Section B

Reclamation/BWMP Cooperative Water Measurement Study

Research and Development; Feasibility Studies, Pilot, or Demonstration Projects; Training, Education or Public Information; Technical Assistance Outline

Due January 11, 2004, by 3 pm

Section B-15a, Project Information Form

Applying for:

1. (Section A) **Urban or Agricultural Water Use Efficiency Implementation Project**
   - ❑ Urban ☑ Agricultural
   - ❑ (a) implementation of Urban Best Management Practice, #_____
   - ❑ (b) implementation of Agricultural Efficient Water Management Practice, #_____
   - ❑ (c) implementation of other projects to meet California Bay-Delta Program objectives, Targeted Benefit # or Quantifiable Objective #, if applicable _____
   - ❑ (d) Specify other: _____
2. (Section B) **Urban or Agricultural Research and Development; Feasibility Studies, Pilot, or Demonstration Projects; Training, Education or Public Information; Technical Assistance**
   - ☑ (e) research and development, feasibility studies, pilot, or demonstration projects
   - ❑ (f) training, education or public information programs with statewide application
   - ❑ (g) technical assistance
   - ❑ (h) other
3. Principal applicant (Organization or affiliation): Reclamation District 108 on behalf of the Sacramento River Basinwide Water Management Plan participants
4. Project Title: Reclamation/BWMP Cooperative Water Measurement Study
5. Person authorized to sign and submit proposal and contract

Name, title	Luther Hintz
	General Manager
Mailing address	Reclamation District 108
Telephone:	
Fax	
E-mail	

6. Contact person (if different):

Name, title	
Mailing address	975 Wilson Bend road
	Grimes,.CA 95950
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7. Grant funds requested (dollar amount): *(from Table C-1, column VI)*	$458,500
8. Applicant funds pledged (dollar amount):	$20,500
9. Total project costs (dollar amount): (from Table C-1, column IV, row n)	$479,000
10. Percent of State share requested (%) (from Table C-1)	96%
11. Percent of local share as match (%) (from Table C-1)	4%
12. Is your project locally cost effective?	
Locally cost effective means that the benefits to an entity (in dollar terms) of implementing a program exceed the costs of that program within the boundaries of that entity.	❑ (a) yes ☑ (b) no
(If yes, provide information that the project in addition to Bay-Delta benefit meets one of the following conditions: broad transferable benefits, overcome implementation barriers, or accelerate implementation.)	❑ (a) yes ❑ (b) no
13. Is your project required by regulation, law or contract?	
If no, your project is eligible. If yes, your project may be eligible only if there will be accelerated implementation to fulfill a future requirement and is not currently required.	❑ (a) yes ☑ (b) no
Provide a description of the regulation, law or contract and an explanation of why the project is not currently required.	

14. Duration of project (month/year to month/year):	January 2006 –March 2008
15. State Assembly District where the project is to be conducted:	2
16. State Senate District where the project is to be conducted:	4
17. Congressional district(s) where the project is to be conducted:	2 and 4
18. County where the project is to be conducted:	Service areas of BWMP participants include Shasta, Glenn, Sacramento, Butte, Colusa, Yolo and Sutter counties.
• Location of project (longitude and latitude)	Approximate center of the BWMP region is Willows, CA, located at Latitude 39.5 N & Longitude – 12.2 W
19. How many service connections in your service area (urban)?	NA
20. How many acre-feet of water per year does your agency serve?	The participates of the BWMP have contracts to deliver 1.9 MAF annually.

21. Type of applicant (select one):

- ❑ (a) City
- ❑ (b) County
- ❑ (c) City and County
- ❑ (d) Joint Powers Authority
- ☑ (e) Public Water District
- ❑ (f) Tribe
- ❑ (g) Non Profit Organization
- ❑ (h) University, College
- ❑ (i) State Agency
- ❑ (j) Federal Agency
- ❑ (k) Other
  - ❑ (i) Investor-Owned Utility
  - ❑ (ii) Incorporated Mutual Water Co.
  - ❑ (iii) Specify _____

22. Is applicant a disadvantaged community? If 'yes' include annual median household income.

(Provide supporting documentation.)

- ❑ (a) yes, _____ median household income
- ☑ (b) no

Section B-15b, Signature Page

By signing below, the official declares the following:

The truthfulness of all representations in the proposal;

The individual signing the form has the legal authority to submit the proposal on behalf of the applicant;

There is no pending litigation that may impact the financial condition of the applicant or its ability to complete the proposed project;

The individual signing the form read and understood the conflict of interest and confidentiality section and waives any and all rights to privacy and confidentiality of the proposal on behalf of the applicant;

The applicant will comply with all terms and conditions identified in this PSP if selected for funding; and

The applicant has legal authority to enter into a contract with the State.

Signature	Name and title	Date
	Luther P Hintz, General Manager	1/7/05

Section B-15c, Statement of Work

Section 1: Relevance and Importance

Introduction

The determination of appropriate water measurement both across and within the service areas of the Sacramento River Settlement Contractors (SRSC) to support improved water management has been an important issue in the development of the Sacramento River Basinwide Water Management Plan (BWMP), which SRSC prepared in cooperation with the U.S. Bureau of Reclamation (Reclamation) with assistance from the Department of Water Resources. Because of the relatively high degree of water reuse both within and among districts (or mutual water companies) and the desire to improve water management, the BWMP recommended that improved water measurement be further evaluated to promote continued reuse and optimal management of inter-district water use.

In addition to evaluating methods of improving water management, the BWMP was used to form a basis for the renewal of the SRSC's Central Valley Project (CVP) contracts with Reclamation. As part of the SRSC long-term contracts, contractors must develop periodic water management plans. Section 3 of the "Regional Criteria for Evaluating Water Management Plans for the Sacramento River Settlement Contractors" instructs the participating contractors to implement a water measurement option. To assist in evaluating how to address and define the appropriate level of measurement and to develop a mutually acceptable water measurement program, the SRSCs developed a Work Plan (see Attachment) to implement a water measurement evaluation in cooperation with Reclamation. Reclamation approved this Work Plan, and the continuation of the study was referenced in the SRSC's CVP contracts. The proposal, "Bureau of Reclamation/Sacramento River BWMP Cooperative Water Measurement Study Work Plan," was submitted to Reclamation in December 2003 and requests funding for implementation. The elements of the Cooperative Water Measurement Study (Cooperative Study) outlined in the attached Work Plan are summarized in this grant application.

Project Need

Continued demands on the state's finite water resources require that water be used efficiently. A technical team of water measurement experts (CALFED Independent Panel on Appropriate Measurement of Agricultural Water Use) concluded recently that water scarcity in California has led to the recognition that improved measurement of agricultural water use is necessary for planning and policy making efforts to ensure reliable water in the future. The panel also noted that additional baseline data is required to assess measurement needs for statewide planning and water use efficiency purposes.

Water measurement is a tool that the SRSCs will continue to use to manage water effectively while ensuring adequate supplies are provided to their customers and supplies are used efficiently. Current measurement approaches vary for each SRSC, ranging from instrument-

based to visual observation measurement techniques. The Cooperative Study between the SRSCs and Reclamation would be the initial phase in investigating current and potential measurement approaches to provide a scientific and practical basis for appropriate changes.

Project Goals and Objectives

The purpose and goal of the Cooperative Study is to determine the appropriate level of agricultural water measurement in a cooperative manner between SRSCs and Reclamation.

