COLORADO WATER CONSERVATION BOARD

ALERNATIVE AGRICULTURAL WATER TRANSFER METHODS COMPETITIVE GRANT PROGRAM

GRANT APPLICATION FORM

Lower South Platte Irrigation Research and Demonstration Project

Program/Project Name

River Basin Name

$435,152

Amount of Funds Requested

$125,644

Amount of Matching Funds

*** The deadline for Grant Applications is November 26, 2010 for consideration at the January 2011CWCB meeting.** It is anticipated that there will be one round of application submittals, yet if funds are not exhausted, the Board will determine when it will consider the next round of grant applications at their January 2011 meeting.

* In completing the application you may attach additional sheets if the form does not provide adequate space. If additional sheets are attached please be sure to reference the section number of the application that you are addressing (i.e., A.1. etc.).

Instructions: This application form must be submitted in electronic format (Microsoft Word or Original PDF). The application can be emailed or a disc can be mailed to the address at the end of the application form. The Alternative Agricultural Water Transfer Methods Competitive Grant Program, Criteria and Guidelines can be found at http://cwcb.state.co.us/LoansGrants/alternative-agricultural-water-transfer-methods-grants/Pages/main.aspx. **The criteria and guidelines must be reviewed and followed when completing this application**. You may attach additional sheets as necessary to fully answer any question, or to provide additional information that you feel would be helpful in evaluating this application. Include with your application a cover letter summarizing your request for a grant. If you have difficulty with any part of the application, contact Todd Doherty of the Water Supply Planning Section (Colorado Water Conservation Board) for assistance, at (303) 866-3441 x3210 or email at todd.doherty@state.co.us.

Generally, the applicant is also the prospective owner and sponsor of the proposed program/project. If this is not the case, contact Todd before completing this application.

Alternative Agricultural Water Transfer Methods – Grant Application Form
October 2010

Part A. - Description of the Applicant(s) (Program/Project Sponsor);

1. Applicant Name(s): Parker Water and Sanitation District

Mailing address: 19801 East Mainstreet
Parker, Colorado 80138

Taxpayer ID#: 84-0646518 Email address: fjaeger@pwsd.org

Phone Numbers: Business: 303-841-4627
Home:
Fax: 303-841-8992

2. Person to contact regarding this application if different from above:

Name: Frank P. Jaeger

Position/Title District Manager

3. If the Contracting Entity is different then the Applicant, please describe the Contracting Entity here.

Same.

4. Provide a brief description of your organization. The applicant may be a public or private entity. Given the diverse range of potential applicants, not all of the following information may be relevant. Where applicable and relevant the description should include the following:

    a) Type of organization, official name, the year formed, and the statutes under which the entity was formed, a contact person and that person's position or title, address and phone number. For private entities, a copy of the Articles of Incorporation and By-laws should be appended to the application.

The Parker Water and Sanitation District (PWSD) is a Title 32 Special District, formed in 1962, which provides water and wastewater services to a service area in the southeastern Denver metropolitan area. Mr. Frank Jaeger has been the District Manager since 1981 and will be the contact person for this project. His address is 19801 East Mainstreet, Parker, Colorado 80138, and he can be reached at 303-841-4627.

    b) For waters suppliers, information regarding the number of customers, taps, service area, and current water usage, and future growth plans, water related facilities owned or used, funding/revenue sources (existing service charges, tap fees, share assessments, etc.), the number of members or shareholders and shares of stock outstanding or a description of other means of ownership.

PWSD's DRCOG service area is 21,240 acres. Currently, PWSD serves approximately 16,400 single family equivalents (SFEs) while, at buildout, is expected to serve over 45,000 SFEs with a population estimated to be 125,000. Current water demand in PWSD, based on PWSD's planning criterion of 0.7 acre-foot per year per SFE (ac-ft/yr/SFE), is approximately 11,480 ac-ft/yr, and this demand will grow to approximately 31,775 ac-ft/yr. Build out is expected in approximately 2030. PWSD is currently primarily reliant on the non-renewable resources of the Denver Basin, but minimizes use of this water by (a) reuse through its augmentation plan, (b) water conservation, (c) development of local renewable resources of Cherry Creek, and (d) water management through surface water storage in Rueter-Hess Reservoir (expected to be on line in 2011). Even with these water management and conservation plans, PWSD will still need to develop additional renewable water supplies in the future to continue to provide reliable water supplies to its customers. PWSD owns and operates a well system comprised of 3 Cherry Creek alluvial aquifer wells, 11 Dawson aquifer bedrock wells, 5 Denver aquifer bedrock wells, 17 Arapahoe aquifer bedrock wells, and 3 Laramie-Fox Hills aquifer bedrock wells. This system includes the wells, pumps, pump houses, wet wells for chlorination, and the distribution system. PWSD also owns and operates two water reclamation facilities that have a treatment capacity of 3.5 MGD, and are currently treating 3.1 MGD. PWSD has completed Phase 1 of the development of Rueter-Hess Reservoir to a capacity of 16,200 ac-ft, and is completing the expansion of Rueter-Hess Reservoir to a capacity of 72,000 ac-ft. As part of the Rueter-Hess project, a surface diversion structure has been completed on Cherry Creek to capture all in-priority flows at that location. Once diverted, the water is routed to the pump station adjacent to the diversion structure and delivered to Rueter-Hess via a 3-mile pipeline. Delivery of water from Rueter-Hess will be routed to a water treatment plant at the reservoir site prior to distribution into the PWSD water supply system. The water treatment plant is currently under design.

All of the above-described infrastructure is either in place, or is being designed, and is all owned

and operated by PWSD. It is expected that Rueter-Hess will serve as a regional water supply storage facility for entities in the south Denver metropolitan area. The Town of Castle Rock, Castle Pines North Metropolitan District, and Stonegate Village Metropolitan District have all agreed to contract for storage space in Rueter-Hess Reservoir. Water from Rueter-Hess will be separately piped and treated for use by these water supply entities.

PWSD's infrastructure is funded currently by charging inclusion fees for new developments, tap fees for new hookups, and a water resources toll to cover water supply issues with new developments. Service charges are only used to meet operation costs. PWSD employs a block-rate water fee structure that encourages conservation by increasing costs for use above base levels. The current fees being charged by PWSD are shown in the attached Exhibit A, District Rate/Fee Schedule, Effective January 1, 2011.

c) For other entities, background, organizational size, staffing and budget, and funding related to water that is relevant in determining whether the applicant has the ability to accomplish the program/project for which funding is sought.

Not applicable. See b) above.

d) A brief history of the Applicant(s).

The Parker Water and Sanitation District has been continuously providing water and wastewater services to its customers since 1962. PWSD initially used a single Cherry Creek well and old Denver Basin wells to meet its water needs. PWSD remained very small until the early 1970s, when there were only a few hundred residential taps being served. In the early 1980s PWSD, under Mr. Jaeger's leadership, began the adjudication process of its Denver Basin and Cherry Creek water rights.

Currently, its principal water supplies come from the Denver Basin and PWSD has adjudicated several Water Court cases to allow the use of all of the Denver Basin water beneath its service area. Its service area currently encompasses 27,604 acres. To supplement its Denver Basin water supplies, PWSD diverts in priority water from Cherry Creek to the extent that it is available. Direct flow and water storage rights adjudicated for Rueter-Hess Reservoir will allow for the more efficient diversion of these Cherry Creek flows. PWSD also has an extensive reuse plan through its adjudicated augmentation plan, which allows PWSD to pump or divert an equivalent volume to the amount of reusable effluent released from its advanced wastewater treatment plants. PWSD also has an aggressive water conservation plan which, over the period 1986-1998, decreased residential water use by 40 percent. That water conservation plan continues today and the conservation levels achieved during the 1980s and 1990s are being maintained today. Even with all of these water supplies, and water conservation programs, PWSD is seeking to increase the amount of renewable water in its water supply system and reduce its dependence on non-renewable water supplies. That is the purpose of this project.

e) Please include any relevant Tabor issues relating to the funding request that may affect the Contracting Entity.

There are no Tabor issues related to this grant request.

Part B. - Description of the Alternative Water Transfer Program/Project –

1. Purpose of the Program/Project

   Please provide a summary of the proposed program/project, including a statement of what the program/project is intended to accomplish, the need for the program/project, the problems and opportunities to be addressed, the expectations of the applicant(s), and why the program/project is important to the applicant(s). The summary must include a description of the technical, institutional (i.e., how the program/project will be organized and operated), and legal elements that will and/or have been addressed by the applicant and proposed program/project. The summary should also discuss relevant project history, if applicable, and any other relevant issues.

   Previous Studies
   To the maximum extent possible, the results of any previous studies and investigation should be utilized and incorporated into the proposed program/project. The application for funding should include a brief summary of the results of previous studies and how they will be utilized.

Previous studies have been completed by PWSD under a WSRA grant (Contract No. 150413) and an alternative agricultural transfer grant (Contract No. 150426) to conduct research on alternative means for agricultural transfers that will not perpetuate the "buy and dry" concept. Physical experiments have been conducted by Colorado State University (CSU) on farms owned by PWSD in Logan County, Colorado and economic analysis has been targeted on the South Platte Basin. The research focuses on (a) evaluating different irrigation methods and amounts to quantify water savings that could be made available for agricultural transfers to municipal use, (b) assessing the applicability of deficit irrigation practices to various crops, (c) evaluating means to quantify the consumptive use savings under varying irrigation techniques and crops, (d) surveying local farmers on the acceptance of water leasing and including local farmers, businessmen, and regulators in an Advisory Committee to assist the project, (e) analyzing regional economic impacts, and (f) evaluating potential institutional frameworks that likely could be adopted by local farmers.

The research has been guided by contributions of an Advisory Committee that includes representatives from water users, farmers, Division of Water Resource staff, scientists and local community leaders. Results from the research have been widely disseminated; including on-site field days, written communications to the Colorado Water Conservation Board and publications by the Colorado Water Institute, and numerous presentations including the Colorado Water Congress, Four States Irrigation Council, Agricultural Water Alliance, and the Governor's Outlook Forum, as well as scientific meetings. Research results have generated significant positive discussion about the Alternatives to Agriculture Transfer Program.

Going forward, this project will be working closely with the Lower South Platte Water Cooperative (Water Cooperative) and its steering committee to examine the feasibility, efficacy and third party impacts of a water-sharing program. Our efforts support the Water Cooperative's own

CWCB grant application by supplying innovative farm-level management practices, a quantitative examination of how a group of farmers might best meet consumptive use requirements of a water-sharing agreement, and suggesting how the pattern of agriculture and associated regional economics are altered with water-sharing programs when compared to "buy and dry".

The research that has been completed to date by CSU has positioned PWSD to bring this alternative agricultural transfer method to fruition because the necessary research and data collection framework has been completed. It is now a matter of taking the knowledge gained from the studies already completed and formulating the completion of the plan to provide a workable solution to the complex issues surrounding deficit irrigation and third party impacts. Once formulated, this plan will be applicable not only in Logan County, but will be able to serve as a model for any similar-type transfer in Colorado. This grant request is an extension of the work completed and is designed to take the remaining steps necessary to (a) define the most appropriate irrigation methods to make water available for urban interests while still maintaining irrigated agriculture, (b) identify the best crops that are suitable for this type of operation, (c) provide the procedures that can be defensible in Water Court, as we believe that Water Court action will be required, (d) determine the economics of agricultural transfer, including water leasing/sales, treatment requirements, and delivery, and (e) propose the institutional framework for setting up an urban/rural partnership designed to protect water rights and limit negative third party impacts vis-a-vis "buy and dry" transfers. As such, the proposed scope under this grant will complete the work started as part of the WSRA grant and the previous alternative agriculture transfer grant.

