WATER CONSERVATION BOARD
1313 SHERMAN STREET, ROOM 721
DENVER, CO 80203

Buyer: ALLAN SMITH
Phone Number: 303-866-3292
Agency Contact: DORI VIGIL
Phone Number: 303 866 3441

DATE: 03-01-13

IMPORTANT
The PO# and Line # must appear on all invoices, packing slips, cartons and correspondence

ACC: 02-28-13

PURCHASE ORDER
STATE OF COLORADO

P.O. # OE PDA 13IBC000017 Page# 01

State Award #

BID #

FEIN 841279548 **Phone:** 719-539-5425
Vendor Contact: RALPH SCANGA
Purchase Requisition #:

VENDOR
UPPER ARKANSAS WATER CONSRVNCY DIST
PO BOX 1090
SALIDA CO 81201

Invoice in Triplicate
To: DIVISION OF WATER CONSERVATION
1313 SHERMAN STREET, ROOM 721
DENVER, CO 80203

Payment will be made by this agency

Ship To: DIVISION OF WATER CONSERVATION
1313 SHERMAN STREET, ROOM 721
DENVER, CO 80203

Delivery/Installation Date: 01-31-15
F.O.B. DESTINATION STATE PAYS NO FREIGHT

INSTRUCTIONS TO VENDOR:

1. If for any reason, delivery of this order is delayed beyond the delivery/installation date shown, please notify the agency contact named at the top left. (Right of cancellation is reserved in instances in which timely delivery is not made.)
2. All chemicals, equipment and materials must conform to the standards required by OSHA.
3. NOTE: Additional terms and conditions on reverse side.

SPECIAL INSTRUCTIONS:

LINE ITEM	COMMODITY/ITEM CODE	UNIT OF MEASUREMENT	QUANTITY	UNIT COST	TOTAL ITEM COST
001	91843000000				$59,215.00

CMS#53663 - WSRA, BUILD ASESS AND DOCUMENT ACCT & ADMIN TOOLS FOR LEAS FALLOWING IN THE ARK RIVER VALLEY

DOCUMENT TOTAL = $59,215.00

THIS PO IS ISSUED IN ACCORDANCE WITH STATE AND FEDERAL REGULATIONS
This PO is effective on the date signed by the authorized individual.
EPSPO PAA

FOR THE STATE OF COLORADO

Dara D. Darwich
Authorized Signature

3/1/13
Date

DP-01 (R-02/06)

EXHIBIT A

Scope of Work

WATER ACTIVITY NAME — Building, Assessing, and Documenting Accounting and Administration Tools for Lease Fallowing in the Arkansas River Basin Between Pueblo Reservoir and John Martin Reservoir

GRANT RECIPIENT — Upper Arkansas Water Conservancy District

FUNDING SOURCE — Water Supply Reserve Account Competitive Grant Program along with a cash match from the Lower Arkansas Valley Water Conservancy District of $17,605, plus an Arkansas Basin Roundtable contribution of $20,000.

INTRODUCTION AND BACKGROUND

Provide a brief project description. (No more than 200 words; to inform reviewers and the public.)

WSRA funding will be used to build, assess, and document tools that will reduce the complexity of calculating transferrable consumptive use and assessing impacts to return flows resulting from lease fallowing agreements. The tools will facilitate the implementation of a "Super Ditch" style lease fallowing program in the Arkansas River Valley between Pueblo Reservoir and John Martin Reservoir to help meet water supply needs. Leasable water can help meet the projected statewide water supply gap of 200,000 to 600,000 acre feet by 2050 (Statewide Water Supply Initiative [SWSI] 2010). The Arkansas Basin Roundtable *Consumptive Use Water Needs Assessment: 2030 – 2008 Update* identified a municipal and industrial shortfall by 2030 of 31,500 acre feet. The State has a sense of urgency regarding its water supply future and identified alternative agricultural transfers as a policy option to meet its gap.

Project benefits include: constraining transactional costs, protecting existing water rights from injury in the least costly fashion, sustaining the area agricultural economy valued at $616.8 million annually, maintaining open space, and preserving the institutionalized and long recognized water court process, while facilitating the implementation of lease fallowing.

