AGREEMENT FOR A COOPERATIVE PROJECT TO DEVELOP A MODEL TO SUSTAIN IRRIGATED AGRICULTURE WHILE MEETING INCREASING URBAN WATER DEMAND IN COLORADO BETWEEN THE PARKER WATER AND SANITATION DISTRICT AND THE BOARD OF GOVERNORS OF THE COLORADO STATE UNIVERSITY SYSTEM, ACTING BY AND THROUGH COLORADO STATE UNIVERSITY.

THIS AGREEMENT is made and executed by and between THE PARKER WATER AND SANITATION DISTRICT, a quasi-municipal corporation of the County of Douglas, State of Colorado (hereinafter called "***District***") and THE BOARD OF GOVERNORS OF THE COLORADO STATE UNIVERSITY SYSTEM, ACTING BY AND THROUGH COLORADO STATE UNIVERSITY, a state university established and operating under and pursuant to the provisions of §§23-31-101 *et seq.*, C.R.S. 2006, (hereinafter called "***CSU***").

WITNESSETH:

WHEREAS District desires to enter into this Agreement with CSU to engage the services of CSU to perform the tasks identified herein; and

WHEREAS CSU is specially trained and possesses certain skills, experience, education and competency to perform those services as hereinafter set forth, and CSU is able and willing to provide such services under the terms and conditions of this Agreement.

NOW THEREFORE in consideration of the compensation to be paid hereunder and the mutual agreements set forth, the parties agree as follows:

1. PERFORMANCE OF SERVICES

District does hereby contract with CSU to enable and authorize CSU to perform and provide the services hereinafter set forth, and CSU does hereby agree to perform such services in accordance with the terms and conditions hereof. CSU shall provide all materials, equipment and personnel required to perform its services under and pursuant to this Agreement, and the parties agree that such materials, equipment and personnel shall be provided and paid for by the parties as respectively provided for in accordance with the provisions hereof.

2. EXHIBITS TO AGREEMENT

The following exhibits are attached to and form an integral part of this Agreement:

Exhibit A - Scope of Services as set forth in the attached document entitled "Developing a Model to Sustain Irrigated Agriculture While Meeting Increasing Urban Water Demand in Colorado" dated August 28, 2006

Exhibit B - Budget Requested from Parker Water
Exhibit C - CSU Project Team

The provisions of each of said Exhibits are expressly incorporated into this Agreement, and are an integral part thereof.

3. SCOPE OF SERVICES

CSU shall provide those services described and set forth on Exhibit A in the manner, at the times, and to the extent therein described. In addition to the duties and obligations set forth on said Exhibit A, CSU shall secure all permits and licenses, pay all charges, fines and taxes and give all notices necessary and incidental to the lawful prosecution of its services.

4. TERM OF AGREEMENT

The term of this Agreement shall begin July 1, 2006. This Agreement shall remain in full force and effect until the earlier of the completion of the services described in the Scope of Services attached hereto as Exhibit A or December 31, 2009, unless sooner terminated as hereinafter provided.

5. COMPENSATION

As compensation for the services to be performed by CSU hereunder, District shall pay CSU the amounts set forth on the attached Exhibit B based upon monthly invoices submitted by CSU to the District which itemized time and materials utilized in completing the duties set forth herein and identified in Exhibit A. Any and all costs incurred by CSU shall be itemized by task in order to enable the District to review and evaluate the same. The District, due to its accounts payable cycle (which includes approval of all expenditures by the District's Board of Directors) shall pay CSU within 45 days of receipt of each monthly invoice. In the event the District questions or disputes any amount billed to the District by CSU, the District shall notify CSU in writing of the item or amount questioned or disputed within 15 days of the date of receipt of any monthly statement which contains such disputed or questioned item. District represents hereby that it has appropriated sufficient monies to make the payments described in said Exhibit B. CSU enters into this Agreement cognizant of the provisions of §29-1-110, C.R.S. 2006, thereby understanding that no monies in excess of those provided for in Exhibit B may be paid to CSU for work performed in completion of this Agreement unless and until the same are appropriated by the Board of Directors of the District. CSU further expressly understands that appropriation of any additional monies in excess of those set forth in Exhibit B is an act to be taken in the sole discretion of the Board of Directors of the District. Provided, however, that District's obligation to pay pursuant to the provisions of said Exhibit B shall be suspended in the event any of the following conditions occur and are not remedied by CSU within fifteen (15) business day from the date of notice thereof to CSU:

A. CSU fails to promptly pay all bills for labor, material or services furnished or performed by others;

B. CSU is in default of any of its obligations under this Agreement of any of the Contract Documents;

C. Any part of such payment is attributable to services not conforming to this Agreement (District will pay for any part attributable to conforming services); or

D. District, in its good faith judgment, determines that the compensation remaining unpaid will not be sufficient to complete the services identified in Exhibit A according to this Agreement.

6. PERSONS UNDERTAKING PERFORMANCE OF AGREEMENT; NON-ASSIGNABILITY OF AGREEMENT BY CSU

CSU understands that the District is entering into this Agreement with CSU because of District's faith and confidence in the abilities of CSU to complete the services described in Exhibit A. In order to complete such services, CSU is able to maintain a professional team of employees as identified in Exhibit C and those additional qualified individuals identified and sponsored by CSU to complete such work. In the event of changes of personnel so identified, CSU shall notify District of such changes within 5 working days of such change. Performance of CSU's undertakings identified in this Agreement may not be assigned in whole or in any part by CSU without the prior written consent of District, which consent District may withhold at its discretion.