The overall purpose and need of this study has remained unchanged throughout the studies that have been conducted to date. *The purpose is to provide much needed water supplies to urban interests for municipal and industrial use, while protecting the rural economies in areas where some, but not all, of the water is removed from agricultural use. The need for this study is to explore alternative means to agricultural water transfers, without using the traditional "buy and dry" concept that can be harmful to rural economies, so that both rural and urban interests can benefit from a more beneficial approach for both interests that involves a cooperative effort and helps sustain both economies.*

Because of the growth expected in PWSD and the reliance on Denver Basin water, which the Statewide Water Supply Initiative (SWSI) identified as raising serious reliability and sustainability concerns, PWSD is trying to reduce its dependence on these non-renewable resources. As SWSI points outs, there is going to be increased competition for water, and in-basin solutions and conservation should be initial steps used to help meet future municipal demands. PWSD has already accomplished these tasks, as described in Part A, Section 4 of this application. PWSD has appropriated all of the remaining in-priority water in Cherry Creek, its local renewable water supply, and will manage the use of this water and its available reusable water, through Rueter-Hess Reservoir. PWSD has also implemented an aggressive water conservation plan that has resulted in a 40 percent reduction of water demand over the past 20 years.

These plans, while reducing the use of Denver Basin water, are not enough to fully reduce PWSD's dependence on non-renewable resources. PWSD recognizes that additional renewable water supplies can be developed from the agricultural sector, but wishes to do it in a manner that minimizes the effects on the rural economy. It is for this reason that PWSD partnered with CSU in 2007 to evaluate means to make historic consumptive use water from agriculture available to PWSD, and potentially other municipal water providers, while still maintaining viable farming operations. PWSD is not interested in the "buy and dry" concept that has historically been used to take water from irrigated

farmland. Therefore, the purpose of this grant request and the proposed scope of work is to bring that concept to fruition.

The proposed 3-year project scope (of which we are only seeking funds for the first two years) described herein has been developed by CSU personnel and much of the proposed work will be implemented by many of the agriculture-related departments at CSU. The detailed scope of work is presented in Section 6 of this application. The key CSU personnel involved in this project are shown in Exhibit B, attached. In addition, consultants to the PWSD will assist with certain tasks in this scope of work, including States West Water Resources Corporation (States West) of Cheyenne, Wyoming, Dewberry-Integra Engineering (Integra) of Denver, Colorado, and Lytle Water Solutions (Lytle Water) of Highlands Ranch, Colorado. Mr. Frank Jaeger, District Manager at PWSD, will be the overall project manager. To gain input from the local community, CSU will continue to use the Advisory Committee, which was set up to gain valuable input from local farmers, businessmen, and regulators. The Advisory Committee members are shown in the attached Exhibit C.

The scope of work for this extension of research that has already been completed as part of the Lower South Platte Irrigation Research and Demonstration Project is to complete the necessary work to develop usable methods to quantify consumptive use under alternative agricultural irrigation practices so that defensible data are developed to support Water Court applications. Since maintenance of return flow patterns is also a key component of any change of use proceeding, this grant application also seeks to complete the work necessary to adequately demonstrate the methodologies by which return flow patterns will be maintained so no senior, vested water rights are injured. However, getting an alternative agricultural water transfer through Water Court is only one step in the overall process. This grant application will also develop a more detailed, specific and sophisticated understanding of a water-sharing program. We will also work closely with the Lower South Platte Water Cooperative and its steering committee to examine the feasibility, efficacy and third party impacts of a water-sharing program. It is also important to understand that our efforts support the Water Cooperative's own grant application by supplying innovative farm-level management practices, a quantitative examination of how a group of farmers might best meet consumptive use requirements of a water-sharing agreement, and suggesting how the pattern of agriculture and associated regional economics are altered with water-sharing programs when compared to "buy and dry". This will ensure a complementary, but not overlapping, effort with meetings at the beginning and during the project, as well as asking Joe Frank and Jim Yahn to serve on our Advisory Committee. The final piece of this proposed work to evaluate an alternative agricultural water transfer will be to assess the delivery aspect of the project; from evaluating water availability and the potential to exchange water upstream (which will be another area where we will coordinate with the Water Cooperative), to evaluating the need for storage and where, to evaluating treatment issues and costs, to the ultimate infrastructure that will be needed to deliver this water to urban areas along the Front Range. Therefore, the scope of work presented in this application will provide all of the necessary analyses to assess the components of an alternative agricultural water transfer.

Given that CSU is the pre-eminent expert institution in the State of Colorado on agriculture and agricultural economics, CSU is the logical choice to lead this very important study. As an indication of the importance of the study, the CSU study team includes 3 department heads and 14 faculty and staff members (see Exhibit B).

2. Study Area/Service Area Description

The study area/service area is generally the geographic area that is the subject of the proposed program/project (include both the source of supply and location and type of new use). The description should include the following items:

a) A narrative description of the study area/service area including: the county, the location of towns or cities, topography, and locations of major surface and ground water features.

The study area is in Logan County, approximately 10 miles downstream of Sterling, along the north side of the South Platte River. The research farms that are part of this study are shown in the map in Exhibit D, and are located in the vicinity of the towns of Iliff and Proctor.

The water supply source for the ongoing farm research portion of this project is the South Platte River, using decreed senior rights on the river that have historically been used for irrigation of farms in Logan County. PWSD has water rights in the Iliff and Platte Valley Canal, the Powell and Blair Ditch, and the Harmony #2 Ditch, as well as storage and irrigation rights in Prewitt Reservoir. The Iliff and Platte Valley Canal has an appropriation date of October 1, 1883 for 150 cubic feet per second (cfs), the Powell and Blair Ditch has an appropriation date of February 19, 1895 for 40 cfs, and the Harmony #2 Ditch has an appropriation date of May 3, 1897 for 50 cfs. All of these rights were adjudicated for irrigation use. PWSD also has 10 shares in the Morgan-Prewitt Mutual Ditch and Reservoir Company that allows approximately 211 acre-feet of storage in Prewitt Reservoir, with a storage right of May 25, 1910. This right includes consumptive use yield (14.4 ac-ft/share), which allows PWSD to assign this yield to its wells for augmentation. The locations of these ditches and their headgate locations on the South Platte River are shown on the map in Exhibit D. Supplemental water supplies to the PWSD farms in Logan County are provided through South Platte River alluvial wells which are allowed to operate under the adjudicated augmentation plan of Lower Logan Well Users, Inc. (Case No. 03CW208) that replace delayed out-of-priority depletions to the South Platte River. There will be no new depletions to the South Platte River as a result of this project.

b) An area map showing each of the items above, as well as the locations of existing facilities, proposed project facilities and boundaries of lands involved in the proposed program/project.

The area map, showing all of the Logan County farms currently owned by PWSD is presented in Exhibit D. The Exhibit D map also shows which farms are being used for the research associated with this project. The Hurst farm is being used for the controlled research being conducted by CSU, and is where the linear sprinkler has been installed to facilitate that research. On-farm demonstrations are being conducted at the Hoogland farm (limited irrigation of corn), the Vant farm (soil salinity study), and the Kaufman farm (partial season irrigation of forage crops). At each of the on-farm demonstrations, existing irrigation equipment and water rights are being used to conduct irrigation consistent with historic practices. Exhibit D also shows the headgates for the Iliff and Platte Valley Canal and the headgate for the Powell and Blair/Harmony No. 2 Ditches (they both divert from the same headgate). The Hurst research farm will be used as the primary site for field-scale validation of the developed stress coefficients. The other PWSD farms will be used for the satellite-based remote sensing tasks.

c) Information regarding the irrigated lands that are involved in the program/project. This must include a tabulation of total irrigated acreage, description of cropping types, crop yields, and total average annual water diversions for existing agricultural lands.

There is a total of 2,529 acres of irrigated land on the farms owned by PWSD, and a total acreage of 4,710 acres. All of the PWSD-owned farms are shown in the map in Exhibit D. Crops historically grown on the farms include alfalfa, corn, sugar beets, sorghum, barley and beans. Headgate deliveries to the farms have ranged from 7,115 to 22,797 ac-ft/yr for the period 1996-2006. Supplemental water provided by junior wells has ranged from 132 to 424 ac-ft/yr for the same period. A full water supply has been provided to the PWSD fields every year for the period of record (1996-2009).

Cropping systems in the South Platte Basin near Iliff, Colorado are dominated by two crops, corn and alfalfa. Corn production makes up about 40 percent of the irrigated land in the area. The majority of this corn is produced for grain, with average yields of 175 bushels per acre (bu/ac). A small percentage of the corn is harvested for silage, with an average yield of 17 T/ac. The second largest crop is alfalfa produced for hay, making up about 35 percent of irrigated land, with average yields of 5.8 T/ac. An additional 8 percent of irrigated land is used for hay crops other than alfalfa, most commonly grassy-type hay crops with an average yield of 2.5 T/ac. Thus, corn and all hay crops make up more than 80 percent of the irrigated crop production in the area. Other important irrigated crops in the area are winter wheat, dry edible beans, and sugar beets.

Information regarding the location of the new water use(s) that will be served by transferred water including the estimated number of users/taps and/or uses served.

This proposed scope of work is designed to complete the work necessary to successfully transfer some portion of the agricultural water for urban use. Once the transfer is completed, the point of use for consumptive use water removed from the farms would be the PWSD service area, and likely other south Denver metropolitan service areas as well. Future water demands at Parker are expected to be 31,775 ac-ft/yr, serving 45,394 single family equivalent (SFE) taps, according to the latest PWSD Water Master Plan. The recent South Metro Water Supply Authority Regional Master Plan, which includes the water needs for 13 water providers in Arapahoe and Douglas County, identifies a cumulative demand of 116,700 ac-ft/yr at buildout. These values are inclusive of Parker's demand. The South Metro area was identified by SWSI as the highest demand area in the South Platte Basin Clearly, there is a demand for additional water supplies in the south Denver metropolitan area. All of the transferred agricultural water would be used to support municipal and industrial demands.

d) Socio-economic characteristics of the area such as population, employment and land use.

The following socio-economic data have been provided by Dr. James Pritchett, agricultural economist at CSU.

Economic Demographics

Annual value of sales and services of the Lower South Platte Basin (Morgan, Logan and Sedgwick Counties) is $3,372 million, with all agriculture industries together comprising 25 percent of this value. Table 1 in Exhibit E shows the top 10 sectors in the basin, in terms of dollars of output. The Lower South Platte Basin accounts for approximately one percent of the state's employment. Employment and earnings are concentrated in agricultural and related industries. According to the U.S. Department of Labor's Bureau of Labor Statistics, the average unemployment rate in the Lower South Platte Basin in 2005 was 4.1 percent. There are relatively few economic alternatives to agriculture in the Lower South Platte Basin and the counties in this area are heavily dependant on agriculture for their economic base.

Agricultural Demographics

Agriculture has been a major influence in almost every area of socioeconomic concern because the basin is located in one of the most agriculturally productive regions of the U.S. The basin's agricultural output has both regional and national significance. Total land area of the Lower South Platte Basin is 2,350,336 acres, with 91 percent of this land area dedicated to farming and ranching activities. Of the area in farm and ranch, 53 percent is cropland. Of the cropland, 14 percent is irrigated cropland and 86 percent is dryland. Grazing lands are utilized for beef cattle. The lands are irrigated by direct flow rights from canals, by storage from reservoirs, and by pumping from alluvial aquifers. The introduction of irrigation from both surface and ground water sources has diversified crops and increased livestock production. Corn (grain and silage), hay, and onions are the main irrigated crops grown today.