OBJECTIVES

The objective of this project is to build, assess, then document tools for accounting and administration of a "Super Ditch" style lease fallowing program in the Arkansas River Basin between Pueblo Reservoir and John Martin Reservoir. The requirements of the accounting and administration tools are:

(1) Quantify the transferrable consumptive use derived from fallowed land parcels;
(2) Quantify the associated changes in the *amount, timing, and location* of:
    (a) surface runoff to drains and to the Arkansas River,
    (b) recharge to the alluvial aquifer, and
    (c) groundwater return flow to drains and to the Arkansas River;

(3) Support the development of plans to maintain return flows at or above historical levels and to quantity transferrable consumptive use at or below historical levels in a manner that complies with Colorado water law and the Arkansas River Compact; and
(4) Develop data interfaces that will complement the Arkansas River Decision Support System (ArkDSS) and build a common technical platform for the transfer of data to and from Hydrobase.

TIMELINE

The lease fallowing tools to be developed are an accounting tool and an administration tool. The project will be completed in seven phases. Work will begin in early 2012 on Phases 1 thru 3, which are fully funded by Alternative Agricultural Water Transfer Methods Competitive grant program funds of $121,500, matched with $157,395 cash contributions in the form of $10,000 each from four project co-sponsors: Upper Arkansas Water Conservancy District, Southeastern Colorado Water Conservancy District, the Board of Water Works of Pueblo, and Colorado Springs Utility with $117,395 from the Lower Arkansas Water Conservancy District.

WSRA funding will complete phase 4 to document the accounting tool then prepare user guidelines. The fully developed accounting tool is scheduled for completion in February 2014.

Phases 5 and 6 involve the development of the administration tool. These phases utilize CDWR hydro-base integration. The final phase 7, deals with development of a GIS interface and annual review process.

TASKS

Phase 1. Define Basic Data Requirements for Accounting Tool (Procedure)

- Task 1a. Define the nature of the required output of the Accounting Tool, considering:
    - Type and units of calculated variables
    - Spatial and temporal resolution of calculations
    - Format of calculations
        - Database structure and access
        - Plots
        - Reporting forms
        - Spatial depiction (GIS)
    - User preferences
    - Requirements of daily river water rights administration
    - Requirements of Compact administration

- Task 1b. Describe the general approach for determining farm headgate (FHG) deliveries of native water rights, considering:
    - Canal headgate diversions
    - Canal system delivery losses
    - On-farm lateral losses

- Task 1c. Describe the general approach for determination of crop ET and consumptive irrigation requirement, considering:

- Colorado Agricultural Meteorological (CoAgMet) or National Weather Service (NWS) weather station data
- Compatibility with H-I Model canal-wide crop potential ET estimates
- Field specific crops
- Field locations relative to specific weather stations

- Task 1d. Describe the general approach for estimating the impact on the water balance in the unsaturated zone (including the crop root zone), considering:
  - Change in soil water content during fallowing year and post-fallowing year
  - Re-irrigation by groundwater wells during fallowing year
  - Impact of precipitation
  - Contribution from shallow groundwater to changes in soil water content and to soil evaporation

- Task 1e. Describe the general approach for modeling the process by which inflows to the alluvial aquifer accrue to the surface drainage system (open drains, tributary streams, and Arkansas River) for both historic (baseline) and lease fallowing conditions, considering:
  - Deep percolation from the crop root zone, canal and lateral seepage losses, and groundwater recharge
  - Site specific aquifer transmissivity, specific yield, and distances to aquifer boundaries
  - Regional groundwater flow patterns and location of accretion to the surface drainage system
  - Farm specific analyses
  - Patterns of return flow to the surface drainage system during both fallowing year and post-fallowing years

- Task 1f. Technical Committee review and feedback of Phase 1 work

- Task 1g. Deliverable Prepare a detailed memorandum including Technical Committee review describing all methods and results of Phase 1

Phase 2: Develop and Evaluate Accounting Tool - Farm Headgate (FHG) Diversion, Crop ET, Surface Runoff, and Recharge to Aquifer (Procedure)

- Task 2a. Describe land parcels within the CSU upstream study region (from west of Manzanola to near Las Animas) for specific investigation as the development context for the Accounting Tool, considering:
  - Super Ditch Pilot Project fields under the Catlin Canal
  - Rule 14 fields (Amended Use Rules well augmentation fallowed parcels) under the Catlin, Holbrook and Ft Lyon Canals

- Task 2b. Define the required data inputs for existing models
  - Irrigation System Analysis Model (ISAM)
  - CSU MODFLOW-UZF models
  - Glover (stream-aquifer response function type) groundwater model (using data derived from calibrated CSU MODFLOW-UZF models)