This goal will be achieved by meeting the following objectives:

- Determine the most cost-effective measurement methods that will work satisfactorily under the conditions of the SRSCs' service area.
- Determine what benefits are derived from measurement at turnout, lateral, and district levels. Verify if there are potential water use issues/benefits of pricing water by volume measured at the turnout or customer level.
- Determine what costs are associated with measurement at the sub-basin, district, lateral, and turnout levels.

The Cooperative Study will address these objectives while also supporting the requirements of the Regional Criteria. The Regional Criteria make reference to measurement at the customer-level within the contractor service area. This study will investigate several levels of measurement, including lateral-level and field-level (also known as turnout- or customer-level). This study will also provide important data and valuable information to the Appropriate Measurement of Agricultural Water Use element of the Water Use Efficiency (WUE) Program.

Consistency with CALFED ROD

The CALFED mission is to improve and restore ecological health and water management for beneficial uses of the Bay-Delta, which includes the entire Sacramento River watershed.

The overarching goal of the WUE Program is to advance the implementation of cost-effective water conservation and recycling practices throughout the state that contribute to California Bay-Delta Program water supply reliability, water quality, and ecosystem restoration goals.

The goals of the WUE Program include the following:

- Reduce water demand through "real water" conservation.
- Improve water quality by altering volume, concentration, timing and location of return flows.
- Improve ecosystem health by increasing in-stream flows, where necessary, to achieve targeted benefits.

The goals and objectives of the Cooperative Study are consistent with CALFED's WUE Program goals relating to appropriate measurement in terms of location, method, cost, and necessity, as shown in Table 1.

TABLE 1
Consistency with CALFED Water Use Efficiency Program Goals

CALFED Water Use Efficiency Program Goals[a]	Consistency with Cooperative Study
Reduce water demand through "real water" conservation	The success of real water conservation is partially determined by an evaluation of actual water diversions and return flows. Improved measurement may facilitate evaluation of conservation projects.
Improve water quality by altering volume, concentration, timing, and location of return flows	Improved measurement and the resulting improved understanding of the water balance would provide necessary information on the volume and timing of return flows.
Improve ecosystem health by increasing in-stream flows where necessary to achieve targeted benefits	Water measurement data could assist with water operations decisionmaking that potentially could improve in-stream flows on the Sacramento River.

[a]Source: http://calwater.ca.gov/Programs/WaterUseEfficiency/WaterUseEfficiency.shtml

One aim of the CALFED WUE Program is to define appropriate water measurement as it relates to agricultural water use efficiency. In August 2000, the CALFED Record of Decision (ROD) called for legislation requiring the appropriate measurement of all water uses in California. To develop such legislation, CALFED committed to convening an Independent Review Panel on Appropriate Measurement and working with the California State Legislature. With an open process, including stakeholder involvement, the panel has focused on the following aspects of water measurement:

- Benefits and costs of measurement to water users, suppliers, and the general public
- Barriers to measurement: technical, economic, institutional, or political

Through summer 2003, the panel provided extensive advice on the technical information needed to support such a definition. Using the panel's recommendations, CALFED staff and consultants have completed an analysis intended to demonstrate current practices and the costs and benefits associated with different measurement intensities. In September 2003, the panel prepared a final report that detailed the panel's recommendation on appropriate agricultural water measurement. CALFED is currently reviewing an implementation approach according to the panel's recommendation.

The Staff Proposed Implementation Approach provides four Key Water Management Objectives, which are listed in Table 2. The Cooperative Study would support this sub-program and would substantially add to the body of knowledge currently being developed across the state. Table 2 describes the ways in which a Water Measurement Program is consistent with the Key Management Objectives.

TABLE 2
Consistency with CALFED Key Water Management Objectives

CALFED Key Management Objectives[a]	Consistency with Cooperative Study
Fill critical data gaps to enable more effective statewide and regional water management planning and investment decisions	Water data regularly collected and compiled at the conveyance and customer level will allow water districts and agencies to fill critical data gaps and allow effective intradistrict and interdistrict management.
Allow users to undertake and demonstrate the effects of water use efficiency measures	Improved water measurement provides a scientific and quantitative means to identify areas that could improve efficiency and evaluate water use efficiency measures that are implemented. Improved understanding of the water balance assists water managers to determine where implementing water use efficiency measures would be most beneficial.
Facilitate valid water transfers	A water measurement program provides data necessary to quantify water available for transfer.
Help the state more effectively administer the existing state water rights system	Accurate water measurement at an appropriate level provides quantifiable means by which to manage water rights.

[a]Source: CALFED. 2004. *Staff Proposed Implementation Approach for Agricultural and Urban Water Use Measurement*. February 17.

Consistency with Regional Water Management

The Cooperative Study approach was developed as a result of years of cooperation among SRSC that culminated in the development of the BWMP and, thereby, resulted in the development of the Sacramento Valley Water Management Program. The primary objective of the BWMP is to provide the SRSC with a comprehensive basis upon which to manage water resources to meet existing and future agricultural water needs in a manner that can also serve other environmental, municipal, and industrial water needs in the Sacramento Valley. Figure 1 shows the geographic scope of the BWMP.

Water measurement at appropriate levels was identified as one component to achieve the following four primary goals and objectives defined for the BWMP:

- Meet valleywide water supply demands in a sustainable manner
- Achieve mutual benefits with Reclamation
- Evaluate opportunities to improve water management through coordinated actions
- Develop mutual data sets for contract renewal

Among the numerous water management improvement options evaluated in the BWMP, appropriate water measurement was identified as an area requiring additional investigation. The BWMP recommended that water management and associated measurement be further evaluated to promote continued reuse and optimal management of interdistrict water use. In July 2003, SRSC completed a separate study, which was sponsored by the CALFED WUE Program, to investigate sub-basin-level water measurement and management (The Sacramento River BWMP Sub-basin-level Water Measurement Study). In addition to

intradistrict approaches, this Cooperative Study would also identify where interdistrict and/or sub-basin-level measurement might be prudent and/or potentially preferable.

This Cooperative Study will support the SRSC and Reclamation in continuing to develop a mutually agreeable surface water delivery measurement program.

Contribution to Existing SRSC Water Management Activities

Water measurement is an essential component of completing future SRSC water management plans. Many local and site-specific factors influence the choice of measurement method, both between and within districts. However, the methods used to measure water within a water district or company boundary are driven largely by the following key factors common to the SRSC service areas:

- Arranged water delivery scheduling (as opposed to purely on-demand or rotation)
- Primarily unlined earthen canals and laterals on open-channel distribution systems
- Extensive use of drainwater
- Predominance of particular crops and related irrigation methods within a given district
- Operations and maintenance (O&M) costs related to different measurement methods

The extent of water measurement, the methods used, and the level of recording and documentation varies greatly between individual irrigation districts, from extensive measurement and reporting at all operations levels to less intensive measurement at key supply and distribution points only. Water measurement for a typical Sacramento Valley irrigation district can be considered in terms of the following basic levels:

1. Supply (diversions from the Sacramento River)
2. Conveyance and distribution (supply distribution canals and laterals)
3. Field turnouts (customer distribution)
4. Drains
5. District outflow

Through data collection, interviews, and data analysis across numerous major water districts in the Sacramento Valley, the Cooperative Study will evaluate the existing measurement methods and potential for improvements. The study will then determine the appropriate method of measurement for each level to promote continued water reuse, optimal management, and data set consistency across the Sacramento Valley. This approach will satisfy regional criteria for evaluating water management plans and provide information, data, and insights on the issue of appropriate agricultural water measurement

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Section B-15d, Statement of Work
Section 2: Technical/Scientific Merit and Feasibility