3. Description of the Alternative Water Transfer Method

Please describe the type(s) of water transfers that will be examined/utilized (i.e., conceived transfer methods include, but are not limited to: 1) interruptible water supply agreements; 2) long-term agricultural land fallowing; 3) water banks; 4) reduced consumptive use through efficiency or cropping changes while maintaining historic return flows; and 5) purchase by end users with leaseback under defined conditions). In addition, please describe how the transferable consumptive use will be calculated and quantified, and how return flow patterns will be addressed/maintained.

The methods being proposed are deficit irrigation and rotational fallowing, whereby agricultural lands are kept in production. The water may be leased or purchased through permanent or interruptible agreements, depending on the components of the water rights transfer. The preliminary research and data collection to define the components of the water rights transfer have been completed as part of the ongoing project. This grant will build on, and complete, that process so the water transfer can be consummated.

The water right transfer will require a standard change of use proceeding in Division 1 Water Court, as there are injury issues related to expansion, or changes in the time and location, of depletions to the river system and maintenance of historic return flow patterns that have to be demonstrated to the satisfaction of the Court that they have been addressed. As such, it is required that the transferable consumptive use be quantified and that historic return flow patterns be replicated to the extent that the transfer will not cause injury to any downstream vested water rights. The transferable consumptive use will be related to rotational fallowing of land, reduced crop irrigation techniques, changes in cropping patterns, or a combination of the three methods. This grant request is to evaluate the research results to date to assess the most effective, and economically-beneficial, means to transfer consumptive use and then apply an allocation approach to quantify transferable consumptive use and historic return flows. For example, transferable consumptive use will be calculated from the research results, comparing the consumptive use under historic irrigation practices to the consumptive use employing the innovative irrigation techniques developed through this research, with the difference being the transferable consumptive use.

Replicating historic return flows is one of the principal issues that has to be demonstrated in Water Court in a change of use proceeding. Historic return flows can be developed similar to the methodology that is standardly used in Water Court, i.e. calculate farm water deliveries, subtract out the historic consumptive use on a monthly basis, and then assign the remaining water as return flow. These return flows would then need to be provided in a manner that returns the water to the stream in a time, location, and amount that is determined from the historic analysis. While this normally is a straight forward process because the land is being dried up, with continued deficit irrigation there is some return flow that accrues from ongoing irrigation and some that will have to be provided from farm water deliveries to make up the balance of the return flow requirement. With ongoing irrigation, the issue relates to return flow to the river versus replenishing soil moisture in the unsaturated soil profile. This proposed extension of the research that has been completed will address the issue of return flow versus soil moisture retention so the return flow issue will be fully covered for a Water Court proceeding.

Since CSU will be working with data from both the South Platte and Arkansas River basins in these various analyses, including data generated from this study and other studies, and we will also be working with the SEO as part of the Advisory Committee, the process may have statewide applicability for change

of use proceedings.

Institutional issues related to how the water will be leased or purchased will be a task of this proposed project, once the initial tasks identifying methodologies and economics have been completed, as this will define the scope of an economically-feasible project. This task will be coordinated with the Water Cooperative so there is not duplication of effort and so we will obtain vital input from agricultural interests in the entire Lower South Platte Basin. The institutional framework will then be developed with that knowledge.

4. Program/Project Eligibility

Please describe how the proposed program/project meets each of the following eligibility requirements (please see Criteria and Guidelines for additional information regarding the alternative water transfer methods/strategies that qualify for funding). Note: If these requirements are addressed in other parts of the application you may simply reference the applicable section(s).

a) A description of how, if implemented, the proposed program/project will protect property and water rights.

This project will maintain agricultural production at some level, versus "buy and dry", so that in and of itself will protect property rights and property values. Any transferable consumptive use water that is removed from the irrigated land will go through the Water Court process, which allows anyone who believes they may be injured by the proposed change to present their case to the Water Court. As part of this process, consumptive use will be quantified, the timing of water deliveries will be determined, and maintenance of return flows will be assessed, all in a public forum. Therefore, vested water rights will be fully protected as part of this project. We believe that the Water Court process allows all potential property and water rights issues to be fully vetted and, therefore, fully protects these rights.

b) Identified group(s) of agricultural users that are or may be willing to transfer a portion of their water and identified entity(s), group(s) or area(s) where the transferred water could or would be put to the new use and a description of the new use.

CSU completed a survey of farmers in the Lower South Platte Basin as part of this ongoing project and found that approximately 60 percent of the respondents were willing to lease their water rights at values mostly in the range of $300 to $500 per ac-ft.

The CSU survey provides a foundation for gauging famer interest in alternatives to agriculture transfers, but it is incomplete. A limitation of the survey method was that the exact nature of the deficit irrigation or rotational fallowing lease was not identified. Our research team has learned more about these arrangements through the previous grant work, and more detailed analysis may be developed. The current scope of work will design an example lease for farmers that builds on the outcomes of the previous survey effort and then elicit the famers' willingness-to-accept leasing for specific terms. Focus groups will be used in lieu of a mail survey for this more intensive analysis. While farmers from the cooperating ditch system will be the initial source of focus groups, the effort will be extended in the Lower South Platte to achieve the grant program's goals of benefitting a larger scope of water users and providers.

A second limitation of the survey was that the profitability of specific rotational fallowing or deficit irrigation systems was not tabulated for review by survey respondents. We developed a better understanding of the economics of these systems, and will use this base to fine tune calculations to the cooperators' system and other irrigators. The economic calculation will be a part of the focus group effort. Results will be widely disseminated using CSU Extension activities and other means.

c) The program/project must at a minimum conceptually describe the technical, institutional, and legal elements of the water transfer. Grant monies may be used to address one or more of these elements. If grant monies are not requested for all three elements, the grant applicant must describe how the applicant has or intends to address the elements, which are not included in the grant request, through other efforts.

The technical aspects of this project are being scoped and conducted by faculty and staff from CSU, as well as States West, Integra, and Lytle Water, as described in the scope of work (Part B, Section 6). CSU will be conducting the final assessments to determine the best method(s) to be employed to maximize transferrable water savings, the methodologies to be used for return flow assessment under deficit irrigation practices, the economics related to the preferred irrigation methods, and the most appropriate institutional framework Issues related to treatment requirements will be conducted by Integra, while States West will evaluate the infrastructure issues related to delivery to the South Metro area. The components of the water rights transfer, including development of an allocation approach, will be evaluated by Lytle Water Solutions, water resources consultant to PWSD, and by Mr. Robert F.T. Krassa, water attorney to PWSD. While the components of the water rights transfer are an integral part of this overall project, no funds for the legal component of the work are being sought through this grant application. Funds are sought solely for the technical research and the economic, treatment, delivery, water rights and institutional analyses being conducted by CSU, and the consultants identified above. The results of this final phase of the project will become the basis for water rights transfers.

d) If grant monies are proposed for use for legal assistance then the use of those funds shall be oriented toward advancing the knowledge of alternative agricultural water transfer methods and techniques; not for preparation of a specific water court case. The total requested funds for legal assistance shall not exceed 40 percent of the total grant request. In addition, grant monies proposed for use for legal assistance must be used to collaboratively address issues and concerns related to agricultural water transfer. Funds shall not be used to solely advance the cause of the project proponents.

There is no part of this grant request that will be used for legal fees (see Part B, Section 4.c)).

e) A minimum of a 10 percent cash match of total project cost (past expenditures and "in kind" can not be counted toward the 10 percent match).

The PWSD has currently spent $522,420.99 for direct and indirect costs associated with the work being conducted by CSU, for the purchase and installation of equipment to facilitate the research, and for fees to Lytle Water to bring this alternative agriculture transfer process to fruition. Therefore, there has been substantial investment in this process by PWSD and it wants to bring this process to completion for the benefit of rural and urban communities throughout Colorado. While we understand that past

expenditures can not be counted towards the match for this grant request, we want you to understand PWSD's both past and ongoing commitment to this process and seeing it through to the end.

For this grant request, PWSD has $125,644 cash match from Colorado State University, as shown in Exhibit F. In addition, the Colorado Corn Grower's Association and the Colorado Livestock Association have indicated a willingness to participate in this project, and likely provide cash match as well. However, no official commitment can be made until their respective Boards approve this action. If the Corn Grower's Association and/or the Livestock Association officially approve participation and a cash match, we will supplement our application with these letters of approval and the amount of the cash contribution, which will increase the percent cash match.

Given a total project budget of $435,152, this represents a cash match of 22.4 percent. This very large percentage match, in addition to the $522,421 that PWSD has already contributed to research that has been conducted, but not completed, make this grant application imperative to approve so the monies already spent can bring this alternative agricultural water transfer concept to completion.

5. Program/Project Evaluation Criteria

The following grant evaluation criteria will be used by the CWCB to evaluate and make recommendations to fund, partially fund or not fund a grant application. The criteria are aimed at advancing alternative transfer methods from the literature and studies to actual on the ground projects/programs that provide reliable water supply and sustain key elements of the agricultural area from which the water is transferred. The applicant should fully address and explain in detail in the application how, and the extent to which, the proposed project/program meets each of the criteria. However, it should be noted that the project does not have to meet all of the criteria to be eligible to receive funding and the criteria below are not listed in any order of important or priority.

a) The proposed project/program builds upon the work of former alternative water transfer methods efforts and addresses key areas that have been identified (e.g. reduced transaction costs, presumptive consumptive use, and verification/administration issues). For more detailed information on this work, please refer to the draft technical memorandum, "*Alternative Agricultural Transfer Methods Grant Program Summary of Key Issues Evaluation," July 16, 2010.*

As stated in previous sections of this grant application, this application is a continuation of the work that has been completed under previous WSRA and alternative agriculture water transfer grant funds at the PWSD farms in Logan County. PWSD is seeking this supplemental grant so that the process that has been extensively developed to date can be completed, and allow alternative agricultural water rights transfers using deficit irrigation methods. The already-completed work will serve as the building blocks to the completion of this process, as described in the attached scope of work (Section 6). All of the grant fund requests will be complementary to the work already completed in this project and will be coordinated with the ongoing Lower South Platte Water Cooperative project, so there is a synergy between the work completed and the work contemplated as part of this grant. Without these additional funds, there is the likelihood that the research and data collection already completed will not be able to be brought to fruition.

b) Preference will be given to projects that provide additional matching resources in the form of cash, past expenditures and in-kind contributions that are in addition to the required 10% cash match.

See Section 4e) above regarding past expenditures and the cash contribution for this grant application. PWSD has contributed more than one-half million dollars to this alternative agricultural transfer process and is committed to seeing this process through to the end. As part of the continuation, and completion, of this process an additional $126,644 of cash is being provided for this project from multiple entities. In-kind match results in an additional $60,788 contribution to this project. (See the budget tables).

c) The proposed project/program has the ability/potential to produce a reliable water supply that can be administered by the State of Colorado, Division of Water Resources.