- Task 2c. Modify and Enhance ISAM (implemented in Excel)
    - Convert to Access and or SQL database
    - Provide flexibility in selection of input data
        - Interface to import data from Hydrobase
        - Incorporate canal diversions, climatic data, and cropping data
        - Provide capability to enter user-developed data independently
        - Interface with CoAgMet data
    - Provide for adjustable distribution of surface runoff and deep percolation fractions (for "water-short" versus "water-long" conditions)
    - Prepare a draft users' manual and example application for the ISAM component

- Task 2d. Develop link to export ISAM prediction of deep percolation (aquifer recharge) to the Glover (or similar) groundwater model (using a standardized form and format of the output)

- Task 2e. Refine the development and calibration of the CSU model
    - Develop model logic to incorporate differences in the unit area water supply (cfs/acre or shares/acre) as it may vary from farm to farm
    - Develop model logic to incorporate definition of a farm unit and to allow rotational fallowing within the farm unit
    - Update calibration against observed groundwater levels, return flows to the Arkansas River, etc.

- Task 2f. Technical Committee review and feedback of Phase 2 work
    - Provide ISAM Model with user manual and example data set

- Task 2g. <u>Deliverable</u> Prepare a detailed memorandum describing all methods and results of Phase 2

Phase 3: Develop and Evaluate Accounting Tool -- Alluvial Aquifer Response (<u>Procedure</u>)

- Task 3a. Define the alluvial aquifer parameters required for groundwater flow modeling using the Glover model, relying upon calibrated values from CSU MODFLOW-UZF model
    - Outer boundary conditions
    - Saturated thickness
    - Transmissivity and harmonic transmissivity
    - Void ratio
    - Distance to the stream from considered fields (parcels), distance from stream to aquifer boundaries
    - Groundwater gradients (flow paths)
        - Elevation contours
        - Location of impact on streams and rivers with
            - Respect to water rights
            - Respect to inflow to John Martin Reservoir

  Consideration must be given to changes in parameter values as a function of

        - Type of water year (dry, average, wet)
        - Water table elevation
        - Differing share loads among parcels
        - Dispersed versus concentrated parcel locations

- Task 3b. Simulate and compare the timing of recharge (deep percolation, canal seepage, and artificial recharge) to accrue to the surface drainage system, using both the Glover model and the calibrated CSU MODFLOW-UZF model, considering:
    - Regional groundwater flow gradients
    - Effects of selected parcels
    - Evaluation of differences in Glover and CSU model predictions with respect to magnitude, timing, and location and in relation to
        - Impact on water rights
        - Impact on inflow to John Martin Reservoir

- Task 3c. If Task 3b differences are significant,
    - Step 1: Compare ISAM predictions of deep percolation (aquifer recharge) with CSU model predictions of deep percolation under irrigated parcels. If necessary, adjust ISAM parameters to achieve an acceptable match.
    - Step 2: Adjust Glover model parameters to achieve an acceptable match.

- Task 3d. Technical Committee review and feedback of Phase 3 work

- Task 3e. Deliverable Prepare a detailed memorandum describing all methods and results of Phase 3

Phase 4: Document Accounting Tool and Prepare Guidelines for Use (Procedure)

- Task 4a. Prepare a Methods Reference Document and a Users' Manual for the Accounting Tool.
- Task 4b. Technical Committee review and feedback for review of document.
- Task 4c. Deliverable Revise and finalize the Methods Reference Document and User's Manual.

Phase 5: Develop and Evaluate an Administration Tool for Augmentation (Procedure)
Development of the Administration Tool requires that the engineering to be conducted by LAVWCD with WSRA grant funding be completed. It is anticipated that the completion of that study will provide data and information (particularly the location of storage vessels and recharge facilities) required for development of this tool. It will also be necessary for the Super Ditch to declare the location or the planned location of augmentation stations and recharge facilities along the routes of the seven participating canals.

- Identify the procedures required to protect all in-basin water rights considering:
    - Location of controlling call and by pass call
    - Replacement water requirements by stream reach, considering timing, amount, and location
    - Volumetric limits including limits on diversions and CU credits to historical levels
    - Protections to insure compliance with River Compacts

    - Protections of non-participants within each ditch
    - Others
- Additional tasks may be identified upon completion of Phases 1 – 4 and review of the engineering completed by LAVWCD with WRSA grant funding.
- Deliverable Subject the methods and results to review by the Technical Committee

Phase 6: Develop an Operational Tool for transfer of consumptive use credits or net depletions to new points of diversions.
The scope of work for this phase can only be generally described at this time. The completion of Phase 1 – 5 will primarily determine the nature and extent of engineering required. The Operational Tool must incorporate terms and conditions required to maintain historical return flows, prevent expansion of use, hold transferrable consumptive use at or below historical levels, prevent injury to other Arkansas River basin water rights, and insure compliance with the Arkansas River Compact.