CSU is under a continuing duty, which continuing duty CSU acknowledges and agrees to, to employ employees, agents and subcontractors who are competent, suitably experienced, and able to perform the services identified in Exhibit A in a first-class, professional and timely manner acceptable to the District. District may comment on CSU's employment of individuals, and CSU agrees to take said comments into consideration before proceeding with employment of said individuals. Retention of subcontractors must be approved in writing by the District. In no event shall CSU, without the prior written consent of District, enter into subcontracts which result in more than forty nine percent (49%) of the work described in Exhibit A being accomplished by subcontractors or other persons or entities not employees of CSU.

7. EXTRA WORK: COMPENSATION THEREFORE: CONTINGENCIES

Unless otherwise specifically stated in Exhibit B, District agrees that an amount of money representing a contingency fund for authorized extra work is included within the funds appropriated by the District. CSU agrees that no extra work for which additional compensation shall be requested shall be commenced or undertaken without the prior advice to and consent of the District. In the event such extra work is requested and approved, the District agrees to pay CSU therefor at the rate and/or in the amount agreed in writing between District and CSU. Any extra work undertaken without such prior consent is undertaken at the sole risk of CSU, with District not being obligated to pay therefor absent such prior written consent.

8. DELAYS; REQUESTS FOR ADDITIONAL TIME TO COMPLETE

Time is of the essence in completion of the services described in Exhibit A. Except for Acts of God, acts of insurrection or national emergency, weather conditions which are significantly abnormal and which render performance of the required services impossible, or other acts or events which are beyond the control, whether direct or indirect, of CSU, CSU shall not be entitled to additional time to complete the services described in Exhibit A, and the CSU shall be held to the time for completion identified in Exhibit A.

Should CSU, for whatever reason, require additional time to complete such services, CSU shall request such additional time in writing, explaining the reasons why such additional time is required. District shall consider such request in good faith, and may grant all or part of the requested additional time if District determines that good cause exists for granting such additional time. District is not under any obligation to grant any additional time for any delay in performance which is attributable to any action or inaction on the part of, or which was in the control of CSU or any agent, employee or subcontractor of CSU.

In the event the District grants Contractor's request for additional time, such grant of additional time shall be CSU's sole relief and shall be granted in lieu of additional compensation.

9. COORDINATION WITH DISTRICT

District and CSU shall each identify an individual who shall act as liaison with the other party. Each such liaison shall be identified in writing, and each liaison shall have authority to receive information from the other party, to make project related decisions which do not require approval from the directors of the respective parties, process pay requests, and negotiate issues requiring immediate resolution.

10. INSURANCE: INDEMNIFICATION

Insurance. As an entity of the State of Colorado, CSU is self-insured for $150,000 per person and $600,000 per occurrence as more fully set forth in the Risk Management provisions of C.R.S §24-30-1501 *et seq.* The parties agree that such insurance shall satisfy all insurance requirements of this Agreement. CSU will provide a certificate evidencing such insurance upon written request of the District. District represents and warrants that it maintains comprehensive general liability insurance arising under this Agreement.

Each Party Responsible for its Own Acts. Each party hereto agrees to be responsible for its own wrongful or negligent acts or omissions, or those of its officers, agents or employees to the extent permitted by law. CSU is an institution of higher education of the State of Colorado, and District is a special district and political subdivision of the State of Colorado, and as such each party is governed and protected by the provisions of the Colorado Governmental Immunity Act (C.R.S.

§24-10-101 *et seq.*) and the Constitution of the State of Colorado. Nothing herein shall be construed as a waiver of immunity pursuant to such laws.

11. AWARE OF LAWS

CSU understands and agrees that it shall, at all times under this Agreement, become familiar with, and comply with, any and all ordinances, laws, orders, rules and regulations which are relevant to the CSU's work and services to be performed hereunder. The District assumes no duty to insure that CSU follows the safety regulations issued by OSHA.

12. COMPLIANCE WITH IMMIGRATION STATUTES

A. Certification. By entering into this Agreement, CSU hereby certifies that, at the time of this certification, it does not knowingly employ or contract with an illegal alien.

B. Prohibited Acts. CSU shall not knowingly employ or contract with an illegal alien.

C. Verification. If CSU obtains actual knowledge that a subcontractor performing work under this Agreement knowingly employs or contracts with an illegal alien, CSU shall:

i. Notify the subcontractor and the District within three (3) days that CSU has actual knowledge that the subcontractor is employing or contracting with an illegal alien; and

ii. Terminate the subcontract with the subcontractor if within three (3) days of receiving the notice required pursuant to subparagraph (i) hereof, the subcontractor does not stop employing or contracting with the illegal alien; except that CSU shall not terminate the contract with the subcontractor if during such three (3) days the subcontractor provides information to establish that the subcontractor has not knowingly employed or contracted with an illegal alien.

13. STANDARD OF PERFORMANCE

CSU shall be responsible to perform to the level of competency presently maintained by other practicing professionals in the same type of work for the professional and technical soundness, accuracy and adequacy of all designs, drawings, specifications, and other work and materials furnished under this Agreement. This provision is not intended to reduce any standard otherwise imposed by law.