The development of the procedure to make this water available in a manner that can be administered by the State Engineer's Office has already been extensively discussed with the Advisory Committee, which includes Mr. Dave Nettles, the Division 1 Engineer, as well as many of the local farmers who likely could be injured by a water transfer case if not done properly and with protection for existing water users. We propose to take the knowledge learned from the Advisory Committee and the results from research already conducted by CSU to make this type of water transfer administrable. The concepts being discussed relate to an allocation approach related to historic versus future irrigation use and the preservation of historic return flow patterns. Since deficit irrigation can result in changes to return flows due to soil moisture deficits, this will be one of the focuses of the study under this grant. If the water is transferable, the water being sought as part of a rotational fallowing and/or innovative crop irrigation management method is the senior surface water ditch rights in the lower South Platte River basin. Therefore, if the water can be shown to be transferable from an administrative standpoint, the water will provide a very reliable water supply, particularly with the terminal storage available at Rueter-Hess Reservoir, which can provide carryover storage to handle multi-year drought conditions.

d) The proposed project/program produces information that is transferable and transparent to other users and other areas of the state (i.e., would provide an example "template" or roadmap to others wishing to explore alternate transfer methods).

One of the principal objectives of the CSU study is to provide information related to cropping methods that could be applied in other agricultural areas of the state. After all, CSU is an agricultural university that is trying to support agriculture, and agricultural technologies statewide, not just in the lower South Platte River basin. While other areas would have to generate site-specific data related to any change of use proceeding in Water Court, the methodologies to achieve that change would be developed as part of this research. In addition, since CSU will be working with data from both the South Platte and Arkansas River basins, including data generated from this study and other studies, and we will also be working with the SEO as part of the Advisory Committee, the process may have statewide applicability for change of use proceedings.

e) The proposed project/program addresses key water needs identified in SWSI or as identified in a basin's needs assessment.

This project is totally consistent with the findings from SWSI in that some of the projected Front Range water needs identified by SWSI could potentially come from historically-irrigated lands. In fact, SWSI identified, as one option, the potential need to retire 133,000 to 226,000 acres of irrigated land to meet future water supply needs in the South Platte River basin. If water can be made available without the total dry-up of these lands, it is an even better option than that suggested by SWSI. Furthermore, SWSI identified the issue of the reliance of many Front Range communities on the non-renewable resources of the Denver Basin and stated that "increased reliance on nonrenewable, non-tributary groundwater for permanent water supply brings serious reliability and sustainability concerns in some areas, particularly along the Front Range". (SWSI, November 2004) This study provides a potential pathway to reduce the reliance of Front Range communities on Denver Basin water resources while, at the same time, preserving the very important rural economies.

f) The proposed project/program advances the preservation of high value agricultural lands. Value can be viewed as: the value of crops produced, the value the agriculture provides to the local community, and the value the agricultural area provides for open space and wildlife habitat.

This research study has the express intent of maximizing the value of existing agricultural land and preserving that value even if some of the transferable consumptive use water is removed from the land. Crops will continue to be produced on these lands under the concepts of this research, and value that is lost due to reduced crop yields will be replaced by the municipal entities changing a portion of the water supply so that the farmers' value in their land is undiminished. In fact, value may increase due to municipal interests essentially guaranteeing a value for the crops.

g) The proposed project/program addresses water quality, or provides other environmental benefits to rivers, streams and wetlands.

Water quality will be unaffected because the lands are kept in production. With "buy and dry", erosion can increase, causing increased sediment loads and impacts to riparian corridors. Therefore, this project preserves the status quo relative to water quality. Since irrigation return flow patterns have to be maintained to the extent to protect vested downstream water rights, there will not a significant change in either stream flows or flows to existing wetlands areas.

h) The proposed project/program increases our understanding of and quantifies program/project costs. This could include: institutional, legal, technical costs, and third party impacts.

This phase of the project, which builds on and completes previous work funded by the CWCB, will provide the methods that can be used to quantify transferable consumptive use water, as well as the means to administer these water rights. As a component of completing the final phase of this project, the costs to

conduct such a program will be developed with these grant funds. Furthermore, economic impacts associated with reduced crop yields and the methods that could be employed to keep the farmers whole economically, the effects to the local rural economies, i.e. the ripple effect on third parties that are not directly involved in this study, and the quantification of costs and impacts related to the methods for transferring some of the water off the land will also be quantitatively developed further with data obtained from completed phases of this project.

i) The proposed project/program does not adversely affect access to other sources of water (not subject to/participating in the program) where owners of these water rights may wish to pursue traditional transfer of their rights to other users.

This project does not affect any other water rights as the water being used for this study is all taken from adjudicated points of diversion, out of priority diversions are fully augmented, and ditch diversions are regulated through the mutual ditch companies. The change of use proceeding in Division 1 Water Court will not result in any new depletions to the stream and return flow patterns will be maintained to the extent that they protect vested downstream water rights. Other users within the mutual ditch companies are not hindered in maintaining their historic uses and/or pursuing a traditional change of use because of this study.

j) The proposed project/program provides a perpetual water supply for the new and/or alternate use and preserves agricultural production and/or helps sustain the area's economy from which the transfer is occurring.

Providing a sustainable water supply for municipal and industrial water uses along the Front Range, while still maintaining healthy rural economies is the ultimate objective of this study, and this objective can only be achieved with these additional grant application funds so the steps in the alternative agricultural water rights transfer process can be completed.

k) The quantity of water produced by the proposed project/program. Preference will be given to programs that can address larger water supply needs.

To be economical to pump and pipe this water back to Front Range water users it is expected that the minimum volume to be moved would be in the range of 20,000 to 40,000 ac-ft. The results of the research to date have indicated that water savings can be realized through innovative irrigation pracitices. This phase of the work to be funded by this grant application will assess and quantify the interest in participating in a water supply delivery project so the quantity of water to be transferred can be determined.

6. Statement of Work

Provide the proposed statement of work. On the following page there is an example format for the statement of work. You can use the example format or your own format, provided that comparable

information is included. The statement of work should outline by task how the proposed program/project will be accomplished. It is important that the statement of work detail the specific steps, activities/procedures that will be followed to accomplish each individual task and the overall program/project and the specific products/deliverables that will be accomplished. The statement of work must include but not be limited to: task description, key personnel, budget, schedule and deliverables and the final report/project documentation upon completion of the water activity.

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.

Please provide a detailed statement of work using the following template. Additional sections or modifications may be included as necessary. Please define all acronyms. If a grant is awarded an independent statement of work document will be required with correct page numbers.

The scope of work for this final phase of the ongoing study is described below in the format suggested by the CWCB. All of the proposed scope of work in this phase builds on work previously conducted by CSU under the WSRA grant (Contract No. 150413) and the alternative agricultural water transfer grant (Contract No. 150426) previously approved by CWCB.

Statement of Work

WATER ACTIVITY NAME - Lower South Platte Irrigation Research and Demonstration Project

GRANT RECIPIENT – Parker Water and Sanitation District

FUNDING SOURCE –SB 09-125

INTRODUCTION AND BACKGROUND
Provide a brief description of the project. (Please limit to no more than 200 words; this will be used to inform reviewers and the public about your proposal)

OBJECTIVES
List the objectives of the project

TASKS
Provide a detailed description of each task using the following format

TASK 1 – [Name]

Description of Task

Method/Procedure

Deliverable

TASK 2 – [Name]

Description of Task

Method/Procedure

Deliverable

REPEAT FOR TASK 3, TASK 4, TAKE 5, ETC.

Shown below is the proposed scope of services for this grant application in the format shown above.

INTRODUCTION AND BACKGROUND

Physical research supported by PWSD and CWCB (2007-2010) has evaluated water conserving cropping practices including limited irrigation and rotational cropping with a variety of crops and crop rotations (corn, wheat, sugarbeet, soybean, sunflower, canola). The research was conducted at the Lower South Platte Irrigation Research and Demonstration project in Iliff, CO and results show as much as 40% reduction in consumptive use compared to fully-irrigated continuous corn. The CWCB-funded research has led to additional supportive work by CSU and USDA-ARS scientists, showing that viable cropping practices reduce consumptive use while avoiding dry-up of irrigated land are attractive alternatives. However, rotational fallow or permanent dry-up are more frequently adopted because they are simpler to administer and enforce in a change of use case. Thus, legal and administrative hurdles stand as major obstacles to adoption of alternative water-conserving practices. This proposal will develop a practical means of calculating and verifying consumptive water use and of addressing return flow concerns and will therefore bring limited irrigation and alternative crop rotation into the feasible set of water saving options. The previous CWCB-funded research also evaluated the role of deficit irrigation in farm level economics, the willingness of farmers to participate in alternative water sharing arrangements, and the contribution that irrigated agriculture makes to the economic vitality of rural communities. The next major step forward is development of a detailed, specific and sophisticated water sharing program that addresses the following: how much water can be released as a result of adopting alternative water saving practices, how much must farmers be paid to participate in the program, what is the cost of this water to the municipal leaser, and how will the alternative transfers impact local businesses and the environment relative to permanent fallowing that follows a 'buy and dry' transfer. This project will address these questions through development of a model water transfer institution based on a case study water organization participant. In addition, the case study will evaluate potential

third party impacts.

SPECIFIC PROJECT TASKS

1. Develop a practical means of calculating and verifying consumptive water use and water savings in alternative systems that will satisfy Water Court requirements.
2. Demonstrate a water allocation approach to simplify the administrative burden to maintain return flows.
3. Develop a model water transfer institution based on a case study water organization that will establish a water delivery plan and organizational structure.
4. Evaluate issues associated with, and develop, ultimate treatment and infrastructure delivery options and costs.

TASKS

Task 1: Develop a practical means of calculating and verifying consumptive water use and water savings in alternative systems that will satisfy Water Court requirements.

Description of Task

In this task, we will develop the necessary approaches to implement water transfers based on the cropping strategies developed with the previous CWCB-funded project. Specifically, we will develop, test, and validate a simplified means to calculate consumptive use water savings. CU savings will be determined using the same methodologies that have been employed in Water Court, e.g. the Blaney-Criddle equation, but using crop growth coefficients that reflect irrigation practices evaluated in the previous CWCB-funded research at Iliff. The study is carried out at three scales. Results of field plots will be used to develop stress coefficients. They will be validated at the field scale with independent evapotranspiration measurements, and then refined and further developed at the basin level with satellite based remote sensing. This task is divided into sub-tasks 1A, 1B, and 1C, but work together to bring the previous research to a point where the findings can be implemented.

Sub-task 1A: Apply results from the CWCB-funded research (Iliff site) to develop stress coefficients for major crops corn, alfalfa, and wheat. The stress coefficients can be used with standardized methods to calculate crop ET, a critical step for implementing study findings.

Sub-task 1B: Conduct a field-scale validation of the stress coefficients and consumptive use calculations under limited irrigation by independently measuring actual crop evapotranspiration. The independent evapotranspiration measurement is based on in-field soil moisture sensors, infra-red radiometry, and a land surface energy balance.

Sub-task 1C: Use satellite-based remote sensing to further develop and validate ET measurements, crop coefficients, and stress coefficients under cropping practices with reduced consumptive use. This sub-task will take a multi-farm, to basin, scale approach to determine ET by measuring instant, daily, and

seasonal actual ET. The surface energy balance model to be used was developed by the Integrated Decision Support at Colorado State University and is called ReSET (Remote Sensing of ET). This model has been extensively used in the South Platte and Arkansas River Basins as well as other parts of the US to calculate ET and develop crop coefficients. The model will be used to calculate CU for targeted fields (deficit irrigation, rotational fallow) throughout the growing season and compared to historical consumptive use (estimated using the Integrated Decision Support Consumptive Use Model (IDSCU) which has been developed over the last twelve years in close cooperation with water users in the South Platte and the State Engineer's Office (www.ids.colostate.edu/projects/idscu)) to estimate the possible water savings from the alternative management practices and hence determine the amount of water available for possible transfer. The ReSET model has a seasonal module which estimates cumulative ET for the season, which is essential in calculating water savings. The seasonal module uses ET grids derived each day a satellite image is available and a network of weather stations or soil moisture sensors to develop a detailed seasonal ET grid for a particular area of interest (field, canal service area, region) with a 30m by 30m resolution when using Landsat 5 imagery.

