RECLAMATION

Managing Water in the West

Water Management Planner

Developed to Meet the 2014 Standard Criteria for Agricultural and Urban Water Management Plans

U.S. Department of the Interior
Bureau of Reclamation
Mid-Pacific Region

December 2014

INTRODUCTION

The Bureau of Reclamation (Reclamation) developed the Water Management Planner (Planner) to assist its water service contractors (contractors) in the preparation and implementation of Water Management Plans (Plan) as required by the Reclamation Reform Act of 1982 (RRA) and the Central Valley Project Improvement Act of 1992 (CVPIA). The Planner is to be used by both agricultural and urban contractors of various sizes and complexities. The Planner can be found on the Internet at www.usbr.gov/mp/watershare/.

Summary of Changes in the 2014 Planner

Reporting Requirements for wholesalers and Their Retailers (subcontractors)

Wholesalers have the option to include their subcontractors in a single plan containing data on each subcontractor or require each retailer to prepare their own plans. Subcontractors that are preparing their own plan, have been sent a notification letter to adjust their plan due date to align the submittal of the plan to the year prior of when the wholesaler's plan is due. For those wholesalers that include their subcontractors' information such as supplies, demographics, and water conservation plan and activities, no adjustment is needed.

Projected Budget

For implementing the BMPs, the projected budget has been expanded from a three-year budget to a five-year budget.

DWR Plans

A chapter has been added as an overview of how your Reclamation plan can be submitted for your California Department of Water Resources Ag Water Management Plan. Please see Chapter 8 for details.

508 Compliance

Your final plan must be submitted 508 Compliant, which means that pictures, graphics, charts, and tables must be tagged for handicap accessibility. Before submitting your final electronic version of your plan, the 508 Compliance website will provide instructions on how to tagged and identify objects within your plan. This will enable software to identify these object for the handicapped. More information can be found on our website at http://www.usbr.gov/vip, Username: Reclamation and Password: Website1.

Annual Best Management Practice (BMP) Updates

For ease of reporting, Urban and Agricultural Annual BMP Updates are due April 30th of each year unless specified in writing by Reclamation. Annual BMP Updates are also due the year your Plan is due which can be included within your plan.

Recommendations for a More Efficient Plan Review Process

Recommend Following Plan Format

Specific information is necessary to assess a plan as adequate. It is highly recommended that your plan follows the plan format to help review the plan expeditiously. If it is necessary for your district to provide your plan in a format that is different than the recommended format, please provide the section and page number of where the information can be found based upon the Plan Review Form.

Use Tables

Use tables and then narrative to clarify information. (may want to put into guidelines)

Update Point of Contact Information

Please provide updated point of contact information for the general manager and the water conservation coordinator. This will provide Reclamation with the most up to date information and correspondence.

Measurement Documentation

Under measurement calibration and maintenance frequency, more information will be requested for the following responses: "as needed" or "as manufacturer's suggestion." Documentation will be required to support either claim. Please be sure that if the manufacturer's specification sheets are included, that recommended maintenance and calibration frequency should be listed on the specification sheet. Sample documentation should be added as an addendum for various types of measuring devices and should be included for production and end use measurement.

Do Not Leave Blanks

If the question does not pertain to your district please state that this is not applicable to your district and why. A blank response could be interpreted that you just missed the question and time will be spent request the information again.

Review the WMP Evaluation Form

It is recommended that the contractor review the WMP Evaluation Form in Chapter 9, to see how Reclamation reviews plans. This can also be used as a Plan checklist to ensure the contractor has addressed all of the aspects of their plan submittal.

BMP Exemptions

In order for a contractor to be exempt from an urban or agricultural BMP, either the district must state that it is not applicable for that BMP or provide the necessary documentation to substantiate a claim within the plan. Please see Addendum A, page 3-47-48 and Addendum B, page 3-50 for details.

Due Date

Due date of your plan is every five years independent of when your last plan was completed or approved. For example, if your plan was due in 2015 and it took four years to get approved, in 2019, your next plan will be due the following year in 2020.

Deadline Date for Final Plan

Deadline date for your final plan is December 31st of the year your plan is due. This is a final plan that has gone through the Federal Register not the initial submittal of your draft plan. It is recommended that you initially submit your plan in January or February of the year your plan is due, if not earlier, to allow sufficient time for review and processing through the Federal Register.

Timeline for Plan Completion

Reclamation is working internally to help expedite the review and processing of your plan. It is also important that your district responds promptly to questions and revisions. This shows that your district is working diligently and in good faith to complete your plan. Failure to do so could deem your district not in compliance with the terms of your contract.