CSU shall undertake all activities under this Agreement in compliance with all standards of ethics and responsibility applicable thereto. During the course of CSU's work under this Agreement, CSU shall make various recommendations to District as to courses of conduct or ways and manners in which to proceed on a particular task. While CSU may advise District on the probability of a favorable outcome, there is no guarantee offered by CSU of a particular result in any proceeding.

14. INDEPENDENT CONTRACTOR

CSU, for all purposes arising out of this Agreement, is an independent contractor and shall not be termed an employee of District. No employee or official of the District shall supervise CSU. CSU shall exercise no supervision over any employee or official of the District. CSU shall not represent that it is an employee of agent of the District in any capacity. It is expressly understood and agreed that CSU shall not be entitled to any benefits to which District's employees are entitled including, but not limited to, overtime, retirement benefits, worker's compensation, injury leave or other leave benefits.

15. CONFIDENTIALITY

A. CSU as a state institution of higher learning engages only in research that is compatible, consistent and beneficial to its academic role and mission. Therefore significant results of research activities must be reasonably available for publication. The parties acknowledge that CSU shall have the right to publish results. CSU agrees, however, that during the term of this Agreement and for 6 months thereafter, District shall have 30 days to review and comment on any proposed publication. CSU agrees that any proprietary information supplied to it by the District during the course of research performed by CSU will not be included in any published material without prior written approval of the District.

B. The District will not include the name of CSU in any advertising, sales, promotion or other publicity without prior written approval of the CSU Vice President for Research.

16. OWNERSHIP OF MATERIAL

All reports, information, data, statistics, forms, designs, plans, procedures, systems, studies, and any other materials or properties produced under this Agreement shall be the joint property of the District and CSU. Except as otherwise provided herein, engineering documents, drawings, and specifications prepared by CSU as part of the Services shall become the joint property of the parties. CSU shall retain its rights in its standard drawing details, designs, specifications, databases, computer software and any other proprietary property. Rights to intellectual property developed, utilized, or modified in the performance of the Services shall remain the property of the CSU.

All documents, including, but not limited to, drawings, specifications, and computer software prepared by CSU pursuant to this Agreement are instruments of service in respect to the Project. They are not intended or represented to be suitable for reuse by District or to others on extensions of the Project or on any other project. Any reuse without prior written verification or adaptation by CSU for the specific purpose intended will be at District's sole risk and without liability or legal exposure to CSU. District shall defend, indemnify, and hold harmless CSU against all claims, losses, damages, injuries, and expenses, including attorney's fees, arising out of or resulting from such reuse. Any verification or adaptation of documents will entitle CSU to additional compensation at rates to be agreed upon by District and CSU.

17. TERMINATION; SUSPENSION

A. This Agreement may be terminated by District or by CSU if one party does not cure a specified default within fifteen (15) days of receipt of a written notice of default from the other party. Such written notice shall specify each and every alleged default, in reasonable detail.

B. District may, at any time, terminate performance of the work, in whole or in part, for its own convenience. The District may effect such termination by giving CSU written Notice of Termination of Work specifying the extent and effective date of termination. In case of termination for the District's convenience, District shall pay CSU for work satisfactorily completed to the date of termination. The District shall determine in good faith the portion of work satisfactorily completed.

C. If either party terminates this Agreement as provided herein, the CSU shall promptly deliver to the District copies of all drawings, computer programs, computer input and output, analyses, plans, photographic images, test, maps, survey and writers materials of any kind generated in the performance of its services under this Agreement up to and including the date of termination.

D. Without terminating or breaching this Agreement, the District may at its pleasure and discretion, suspend fee services of the CSU hereunder. District may affect suspension by giving the CSU written notice one (1) day in advance of the suspension date. Upon receipt of such notice, the CSU shall cease its work as efficiently as possible, to keep total charges at a minimum. The District must specifically authorize any work preformed during suspension. Since suspension and subsequent reactivation may inconvenience the CSU, District will endeavor to provide advance notice and minimize its use. After a suspension has been in effect for thirty (30) consecutive calendar days, the CSU may terminate this Agreement at will.

18. NOTICE

Any notice or notices required or permitted to be given pursuant to this Agreement may be personally served on the other party by the party giving such notice or may be served by certified mail, postage prepaid, return receipt requested, to the following addresses:

To the District:	Frank Jaeger, Manager 19801 E. Mainstreet Parker, CO 80134
To CSU:	Candyce Jeffery, Senior Research Administrator Office of Sponsored Programs Colorado State University 2002 Campus Delivery Fort Collins, CO 80523-2002

19. APPLICABLE LAW

This Agreement shall be construed and interpreted in accordance with the laws of the State of Colorado. The parties specifically agree that exclusive venue for judicial resolution of any dispute between the parties shall be the District Court in and for the City and County of Denver, State of Colorado.

20. ENTIRE AGREEMENT

This Agreement constitutes the entire agreement between the parties covering the subject matter. No modifications or amendment shall be valid unless in writing and signed by all of the parties.

21. THIRD PARTY RIGHTS

Nothing in this Agreement shall be construed to give any rights or benefits to anyone other than District and CSU.