Detailed Methods and Procedures

Subtask 1A: This subtask will develop crop stress coefficients that will allow the Iliff-based research results to be applied to limited irrigation systems throughout the South Platte Basin. Past field research collected detailed water balance data on a replicated field study of alternative water saving crops and cropping systems. The water balance data collected can be used to calculate crop consumptive use and coupled with weather data to develop and evaluate crop stress coefficients for limited irrigation or rotational cropping. Water stress coefficient (K_s) will be based on those developed for the FAO standardized Penman-Monteith equation (Allen et al., 1998). The stress coefficients modify crop coefficients on a daily time step when soil water content is less than a crop-specific readily available water (RAW) level. We will test the use of K_s against observed ET data from the Iliff site for corn and wheat, and for alfalfa from a Fort Collins study, and make adjustments in RAW as needed to obtain reliable ET estimates. These stress coefficients will be subjected to testing and validation in subtasks 1B and 1C so they can provide defensibility in a Water Court proceeding.

Subtask 1B: This subtask is a field-scale validation of the stress coefficients and consumptive use calculations under limited irrigation with an independent measurement of actual crop evapotranspiration. By using state-of-art instrumentation, we will verify consumptive use savings and substantiate how the simplified algorithms developed can be used when farmers choose to conserve water by means other than land dry-up. There are two components to the independent evapotranspiration estimates:

1. *Synoptic surface/canopy temperature and soil moisture monitoring using five in-situ stations*. Each station will have one IRT sensor, two soil water potential sensors and one soil temperature sensor. Additional components for each station include mast or pole with cross-arms, environmental enclosure, datalogger, power supply, pvc pipes, and ancillary material. These stations will acquire every hour surface (canopy) temperature, soil moisture potential, and soil temperature data. The sensors will be mounted at least one meter above

the canopy level at all times and will be oriented south to avoid casting shadows at the observed surface.

Five monitoring stations will be installed, one per field. Three of the fields will be from the Lower South Platte Irrigation Research and Demonstration project near Iliff, CO. Two additional fields will be on private land of cooperating farmers. The selected fields will be planted to corn and alfalfa, two crops that consume large amounts of water and that are largely grown in northern Colorado. Measurements will start in June 2011, be collected during the irrigation season, and will end in October 2012, for a two-year study period.

Daily crop water stress indices (CWSI) will be produced using the canopy minus air temperature difference method which is based on an upper and lower boundary temperature difference limits. The methodology outlined by Payero and Irmak (2006), Irmak et al. (2002), Alves and Pereira (2000), and Steele et al. (1994) will be applied.

Relationships between CWSI and soil water potential will be established. The crop consumptive use and crop stress coefficients will be derived from the CWSI using reference (potential) evapotranspiration (ETr) calculated using weather data.

Soil moisture will be measured at two depths. The first depth will be one foot from the surface. The soil temperature will be measured at the first foot depth. This sensor will track the soil water status within the root zone. The second soil water potential sensor will be installed below the root zone to determine any deep percolation or water up-flux from high water table.

The CWSI indices will be evaluated using the SMS data and a Large Aperture Scintillometer (LAS) energy balance (EB) system. The procedure detailed in Ezzahar et al. (2009) and Hemakumara et al. (2003) will be followed. Besides installing the LAS transmitter and receiver, a net radiometer sensor and soil heat flux plates will be installed in the field to obtain the needed components of the EB, thus being able to compute ET or CU.

2. *Ground-based remote sensing campaigns of crop surface/canopy reflectance will take place using a handheld multispectral radiometer* (visible and near infra-red bands) every two weeks (from June to October of 2011 and 2012) to follow the crop biomass development stages and derive surface albedo, vegetation indices like the Green Normalized Difference Vegetation Index (GNDVI), the Normalized Difference Vegetation Index (NDVI), and the Optimized Soil-Adjusted Vegetation Index (OSAVI) which can be used to infer on the plant Leaf Area Index (LAI) and fractional vegetation cover (fc); both indicators of crop growth. The data obtained with the handheld multispectral radiometer will be used, in conjunction with weather data and the IRT data, to compute net radiation, soil heat flux, and sensible heat flux. Then, using the EB approach we will be able to get

the crop actual CU (CUa). The CUa will be related to potential CU to determine the crop water stress and therefore the amount of water saved by the limited irrigation management strategy.

This method will be evaluated using the SMS and LAS EB systems as described above in Sub-task 1B, item (1) for the CWSI derived from IRT sensors only.

Subtask 1C: This sub-task will provide further validation of the crop stress coefficients based on using remote sensing techniques. This sub-task will provide additional defensible documentation that can be used in a Water Court proceeding. The ReSET land surface energy balance model (Elhaddad and Garcia 2008) will be used to process available satellite images of the region. The model estimates the actual ET at the time of a satellite image. Summing up values of actual ET (ET_a) over any length of time *(day, week, month, season)* for a particular field provides an estimate of the actual consumptive use for a field. The model can also be applied to large areas (180 km x 180 km) yet retaining a resolution of 30m x 30 m which allows the model to determine the ET for small parcels.

The ReSET model is built on the same theoretical basis of its two predecessors METRIC (Allen et al. 2007 a,b) and SEBAL (Bastiaanssen et al 1998 a,b) with the additional ability to handle data from multiple weather stations. This enhances regional ET_a estimates by taking into consideration the spatial variability of weather conditions through data acquired from different weather stations (across the area covered by the remote sensing system/imagery).

Cumulative ET calculations derived from ReSET are needed to estimate seasonal water savings from specific fields that either had deficit irrigation or rotational fallowing. Seasonal ET is calculated using actual individual ET grids developed at each image date and filling interpolated ET grids between them. The ET grids on days when images are not available are calculated using the ReSET seasonal tool which is a GIS application that uses a network of available weather stations and/or field soil moisture sensors to estimate the ET taking into consideration the spatial and temporal variability of ET. Next, all calculated ET grids are added to calculate the total water volume per unit area for the season for each field being monitored.

ReSET is currently being used in a joint project between Northern Colorado Water Conservancy District (NCWCD), the US Bureau of Reclamation and CSU to calculate ET in the NCWCD service area. As part of this project, the ReSET model is being used to develop regional crop coefficient curves (Kc) for the Penman-Monteith equation for several agricultural crops. The Kc developed for grain corn fields in the South Platte Basin used data for a period of four years, with a total of 79 Landsat images using over 1,000 corn fields during the growing season which extends from May to October. The Kc curve developed is shown below:

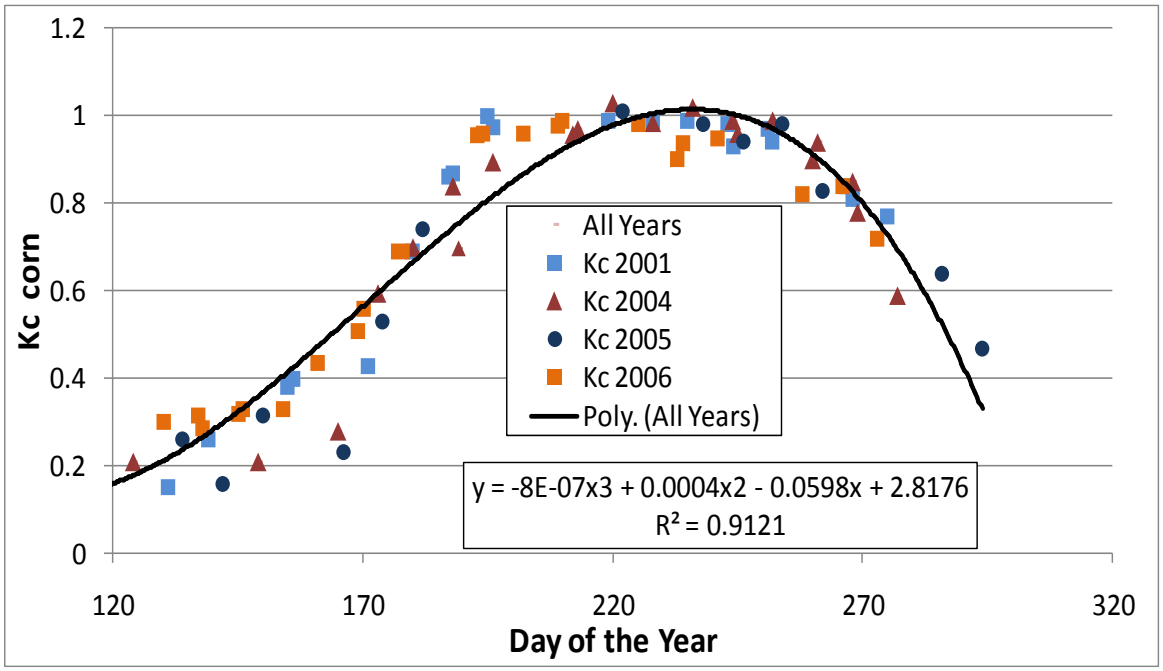


Figure 1. ReSET corn Kc values developed using 2001, 2004, 2005 and 2006 data.

The model has also been applied to the Lower Arkansas River Basin in Colorado to calculate the ET for numerous fields where CSU has been working with the CWCB on an irrigation monitoring project. The ReSET model was used to estimate the ET for each of the fields being monitored. The ReSET ET was used as part of the water budget to determine the irrigation efficiency and the deep percolation for each irrigation and field that was monitored. A draft of a comprehensive final report on the irrigation monitoring work was recently submitted to CWCB. Another area that the model was used to estimate and accurate seasonal ET for Alfalfa is the Palo Verde Irrigation District in California, San Joaquin Valley in California and the United States, the seasonal estimate by the model was very accurate (1.5% off weather station estimates), also the Bureau of Reclamation is applying ReSET as part of their Colorado River Basin Uses and Losses Report.

As such, these sub-tasks will build on existing data to develop the necessary, but simplified, algorithms to be used for changes of use in Water Court.

Task 1 Deliverables

This task will deliver a procedure to efficiently and economically determine the actual ET from areas of deficit irrigation, alternative crop rotations, or rotational fallowing. The ET can then be compared to historic ET to determine the amount of water for potential transfer. As such, this task will complete the procedures necessary to successfully transfer agricultural water to municipal use .

Task 2: Demonstrate a water allocation approach to simplify the administrative burden to maintain return flows.

Description of Task

Implementation of cropping practices that reduce consumptive use without complete dry-up or fallow is dependent on a reliable approach to maintain and verify historical return flows. Results from the Iliff study do show a reduced volume of water moving below the root zone from limited irrigation, suggesting that return flows would be diminished under these practices. Under a change of use case involving any of these practices, a secondary approach to maintain return flows may be implemented (recharge ponds, wetlands, etc). Field-scale approaches to determine and verify the contributions to return flow under limited irrigation have the potential to be very complex and expensive, making this a significant barrier to adoption of these alternative methods. We propose to demonstrate the feasibility of a water allocation approach to simplify the administrative burden of maintaining return flows when a deficit irrigation or alternative crop rotation is implemented.