RECLAMATION

Managing Water in the West

Mid-Pacific Region

2014 Standard Criteria

U.S. Department of the Interior
Bureau of Reclamation
Mid-Pacific Region

The Standard Criteria (Criteria) were developed by the Bureau of Reclamation (Reclamation) in response to the Central Valley Project Improvement Act of 1992 (CVPIA) (Public Law 102-575) and in accordance with the Reclamation Reform Act of 1982 (RRA) (Public Law 97-293).

Who Must Use These Criteria

The Criteria apply to any Water Management Plan (Plan) submitted to Reclamation as required by applicable Central Valley Project (CVP) water service contracts, repayment contracts, Settlement Contracts, or any contract that specifically invokes the Criteria.

Exceptions

The following are exempted from preparing a Plan using the Criteria:

- All contractors that receive only irrigation water from any Federal Reclamation project, and deliver water to less than a current five-year average of 2,000 acres of land.
- All contractors that receive less than a five-year average of 2,000 acre-feet per year (AFY) of only municipal and industrial (urban) water from any Federal Reclamation project.
- All contractors that receive any combination of irrigation and/or urban water amounting to less than a current five-year average of 2,000 acre-feet from any Federal Reclamation project.

For new Plans and if data called for in the Criteria are not available, the contractor shall include in their Plan how they (the contractor) will gather the data and make it available for the next Plan revision.

Where to Submit Plans

Contractors shall submit Plans in electronic format to the local Area Office for review. For Area Office representatives and contact information, please visit *http://www.usbr.gov/mp/watershare/contacts.html*. After Plans are reviewed by the Area and Regional Offices and deemed adequate, the Board of Directors is required to pass a resolution adopting the Plan.

CRITERIA CONTENTS

INTRODUCTION **2-5**
Background and General Information 2-5
GLOSSARY **2-7**
PLAN EVALUATION, IMPLEMENTATION, AND COMPLIANCE **2-9**
Flexibility and Coordination 2-9
Review Process 2-9
Annual BMP Updates 2-9
Five-Year Plan Revision Procedure 2-10
Consequences of Non-Compliance 2-10
Verification 2-10
PLAN CONTENTS **2-11**
Section 1 - Description of The District 2-11
Section II - Inventory of Water Resources 2-12
Section III - BMPs for Agricultural Contractors 2-14
Section IV - BMPs For Urban Contractors 2-16
ADDENDUM A: EXEMPTION PROCESS **2-17**
Intent 2-17
Evaluation 2-17
Detail Expected in an Adequate BMP Exemption 2-17
ADDENDUM B: APPLICABILITY PROCESS **2-19**
Exemptible BMPs for Agricultural Contractors 2-19
ADDENDUM C: INFORMATION REQUIRED OF CONTRACTORS LOCATED IN DRAINAGE PROBLEM AREA **2-21**

This page intentionally left blank

INTRODUCTION

Background and General Information

The purpose of the Criteria is to promote, using the best available cost-effective technology and Best Management Practices (BMPs), the highest level of delivery water management achievable by contractors, along with the implementation of water-use efficiency measures reasonably achievable by their customers.

Section 210 of the RRA requires contractors to prepare and submit Plans every five years with definite goals, appropriate water conservation measures, and timetables.

Section 3405 (e) of the CVPIA requires that the Secretary of the Interior establish Criteria to evaluate CVP Plans by April 30, 1993. The Criteria shall be reviewed at least every three years and revised, if necessary.

The CVPIA specifies that the Criteria identify BMPs including, but not limited to, efficient water management practices being developed pursuant to California State law or reasonable alternatives.

Reclamation developed and distributed a Water Management Planner detailing the type of information required by the Criteria. The Water Management Planner will be updated to conform to the revised Criteria.

This page intentionally left blank

GLOSSARY

For the purposes of the Criteria only, the following definitions will be used:

Agricultural Water Management Council (AWMC) – A consortium of agricultural water agencies and public interest groups working together to implement water conservation practices in California. This effort was formalized in a Memorandum of Understanding (MOU) signed in 1996. Signatory water suppliers agree to develop and implement comprehensive conservation efficient water management practices using sound economic criteria. AWMC is going through a transitional phase. Reclamation will continue with the management of the agricultural annual BMP reporting database and will notify contractors of any changes in the future.

Best Management Practice (BMP) – A policy, program, practice, rule, regulation and/or ordinance, or the use of devices, equipment, or facilities that meet either of the following:

- An established and generally accepted practice among contractors that results in more efficient use, conservation/management of water;
- A practice for which sufficient data are available from existing water management projects to indicate that significant efficiency improvements or management-related benefits can be achieved; that the practice is technically and economically reasonable and not socially or environmentally unacceptable; and that the practice is not otherwise unreasonable for most contractors to carry out.