Overall Study Approach

This Cooperative Study draws from the following three components to provide guidance that will be used in continued cooperation between Reclamation and SRSCs in determining an appropriate level of water measurement:

1. Field Measurement Study
2. Water Management and Measurement Interviews
3. Delivery Data Analysis

These components were identified during the development of the Cooperative Study Work Plan with input from critical sources. Reclamation provided input on a water conservation and technical level, as well as input on a plan that would satisfy the intent of Regional Criteria in water management plans. Input on the study approach also was provided by a third-party reviewer, Jack Keller. Dr. Keller is a recognized expert in irrigation and measurement methods and policy and he is involved with Independent Panel on Appropriate Measurement of Agricultural Water Use Convened by the California Bay-Delta Authority. Work Plan development was also coordinated with CALFED WUE staff to ensure that approaches and goals of the Cooperative Study were consistent with WUE objectives. Lastly, direct input and involvement from the SRSCs occurred throughout the development of the Work Plan. These components will assist in determining the appropriate level of measurement throughout the Sacramento Valley; therefore, active participation from several SRSCs is essential and is part of the proposed study.

The results of any one component will not be used independently in determining the appropriate level of water measurement for SRSC. Rather, the results from all three components will be used to support a mutually acceptable long-term water measurement program for the SRSC, which, in turn, is anticipated to likely vary across districts depending on their specific facilities, needs, and characteristics. Tasks outlined in the attached Work Plan that are required to complete the study are described below.

Task 1: Field Measurement Study

Approach

The intent of the field study is to measure water supplied, distributed, and drained at two operational levels and determine the effects, if any, of the different levels of measurement on water use and management. During the first year, water will be measured at the lateral level only. Over the second year, measurement will take place at both the lateral level and turnout (or field) level. At the end of the second year, Years 1 and 2 results will be compared.

Site Selection

Evaluation of field-level measurement approaches (including installation of in-the-field measurement devices) was determined to be mutually acceptable within one district in the SRSC study area. The Natomas Central Mutual Water Company (NCMWC) volunteered to participate and identified specific study sites. The data and observations made at these sites are intended to support recommendations and provide insights beneficial throughout the Sacramento Valley. The operations and management staff of NCMWC were actively involved with the site selection process.

The sites were chosen so that a reasonable number of measurement points would be required to measure the inflows and outflows for an evaluation of the various flow paths and minimize the number of variables that could affect the study. Sites were chosen to provide a continuous block of irrigated lands with mostly isolated water supply and drainage systems, where inflow and outflow points were well defined. None of the sites are served by private or district-owned wells, nor is there any significant inflow of groundwater by natural means. The sites chosen are each several hundred acres in area and include mostly rice, because of the prevalence of rice land within NCMWC's boundary and the Sacramento Valley in general, but have also included other crops. Irrigation practices and soils of the study sites are typical for other districts. The study sites are historically irrigated in most years, but some factors, such as temporary water transfers or market conditions, could affect future application of water on the sites. Other factors considered were accessibility and landowner cooperation. Alternative NCMWC sites could be identified for implementation if unanticipated circumstances, such as landowner cooperation, cause the sites described below to be less favorable.

A vicinity map showing the two site locations, with respect to NCMWC boundaries, is shown on Figure 2. A more detailed map of the study sites, with measurement device locations, is shown on Figure 3.

The study sites are located within the eastern portion of NCMWC's service area. These sites were chosen because of their proximity to each other, which should result in very similar conditions relative to soils types and climatic conditions. Both parcels are irrigated solely with surface water supplies that originate from the same source. The two sites are separated by a large delivery canal, which runs from west to east and terminates at NCMWC's E-Drain Pumping Plant. The northern parcel consists of approximately 512 acres, and the southern parcel is approximately 318 acres. Both parcels are generally planted to rice.

Water is delivered to the study sites through the E-Drain Pumping Plant. The E-Drain Pumping Plant consists of two 50-horsepower pumps with 24-inch-diameter discharge pipes. According to pump tests conducted in 2002, the capacity of these pumps is approximately 9,500 gallons per minute (gpm) for the northern pump and approximately 7,600 gpm for the southern pump. The pump tests found the efficiencies of both pumps to be very low and NCMWC has repaired both pumps in 2003, which has improved the pumps' efficiency.

Water is lifted from the E-Drain to a lateral canal, which flows north and south. This lateral supplies water to the Northern and Southern Study Sites. It is proposed to use the Northern Study Site for the Turnout-level Study in Year 2 and the Southern Study Site for the Lateral-level Study control.

Northern Study Site

As identified above, the Northern Study Site encompasses approximately 512 acres within four separate fields: 22, 23, 24, and 33. Water is lifted from the E-Drain into a lateral canal where it can be directed either north or south. Flow direction is determined by the configuration of flashboard structures located on the lateral a short distance north and south of the pumping plant. The lateral is approximately 30 feet wide at its top, 8 feet wide at its bottom, and 8 feet deep. The flashboard structure, which controls or regulates water flowing north, consists of a 45-inch flashboard riser, which is connected to a 36-inch-diameter corrugated metal pipe (CMP). This structure is identified as CP-1. After the canal is brought to its normal operating levels, the CMP is submerged and remains full until the canal is drained. Deliveries from the lateral to the fields located in the Northern Study Site consist of seven, 18-inch screw gates connected to short sections of CMP. Figure 3 shows the locations of the delivery points and are identified as S-1 (Delivery Point Number 1) through S-7. For information purposes, other structures are also shown on Figure 3, including both screw gates and risers, which are used to distribute water to specific fields.

In addition to the field deliveries, water can be discharged from the northern lateral at two locations. These outflow points are used to help control water levels in the canal and to drain the canal for maintenance. These drain points are shown as CP-1A and CP-1B on Figure 3. CP-1A is an 18-inch flashboard riser structure with an 18-inch-diameter dis-charge pipe. This discharge pipe does not flow full except when the lateral is being drained. CP-1B is an 18-inch screw gate that at one time was used to deliver water to fields north of the study area. Under current operations, this structure is rarely used for this purpose. In addition to lateral drains, CP-1A and CP-1B, each field contains one or two drains or out-flow structures. Five of these drain structures are located in the Northern Study Site. These outflow structures are shown on Figure 3 and identified as D-1 (Outflow Point Number 1) through D-5.

Field 33 is approximately 210 acres, which are typically planted to rice. Water flows generally from east to west. This field is served by two, 18-inch screw gate delivery points (S-1 and S-2) and two drains identified as D-1 and D-2. D-1 consists of an 18-inch flashboard riser attached to a short section of 18-inch-diameter CMP. D-2 is a 17-inch flashboard riser with an 18-inch-diameter CMP discharge pipe.

Field 24 is approximately 88 acres, which are typically planted to rice. Water flows generally from northeast to southwest. This field is served by three, 18-inch screw gate delivery points (S-3, S-4, and S-5) and one drain identified as D-3. D-3 consists of a 29-inch flashboard riser attached to a short section of 18-inch-diameter CMP discharge pipe.

Field 23 is approximately 106 acres, which are typically planted to rice. Water flows generally from east-northeast to west-southwest. This field is served by an 18-inch screw gate delivery point S-7. Water can also be delivered to Field 23 through S-6, which supplies water to a ditch flowing north to south between Fields 23 and 24. This ditch terminates at a 23-inch flashboard riser structure (S-6B) located at the southeast corner of Field 23, which controls delivery to Field 22. Water from the ditch can be delivered to Field 23 by way of a 34-inch-wide flashboard check structure located just upstream of the terminus of the ditch. This checkboard delivery structure is designated as S-6A. A single drain services Field 23 (designated as D-4), and consists of a 23-inch flashboard riser attached to a short section of 18-inch-diameter CMP discharge pipe.

