., "typical" irrigation).

During Year 1 (2015), partial-season irrigation (alfalfa fields) or non-irrigation (grass pasture) will also commence on the test plot within the research sites. This test plot is expected to comprise half the acreage of the research site. During Year 2 (2016), some decisions will have to be made on the sequence of irrigation:

- *Option 1*. The same experimental design will be imposed on the research sites to compare "typical" irrigation throughout the season versus partial-season irrigation. Under *Option 1*, the test-plots would be expected to remain under the regime of reduced irrigation, in order to determine the multi-year impacts of this practice. *Option 1* is the most preferred and likely choice, due to the goals of the Water Bank Partners, although this option depends on the availability of funding to continue the project.
- *Option 2*. The experimental design would be modified to bring the test-plots back into full production, after only one year of reduced irrigation.

Partial-season irrigation practices will vary for the alfalfa and grass/hay research sites. Partial-season irrigation is optimal for perennial crops such as alfalfa and grass, which are prevalent in western Colorado, but has not been a common practice in the region.

Grass/Hay Irrigation. One of the criterial for research site selection is the availability of gated pipe, which will allow irrigation rates to be easily controlled. As explained above, the reference plots will receive irrigation at rates comparable to historic or agronomic baselines. The test-plots for grass/hay will not be irrigated, and thereby will only survive on natural rainfall or stored soil moisture. Understanding the year-over-year carryover of the soil moisture deficit will be critical.

Alfalfa Irrigation. Comparatively, summer *deficit* irrigation of alfalfa has shown potential to conserve more than 22 inches per year in the Palo Verde and Imperial Valleys (Bali et al., 2010; Bali et al., 2001). It is important to note that this project focuses on *partial-season* irrigation, which differs from deficit irrigation, in that some cuttings of alfalfa will receive water at rates equal to historic or agronomic requirements. At some point in the season, the field will be intentionally stressed during a period where plants are deprived of irrigation water. The start of this period can be after the 1st cutting or after the 2nd cutting. Another alternative would be irrigate the 1st cutting, then eliminate irrigation during the peak CU period of the summer, and then re-initiate irrigation later in the season. Irrigation of the alfalfa test plots will be designed in manner and sequence that best represents the desired administrative structure of the Water Bank.

The sites are being selected for their rectangular or square shape, however, the collection of data will be done in specific locations (e.g., 1 m2, randomized or strategic) within the test plots, so as to gain the most information from sampling replication and redundancy.

The *existing study* (Phase IIB) is comprised of four (4) grass/hay sites (C-Ranch in Hayden, F-Ranch in Steamboat Lake, T-Ranch in Gunnison, BV-Ranch in Kremmling) and 3 alfalfa sites (K-Farm in Eckert, Western Colorado CSU-AES in Fruita, Southwest CSU-AES in Yellow Jacket). The different locations and parameters for the *proposed* new study are detailed below in Table 1. There are six (6) research sites proposed with an optional seventh site for Garfield County in the Rifle Creek area. The primary priority used for research site selection under this proposed study was to locate the sites within the largest water user districts that would be approached first to participate in the Water Bank. The sites of greatest interest are those in the Grand Valley Water Users Association (GVWUA) and the Uncompahgre Valley Water Users Association (UVWUA), represented by the sites in Mesa and Montrose Counties. Additionally, the site in Delta County will be kept in the project due to an exceptionally good cooperative farmer. This site is close to the area served by the UVWUA. The site in the Upper Gunnison is intended to develop an understanding of high-mountain pasture sites. The CSU AES(AES) in Montezuma County will be useful to document the impacts of reduced irrigation practices that may be practiced on in the area served by the Doc Morrison Ditch, which is in La Plata County.

The instrumentation to be installed at each site will be designed to provide "real-time" measurements soil moisture conditions, soil electrical conductivity and temperature. Additionally, metering equipment will be deployed to measure the rates, totals and timing of irrigation water inputs tail water. Details may vary by site, but the smaller (<30 ac) reference and test plots would each consist of two (2) "sensing stations," comprised of two (2) soil sensors and telemetric capability. The larger (>30-ac) plots would have four (4) sensing stations. The location of the sensing stations will be determined on the basis of different irrigation treatments, irrigation systems and soil types. The site locations will be instrumented with telemetric capability. This capability requires an additional "base station" that can relay data to a headquarters, which will likely be the CSU Orchard Mesa AES in Grand Junction.