Methods and Procedures

The allocation approach is proposed to simplify and reduce the costs to administer a change of use case and protect historic return flows even while maintaining some level of irrigation on the farm. In this approach, 100% of the historic return flows would be met with a secondary method (i.e., constructed wetlands or recharge ponds) and the allowable diversion would be capped at the fraction of historic consumptive use kept for irrigation. The cap in diversion allocation guarantees the target CU savings and historic return flow, and the irrigator is allowed to fully consume the diverted water. A major advantage to this approach is that it motivates the use of efficient irrigation practices. Diversion/flow measurements are needed for the farm and for the diversion into the secondary return flow system, but this approach avoids the need for expensive and complicated instruments such as soil moisture sensors, drainage gauges, etc. at the field level. From the perspective of return flow maintenance, the allocation approach is conservative because water diverted for irrigation that becomes return flow is additional flow above the requirement. For this task, we will use existing field research results to synthesize the costs, strengths, and weaknesses of the allocation approach and we will conduct a field-scale demonstration at the Lower South Platte Irrigation Research and Demonstration site in Iliff, CO.

Task 2 Deliverables

This task will deliver (1) a simplified approach to administer change of use cases and to protect return flow while maintaining on-farm irrigation and (2) a field demonstration of the allocation approach using limited irrigation.

Task 3: Develop a model water transfer institution based on a case study water organization that will establish a water delivery plan and organizational structure.

Description of Task

Previous research funded by CWCB creates a better understanding of the role of deficit irrigation in farm-level economics, the willingness of farmers to participate in alternative water sharing arrangements and the contribution that irrigated agriculture makes to the economic vitality of rural communities. The next evolution in identifying and creating a successful alternative to agriculture transfers program is to develop more detailed, specific and sophisticated understanding of a water-sharing program. Relevant questions include: how much water can be released as a result of an innovative alternatives to agriculture program, how much must farmers be paid to participate in the program, what is the cost of this water to the municipal leaser, and how will the alternative transfers impact local businesses and the environment relative to permanent fallowing that follows a 'buy and dry' transfer?

As described below, we are working closely with the Lower South Platte Water Cooperative (Water Cooperative) and its steering committee to examine the feasibility, efficacy and third party impacts of a water-sharing program. Our efforts support the Water Cooperative's own grant application by supplying innovative farm-level management practices, a quantitative examination of how a group of farmers might best meet consumptive use requirements of a water-sharing agreement, and suggesting how the pattern of agriculture and associated regional economics are altered with water-sharing programs when compared to "buy and dry". We ensure a complementary, but not overlapping, effort with meetings at the beginning and during the project, as well as asking Joe Frank and Jim Yahn to serve on our Advisory Committee.

Sub-task 3A: In this sub-task we will complete a case study evaluation. We propose identifying an agricultural water user group (e.g, mutual ditch company or ditch system) willing to serve as a case study for an alternative agriculture transfer program. The user group should have sufficient water resources to satisfy a sufficiently large portion of the needs of Parker Water and Sanitation District and a willingness to participate in detailed consumptive use and economic analyses. Farmer members of the ditch company will be asked to contribute information and evaluate agronomic and farm management practices, including a review of profitability and production information. More specifically:

a) Famers will work with CSU researchers to identify current production practices and historical consumptive use of water resources throughout the ditch system or water user group.
b) Farmers will be asked to identify water saving practices and land management techniques that are associated with a deficit irrigation and rotational fallowing program,
c) Farmers will evaluate proposed lease agreements developed by the research team's Advisory Committee and indicate their willingness to participate.

Farmer input will help to establish likely crop rotation adaptations in the water-sharing program as well as the type of lease needed to facilitate water sharing. An important research question is how farmers adapt to the alternative program so that impacts to rural communities can be better understood in

contrast to "buy and dry" activities. Important lease agreement characteristics can be identified including lease amounts, timing of payment, notification period for fallowing, length of lease, tax implications, and risk. We plan to work with farmers that include, but are not limited to, individuals who currently work with the Parker Water and Sanitation District in Logan County, interested farmers that have already entered into leasing programs in both Logan and Morgan Counties, and farmers and water user organizations that are actively participating in the Lower South Platte Water Cooperative in Water Districts 1 and 64. The steering committee of the Lower South Platte Water Cooperative will assist in identifying these individuals.

Subtask 3B: For this sub-task we will design a specific water transfer institution. Designing an institution that meets municipal and agricultural needs is important in the proposed research. Municipal interests seek to work with relatively few water suppliers in obtaining their water resources, want to contract a sufficiently large water supply to reduce transactions costs and seek assurance that contracts will be met. Agriculture water right holders seek to partner with others to create a pool of water available for lease that still permits flexibility in maintaining agricultural operations and gains market access. Designing an institution that meets these client needs is a goal of the research. Institutional design includes, but is not limited to: rules for participation, a plan for monitoring and enforcement, payments to participants, gauging famer participation and guaranteed supplies for municipalities that meet requirements to protect water right holders. Institutions can include a contemporaneous value-added investment in communities or in the purchase of community resources.

A specific institutional model will be designed for the case study that coordinates the farming and water activities of the cooperating ditch system. The model will represent the current agricultural activity and consumptive use in the system, and then proxy how acreage allocation, costs and revenues change under various institutional designs. For instance, the economic model can answer the question "how will planted acreage change under a rotational fallowing program that in which leasing payments are $500 per acre?" Or alternatively "what lease price is needed to guarantee 10,000 ac-ft of consumptive use in the system. What will be the crop rotation that results from this system?" Specific institutional design will gain from the insight of the Advisory Committee and may include deficit irrigation, rotational fallowing, interruptible supply arrangements, conjunctive use of water resources, nest generation cooperative structure, etc.

Consumptive use savings, whether they are obtained through rotational fallowing or through deficit irrigation, must be marketed, managed and monitored by an entity that can join those supplying water with those that are interested in receiving the water. We propose to work directly with the Lower South Platte Water Cooperative steering committee and project team to demonstrate how our case study farms might supply water to the Cooperative so that it can be used to meet the needs of contracted leasers. Our proposal is consistent with the aims of the Water Cooperative's own CWCB grant proposal. We plan to continue having Joe Frank and Jim Yahn (members of the Water Cooperative steering committee) on our Advisory Committee and will have meetings with them to coordinate efforts between the two projects as appropriate.

Subtask 3C: This sub-task will evaluate third party impacts. The alternative agriculture transfer grants

program seeks alternatives that mitigate the third party impacts of sharing water resources between municipal and rural interests. Analyzing third party effects require the evaluation of alternatives at a basin level in terms of economic and environmental impacts. This proposal suggests that the previously-mentioned farm level and institutional information (e.g., management practices, costs, consumptive use of water) be used as inputs in an equilibrium displacement model (EDMP) of the South Platte Basin. The EDMP can quantify the economic and distributional impacts of shifting consumptive use from agriculture to municipal purposes. As an example, the EDMP can determine how agricultural production, commodity prices and input purchases adapt when water is shifted in a rotational fallowing program and this can be compared to a current baseline and a "buy and dry" scenario. The shift in water use created ripple effects to allied and indirect industries represented in the EDMP. The structure of the EDMP has been built at CSU, but it needs to be populated with data from the farm and institutional analysis described above.

Task 3 Deliverables

The deliverables for this task will include:

a) A written synthesis and analysis of famer adaption to water-sharing arrangements, including rotational fallowing, deficit irrigation and interruptible supply agreements. A description of preferences of lease provisions will be included.
b) An economic optimization model that allocates consumptive use among farmers participating in a water sharing program. The optimization model will be based in Excel, available for public use and have required documentation.
c) An equilibrium displacement mode and completion report detailing the third party impacts of alternative water sharing arrangements.
d) Presentations to constituent groups of the deliverables in a) – c).

Task 4: Evaluate issues associated with, and develop, ultimate treatment and infrastructure delivery options and costs.

Description of Task

The first two tasks focus on determining methodologies that likely can be successful in Water Court to affect a change of use in Water Court from agricultural use to municipal use, while still maintaining farming practices. Task 3 then evaluates the impacts that likely will occur to rural economies as a result of these changes, as well as the parameters and framework that will be necessary to make these types of alternative agricultural transfers attractive to the farming community. This task is designed to evaluate what remaining issues there are to bring the transferred water to urban communities along the Front Range. The principal issues associated with this task relate to timing of water availability, treatment issues, and the infrastructure required to deliver the water.

Methods and Procedures

Agricultural water rights are only available during the irrigation season, typically April through October. Long distance water deliveries need to be made on an average daily basis, rather than a peak day basis. The first objective of this task will be to evaluate the timing and location of water availability for transfer. As part of this work we will coordinate with the Water Cooperative associated with work they have already completed on the exchange potential on the South Platte River. These data will assist us in evaluating where, and how much, water is available for potential delivery to the urban areas along the Front Range. We will develop a scenario related to where, when, and how much water can be delivered.

Using the water availability values, the water quality of the water will be assessed from existing data bases to determine the level of treatment that will be required prior to delivery. As part of this assessment, we will also evaluate issues associated with the required treatment technologies, e.g. brine disposal from reverse osmosis treatment. To the extent possible, we will utilize data being developed in the CWCB-funded study on treatment issues.

The water availability values will also be used to assess the need for carryover storage in reservoirs in the Lower South Platte Basin and the infrastructure required to deliver this water to urban areas along the Front Range on a baseload basis.

Work related to water availability assessments, storage needs, and exchange potential on the South Platte River will be conducted by Lytle Water Solutions, LLC of Highlands Ranch, Colorado, while the treatment issues will be assessed and completed by Dewberry-Integra Engineering of Denver, Colorado, and the infrastructure issues will be addressed and completed by States West Water Resources Corporation of Cheyenne, Wyoming.

Task 4 Deliverables

The deliverable from Task 4 will be a final report assessing the issues associated with the ultimate delivery of changed agricultural water to urban areas along the Front Range, the feasibility of such a plan, and the estimated costs for this water collection, treatment, and delivery system.

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.

This task is acknowledged as being a part of the scope of work described above. Deliverables are described for each task in the scope of work.

BUDGET

Provide a detailed budget by task including number of hours and rates for labor and unit costs for other direct costs (i.e. mileage, $/unit of material for construction, etc.). A detailed and perfectly balanced budget that shows all costs is required for the State's contracting and purchase order processes. Sample budget tables are provided below. Please note that these budget tables are examples and will need to be adapted to fit each individual application. Tasks should correspond to the tasks described above.

Total Costs				
	Labor	Other Direct Costs	Matching Funds (If Applicable)	Total Project Costs
Task 1 - (Specify name of task)				
Task 2 -				
In-Kind Contributions				
Total Costs:				

Example Titles

Example Project Personnel: Hourly Rate:	Project Manager	Project Engineer	Geologist	Scientist	Graphics/ Designer	Clerical		Total Costs
Task 1 -								
Task 2 -								
Total Hours:								
Cost:								

Other Direct Costs						
Item:	Copies	Materials	Equipment/ Supplies	Mileage		Total
Units:	No.			Miles		
Unit Cost:						
Task 1 -						
Task 2 -						
Total Units:						
Total Cost:						

In-Kind Contributions (If Applicable)				
Project Personnel: Hourly Rate:				Total
Task 1 -				
Task 2 -				
Total Hours:				
Total Cost:				

Shown below is the proposed budget for this grant application in the format shown above.