Field 22 is approximately 108 acres, which are typically planted to rice. Water flows generally from northeast to south-southwest. This field is served by a single delivery point (S-6B) and two drains (D-5 and D-6). D-5 consists of a 23-inch flash-board riser attached to a short section of 18-inch-diameter CMP. D-6 consists of an 18-inch flashboard riser attached to a short section of 18-inch-diameter CMP. Table 3 summarizes the turnout-level site.

TABLE 3
NCMWC Turnout-level Site Summary

Field	Irrigated Acres	2003 Crop
33	210	Rice
24	88	Rice
23	106	Rice
22	108	Rice
Total	**512**	

Southern Study Site

The Southern Study Site encompasses approximately 318 acres within three separate fields: 8, 9N, and 9S. Water is lifted from the E-Drain into a lateral canal where it can be directed either north or south. Flow to the Southern Study Site is controlled by a 30-inch flashboard riser structure with a 30-inch-diameter CMP discharge pipe (CP-2) located on the lateral a short distance south of the pumping plant.

The main lateral is approximately 30 feet wide at its top, 8 feet wide at its bottom, and 8 feet deep. After the lateral is brought to its normal operating levels, the CMP discharge pipe is submerged and remains full until the canal is drained. Deliveries from the lateral to the fields located within the Southern Study Site consist of five, 18-inch screw gates connected to short sections of CMP (S-8 through S-12). Figure 3 shows the locations of these delivery points. Two other structures (S-8A and S-8B) are used to distribute the water delivered to Fields 8 and 9N through delivery point S-8. Each of these structures is shown on Figure 3.

To provide outflow, a 24-inch flashboard riser, with an 18-inch-diameter CMP discharge pipe, is located at the southern end of the south lateral. This structure, identified as CP-2A, controls water levels in the lateral by allowing excess water to spill into a drain that runs east to west along the southern border of the study site. This structure can also be used to help drain the lateral for maintenance purposes. Outflow from the fields in the Southern Study Site are controlled by flashboard riser structures. Each field contains one or two of these outflow structures. Four of these drain structures are located in the study site. These outflow structures are shown on Figure 3 and identified as D-7 through D-10.

Field 8 is approximately 113 acres located in the western portion of the study site. This field is typically planted to rice. Water flows generally from northeast to southwest. This field is served by a single delivery point (S-8B) located at the end of a ditch that runs from east to west from the lateral at S-8 to the northeast corner of Field 8. The structure at S-8A consists of a 39-inch flashboard riser with a 24-inch-diameter CMP discharge pipe. The single drain for this field (D-7) is located at its southwest corner and consists of a 29-inch flashboard riser with an 18-inch-diameter CMP discharge pipe.

Field 9N is approximately 97 acres and is typically planted to rice. Water flows from the north and east to the southwest. Water can be delivered to field 9N at delivery point S-8A,

S-9, and S-10. S-8A consists of a 24-inch flashboard riser structure located near the north-west corner of Field 9N. Delivery points S-9 and S-10 consist of 18-inch screw gates with short sections of 18-CMP-diameter discharge pipe. Field 9N has a single 21-inch flashboard riser drain with an 18-inch-diameter discharge pipe located at the field's southwest corner (D-8). This drain discharges into a drain ditch that flows north to south, which empties into a larger drain that flows east to west along the southern boundary of the study site.

Field 9S is approximately 108 acres and, as with the other fields in the study sites, is typically planted to rice. Water is delivered to this field through two, 18-inch screw gates (S-10 and S-11). These two delivery points were included in a previous measurement study conducted by NCMWC and are equipped with McCrometer flow meters. NCMWC has not read or serviced the flow meters for several years. Water flows generally from east-northeast to west-southwest. There are two drains in this field: one drain is located at the northwest corner of the field (D-9); and another drain is located at the southwest corner of the field (D-10). D-9 is a 24-inch flashboard riser structure with an 18-inch-diameter CMP discharge pipe. D-10 consists of a 20-inch flashboard riser and an 18-inch-diameter discharge pipe. Table 4 summarizes the lateral-level site.

TABLE 4
NCMWC Lateral-level Site Summary

Field	Irrigated Acres	2003 Crop
8	113	Rice
9N	97	Rice
9S	108	Rice
Total	**318**	

Task 1.1: Lateral-level Measurement Study

The Southern Study Site is proposed for lateral-level measurement only.

Task 1.1.1: Purchase Lateral-level Equipment at NCMWC

First, equipment capable of measuring and recording water levels at the control structure located at the head to the Southern Lateral (CP-2) and at the overflow drain CP-2A would be purchased. Technical staff would coordinate equipment purchase and installation with participating district staff and manufacturer staff. The equipment proposed for use in the Lateral-level Study in Years 1 and 2 are identified in Table 5.

TABLE 5
Equipment for the NCMWC Lateral-level Site – Years 1 and 2 Installations

Location(s)	Description	Measurement Device[a]	Estimated Cost ($)	Years Installed
CP-2	Head of Southern Lateral	Unidata Precision Water Level Sensor #6541	2,000[b]	Years 1 and 2
CP-2A	Emergency spill and drain	Unidata Precision Water Level Sensor #6541	2,000[b]	Years 1 and 2

[a]The manufacturer name and model number are provided for reference and the basis for the cost estimate. Other suitable equipment may be substituted during study implementation.

[b]Cost estimate includes cost for equipment estimated to be approximately $1,500 per meter plus estimated installation cost of $500 per meter. Additional costs will be required to make measurements to develop rating for each of the structures.

Task 1.1.2: Install and Calibrate Lateral-level Equipment at NCMWC

Installation would occur prior to the irrigation season (prior to April) and would be coordinated with district O&M staff at NCMWC. Equipment would be installed according to the manufacturers' specifications and, if possible, using the expertise of technical representatives of device manufacturers. Manufacturer representatives may also provide installation training.

Participating O&M staff may be required to assist with some aspects of device installation. For example, a backhoe or shovel assistance may be required to clean sediment and heavy brush from turnout outlets prior to device installation and calibration. If device installations require a new section of pipe at turnouts or supply laterals, O&M staff may be required to weld pipe extensions and to backfill exposed pipe.

Depending on the measurement device used, calibration would involve either verifying flow or developing a rating curve (head-discharge relationship) using a portable meter. Calibration would also ensure that the data collection equipment is recording the correct measured values. The calibration process would follow manufacturers' recommended procedures. The technical staff would be responsible for the calibration process to ensure accurate measurement and data collection.

Task 1.1.3: Collect Lateral-level Flow Data at NCMWC

Deliveries to the Southern Study Site would be measured at the lateral level only in both Years 1 and 2. In addition to the water-level sensors, measurements would be made to develop ratings for the existing drop structures located at CP-2 and CP-2A.

The technical staff would be responsible for downloading data monthly from field units and transferring data to a centralized database. A process for downloading is suggested to help ensure measurement data accuracy. The basic components include the following:

- Visually inspect measurement and data logging equipment.
- Check reported values against the staff gage if possible. Check totalizer readings on flow meter against recorded data.
- Conduct necessary repairs or maintenance.