DISTRICT:

PARKER WATER AND SANITATION DISTRICT

By:
Frank Jaeger, Manager

ATTEST:

Secretary

BOARD OF GOVERNORS OF THE COLORADO STATE UNIVERSITY SYSTEM, ACTING BY AND THROUGH COLORADO STATE UNIVERSITY:

By:
Lynn Johnson, Director, Office of Sponsored Programs

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Developing a Model to Sustain Irrigated Agriculture While Meeting Increasing Urban Water Demand in Colorado

Proposal for a Cooperative Project between
Parker Water and Sanitation District
And Colorado State University

The transfer of agricultural irrigation water rights is needed to meet future municipal and industrial water needs (M&I) in Colorado. Yet, stakeholders are concerned about how water transfers affect farmers and the economies of agriculturally dependent communities. **The principle objective of this project is to develop a model to sustain irrigated agriculture while meeting the increasing urban water needs in Colorado.** Creating a model for transfer of agricultural water to M&I will require significant communication, cooperation, and risk sharing among M&I and agricultural water users, but will ultimately benefit the state of Colorado and its citizens. This project is a cooperative effort between Parker Water and Sanitation District, Colorado State University, and cooperating farmers in the South Platte River Valley to develop practical irrigated cropping systems and management approaches that will facilitate water transfer agreements benefiting both farmers and M&I water users.

The project is comprised of three distinct phases: an initial discovery phase in which a feasible set of cropping systems, including rotational cropping (i.e., fallowing) are identified and evaluated based on economics, potential water savings, and practicality. The second phase examines and demonstrates these systems in the field while documenting water savings and expected profitability. A third contemporaneous phase examines the likelihood that producers will adopt cropping systems, and then quantifies the regional economic impacts of South Platte farmers adopting the system(s). Representatives from the Parker Water and Sanitation District and CSU will meet frequently to guide the project phases while adapting plans to contingencies as appropriate. A more detailed description of each phase is found below.

Phase 1: Concept Discovery and Feasibility Study
Timeline: July 31 – November 15, 2006

This phase's objective is to identify and evaluate the "feasible set" of cropping systems, including rotational cropping, that meet M&I demands for water while sustaining agricultural production. Since rotational cropping (fallowing) has already been identified as a potential water savings alternative, it will serve as a benchmark in the feasibility study by which the profitability and performance of other systems are measured. For a cropping system to part of the feasible set, it must have the potential to:

- Reduce consumptive use by 20% from an historical baseline. This includes the option of total fallowing 20% of the irrigated land.
- Consumptive use savings can be scientifically documented for use in court proceedings.
- The cropping system is profitable for farmers under expected prices and yields.
- The cropping system can be adapted with existing technology, equipment, capital and labor in the South Platte River Basin.

Cropping system alternatives will likely include water conserving crop rotations (e.g., fallowing or a corn-wheat-sunflower rotation), limited irrigation practices for forage and grain crops (water spreading in space and time), alternative crops and markets, drought tolerant crops and crop varieties, irrigation methods and timing, and conservation tillage practices.

Initially, farmers leasing land from Parker will be the key contacts used to develop concepts and screen ideas for practical utility. Beginning in the summer of 2006, willing farmers will participate in a detailed, face to face survey designed to characterize baseline farm information and to solicit innovative water savings concepts. Innovative ideas obtained from farmers will be combined with concepts from agricultural scientists, extension agents, and agricultural professionals. This project will evaluate all cropping strategies regardless of Colorado statute governing the transfer of "saved" water. In fact, the project may inform the process needed to revise Colorado statute to allow transfer of savings. Thus, the outcomes from this initial survey are a list of potential water saving cropping alternatives and detailed information about the resources and limitations that must be considered in selecting practical cropping options from the list.

Potential cropping alternatives, including fallowing, will then go through a screening and feasibility evaluation. This evaluation will be based on the four criteria listed above, on farm operator input and farm level profits and on economic and water use analysis performed by CSU scientists. Existing economic information, such as South Platte specific crop enterprise budgets will be applied in the screening process. Evaluation will reduce the concept list to a feasible set of practices. This feasible set will be used to prioritize specific cropping practices to be included in on farm demonstrations and the farm level research components of the study (Phase 2). In other words, this phase of the project will assure that cropping systems chosen to be part of the detailed field research will have been carefully selected to meet the criteria listed above and to be practical for implementation by farmers.

Outputs: A technical report outlining the feasible set will be presented to the Parker Water and Sanitation District. The merits and drawbacks of the feasible set will be discussed with particular comparison to rotational cropping (fallowing) benchmark. Knowledge gaps to be filled in Phase 2 will be presented.

Specific elements of this project phase include:

1. Inventory of all land resources including acreage, soil type, water table, etc. using existing information with new data collection where needed (e.g., soil testing).
2. Inventory of water resources including quantity, timing, historical supply and quality.
3. Inventory of equipment resources including irrigation equipment, planting, tillage and harvest equipment.
4. Inventory of labor and managerial requirements for farm(s).
5. Collection of weather, yield, cost, price, farm program payment, insurance indemnity and other relevant data (see note below).
6. Interview of current operators to better understand current cropping practices, irrigation management practices, potential innovative limited irrigation best management practices

and future alternatives. Interview of regional farm managers and technical experts considered as well.