- Evaluate whether the Alluvial Aquifer Accretions/Depletions Analysis Tool (AAA/DAT) might be useful as part of the Administration Tool.
- Evaluate administration/operational tools of existing or pending augmentation plans to determine if they may be useful as an Operational Tool.
- Develop the Operational Tool in coordination with the Colorado Division of Water Resources (CDWR) Information Technology (IT) staff to ensure that all facets of the tool can be fully integrated into Hydrobase and meets all DWR IT requirements
- Subject the methods and results to review of the Technical Committee

Phase 7: Evaluate the extent to which GIS-based data display and management might be used to enhance the Administration Tools and the review process for annual operations of a "Super Ditch" style lease fallowing program. **The scope of work for this phase can only be generally described at this time. The completion of Phase 1 – 6 will determine the nature and extent of engineering required.**

BUDGET

Attachment B contains detailed budget documentation, specifically:

Total Costs By Task
Labor Hours By Task and Personnel
Other Direct Costs By Task and Item
In-Kind Contributions By Task

SCHEDULE

The proposed project schedule is reflected Total Costs By Task in Attachment B.

PAYMENT / REQUESTS FOR REIMBURSEMENTS

Payment will be made based on actual expenditures and invoicing by the applicant. 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 Upper Arkansas Water Conservancy District W-9 Form (Required for All Projects) is in Attachment C.

Build, Assess, and Document Accounting and Administration Tools for Lease Fallowing in the Arkansas River Valley

TOTAL COST BY TASK	Personnel Costs	Other Direct Costs	Matching Funds	In-Kind	Total Project Costs	ATM GRANT FUNDS	WSRA GRANT FUNDS	COST SHARE FUNDS
Timeline: 1 Mar - 31 Aug 2012 (6 months)								
Phase 1: Define Accounting Tool Basic Data Requirements								
SubTotal Task Costs	$53,708	$5,925		$13,800	$59,633	$33,679	$0	$25,930
Timeline: 1 Jun 2012 - 31 May 2013 (12 months; overlap 3 months with Phase 1)								
Phase 2: Accounting Tool-FHG Diversion, Crop ET, Surface RO, and Aquifer Recharge								
SubTotal Task Costs	$94,417	$6,470		$27,600	$100,886	$56,719	$0	$43,668
Timeline: 1 Dec 2012 - 28 Feb 2014 (15 months; overlap 6 months with Phase 2)								
Phase 3: Develop and Evaluate Accounting Tool-Alluvial Aquifer Response								
SubTotal Task Costs	$113,052	$5,323		$27,600	$118,376	$66,998		$51,902
Timeline: 1 Mar - 31 Dec 2014 (10 months)								
Phase 4: Document Accounting Tool and Prepare Use Guidelines								
SubTotal Task Costs	$74,989	$1,831		$6,900	$76,820		$59,215	$17,605
Timeline: 12 months								
Phase 5: Develop and Evaluate Adminstration Tool for Augmentation								
SubTotal Task Costs	$100,260	$4,462		$27,600	$104,722			

TOTAL COST BY TASK	Personnel Costs	Other Direct Costs	Matching Funds	In-Kind	Total Project Costs	ATM GRANT FUNDS	WSRA GRANT FUNDS	COST SHARE FUNDS
Timeline: 12 months, 6 months overlap with Phase 5								
Phase 6: Develop/ Evaluate Adminstration Tool for Operation of CU Transfer Credits/Depletions								
SubTotal Task Costs	$62,994	$4,462		$27,600	$67,456			
Timeline: 6 months								
Phase 7: Evaluate GIS Enhancement Options and the Annual Review Process for Operations								
SubTotal Task Costs	$78,070	$4,597		$27,600	$82,667			
Total for Phases 1 - 4	$336,166	$19,549			$355,715			
Total for Phases 5 - 7	$241,325	$13,520			$254,845			
Grand Total	$577,490	$33,070			$610,560			
In-Kind Contribution Total				$158,700				

ACCOUNTING & ADMINISTRATION TOOL FOR LEASE FALLOWING TIMELINE