While the district staff would not be responsible for data downloads, they would be relied upon to inspect and report problems to the technical staff that could affect data collection or accuracy in the interim between monthly data downloads. System operators would be educated on the effects of excess debris or silt build-up. Water operations staff would be responsible for reporting vandalism or broken equipment. Immediate reporting of observed problems would minimize the loss of flow data.

After downloading raw data from the field, the data would be organized into a database. The technical staff would also be responsible for checking and verifying data accuracy and reasonableness. The source of data errors would be investigated and corrected. If possible, data gaps caused by equipment malfunction or other factors would be estimated.

Task 1.2: Turnout-level Measurement Study

The Northern Study Site is proposed for turn-out level measurement.

Task 1.2.1: Purchase Turnout-level Measurement Equipment at NCMWC

Measurement devices and data collection equipment would be purchased and installed prior to the irrigation season. Cultural practices for rice typically require outflow throughout the irrigation season. After the fields are flooded, a certain amount of flow through the fields is required to produce a healthy crop. Because small changes in water levels may occur throughout each day, from climatic and operational conditions, water-level sensors using floats contained in a temporary stilling well are proposed. These types of devices are typically more accurate in measuring small changes in water levels at a lower cost than pressure transducers. The equipment proposed for use in Years 1 and 2 of the study are identified in Table 6.

TABLE 6
Equipment for the NCMWC Turnout-level Site – Years 1 and 2 Installations

Location(s)	Description	Measurement Device[a]	Estimated Cost ($)	Year(s) Installed
CP-1	Head of Northern Lateral	Unidata Precision Water Level Sensor #6541	2,000[b]	Years 1 and 2
CP-1A	Emergency spill and drain	Unidata Precision Water Level Sensor #6541	2,000[b]	Years 1 and 2
S-1 through S-6 and S-7	Field supply – 18-inch screw gates	McCrometer Flow Meter #M1718	2,500 each[c]	Year 2 only
S-6A and S-6B	Field supply for Fields 22 and 23	Unidata Precision Water Level Sensor #6541	2,000[b]	Year 2 only
D-1 through D-6	Field drains	Unidata Precision Water Level Sensor #6541	2,000 each[b]	Years 1 and 2

[a]The manufacturer name and model number are provided for reference and the basis for the cost estimate. Other suitable equipment may be substituted during study implementation.

[b]Cost estimate includes cost for equipment estimated to be approximately $1,500 per meter plus estimated installation cost of $500 per meter. Additional costs will be required to develop ratings for each of the structures.

[c]Cost estimate includes an estimated $500 for installation.

Task 1.2.2: Install and Calibrate Turnout-level Measurement Equipment at NCMWC

In Year 1, deliveries to the Northern Study Site would be measured at the lateral level. As envisioned, this would entail installation of equipment capable of measuring and recording water levels at the control structure located at the head to the Northern Lateral (CP-1), and at the overflow drain CP-1A. According to the information provided by NCMWC staff, there is typically no outflow at the end of the lateral location CP-1B; therefore, no measurement equipment is proposed for this location. In addition to the water-level sensors, measurements will be made to develop ratings for the existing drop structures located at CP-1 and CP-1A.

In Year 2, additional equipment will be installed to measure deliveries to and outflow from each field. NCMWC staff have indicated that there is little problem with debris in the lateral; therefore, propeller flow meters, equipped with totalizers and data loggers, should be used to measure and record field-level deliveries.

Task 1.2.3: Collect Turnout-level Flow Data at NCMWC

Deliveries to the Northern Study Site would be measured at the lateral level in Year 1. Field deliveries and outflow will be measured in Year 2. Information from these measurements

will be compared with the Year 2 lateral-level measurements to help evaluate the measurement program. Refer to Task 1.1.3 for staff roles and responsibilities.

Task 2: Water Management and Measurement Interviews

Three SCRCs were chosen and agreed to be interviewed as part of this study: NCMWC, Reclamation District 108 (RD 108), and Glen-Colusa Irrigation District (GCID). The NCMWC is an ideal participant simply because measurement equipment will be installed on two plots of land. Also, to fully understand the field study portion of the Cooperative Study, the interviews are necessary. RD 108 and GCID have volunteered to actively participate. Although all SRSCs have unique physical and policy characteristics, interviewing these three is expected to provide a better understanding of current practices that could be observed through most of the Sacramento Valley. Other SRSCs may be identified during the Cooperative Study to participate as well. While GCID was not included in the original attached Work Plan, they have requested to become more directly involved in the study, and their participation would provide valuable reference data and information.

Interviews will occur at NCMWC, RD 108, and GCID with managers, operations staff, and landowners in Year 1 of the Cooperative Study. Managers would help identify landowners to interview. A questionnaire will be developed for participants to fill out as part of the initial interview. Follow-up interviews would also be conducted in the second year of study to gain further insight into the measurement issue. The questionnaire would be developed and reviewed in conjunction with a social scientist. The social scientist will help formulate the questionnaire in a manner that will avoid bias and will assist in the evaluation of the interviews. Some examples of questions for operations superintendents, ditch riders, and individual landowners include the following:

- How is water measured currently at the sub-basin level, district level, lateral level, and field level (inflows and outflows)?
- How is water ordered?
- How is water apportioned for simultaneous orders along a lateral below the last point of measurement?
- In the absence of volumetric water pricing, what are the incentives (to operators and farmers) for being “wise water managers”?

The results of the interviews would be documented in the Cooperative Study reports.

Task 3: Delivery Data Analysis at SMWC and RD 1004

Approach

Prior to 1992, RD 1004 charged for water on a “flat rate” per acre basis. The rate was derived from the crop planted for that year. Beginning in 1992, RD 1004 began charging for water on a per-acre-foot delivered basis. The new billing method required that the volume of water delivered to each field be known. To measure the quantities delivered to RD 1004’s customers, meters were installed and records kept for each turnout.

In the case of Sutter Mutual Water Company (SMWC), until the 2003 irrigation season, water deliveries were measured and water was charged for based on the actual quantity delivered. Deliveries were measured using rating tables for the various sizes of gates used as turnouts by SMWC. The rating tables provide flow rate for various gate opening and head differentials. The SMWC staff typically check the gate opening and the water levels upstream and downstream of the gate once each day. This data is recorded manually by the ditch rider. For the 2003 irrigation season, the SMWC Board of Directors directed that water would be charged on a flat rate basis according to the crop and acreage. Although water pricing is currently based on a flat rate, SMWC personnel continue to measure quantities delivered to each field for operational purposes.

Because of these recent changes in water pricing policies, an opportunity to examine the effects of pricing and measurement without installing measurement equipment was recognized. First, water management and use records from RD 1004 and SMWC would be obtained, and all data will be organized into databases. After the database is developed, data will be analyzed for trends in district diversions, internal water deliveries, and flow path under each billing practice. Differences in deliveries with and without volumetric water pricing will be identified. In addition, other factors that may have affected water deliveries, such as changes in crop varieties and patterns, irrigation methods, weather, and hydrologic conditions, will be identified.

Task 3.1: Collect Data and Develop Database

Data to be collected includes river diversions, available lateral flow measurements, turnout-level measurements, and groundwater pumping estimates. Crop acreages will be identified and used to understand the quantity of water consumed by crops. Where appropriate, records from neighboring districts with similar soils, land use, and water delivery practices may be included if access to these records can be obtained. The data included in the database will include at least a 5-year period before and after the change in pricing method, or, in the case of the volumetric pricing for SMWC, as much data as are available at the time the study is conducted.