Table 1. Site Location and Info by County

County	***Delta***	***Garfield***	***Gunnison***	***Mesa GVWUA***	***Mesa CSU-AES***	***Montezuma CSU-AES***	***Montrose UVWUA***
Crop Type	alfalfa	grass/past	grass/past	alfalfa	grass/past	alfalfa	alfalfa
Site Size (ac)	30	40	40	80	30	30	80
Plot Size (ac)	10	10	20	40	10	10	40
No. of Plots	3	4	2	2	3	3	2

GVWUA: Grand Valley Water Users Association; CSU-AES: Colorado State University Agricultural Experiment Station; UVWUA: Uncompahgre Valley Water Users Association

All of the Principal Investigators will be involved in the instrumentation of the sites, but Prof. Chavez and Dr. Cabot will take the lead. The purpose of funding summer salary for Prof. Chavez in the first two years is to avail the project of his expertise with soil sensing equipment and telemetry systems. The establishment of the research sites will be a major duty of the incoming graduate student in Year 1. Because this work is intensive and must move at a fairly rapid pace, an intern will also be hired to assist.

Deliverables:

- Identification of study sites and recruitment of participating producers.

- Installation of monitoring equipment.
- Summary reports detailing characteristics of each site.

TASK 3 (COOPERATORS) – Coordination with irrigators and land managers before each irrigation season

Description:

Before the beginning of each field season, the research team will meet with the land managers at each and establish a plan for irrigating during the year. Any surprises or challenges that were encountered in the previous year or changes to the upcoming year will be addressed. The budget includes travel funding for the graduate students to visit the Western slope a few times during the semester before they relocate to Grand Junction for the summer. Because the irrigation season typically lasts longer than August, the graduate student is also budgeted to return a couple times as the irrigation season finishes. Dr. Cabot will take the lead to facilitate these meetings between the land managers and the graduate student.

Deliverables:

- Annual irrigation plan for each study site.
- Summary document of participant experiences with reduced irrigation practices.

TASK 4 (RESEARCH - AGRONOMY) – Collection and analysis of agronomic field data

Description:

The first major goal of this project is to assess the recovery period and pattern of vegetation on fields that have undergone a period of reduced irrigation. To this end, agronomic data collection will follow a similar pattern as has been conducted under the current research supervised by Prof. Brummer in Phase IIB of the Water Bank Feasibility Study. General data being collected at the sites includes plant count and density, yield, and quality. Because the nature of the project is to understand the relationship between consumptive use (CU) and agronomic variables, there may be additional study parameters that could be useful in establishing this relationship.

When conducting research on irrigation, a reasonable concern always exists that subsurface water may affect the study through lateral inputs from adjacent irrigated plots that are not included in the study. These impacts could likely affect the reference plots as well as the test plots. The primary measure taken to avoid the intrusion of lateral flow is to select sites that are side-bound by roadways or nonirrigated areas. A secondary measure is to exclude “buffers” from sampling and measurement. These buffers are wide enough to separate the research plots dimensions from any potential intrusion. In typical research, the buffer width can be approximately 2-3 m wide or less, depending on soil types. Soil moisture levels will accurately be reflected by locating the sensing stations far enough into the plots, so as to be unaffected by lateral wicking of subsurface flows. Finally, the actual sampling design will be arrayed within the sites, so that several specific locations (e.g., 1 m2, randomized or strategic) within the test-plots. For instance, forage samples will be taken from specific locations arrayed within the plots. The data from these specific locations will be used for averaging, modeling inputs and statistical comparisons.

Prof. Brummer will take the lead on supervising the graduate student in this task. Additional input will be received from Prof. Chavez and Dr. Cabot in order to develop the CU/ET relationship with agronomic variables. Field visits will be regularly scheduled during the summer in order to collect data at the sites.

Deliverables:

- Annual and summary agronomic data for each field site, including yield, plant count, density, relative feed value.
- Annual and summary crop enterprise budgets for each field site.

TASK 5 (RESEARCH - WATER) – Collection of irrigation water budget data

Description:

Water budget data collection will be assisted through telemetric reporting systems that will be established at each site. Irrigation data will include water flow rates and totals applied to the fields under gated pipe systems. In the case on one location where gated pipe does not exist – in Gunnison County – funding has been added to the budget in order to install it. Dr. Cabot will take the lead on supervising the graduate student in this task. Additional input will be received from Prof. Brummer and Prof. Chavez in order to develop the CU/ET relationship with agronomic variables. Ongoing storage of the data from the telemetric system will be a duty of the graduate student, who will provide assistance remotely, during the semesters, and directly, during the summer.

Deliverables:

- Annual and summary irrigation water budget data for each study site, including applied irrigation water, potential ET, field runoff, and soil moisture.

TASK 6 (DATA APPLICATION) – Determination of saved consumptive use (CU) estimates

Description:

The second major research goal of this project is to understand the change in consumptive use (CU) exhibited as a function of irrigation reductions. Accomplishment of this goal requires that a difference in CU be measured between: 1) a fully-irrigated reference condition (intended to match historic CU rates), and; 2) the "treatment" condition that represents reduced irrigation management, as would occur under the water banking strategy.