7. Development of a whole farm budget including needed water, labor, capital, and resource requirements. Timing of resource use will also be included.
8. Development of enterprise budgets for cropping system alternatives.
9. Construction of a rudimentary mathematical programming model to optimize profits subject to resource constraints, especially the consumptive use constraint. Sensitivity analysis will be performed with particular attention to crop-water response functions, crop prices and energy costs.
10. Ranking of cropping systems according to the mathematical optimization model mentioned previously. Discussion of cropping system advantages and disadvantages will accompany the ranking.
11. Technical report outlining the farm resources, potential cropping systems and those alternatives that comprise the feasible set.
12. Assessment of potential research locations, to include assessment of groundwater depth during growing season.
13. Final location for the Irrigation Research and Innovation Farm and setup of the linear move sprinkler irrigation system.

NOTE: Good data on precipitation amount, intensity, and distribution is important to the goals of this project. It is proposed that CSU work with the Caliche School FFA group to run a precipitation monitoring network across the full area of the study. This would provide the needed precipitation data as well as a cooperative educational opportunity for Caliche School and CSU.

Resources Needed: Personnel needed to complete Phase 1 include a ½ time research associate located in Logan County (Heather Amen, daughter of Ken Amen, has been identified as a potential associate) to assist in basic data collection, surveys, and interviews; salary for two agricultural economists at one month each (Drs. James Pritchett and Marshall Frasier) so that they may assist in data collection, development of enterprise budgets, construction of mathematical programming model and compilation of results, soil and water analysis, travel funds and basic supplies.

Phase 2: Developing Viable Cropping Practices With Reduced Consumptive Water Use
Timeline: January 2007-December 2009

While Phase 1 establishes a feasible set of alternatives, actual demonstration, basic research and replication are needed to scientifically document water savings and profitability. Consequently, Phase 2's objective is to document the water savings and profitability. Two types of field demonstrations will be conducted, on-farm demonstrations and controlled research. On-farm demonstrations will be done on full sized fields with farmers managing the system. These on-farm demonstrations will not be replicated and will be done to evaluate the practicality and feasibility of the cropping systems. The second approach will be controlled research done under a state of the art linear move sprinkler irrigation system. The linear move sprinkler system will allow scientifically defendable, replicated research plots to be established with individualized control of irrigation amounts. Details of the on-farm demonstrations and the controlled field research follow.

On Farm Demonstrations

On farm demonstration of cropping systems will be used to test water saving concepts while recording profit potential. The demonstrations are particularly useful for illustrating how systems might be adopted throughout the South Platte River Basin and to the Basin's farmers a practical, hands-on illustration of these systems.

Farmer led demonstrations will be conducted on 3 to 5 fields selected from farms owned by Parker. Parker farm operators will participate voluntarily, and Parker will underwrite the economic risk associated with demonstrating reduced water use cropping practices. Therefore, an agreement will be made between Parker, the cooperating farmer and CSU regarding the scope and concepts tested for all demonstrations conducted in farmers' fields. Individual producers that participate in phase 1 will be selected as potential demonstration sites. However, the overarching goal will be to represent the wide range of cropping systems, soil types, and marketing approaches that exist in the South Platte River Basin. We expect that practices such as alternative crops and crop rotations, fallowing, limited irrigation, conservation tillage, fertilizer and pest management will be included in the demonstrations performed. As part of the on-farm fallowing demonstration, we will evaluate the productivity of land that is returned to an irrigated crop following a period of non-irrigated fallow. These demonstrations will be conducted on parcels within a center pivot irrigation system rather than on the entire field. Farmers will conduct all crop management practices and CSU researchers will monitor the demonstrations, assist in water use measurements, yield measurement, and production cost determination to obtain detailed economic and water use data. A project manager will oversee the data collection and coordinate the projects with the participating farmers.

Controlled Research and Innovation Farm with Linear Sprinkler Irrigation System

A state of the art irrigation research site will be created to intensively test and evaluate new and innovative water conservation practices, including rotational cropping (fallowing). The research farm will be designed for scientifically defendable evaluations of cropping systems identified as viable alternatives in Phase 1 and a more detailed quantification of water use, crop productivity, and economic evaluations than is feasible in the on farm demonstrations. Installation of a linear move sprinkler irrigation system is critical to development of a facility where irrigation can be controlled, quantified, and uniformly applied in a research setting with multiple irrigation levels. The linear move has particular advantages relative to other irrigation methods including:

- Side-by-side treatments of water application levels under similar soil, climatic and geographic conditions.
- Intensive comparison of many different irrigation and crop regimes.
- Precise control and documentation of water savings.
- Efficient use of land and labor resources in the research area.

Parker will own the linear move sprinkler. A Research/Extension Advisory team will be organized which will be made up of local farmers, county agents, Parker personnel and the interdisciplinary CSU research and extension team. The Research/Extension Advisory group will provide guidance in all aspects of Phase 1 and Phase 2 of this project.