Monthly data regarding river diversions are available in electronic format from Reclamation for both RD 1004 and SMWC from 1964 through the 2003 irrigation season. Records of deliveries and crop acreages for SMWC are available in electronic format for the years 2000 through 2002. Records for the years 1992 through 1999 and 2003 are also available; however, these records will have to be input to be included in the electronic database for analysis. The 1992 through 2002 records would provide an 11-year period of volumetric pricing by SMWC. For RD 1004, records of deliveries and crop acreages are available in electronic format for the years 1999 through 2002. Records for the years 1992 through 1998 are available; however, these records will have to be input to be included in the electronic database for analysis.

After the database is set up for each district, time series of available data will be plotted for use later in the delivery data analysis task.

Task 3.2: Collect Hydrologic, Operational, and Policy Information

Additional information regarding other factors that might affect the timing and quantity of water deliveries will be obtained through detailed interviews with managers and operations staff, and from hydrologic and weather records. These interviews will be undertaken to get a full understanding of the whole picture on water supply and any observed changes in water operations indicated by the delivery data.

Operations staff from both RD 1004 and SMWC will provide information on the real costs of installing, calibrating, maintaining and purchasing measurement devices. An estimate of the labor involved in collecting and managing data retrieved from devices will also be undertaken.

The interview process will include documenting the reasons that the board of directors for these SRSCs made changes in pricing and measurement policy. Pricing and measurement policy at the field level is a contractor decision, and understanding the decisionmaking process for these two organizations may provide insights when comparing delivery records and drawing any conclusions.

To assure data quality control, calibration and maintenance records will also be examined.

Task 3.3: Analyze Delivery Data at SMWC and RD1004

Data will be analyzed for trends in district diversions, internal water deliveries, and flow path under each billing practice. Differences in deliveries with and without volumetric water pricing will be identified. In addition, other factors that may have affected water deliveries, such as changes in crop varieties and patterns, irrigation methods, weather, and hydrologic conditions, will be identified.

In the event that the number of years of data available for before and after the policy change is not enough to draw useful conclusions or provide guidance, delivery data from neighboring districts may be obtained, if possible, to make general comparisons between pricing by volume delivered versus pricing by acreages and crop type.

Task 4: Analyze Field Study Measurement Data from NCMWC

One critical outcome of the Cooperative Study is determining the value of two levels of improved water measurement in terms of information gained. This study would present an analysis on how more detailed flow data collection could be beneficial.

Flow Path Analysis

The current flow path, using estimates of on-field water use, would be documented; and a comparison would be made to the flow paths using lateral-level measurements and turnout-level measurements. The flow paths using Year 1 data (lateral-level data) would be compared against current estimates. In Year 2, the flow paths using lateral-level data would be compared against the data that used the turnout-level data for all three participating districts.

Measurement Data Comparison

A comparison would be made using continuously recorded lateral-level measurement and turnout-level measurement data. A volumetric comparison of the inflow and outflow would be made between continuously recorded data and a daily flow estimate or periodic checks (as an operator may estimate or check). This study would investigate the potential benefits of having continuous data and making that data available to system operators. Access to continuous flow data may have implications on how operators run the system and how districts manage their supplies and drainwater.

Task 5: Benefits and Costs Documentation

The potential benefits and costs of current measurement practices, lateral-level measurement, and turnout-level measurement will be documented using as a basis the analysis of SMWC and RD 1004 data, field data from NCMWC, and interviews at NCMWC, RD 108 and GCID. Any observations related to potential interdistrict measurement, cooperation, or coordination (including at a sub-basin level) will also be identified and noted.

Task 6: Third-Party Review

Refer to Section B-15e: *Statement of Work, Section 3, Monitoring and Assessment*.

Task 7: Share Results and Prepare Final Report

Refer to Section B-15e: *Statement of Work, Section 3, Monitoring and Assessment*.

Task 8: Study Coordination and Outreach

Refer to Section B-15g: *Outreach, Community Involvement, and Acceptance*.

Task List and Schedule

The Cooperative Study would take place between January 2006 (once funding is secure) through March 2008. A detailed schedule by task is shown on Figure 4.

Study Budget

The Cooperative Study budget is presented by task and year in Table 7. The cost budget breakdown is presented by year and major tasks that comprise the Work Plan. Costs associated with cooperation with the Cal Poly Irrigation Technology Research Center are assumed to be covered under work agreements between Reclamation and the Irrigation Technology Research Center.

TABLE 7
Cooperative Study Budget – Equipment and Labor

Description	Year 1 Cost ($)	Year 2 Cost ($)
TASK 1: Field Measurement Study		
TASK 1.1 Lateral-level Measurement Study	20,000	—
TASK 1.2 Turnout-level Measurement Study	—	22,000
Facility Modifications (pipe extensions, vegetation, or sediment removal)	5,000	5,000
Calibrate/Un-install Equipment	5,000	10,000
Data Collection	35,000	60,000
Data Management and Engineering Analysis	25,000	25,000
TASK 2: Water Management and Measurement Interviews	20,000	15,000
TASK 3: Delivery Data Analysis and Interviews at SMWC and RD 1004	50,000	—
TASK 4: Analyze Field Study Measurement Data from NCMWC		
TASK 5: Benefits and Cost Documentation		
TASK 6: Third-party Review	5,000	8,000
TASK 7: Share Results and Prepare Final Report (includes Annual Summary Reports)	20,000	40,000
TASK 8: Study Coordination and Outreach	25,000	25,000
Total	**210,000**	**220,000**

Note:

This study budget table does not include a contingency or the applicant's administrative costs.

Environmental Documentation

The proposed study and data collection effort is anticipated to require relatively few facilities (measurement instrumentation) and the installation of such facilities would be categorically exempted and excluded under CEQA and NEPA respectively.

Section B-15e, Statement of Work
Section 3: Monitoring and Assessment

Monitoring Methodology

The methods of monitoring technical quality throughout the study and monitoring whether or not the study will achieve the goals stated in Section 1 are noted below. In addition, the means for reporting study results is presented. The costs of these monitoring components are provided in Table 7, which lists project costs by task.

Data Management (Task 1)

The value of the Cooperative Study begins with accurate data which will lead to solid data analysis providing insights and recommendations on the issue of appropriate agricultural water measurement. All field study instruments will be installed and calibrated by water measurement technical specialists utilizing standard procedures outlined by manufacturer's recommendations and standard engineering practices. Data will be downloaded on a regular basis and checked for errors. After downloading raw data from the field, the data would be organized and stored in a database. The technical staff would also be responsible for checking and verifying data accuracy and reasonableness. The source of data errors would be investigated and corrected. If possible, data gaps caused by equipment malfunction or other factors would be estimated. The technical team will be comprised of a consultants with expertise in irrigation, agricultural measurement, agricultural water management, and data management and analysis.

Third-party Review (Task 6)

Involvement of a third-party expert will provide technical expertise and review of study approaches and data analysis, and will help build broad-based support of the study among many stakeholders. Third-party review and involvement by a recognized expert in agricultural water measurement and irrigation has been an integral part of the development of the Cooperative Study Work Plan and will continue during study implementation. The outside expert will be involved in approaches to data analysis and study conclusions, but will not be directly involved with field aspects, data analysis, or interviews of the study.

The outside expert will review study data and results of the interviews. The reviewer will provide input on the study results after Year 1 and after Year 2. Upon completion of Year 1, the outside expert will provide suggestions for refining the study in the second year. After the 2-year period of data collection, the outside expert will review and provide input to study conclusions in the final report.