By measuring the water budget of the reference and treatment fields, the known variables of a simplified water balance equation can be determined:

$$Dc = Dp + ETc - P - Irr - U + SRO + DP \quad [1]$$

Where *Dc* is the soil water deficit (net irrigation requirement) in the root zone on the current day, *Dp* is the soil water deficit on the previous day, *ETc* is the crop-based evapotranspiration amount for the current day, *P* is the gross precipitation for the current day, *Irr* is the net irrigation amount infiltrated into the soil for the current day, *U* is upflux of shallow ground water into the root zone, *SRO* is surface runoff, and *DP* is deep percolation or drainage.

Because *U* and *DP* are difficult to estimate in the field, our approach will be to select locations where the water table is significantly deeper than the root zone and *U* can be assumed zero. The SRO parameter will be accounted for by measuring runoff using small flumes equipped with water level loggers. The *DP* parameter can be accounted for by setting *Dc* to zero whenever water additions (*P* and *Irr*) to the root zone exhibit patterns of being greater than *Dp* + *ET*c. For these purposes, *ETc* may be estimated using the Penman-Montieth, Kimberly-Penman, or other comparable models. Additionally, however, the instrumentation of the entire field with soil moisture and flow monitoring equipment will allow for a direct calculation of *ETc* by knowing all other parameters.

Prof. Chavez and Dr. Cabot will take the lead on supervising the graduate student in this task. Assistance will also be requested from Ben Harding and Shaden Musleh (AMEC), so that such calculations can be integrated usefully with the larger Water Bank project.

Deliverables:

- Annual and summary estimates of saved consumptive use for each study site treatment plot.
- Revised estimates and description of the factors influencing the range of potential supply available to the water bank.

TASK 7 (REPORTING) – Documentation and reporting of data

Description:

Data from the project will be compiled and reported to the funding entity on a timely basis that is scheduled at the outset of the project. All of the Principal Investigators will be involved in the reporting and presentation of data, but Dr. Cabot will take the lead on this task, given closer proximity to the region being researched. The graduate student will be expected to assist with this task in the preparation of slides, graphs and concepts.

Deliverables:

- Annual progress reports.
- Final report summarizing study, key findings, and recommendations.

TASK 8 (COAGMET) – Maintenance of research equipment and COAGMET stations

Description:

All COlorado AGricultural Meteorological nETwork (COAGMET) stations require regular maintenance.

Table 2. COAGMET Station Planning and Procurement

County	***Delta***	***Garfield***	***Gunnison***	***Mesa GVWUA***	***Mesa CSU-AES***	***Montezuma CSU-AES***	***Montrose UVWUA***
Existing Station?	No	No	No	Yes	Yes	Yes	No
Procurement	move CDG01	Considering	CWCB-ATM	n/a	n/a	n/a	CWCB-ATM
Support Source	CWCB-ATM	Considering	CWCB-ATM	n/a	n/a	n/a	CWCB-WSRA

CWCB-ATM – refers to this proposal
CWCB-WSRA – refers to "Agricultural Weather Data Delivery Improvements to Uncompahgre Valley Irrigators"

A portion of the budget will be used to pay the Colorado Climate Center staff in charge of COAGMET system maintenance. An existing WSRA Grant entitled "Agricultural Weather Data Delivery Improvements to Uncompahgre Valley Irrigators" also contains funding for one station (likely in or near Montrose, CO) that can play a duplicate role for this project.

Deliverables:

- Development of expanded COAGMET capacity on the Western Slope

TASK 9 (QA/QC) – Quality analysis and quality control

Description:

In order to maintain data quality and address problems as they are encountered a Quality Analysis and Quality Control (QA/QC) protocol will be established. This will involve regular (weekly) compiling of data, formatting spreadsheets and generating appropriate charts in order to determine any issues arising with the data collection system. Additionally, regular interactions with the land managers will allow any unplanned changes to the irrigation schedules to be understood and reflected in the data. The graduate student will be primarily responsible for QA/QC, submitting regular updates to the Principal Investigators.

TASK 10 (EXTENSION) – Extension and Outreach

Description:

At the request of the funding entity, an extension and outreach program can be developed for the project, consisting perhaps of such approaches as field tours, video materials, fact sheets, etc. The project team will work with the funding entity to determine a schedule and structure for extension and outreach. The graduate student will be primarily responsible for coordinating the details of Extension and Outreach, as component of their degree requirements in the Department of Soils and Crop Sciences.

Deliverables:

- Annual or semi-annual field tours.
- Fact sheets/summary sheets for water bank outreach.
- Other materials as needed or requested.