A full time manager will oversee operations and coordinate field activities and data collection. The project will pay for production inputs such as seed, fertilizer, and herbicides, while farmer cooperators will assist with field operations, market crops, and will be compensated by Parker for their time and use of their equipment. All revenue from crop sales will go to the farmer cooperator as part of the contract arranged between Parker and participating farmers. The specific location for this research farm will be determined as part of project phase 1. Initially, there is interest in locating the site on either the Steib or Hurst farm. Among the research concepts to be evaluated at the research farm are water conserving crop rotations, rotational cropping (fallowing), rotating fallowed land back to irrigated crops, limited irrigation practices for forage and grain crops, alternative crops and markets, drought tolerant crops and crop varieties, irrigation methods and timing, and conservation tillage practices. A systems approach will be used when evaluating the various research concepts tested, therefore all aspects of crop production will be considered during this research phase. Specific elements of Phase 2:

1. Three to five on-farm demonstration of cropping approaches that reduce historic consumptive water use by 20%.
2. Evaluation of rotational cropping (fallowing), including evaluation of irrigated crop production following fallow periods of different durations (1, 2, 3 yrs fallow) and different fallow period management
3. Creation of a state of the art irrigation research and innovation farm with a linear move sprinkler irrigation system where the various cropping systems research concepts identified above will be tested.
4. Detailed economic analysis of the water savings practices including input costs, labor, yields, and price, and net returns of the various systems.
5. Detailed measurements of the water balance for innovative cropping systems including precipitation, applied irrigation, soil moisture dynamics, and consumptive water use.
6. Annual public field days to share information with the agricultural community as well as all interested parties in the greater water community.

Resources Needed: Cropping systems research and demonstration require a significant amount of time to document the outcomes of new cropping systems. Five or more years is a likely time frame for this project phase. However, this proposal and the associated budget is for three years in order to allow an interim project assessment with the expectation that the project will be continued beyond three years. It is anticipated that Parker will purchase and own the linear move sprinkler irrigation system and therefore cost estimates for this are not included in this project budget. CSU will assist in developing specifications and help to oversee installation. The system needs to include the associated collection pond, pumps, controllers, and nozzles. Risk underwriting for participating farmers is expected to be negotiated directly between farmers and Parker and associated costs are not included in this project budget. In addition, arrangements for some office and equipment storage space will be needed but are not budgeted for in this proposal.

Hiring a full time project manager to oversee phase 2 of this study is vital to the success of the project. A highly qualified candidate will be identified and hired by CSU in early 2007. This

individual will live and have an office in the project area, but report to the CSU project principle investigators. Salary will be needed for CSU faculty acting as principle investigators on the project (equivalent of 5 months of salary). As an educational component of phase 2, a graduate student will be supported and will have responsibility for conducting an academic study on irrigation water savings for the cropping system being evaluated. Support is requested for the student stipend and in-state graduate tuition. Other salary will be needed for hourly labor during the cropping season to assist with field activities, data collection, and analysis. Equipment needed for the project are anticipated to include a dedicated row-crop tractor, a hooded pesticide sprayer, a precision weigh wagon for grain yield analysis, a leased vehicle for the project manager, and monitoring equipment. Cropping systems inputs such as seed, fertilizer, and herbicides are needed for the irrigation research and innovation farm, and are included in the budget. Other expenses will include travel costs, materials supplies, and costs associated with publications and field day activities.

Outputs: Field scale demonstrations of cropping practices that reduce consumptive water use and a high visibility state of the art irrigation research and innovation farm will be developed. Appropriate signs showing the cooperation between Parker and CSU will be installed at each demonstration site as well at the research and innovation farm. Appropriate press releases will be made as progress is made on the project. Detailed economic analysis of each practice will be performed. We will produce an annual technical report documenting the results of the on-farm demonstrations and the cropping systems research projects including water balance data and economic outcomes. In addition, farmer oriented CSU Extension fact sheets on the individual practices demonstrated will be developed. Additional CSU Extension fact sheets will be produced for interested non-farm audiences such as regulatory agencies, elected officials, M&I water users, and water suppliers. All of this information will also be made available on the internet. An annual field day will be held where the latest research results will be presented and a field tour of the on-farm demonstration sites will occur. Extension meetings will be held in the winter to inform the cooperating farmers, other stakeholders and interested parties of the details of the results and project implications on the farm and regional level economic viability as a result of water transfer by Parker. Information generated by CSU personnel is generally considered to be openly available to the public. However, to assure coordination, CSU and Parker will inform each other of the content of information to be released to the public in advance of release.

Phase 3: Regional Adoption and Economic Impacts
Timeline: January 2007 – December 2008

Phase 1 of the project involves an economic feasibility of cropping systems for Parker's representative farms. However, adoption of innovative cropping systems may extend throughout the South Platte Basin in order to satisfy the water needs of growing municipalities. But, how many farms are likely to adopt these innovative systems, and what are the critical barriers to adoption? In order to answer these questions, a farmer survey is needed to capture variation in the likelihood of system adoption associated with farm-specific characteristics such as soil type or water rights, or by demographic issues such as irrigator age and off-farm employment. The specifics of the adoption study are listed in **Part A** below. Additionally, a strong potential for

spillover effects into the regional economy exists because adopting alternative irrigation systems will have effects on farm cash flow and productivity. Altered cash flows create ripple effects that include, but are not limited to, agribusinesses that sell inputs directly to adopting farms, businesses that receive revenues from adopting farms' and agribusiness employees that spend wages their wages locally and a changing sales/property tax base. A regional economic impact model will quantify these effects as discussed in **Part B.**

Part A: Determine Adoption of Innovative Cropping Systems in the South Platte Basin
Timeline: January 2007 – January 2008.