BUDGET

	Total Costs				
	Labor	Other Direct Costs	Indirect Costs	Matching Funds	Total Project Costs
Task 1 – calculating and verifying consumptive water use	$99,406	$32,298	$32,926	$41,881	$206,511
Task 2 – water allocation approach	$91,001	$1,428	$23,107	$41,881	$157,417
Task 3 – model water transfer institution	$69,421	$22,568	$22,997	$41,881	$156,867
Task 4 – Evaluate delivery issues	$40,000				$40,000
Total-Costs:	$299,828	$56,294	$79,030	$125,644	$560,796

Project Personnel: 3-Year cost:	Scientists	Graduate Student	Research Associate	Consultants	Total Costs
Task 1 – calculating and verifying consumptive water use	$29,216	$46,353	$23,837		$99,406
Task 2 – water allocation approach	$67,164		$23,837		$91,001
Task 3 - model water transfer institution	$23,068	$46,353			$69,421
Task 4 – Evaluate delivery issues				$40,000	$40,000
Total Cost:	$119,448	$92,706	$47,674		$299,828

Other Direct Costs: 3-Year cost:	Equipment	Mileage	Materials / supplies	Tuition	Total
Task 1 – calculating and verifying consumptive water use	$11,206	$3,060	$2,792	$15,240	$32,298
Task 2 – water allocation approach		$1,428			$1,428
Task 3 - model water transfer institution		$2,122	$5,206	$15,240	$22,568
Total Cost:	$11,206	$6,610	$7,998	$30,480	$56,294

In-Kind Contributions				
Project Personnel:	Scientist	Equipment		Total
Task 1 – Monitoring crop consumptive use using in-situ sensors	$11,788	$34,000		$45,788
Task 2 – Monitoring crop consumptive use using satellites	$15,000			$15,000
Total Units:				
Total Cost:	$26,788	$34,000		$60,788

Note: Scientist contribution includes 0.5 month salary the first year of the project and 0.5 month salary the last year of the project (i.e., year 3). Equipment contribution includes purchasing a Large Aperture Scintillometer (LAS) and ancillary sensors for validation of the in-situ and remote sensing method.

SCHEDULE

Provide a project schedule including key milestones for each task and the completion dates or time period from the Notice to Proceed (NTP). This dating method allows flexibility in the event of potential delays from the procurement process. Sample schedules are provided below. Please note that these schedules are examples and will need to be adapted to fit each individual application.

Example 1

Task	Start Date	Finish Date
1	Upon NTP	NTP + 90 days
2	Upon NTP	NTP + 180 days
3	Upon NTP	NTP + 180 days
4	Upon NTP	12/31/11
5	NTP + 60 days	12/31/11
6	NTP + 60 days	12/31/11
7	NTP + 60 days	12/31/11

NTP = Notice to Proceed

Example 2

Task	First 6 Months						Second 6 Months					
	1/10 – 3/10			4/10 – 6/10			7/10 – 9/10			10/10 - 12/10		
A – Economic Analysis												
B – Storage Analysis												
C – TA for Ditch Cos												
D – Injury Analysis												
Final Reports												

Shown below is the proposed schedule for this grant application in the format shown above.

SCHEDULE

Task 1 – Calculating and verifying consumptive water use	2011				2012				2013			
	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q
A – Acquiring & Installing Instrumentation		X				X						
B – Data acquisition		X	X	X		X	X	X				
C – Data processing and Analysis				X	X	X	X	X	X	X	X	
D - Preliminary reports				X				X				
Final Reports												X
Note: 1Q = first quarter of the year.												

Task 2 – Water allocation approach	2011				2012				2013			
	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q
A – Data processing and Analysis		X	X	X	X	X	X	X	X	X		
B - Preliminary reports				X				X				
Final Reports												X
Note: 1Q = first quarter of the year.												

Task 3 – Model water transfer institution	2011				2012				2013			
	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q
Designate case study scope including participants and advisory committee mtgs.	X	X		X				X				X
Collect CU, Agronomic and Farm Information		X	X	X								
Case Study Institution Analysis					X	X	X	X				
Regional Economic Analysis								X	X	X	X	
Final Report												X
Note: 1Q = first quarter of the year.												

Task 4 – Evaluate delivery issues	2011				2012				2013			
	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q
Evaluate water delivery timing					X							
Evaluate treatment/infrastructure issues					X							
Prepare report						X						
Note: 1Q = first quarter of the year.												

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 5 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 the public and help promote the development of alternative agricultural transfer methods.

Additional Information – If you would like to add any additional pertinent information please feel free to do so here.

The references used for this application include:

Allen, R.G., L.S. Pereira, D. Raes, and M. Smith. 1998. Crop evapotranspiration - Guidelines for computing crop water requirements - FAO Irrigation and drainage paper 56. Food and Agriculture Organization of the United Nations. Rome.

Alves, I., and L.S. Pereira (2000). Non-water-stressed baselines for irrigation scheduling with infrared thermometers: A new approach. Irrigation Science, 19: 101-106..

Ezzahar, J., A. Chehbouni, S. Er-Raki, and L. Hanich (2009). Combining a large aperture scintillometer and estimates of available energy to derive evapotranspiration over several agricultural fields in a semi-arid region. Plant Biosystems, 143: 209-221.

Hemakumara, H.M., L. Chandrapala, and A.F. Moene (2003). Evapotranspiration fluxes over mixed vegetation areas measured from large aperture scintillometer. Agricultural Water Management, 28: 109-122.

Irmak, S., D.Z. Haman, and R. Bastug (2000). Determination of crop water stress index for irrigation timing and yield estimation of corn. Agronomy Journal, 92(6): 1221-1227.

Payero, J.O., and S. Irmak (2006). Variable upper and lower crop water stress index baselines for corn and soybean. Irrigation Science, 25: 21-32.

Steele, D.D., E.C. Stegman, and B.L. Gregor (1994). Field comparison of irrigation scheduling methods for corn. Transactions of ASAE, 37(4): 1197-1203.

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

Signature of Applicant: 

Print Applicant's Name: Frank P. Jaeger

Project Title: Lower South Platte Irrigation Research and Demonstration Project

Return this application to:

Mr. Todd Doherty
Colorado Water Conservation Board
Water Supply Planning Section
1580 Logan Street, Suite 200
Denver, CO 80203
Todd.Doherty@state.co.us

EXHIBIT A

Resolution 1997- 2
Amended 8/14/97

Resolution 1997- 14

Resolution 1998-10
Amended 2000 Budget

Resolution 2000- 12 raw water only

District Rate / Fee Schedule

Amended 2001 Budget
Amended Resolution 2001 - 24
Amended Resolution 2002 - 24
Amended Resolution 2004 - 02
Amended Resolution 2005 - 24
Amended Resolution 2009 - 12

Effective January 1, 2010

Tap & Development Fees

Tap Size	Water Tap	Sewer Tap	Water Dev. Fee	Outfall Dev. Fee	Water Resource
3/4"	$ 2,500	$ 2,850	$ 12,725	$ 800	$ 5,000
1"	$ 5,000	$ 5,700	$ 25,450	$ 1,600	$ 10,000
1 1/2"	$10,000	$11,400	$ 50,900	$ 3,200	$ 20,000
2"	$20,000	$22,800	$101,800	$ 6,400	$ 40,000
3"	$40,000	$45,600	$203,600	$12,800	$ 80,000

Effective January 1, 2010

Water Rates
Per Single Family Equivalent

Water Service Fee	$25.16 per month
Use Fee	$2.24 per 1,000 gallons for first 20,000 gallons per month
Use Fee	$4.56 per each additional 1,000 gallons up to and including 10,000
Use Fee	$7.16 for each additional 1,000 gallons in excess of 30,000 gallons per month.

Sewer Rates
Per Single Family Equivalent

Sewer Service Fee	$56.93 per month

Resolution 1997- 2
Amended 8/14/97

Resolution 1997- 14

Resolution 1998-10
Amended 2000 Budget
Resolution 2000- 12 raw water only

Amended 2001 Budget
Amended Resolution 2001 - 24
Amended Resolution 2002 - 24
Amended Resolution 2004 - 02
Amended Resolution 2005 - 24
Amended Resolution 2009 - 12

District Rate / Fee Schedule

Effective January 1, 2010

Tap & Development Fees

Tap Size	Water Tap	Sewer Tap	Water Dev. Fee	Outfall Dev. Fee	Water Resource
3/4"	$ 2,500	$ 2,850	$ 12,725	$ 800	$ 5,000
1"	$ 5,000	$ 5,700	$ 25,450	$ 1,600	$ 10,000
1 1/2"	$10,000	$11,400	$ 50,900	$ 3,200	$ 20,000
2"	$20,000	$22,800	$101,800	$ 6,400	$ 40,000
3"	$40,000	$45,600	$203,600	$12,800	$ 80,000

Effective January 1, 2010

Water Rates
Per Single Family Equivalent

Water Service Fee	$25.16 per month
Use Fee	$2.24 per 1,000 gallons for first 20,000 gallons per month
Use Fee	$4.56 per each additional 1,000 gallons up to and including 10,000
Use Fee	$7.16 for each additional 1,000 gallons in excess of 30,000 gallons per month.

Sewer Rates
Per Single Family Equivalent

Sewer Service Fee	$56.93 per month

EXHIBIT B
CSU PERSONNEL

The following is the list of the personnel on the **CSU Project Team**.

Principal Investigator:
- Dr. Thomas Holtzer, Head, Department of Bioagricultural Sciences and Pest Management

Co-Principal Investigators:
- Dr. Neil Hansen, Department of Soil and Crop Sciences (Cropping Systems)
- Dr. James Pritchett, Department of Agricultural and Resource Economics

Co-Investigators:
- Dr. Jose Chavez, Department of Civil and Environmental Engineering
- Dr. Allan Andalles, Department of Soil and Crop Sciences (Irrigation Specialist)
- Mr. Troy Bauder, Department of Soil and Crop Sciences (Extension Water Quality Specialist)
- Mr. Bruce Bosley, Department of Soil and Crop Sciences (Extension Forage Specialist)
- Dr. Joe Brummer, Department of Soil and Crop Sciences (Forage Crop Specialist)
- Dr. Aymn Elhaddad, Research Associate, Department of Civil and Environmental Engineering
- Dr. Luis Garcia, Head, Department of Civil and Environmental Engineering
- Dr. Christopher Goemans, Department of Agricultural and Resource Economics (Water Economist)
- Dr. Gary Peterson, Head, Department of Soil and Crop Sciences
- Mr. Joel Schneekloth, Department of Soil and Crop Sciences (Extension Irrigation Specialist)
- Dr. Reagan Waskom, Department of Soil and Crop Sciences (State Water Resources Extension Specialist)

CONSULTANT PERSONNEL

Dewberry-Integra
Alan M. Pratt, P.E.
Randall Parks, P.E.
Michael P. Lutz, P.E.
Mark J. Nance, P.E.
Patrick Radabaugh, P.E.