Follow-up Interviews and Coordination Meetings before Year 2 (Tasks 2, 3.2 and 8)

Follow-up interviews or coordination meetings with BWMP participants with active roles in the Cooperative Study (i.e. RD 108, NCMWC, SMWC, RD 1004, GCID) will occur upon completion of study components in Year 1. Other BWMP participants will have the

opportunity to provide input to the study progress at coordination meetings. The purpose of the follow-up coordination is to look back at the initial Cooperative Study progress and recommend study refinements that could be made in Year 2.

Share Results and Prepare Final Report (Task 7)

Cooperative Study data and analysis results would be distributed to Reclamation, participating districts, other BWMP participants, and the Study funding agency in the form of summary reports at the end of both years of the study and a Final Report. The study results would provide science-based information for the issue of water measurement in the Sacramento Valley.

Year 1 Summary Report (Task 7.1)

A summary report after Year 1 will have initial study data, preliminary analyses, and study accomplishments. This report will also document any study refinements that may be necessary to carry out the second year of the proposed initial field study. Potential refinements to the study approach, equipment, or sites would be identified. Suggested refinements from the third-party reviewer would be included in the report. All potential refinements would be presented to the Cooperative Study Working Group, which includes the participating districts, Reclamation, and the funding source(s), for their consideration and approval.

Year 2 Summary Report (Task 7.2)

The second study summary report would contain summaries of data and other information collected during Year 2 of the study.

Final Report (Task 7.3)

Following Year 2, a final report would be prepared that would summarize the purpose of the study and whether or not the study achieved the objectives and made progress toward a mutually acceptable measurement program. The report would include the data and other information collected during the 2-year study and an analysis of the data and other information collected in the interviews. This analysis would include comparisons of water use based on current measurement practices, lateral-level measurement, field-level measurement, and the potential for interdistrict and/or sub-basin-level measurement. An evaluation of the equipment used, including the field performance, ease of operation, and durability, would also be included in the final report. This report would also summarize the real costs of measuring agricultural water supply at various operational levels and the associated labor costs of downloading and managing flow data.

An important component of the final report would be an overall evaluation of the study, including whether or not a longer-term study would be a valuable undertaking. Refinements to the study approach or equipment, if necessary, would be noted in the report.

Section B-15f, Qualifications

Applicant

Luther Hintz is the General Manager of RD 108. Mr. Hintz is the lead grant applicant and will be managing the project on behalf of all BWMP participants after funding and managing technical team (consultants). His resume is attached for reference.

Mr. Hintz has prior experience leading previous WUE grant projects. He led the Sacramento River BWMP Sub-basin-level Water Measurement Study, which has lead to the development of the current grant application for a demonstration project of the Sub-basin Measurement Program. The $100,000 feasibility study was completed in July 2003 and featured in Department of Water Resource's Office of Water Use Efficiency Water Conservation News in the Spring/Summer 2004 issue.

Mr. Hintz will be responsible for contracting with the funding agency and consultants, communicating quarterly reports to the Department of Water Resources, and all study results reporting.

In addition to overall project management, Mr. Hintz will be responsible for identifying appropriate people for the water management and measurement interviews. He will identify RD 108 management and operations staff and landowners to assist with the interview task.

Cooperators

Potentially, all general managers and staff of the SRSCs could participate in the Cooperative Study at varied levels of engagement. In addition, Reclamation water measurement/conservation planning staff will be involved in the cooperative effort. The third-party reviewer is another external cooperator critical to the study. The following list includes cooperators that have an active role in one or more of the Cooperative Study components:

Van Tenney, General Manager, Glen-Colusa Irrigation District - Mr. Tenney will be assisting in identifying appropriate people for the water management and measurement interviews. He will identify GCID management and operations staff and landowners to assist with the interview task.

Kelly Boyd, Operations Manager, Reclamation District 1004 - Mr. Boyd will be responsible for providing RD 1004 water delivery data from recent years, both before and after the change in water pricing policy. He will also coordinate interviews with operations staff to fully understand the hydrologic, irrigation practices, crop patterns that may also factor into the analysis.

Max Sakato, General Manager, Sutter Mutual Water Company - Mr. Sakato will be responsible for providing SMWC water delivery data from recent years, both before and after the change in water pricing policy. He will also coordinate interviews with operations staff to

fully understand the hydrologic, irrigation practices, and crop patterns that may also factor into the analysis.

Tom Barandas, Operations Manager, Natomas Central Mutual Water Company - Mr. Barandas will be the primary contact for establishing the field measurement study component of the Cooperative Study. He will assist with coordination of installation, maintenance required for measurement devices. Mr. Barandas will also assist in identifying appropriate people for the water management and measurement interviews. He will identify NCMWC management and operations staff and landowners to assist with the interview task.

Mid-Pacific Region Water Conservation Program, Bureau of Reclamation - Technical and management staff of the Water Conservation Program have been involved with the development of the Cooperative Study Work Plan and the BWMP. Program leads will coordinate water measurement specialists at Reclamation to provide input to study results and analysis. Potentially, the study could benefit from measurement specialists at Cal Poly Irrigation Technology Research Center, with which Reclamation has ongoing agreements to work on projects such as this one. Conservation staff would coordinate Cal Poly involvement as needed.

Third-party Reviewer - A third-party reviewer will be identified in the initial stage of the study start-up. The third-party reviewer will be a recognized irrigation and agricultural water measurement expert agreed upon by the SRSCs and Reclamation.

Section B-15g, Outreach, Community Involvement and Acceptance

Consistency with Local and Regional Plans

The Cooperative Study is a extension of the regional cooperation developed in the Sacramento Valley in the recently finalized Sacramento River BWMP. The BWMP recognized the need to focus on the specific issue of appropriate agricultural water measurement and developing a mutually acceptable water measurement program is written into the Regional Criteria for evaluating the SRSC Water Management Plans. Reclamation will continue to provide a key role in implementing the Cooperative Study to ensure that the study takes the correct steps in defining a mutually acceptable measurement program.

Study outreach will focus on BWMP participants and especially those with an active role in the Cooperative Study components as described below. Outreach and public acceptance of the methods and results of the study will be assisted by involving a third-party review that is an expert in irrigation and water measurement methods and issues, including California water management issues.

Study Coordination and Outreach (Task 8)

Study outreach would continue in the form of regular manager meetings with representatives from the SRSCs and as necessary with Reclamation representatives. Regular updates will be provided to interested entities in the form of progress reports and technical meetings that present study results as needed.

The implementation of this Cooperative Study requires either a participating district or a consulting engineer to take the lead role in providing project coordination for all study components, technical support, and a centralized repository for collected flow data. It is anticipated that participating districts may not have staff or resources available to lead such an effort; thus, funding would be necessary to provide technical support for the study. Technical support would be required for the purchase, installation, and calibration of equipment; data collection, management, and analysis; and the production of study reports.

Study coordination activities would include planning and scheduling the device installation and calibration tasks with the participating NCMWC staff. This process would be followed by a training session for system operators and farmers on common indicators of improperly functioning measurement devices. The implementation lead would coordinate all interviews and data collection. Technical staff would facilitate coordination of the field study, the interviews, and the delivery data analysis among Reclamation, the participating districts, and other BWMP participants. After project funding is approved, a study kick-off meeting would be held with subsequent meetings at the conclusion of each study year.

Study progress and results would be shared in the form of periodic reports (see Section 3: Monitoring and Assessment) with Reclamation and BWMP participants. Progress reports, the final report, and study data would be shared with the CALFED WUE Program to assist with the evaluation of Appropriate Measurement of Agricultural Water Use.