Information is needed to capture variations in the likelihood of system adoption associated with farm-specific characteristics. To forecast the likely adoption rate, irrigators in Morgan, Logan, Sedgwick, Phillips, Yuma, and Washington counties (the region surrounding the Parker Water and Sewer-owned properties) will be surveyed about their irrigation technology preferences. Much of the focus of the survey will be on how irrigators expect adopting less water-intensive irrigation systems to influence farm cash flow and labor needs. Additional questions will focus on why irrigators are or are not choosing specific technologies, their time horizon for making changes in irrigation systems, and what levels of cost-sharing, if any, are needed to promote adoption of less water-intensive irrigation systems. As such, this survey will provide a much more precise understanding of why, when and how irrigators in the region adopt different irrigation systems. It will also reveal what producers might need to be paid in order to participate in a rotational fallowing program

This survey will also leverage pre-existing surveys of irrigation technology adoption used during the 2002 drought and the Arkansas River Valley. Once the survey data is gathered, it will be used to provide more realistic estimate of the anticipated benefits and costs of innovative cropping systems. It will also provide more specific understanding of what irrigators' value in an irrigation system.

The lessons learned from the survey effort will inform stakeholders as to the barriers to adoption that may exist in other reaches of the South Platte Basin and the Arkansas River Basin. In particular, the economics of irrigated agriculture are consistent in the South Platte basin so that strategies to overcome adoption barriers in Morgan County will be quite similar in Weld County. Some differences exist between irrigated agriculture in the South Platte Basin and the Arkansas River Basin, but the survey results will also provide key insights into whether Arkansas Valley farmers will be able to adopt limited irrigation practices.

Part B. Regional Economic Impacts of Adopting Innovative Cropping Systems
Timeline: January 2008 – December 2008.

A strong potential for spillover effects into the regional economy exists because adopting alternative irrigation systems will have effects on farm cash flow and productivity. The effects on regional employment and income stemming from changes in on-farm income and cash flows will be estimated using a regional planning model (such as IMPLAN) and drawing on the expected changes in farm profitability and production practices indicated by the results from

Phases 1 and the adoption survey. This will provide an estimate of the off-farm benefits of improvements in on-farm productivity and ensure that the estimation of benefits from this project is assessed at a social and not simply a private scale. It will also provide estimates of what levels of support might be available from the regional economy to support changes in on-farm irrigation efficiency if the expected benefits to the regional economy of such changes are positive.

The regional economic analysis in the South Platte Basin will provide a significant foundation for similar modeling in the Arkansas River Basin. Key relationships regarding the purchase of local inputs, use of local labor and their impact on the economy can be used to build an IMPLAN model for the Arkansas basin. However, estimated regional impacts for the fallowing of a similar area of land (e.g., 25,000 acres) will likely have significantly different impacts between the South Platte and Arkansas River Basin economies, due to differences in the diversity of the economic base, the amount of goods and services exported out of the regional economy, and differences in crop rotations and other agronomic factors.

Phase 3 Resources Need: Resources Needed: Survey expenses (~$8,000) are anticipated along with a dedicated effort from a gradate research assistant to implement and analyzed the survey data (stipend and tuition. Faculty effort will be needed as well to coordinate, direct and present results.

Phase 3 Outputs: Survey and regional economic impact results will be presented to a meeting of interested stakeholders, especially Parker Water and Sanitation members and the Colorado Water Conservation Board. Published materials will included a technical bulletin from Colorado State University Agricultural Experiment Station and fact sheets via Cooperative Extension.

Budget Requested from Parker Water

Description	Year				
	2006	2007	2008	2009	Total
Personnel					
Faculty/Staff	18,647	47,206	49,136	51,312	166,301
Proj. Manager		51,088	53,175	55,532	159,795
Grad. Students		33,519	34,826	36,395	104,740
R.A. and Hourly	6,786	21,210	22,195	23,183	73,374
TOTAL	25,433	153,023	159,332	166,422	504,210
Other Direct Costs					
Equipment		69,680			69,680
Materials	1,900	29,224	15,684	16,311	63,119
Travel	1,500	7,488	7,788	8,099	24,875
Grad. Tuition		7,749	8,136	8,543	24,428
Other		6,240	6,490	6,749	19,479
TOTAL	3,400	120,381	38,098	39,702	201,581
Total Direct Costs	$28,833	$273,404	$197,430	$206,124	$705,791
Modified Total Direct Costs (TDC minus Equipment and Tuition)	$28,833	$195,975	$189,294	$197,581	$611,683
Indirect Costs (F&A) (25% of MTDC)	$7,208	$48,994	$47,324	$49,395	$152,921
TOTAL (Total Direct Costs plus Indirect Costs)	$36,041	$322,398	$244,754	$255,519	$858,712

Narrative Description of Requested Budget

1. Personnel ($504,210)

2006 ($25,433) – Includes two months faculty salary ($15,500) and salary for a part time research associate ($6,000) and associated fringe benefits ($3,933).

2007 ($153,023) – Includes five months faculty salary ($39,208), a full time project manager ($42,432), stipends for two graduate students ($32,448), a part time research associate ($6,240) and hourly labor ($12,480) with associate fringe benefits ($20,215).

2008 ($159,332) – Includes five months faculty salary ($40,777), a full time project manager ($44,129), stipends for two graduate students ($33,746), a part time research associate ($6,490) and hourly labor ($12,979) with associate fringe benefits ($21,211).