Table 3: Complete Itemized Budget by Year (Matching Funds)

Matching Contribution	Year 1	Year 2	Total
MATERIALS AND SUPPLIES	**$61,631**	**$0**	**$61,631**
OTHER DIRECT COSTS			
In-State Tuition:	$9,076	$9,757	$18,833
Crop Offset Payments:	$17,667	$18,374	$36,041
TOTAL OTHER DIRECT:	**$26,743**	**$28,131**	**$54,874**
TOTAL DIRECT COSTS:	**$88,374**	**$28,131**	**$116,505**
Facilities & Administrative (3%):	**$2,651**	**$844**	**$3,495**
TOTAL Matching:	**$91,025**	**$28,975**	**$120,000**

Table 4: Complete Itemized Budget by Year Total Project)

CWCB Contribution	Year 1	Year 2	Total
PERSONNEL SALARIES			
Academic Faculty:	$4,909	$5,105	$10,014
Fringe Rate	$1,242	$1,310	$2,552
Student Hourly:	$7,560	$0	$7,560
Fringe	$76	$0	$76
GRA's:	$21,600	$22,464	$44,064
Fringe	$1,728	$1,822	$3,550
TOTAL SALARY:	$34,069	$27,569	$61,638
TOTAL FRINGE:	$3,046	$3,132	$6,178
TOTAL PERSONNEL:	**$37,115**	**$30,701**	**$67,816**
DOMESTIC TRAVEL:	**$5,328**	**$4,966**	**$10,294**
MATERIALS AND SUPPLIES	**$128,197**	**$6,000**	**$134,197**
OTHER DIRECT COSTS			
Publications:	$0	$1,248	$1,248
In-State Tuition:	$9,076	$9,757	$18,833
Crop Offset Payments:	$17,667	$18,374	$36,041
TOTAL OTHER DIRECT:	**$26,743**	**$29,379**	**$56,122**
EQUIPMENT:	**$4,598**	**$0**	**$4,598**
TOTAL DIRECT COSTS:	**$201,981**	**$71,046**	**$273,027**
Facilities & Administrative:	**$19,692**	**$7,281**	**$26,973**
TOTAL CWCB Request:	**$221,673**	**$78,327**	**$300,000**

Table 5: **Project Costs associated with ATM request.**

	Personnel + Fringe	***Tuition***	***Travel Mileage***	***Materials Equipment***	***Payments to Farmers***	***Indirect Costs***	***Total***
Item Description							
Task 1. Graduate student, intern selection	$6,782	$18,833	$1,029	---	---	$1,737	$28,381
Task 2. Site selection & deployment of monitoring	$13,563	---	$2,059	$131,295	---	$14,642	$161,559
Task 3. Coordination with irrigators before season	$3,391	---	$515	---	$36,041	$1,667	$41,614
Task 4. Collection, analysis of agronomic field data	$3,391	---	$511	---	---	$586	$4,488
Task 5. Collection of irrigation water budget data	$13,563	---	$2,059	---	---	$2,343	$17,965
Task 6. Determination of saved CU estimates	$13,563	---	$2,059	---	---	$2,343	$17,965
Task 7. Documentation and reporting of data	$3,391	---	$515	---	---	$586	$4,491
Task 8. Maintenance of equipment, COAGMET	$3,391	---	$515	$7,500	---	$1,711	$13,116
Task 9. Quality analysis and quality control	$3,391	---	$515	---	---	$586	$4,491
Task 10. Extension and Outreach	$3,391	---	$515	$1,248	---	$ 773	$5,927
TOTAL Project Cost	**$67,816**	**$18,833**	**$10,294**	**$140,043**	**$36,041**	**$26,973**	**$300,000**

Matching (Colorado River District)	**$30,000**
Matching (The Nature Conservancy)	**$30,000**
Matching (Southwestern Colorado Water Conservancy District)	**$30,000**
Matching (Front Range Water Council)	**$30,000**
TOTAL FUNDS REQUESTED from CWCB Alternative Transfer Methods Program	**$180,000**

SCHEDULE

Task		Year 1				Year 2				Year 3	
	Fall 2014	Winter 2015	Spring 2015	Summr 2015	Fall 2015	Winter 2016	Spring 2016	Summr 2016	Fall 2016	Winter 2017	Spring 2017
1. Grad student and intern interview and selection											
2. Study site selection, deployment of research equipment											
3. Coordination with irrigators/managers before irrigation season											
4. Collection and analysis of agronomic field data											
5. Collection of irrigation water budget data											
6. Determination of saved consumptive use estimates											
7. Documentation and Reporting											
8. CoAgMet station maintenance	----- Ongoing -----										
9. Quality Assurance and Quality Control											
10. Outreach	----- Ongoing -----										