Section B-15h, Innovation

Methodologies

Evaluation of the appropriate level of measurement is necessary to support improved water management both across and within water districts. Evaluating existing measurement techniques in the SRSC service area and comparing management effectiveness at both the lateral and turnout levels will enable water districts to make more informed and efficient management decisions based on scientific, quantifiable data. Studying existing water measurement in several districts will also encourage cooperation across district boundaries to develop a management program suitable for a specific region. This proposed study is innovative in that such an inter-district effort in direct cooperation with Reclamation has not been previously conducted and has the potential to influence water measurement and management approaches across the Sacramento Valley.

Study and analysis techniques shown effective by this study can later be used to develop customized approaches to water measurement in other parts of the state, ultimately leading to improved water management and efficient water use statewide. Therefore, this study will contribute to a statewide effort to establish water measurement guidelines that are cost-effective, efficient, and provide adequate data for effective management.

Technologies

Water Level Monitoring

Float-operated instruments can be the most accurate way to monitor water surface levels. The very low mechanical friction and inertia of the instrument produces data of high precision and accuracy. The Unidata Model 6541 Precision Water Level Instrument can achieve an operating accuracy and resolution of 0.2 millimeter, which is maintained for the service life of the instrument.

The Unidata instrument is normally connected to the water surface by a float system. As the water surface rises or falls, an input shaft rotates. The position of the shaft is continually monitored by a high resolution optical encoder. The encoder produces a serial digital signal which is conveyed to an LCD screen, which displays the water level. The displayed reading can be recorded by an associated data logger, which can record the basic water level measurement. This technology can potentially be used to compute and log the flow rate in open channels.

Flow Monitoring

McCrometer propeller flowmeters are top-selling irrigation measurement devices, achieving accuracies of +/- 2 percent. The McCrometer meter offers economical and versatile flow measurement for a range of water applications, and is especially suited to dirty water flows. Both forward and reverse flow is measurable.

The McCrometer propeller meter uses corrosion-resistant polymer impellers, a flexible drive-train and sealed ball bearings, unlike traditional propeller meters. This innovative design allows easy serviceability in the field and lowers maintenance costs. Because there are no tight tolerances in the McCrometer design, it is self-cleaning and can handle solids suspended in water without clogging. A mechanical instantaneous flowrate indicator and totalizer is standard.

Because of its high accuracy, this flowmeter can also be used as a water management tool, helping to reduce water costs and preventing over-irrigation, essential for other water use efficiency projects.

Section B-15i, Costs and Benefits

Benefits

The Cooperative Study will provide benefits that are consistent with the goals and objectives of the CALFED Bay-Delta Program and will provide valuable information on the Appropriate Measurement of Agricultural Water Use as noted in Tables 1 and 2 in Section 1.

In addition, the Cooperative Study will take a necessary step towards developing a mutually acceptable long-term measurement program for SRSCs by working cooperatively with Reclamation. Specific benefits include determination of the following:

- Cost-effective measurement methods that will work satisfactorily under the conditions of the SRSCs' service area.
- Benefits that are potentially derived from measurement at turnout, lateral, and district levels. Verification of potential water use issues/benefits of pricing water by volume measured at the turnout or customer level.
- Costs associated with measurement at the sub-basin, district, lateral, and turnout levels.

Costs

A summary of project costs is given in Table C-1. It is assumed that administrative costs apply to the applicant. All consulting costs, including labor, travel, equipment, and supplies are included in items (b) through (m).

Item (a), *Total Administration Costs*, includes wages, fringe benefits, and travel that would be incurred by the applicant for contracting, meetings, travel, and other associated costs during the approximately 2-year execution of the study. This cost is therefore subtracted from the total grant amount.

Item (b), *Planning/Design/Engineering*, includes all study coordination and third-party review, as described by Tasks 6 and 8.

Item (c), *Equipment Pur*chases, is a summary of equipment costs previously described in Tasks 1.1 and 1.2. Item (d), *Materials/Installation/Implementation* gives the total equipment installation and implementation costs, as also described in the Task List. *Implementation Verification*, Item (e), totals the cost required to calibrate the instrumentation.

Items (f) through (j) do not apply to the Cooperative Study, and are therefore listed as $0.

Interviews for NCMWC, RD 108, and GCID (Task 2), as well as data collection and maintenance for the installed equipment, is given for Item (k), *Other*. *Monitoring and Assessment* includes engineering analysis, delivery data analysis, and labor required for SMWC interviews, as described in Tasks 3 and 4.

The costs to prepare both annual summary reports as well as the final comprehensive report are included in Item (m), *Report Preparation*.

APPENDIX C
PROJECT IMPLEMENTATION COSTS TABLE

APPLICANT: Reclamation District 108 on behalf of the Sacramento River Basinwide Water Management Plan participants
Project Title: Reclamation/BWMP Cooperative Water Measurement Study

<u>If using the excel tables on DWR website, complete shaded areas only.</u>

Section A projects must complete Life of Investment, column VII and Capital Recovery Factor, column VIII. Do not use 0.

Table C-1: Project Costs (Budget)

	Category	Project Costs ($)	Contingency % (ex. 5 or 10)	Project Cost + Contingency ($)	Applicant Share ($)	State Share ($)	Life of investment (Years)	Capital Recovery Factor (Table C-4)	Annualized Costs $
	(I)	*(II)*	*(III)*	*(IV)*	*(V)*	*(VI)*	*(VII)*	*(VIII)*	*(IX)*
	Administration (for initiation of project)								
	Salaries, wages	$15,000	0	$15,000	$15,000	$0			
	Fringe benefits	$5,000	0	$5,000	$5,000	$0			
	Supplies	$0	0	$0	$0	$0			
	Equipment	$0	0	$0	$0	$0			
	Consulting services	$0	0	$0	$0	$0			
	Travel	$500	0	$500	$500	$0			
	Other	$0	0	$0	$0	$0			
(a)	Total Administration Costs[1]	$20,500		$20,500	$20,500	$0			
(b)	Planning/Design/Engineering	$63,000	10	$69,300	$0	$69,300			
(c)	Equipment Purchases/Rentals/Rebates/ Vouchers	$32,000	10	$35,200	$0	$35,200			
(d)	Materials/Installation/Implementation	$10,000	10	$11,000	$0	$11,000			
(e)	Implementation Verification	$15,000	10	$16,500	$0	$16,500			
(f)	Project Legal/License Fees	$0	10	$0	$0	$0			
(g)	Structures	$0	10	$0	$0	$0			
(h)	Land Purchase/Easement	$0	10	$0	$0	$0			
(i)	Environmental Compliance/Mitigation/ Enhancement	$0	10	$0	$0	$0			
(j)	Construction	$0	10	$0	$0	$0			
(k)	Other – *Interviews, Data Collection, Maintenance*	$130,000	10	$143,000	$0	$143,000			
(l)	Monitoring and Assessment	$100,000	10	$110,000	$0	$110,000			
(m)	Report Preparation	$70,000	5	$73,500	$0	$73,500			
(n)	TOTAL (=a+…+m)	$440,500	NA	$479,000	$20,500	$458,500	NA	NA	
(o)	Cost Share Percentage	NA	NA	NA	4	96	NA	NA	NA

1 (Excludes administration O & M costs)

Attachment 1
Figures

Attachment 2
Luther Hintz Resume

Attachment 3
Support Letter from NCWA

Attachment 4
Support Letter from Reclamation

Attachment 5
Copy of USBR/Sacramento River BWMP, December 2003, Cooperative Water Measurement Study Work Plan