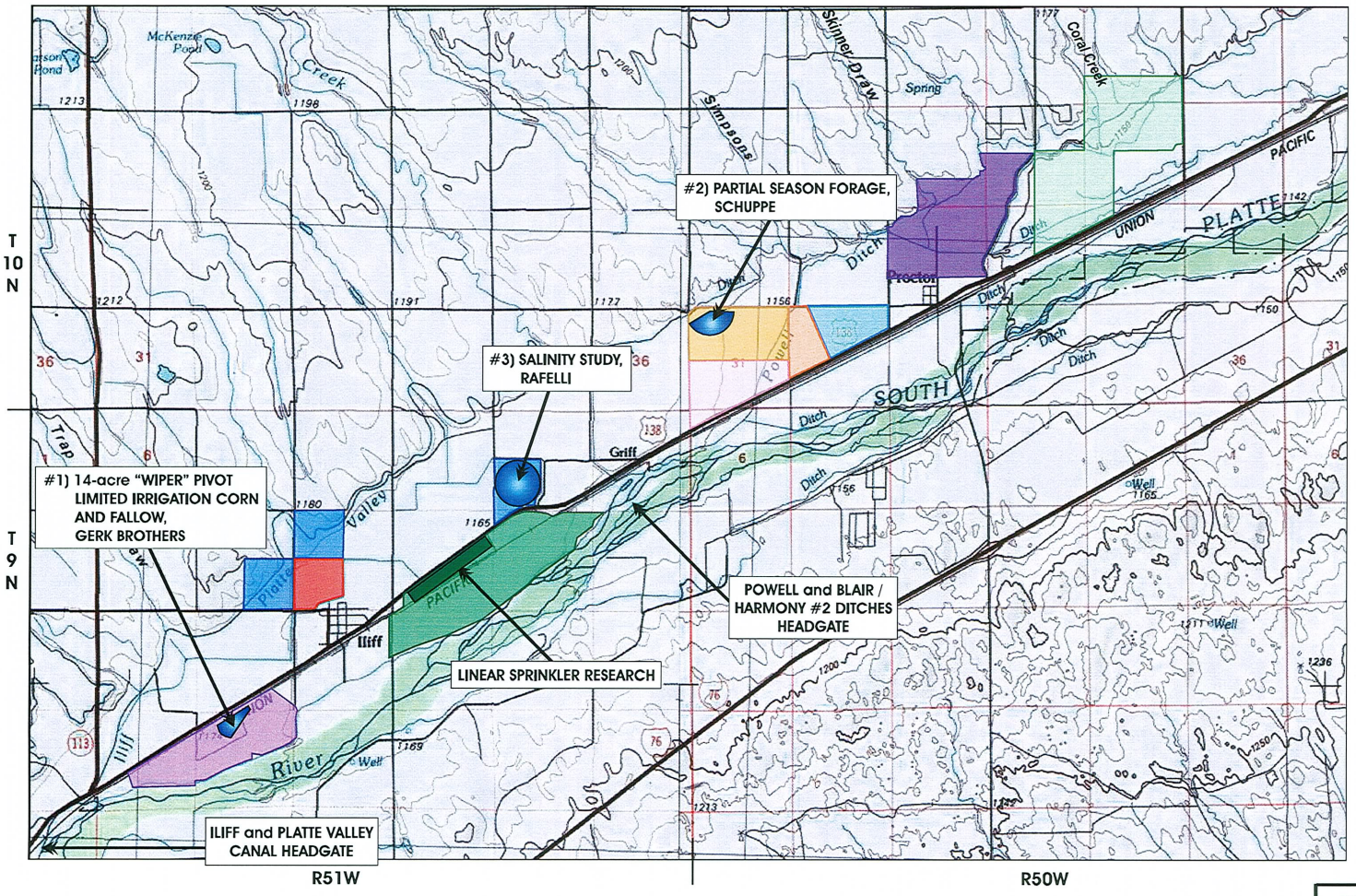
Lytle Water Solutions, LLC
Cristina Story
Hayden Strickland, P.E.
Bruce Lytle, P.E.

States West Water Resources Corporation

Victor Anderson, PE
Jack Meena, PE
Jennifer Russell, PE
Brandon Gebhart, PE
Dylan Wade, PE
Skylor Wade, PE

EXHIBIT C
LOWER SOUTH PLATTE IRRIGATION RESEARCH AND DEMONSTRATION PROJECT
ADVISORY COMMITTEE MEMBERS

Last	First	Address	City	State	Zip	Business Phone	Cell Phone	Email
Altenhofen	Jon	220 Water Ave	Berthoud	CO	80513	970.532.7700		jaltenhofen@ncwcd.org
Frank	Joe	100 Broadway Plaza, Suite 12	Sterling	CO	80751	970.522.1378	970.520.0628	jmfrank@lspwcd.org
Lingreen	Bob	335 E Chestnut Street	Sterling	CO	80751	970.522.8816	970.466.2071	Circle@Sterlingcomputers.com
Manuello	Gene	138 Club Rd	Sterling	CO	80751	970.622.7639	970.580.7639	geno1@kci.net
Patterson	Joe	201 S 3rd St	Sterling	CO	80751			JPatterson@PINNBANK.COM
Nettles	Dave	810 9th St. 2nd Floor	Greeley	CO	80631	970.352.8712		David.Nettles@State.CO.US
Odor	Jack	833 Wilson Ave	Fort Morgan	CO	80701	970.867.8655		schuetzen1@yahoo.com
Reck	Mark	PO Box 407, 302 N. 3rd St.	Sterling	CO	80751	970.522.7770		marcreck@reckagri.com
Schuppe	Gordon	26785 CR 63	Iliff	CO	80736	970.522.8195		gschuppe@kci.net
Stieb	Leo	24153 County Rd. 55	Iliff	CO	80736	970.522.8173		Lstieb@yahoo.com
Stromberger	Brad	30608 County Rd. 385	Iliff	CO	80736	970.521.1028		stromber@Kci.net
Yahn	Jim	PO Box 103	Sterling	CO	80751	970.522.6918	970.520.0170	nsidyahn@kci.net



LEGEND

- BREIDENBACH
- DEBUS
- HOOGLAND
- HURST
- KAUFMAN
- SCHOTT
- SPRING VALLEY
- STIEB
- STUMPF
- VANT

N

0 6,000 12,000 feet

Notes:
1) Locations are approximate.
2) Research farm shown in dark green;
on-farm demonstrations shown in royal blue fill.

PARKER WATER AND SANITATION DISTRICT

LOCATIONS OF RESEARCH FARM AND ON-FARM DEMONSTRATIONS

File Name: Research_Farms.cdr		Date: 03/05/2008
Project No.: 1103-07	Drawn By: VAL	Fig. No.: Exhibit D

EXHIBIT E

Table 1: Economic Demographics for the 3 LSP Counties (2002) Industry Output

Industry	Output (Million $)	Percent of Total Output
Animal, except poultry, slaughtering	$678	20%
Cattle ranching and farming	$596	18%
Cheese manufacturing	$213	6%
Irrigated Crops	$151	5%
Owner-occupied dwellings	$110	3%
State & Local Education	$109	3%
Power generation and supply	$90	3%
Wholesale trade	$72	2%
Hospitals	$65	2%
New residential 1-unit structures	$64	2%
Total Output	**$3,374**	**100%**

EXHIBIT F -Budget Justification

*In year 2, figures are adjusted for inflation at 4% unless otherwise noted.

Total Budget ($395,154)

Year 1 ($197,015)

Year 2 ($198,139)

Personnel ($259,829)

Year 1 ($122,338)

Faculty salary is requested for Dr. Neil Hansen (1 month - $9,222), Dr. James Pritchett (1 month - $9,000), and Dr. Jose Chavez (0.5 months - $4,500). Salary is requested for a postdoctoral research associate to work on the remote sensing (5 months - $19,600). Two MS level graduate students will be supported, one in Department of Agricultural and Resource Economics and one in Civil and Environmental Engineering ($21,600/year x 2 = $43,200). Funds are also requested for a research associate to manage the field research locations (6 months - $18,600). Fringe is requested for each of these positions according the following rates: faculty-26%, postdoctoral research associate – 26%, graduate students – 5.5%, and research associate – 26%. Total fringe is $18,465.

Year 2 ($137,491)

Faculty salary is requested for Dr. Neil Hansen (1 month - $9,591), Dr. James Pritchett (1 month - $9,360), and Dr. Jose Chavez (1 month - $9,360). Salary is requested for a postdoctoral research associate to work on the remote sensing (6 months - $24,461). Two MS level graduate students will be supported, one in Department of Agricultural and Resource Economics and one in Civil and Environmental Engineering ($22,464/year x 2 = $44,928). Funds are also requested for a research associate to manage the field research locations (6 months - $19,344). Fringe is requested for each of these positions according the following rates: faculty-25.3%, postdoctoral research associate – 25.3%, graduate students – 4.9%, and research associate – 25.3%. Total fringe is $20,699

Domestic Travel ($6,610)

Year 1 ($3,240)

In-state travel is for project staff to travel to field research locations and coordination meetings throughout Colorado. Four staff would average 6 trips per year, with average round-trip mileage of 308 miles. Mileage rage is $0.45/mile. (4 staff x 6 trips x 300 miles/trip x $0.45/mile = $3,240)

Year 2 ($3,370)

Travel costs in year 2 are the same as for year 1 with a 4% inflationary adjustment.

Materials and Supplies ($7,998)

Year 1 ($5,960)

Costs are requested for 15 soil moisture sensors ($110/ea x 15 = $1,650), for a project dedicated computer ($2,000) and software ($350) for the graduate students to evaluate evapotranspiritaton data logged at from field sites, the printed communication and handout materials needed for 7 individual focus group meetings ($200/ea x 7 = $1,400) and for cabling, hardware, and repair supplies for the field instrumentation ($560).

Year 2 ($2,038)

Costs are requested for printed communication and handout materials needed for 7 individual focus group meetings ($208/ea x 7 = $1,456) and for cabling, hardware, and repair supplies for the field instrumentation ($582).

Other Direct Costs ($30,480)

Year 1 ($14,868)

Costs for 4 semesters of in-state graduate tuition is requested for the 2 students working on this project ($3,717/semester x 4 + $14,868).

Year 2 ($15,612)

Costs for year 2 are the same as for year 1 with a 5% inflationary adjustment.

Equipment ($11,206)

Year 1 ($11,206)

An integrated sensor tower that includes infrared thermometer, standard weather observations, and multi-spectral imaging capabilities will be purchased for use the field locations ($11,206). This cost is based on the cost of a recent purchase of similar equipment by Dr. Jose Chavez for a related research project.

Indirect Costs ($79,031)

Year 1 ($39,403)

Year 2 ($39,628)

Indirect costs are calculated at 25% of total direct costs, which is the equivalent of 20% of total project cost, the limit authorized by Colorado HB 08-1026 for projects at Colorado State University funded by the Colorado Water Conservation Board.

Colorado State University Cost Share

Total Cost Share ($125,645)

Year 1 ($61,840)

Year 2 ($63,805)

Personnel ($35,172)

Year 1 ($17,290)

CSU will cost share for the faculty salary of Dr. Neil Hansen (1 month - $9,222) and Dr. James Pritchett (0.5 months - $4,500) and the associated fringe at 26% ($3,568).

Year 2 ($17,882)

CSU will cost share for the faculty salary of Dr. Neil Hansen (1 month - $9,591) and Dr. James Pritchett (0.5 months - $4,680) and the associated fringe at 25.3% ($3,611).

Indirect Costs ($16,972)

Year 1 ($8,299)

Year 2 ($8,673)

Indirect costs are calculated on the non-federal portion of CSU's costs using CSU's federally negotiated rates of 48% in Y1, 48.5% in Y2, and 48.7% in Y3.

Unrecovered Indirect Costs ($73,501)

Unrecovered Indirect Costs have been calculated on the modified total direct cost base of the project request ($157,612 Y1, $158,511 Y2) and represents the difference between CSU's federally negotiated rates of 48% in Y1 and 48.5% in Y2 and the indirect cost rate of 25% TDC on this proposal. This amounts to $36,251 Y1 and $37,250 Y2.

Total CSU Cash Match ($125,645)