2009 ($166,422) – Includes five months faculty salary ($42,407), a full time project manager ($45,894), stipends for two graduate students ($35,096), a part time research associate ($6,749) and hourly labor ($13,498) with associate fringe benefits ($20,215).

2. Equipment ($69,680)

2007 ($69,680) – Includes a row crop tractor ($26,000), a hooded sprayer ($15,600), a precision yield weigh wagon ($7,280), and dataloggers and sensors for automated weather and water data acquisition ($20,800).

3. Materials ($63,119)

2006 ($1,900) – Supplies for soil and water analysis.

2007 ($29,224) – Cropping inputs such as seed, fertilizer, and herbicides for research farm ($10,400), soil and water analysis ($3,640), publication materials ($1,040), a computer, printer, and other hardware for data entry and analysis ($5,824), and survey materials for project phase 3 ($8,320).

2008 ($15,684) – Cropping inputs such as seed, fertilizer, and herbicides for research farm ($10,816), soil and water analysis ($3,786), publication materials ($1,082).

2009 ($16,311) – Cropping inputs such as seed, fertilizer, and herbicides for research farm ($11,294), soil and water analysis ($3,937), publication materials ($1,125).

4. Travel ($24,875)

2006 ($1,500) – Part time research associate will travel 100 miles per week in for 14 weeks ($500), six overnight research faculty trips from Fort Collins to Sterling (mileage $250, lodging $450, per diem $300) (mileage cost [ca. $0.35/mi] is in addition to the monthly charge for vehicles available from Colorado State University Transportation Services described elsewhere).

2007 ($7,488) – Part time research associate will travel 100 miles per week for 14 weeks ($520), six overnight research faculty trips from Fort Collins to Sterling (mileage $260, lodging $470, per diem $310), and full time project manager will travel an average of 285 miles per week during the year ($5,928) (mileage cost [ca. $0.35/mi] is in addition to the monthly charge for vehicles available from Colorado State University Transportation Services described elsewhere).

2008 ($7,788) – Part time research associate will travel 100 miles per week for 14 weeks ($541), six overnight research faculty trips from Fort Collins to Sterling (mileage $266, lodging $500, per diem $316), and full time project manager will travel an average of 285 miles per week during the year ($6,165) (mileage cost [ca. $0.35/mi] is in addition to the monthly charge for vehicles available from Colorado State University Transportation Services described elsewhere).

2009 ($8,099) – Part time research associate will travel 100 miles per week for 14 weeks ($562), six overnight research faculty trips from Fort Collins to Sterling (mileage $272, lodging $530, per diem $323), and full time project manager will travel an average of 285 miles per week during the year ($6,412) (mileage cost [ca. $0.35/mi] is in addition to the monthly charge for vehicles available from Colorado State University Transportation Services described elsewhere).

5. Graduate tuition ($24,428)

2007 ($7,749) – In-state graduate tuition for two semester each for two graduate research assistants.
2008 ($8,136) – In-state graduate tuition for two semester each for two graduate research assistants.
2009 ($8,543) – In-state graduate tuition for two semester each for two graduate research assistants.

6. Other direct costs ($19,476)

2007 ($6,240) – Monthly charges through Colorado State University Transportation Services for a truck for the project manager to use for project activities.
2008 ($6,490) – Monthly charges through Colorado State University Transportation Services for a truck for the project manager to use for project activities.
2009 ($6,749) – Monthly charges through Colorado State University Transportation Services for a truck for the project manager to use for project activities.

7. Indirect Costs ($152,921)

2006 ($7,208) – Calculated as 25% of Modified Total Direct Costs (Total Direct Costs minus equipment and tuition).
2007 ($48,994) – Calculated as 25% of Modified Total Direct Costs (Total Direct Costs minus equipment and tuition).
2008 ($47,324) – Calculated as 25% of Modified Total Direct Costs (Total Direct Costs minus equipment and tuition).
2009 ($49,395) – Calculated as 25% of Modified Total Direct Costs (Total Direct Costs minus equipment and tuition).

Estimated Investments by Parker Water to the Project (Required for Successful Completion of the Project, but Not Included in the CSU Portion of the Budget)

Description	Year				
	2006	2007	2008	2009	Total
Other Direct Costs					
Equipment		125,000			125,000
Subcontracts		24,000	26,000	27,100	77,100
TOTAL		149,000	26,000	27,100	202,100
Indirect Costs					
TOTAL		$149,000	$26,000	$27,100	$202,100

Narrative Description of Investments by Parker Water to the Project (Required for Successful Completion of the Project, but Not Included in the CSU Portion of the Budget)

1. Equipment ($125,000)

2007 ($125,000) – Estimated cost for purchase and installation of a state of the art research ready linear move irrigation system with associated pumps, controllers, nozzles, etc.

2. Subcontracts (126,100)

2007 ($24,000) – Estimated compensation to farmers participating in on-farm demonstrations and in activities at the research and innovation farm for contract field work ($16,000) and contracts for office and equipment storage space ($8,000).

2008 ($26,000) – Estimated compensation to farmers participating in on-farm demonstrations and in activities at the research and innovation farm for contract field work ($17,000) and contracts for office and equipment storage space ($9,000).

2009 ($27,100) – Estimated compensation to farmers participating in on-farm demonstrations and in activities at the research and innovation farm for contract field work ($18,000) and contracts for office and equipment storage space ($9,100).

CSU Project Team

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