California Urban Water Conservation Council (CUWCC) – A consortium of urban water agencies and public interest groups working together to develop water best management practices in California. This effort was formalized in a MOU. Signatory water suppliers agree to develop and implement comprehensive conservation BMPs using sound economic criteria.

Class 1 Water – The Friant Division of the Central Valley Project employs a "Class 1/Class 2" water contracting system. Class 1 Water is the supply of water stored in or flowing through Millerton Lake which will be available for delivery from Millerton Lake and the Friant-Kern and Madera Canals as a dependable water supply during the year.

Class 2 Water – The supply of water which can be made available for delivery from Millerton Lake and the Friant-Kern and Madera Canals in addition to the supply of Class 1 Water. Because of its uncertainty as to availability and time of occurrence, such water will be undependable in character and will be furnished only if, as, and when it can be made available as determined by the Contracting Officer.

Conjunctive Use – The planned and coordinated use of surface and groundwater supplies to increase water supply reliability, as may be included in a groundwater management plan or banking program.

Contractor – Entities that contract with Reclamation for urban and/or agricultural water.

Customer type (urban) – Urban customer types may include: single-family, multi-family, commercial, industrial, institutional, landscape irrigation, wholesale, or recycled.

District – The physical boundaries of the contractor's service area.

Five-Year Plan Revision – The revision of a Plan using the most recently adopted Criteria. Under the RRA, contractors are required to submit an updated Plan to Reclamation every five years, using the previous water year's data. If it is not a normal water year and the District would like to use a different year's data, please see Section II – Inventory of Water Resources.

Frost Free Days – According to National Oceanic and Atmospheric Administration (NOAA), frost free days are days with temperatures greater than 28 degrees Fahrenheit.

Groundwater Banking Program – The intentional storage of water supplies in subsurface aquifers with plan for retrieval and beneficial use. Groundwater banking usually involves keeping an account of water input and the subsequent use by predetermined or specified parties. Groundwater recharge alone is not a groundwater management plan or banking program. An acceptable groundwater management plan or groundwater banking program must have a reasonable rationale of how the contractor or customers will retrieve such water for beneficial use.

Groundwater Management Plan – A set of practices and management actions that improve groundwater conditions (with the intent of protecting and/or increasing benefits, including the sustainability of groundwater aquifers).

Groundwater Recharge – Infiltration of water into the saturation zone can occur by one of the following processes:

- Natural recharge - recharge of a groundwater basin due to precipitation and stream flow;
- Planned recharge - intentional recharge of a groundwater basin via percolation ponds or injection wells; or
- Incidental recharge - recharge resulting from canal seepage or deep percolation from excess irrigation

Implementation – Achieving and maintaining the staffing, funding, and the priority levels necessary to achieve the level of activity called for in the descriptions of the various BMPs. Also, to satisfy the commitment by the contractor to use good-faith efforts to optimize benefits from implementing BMPs.

Inflow – Water that enters the district boundaries, which also enters the district distribution system.

MOU – Memorandum of Understanding.

Outflow – Water from the distribution or drainage system that leaves the district boundaries.

Subcontractor – A contractor who purchases water from a Wholesaler and sells all water directly to the end user. A subcontractor may also be referred to as a retailer or retail agency in the urban sector.

Riparian Evapotranspiration (ET) – ET from non-crop vegetation that usually grows along the banks of water conveyance and storage facilities.

Water Conservation/Water Management – Use of less water to accomplish the same purpose(s) or the use of the same amount of water to accomplish additional benefits. An example of the latter is implementation of a BMP that results in increased total crop production using the same amount of water. Water management that results in the increased benefits of water can be achieved through the implementation of BMPs identified in these Criteria. For the purpose of these Criteria, water conservation is considered the same as water management.

Water Inventory – An approach used in the Plan that identifies and quantifies all inflows, outflows, and other uses of water by the contractor in order to identify areas of potential improved water management.

Wholesaler – A contractor who sells water to the subcontractor who then resell the water, usually to multiple end users.

PLAN EVALUATION, IMPLEMENTATION, AND COMPLIANCE

Water management and water management planning are on-going processes that begin with the preparation of a comprehensive Plan. The purpose of preparing a Plan is for the contractor to implement the programs developed during the planning process. Implementation of programs identified in the Plan is critical to the success of water management within a district. The Criteria focuses not only on what constitutes an adequate Plan, but also on the implementation of the programs described in that Plan.

The Plan should be prepared using the Plan Format identified in the guidebook. Plans shall include description of the district, inventory of water resources, and BMPs.

Flexibility and Coordination

The Criteria recognizes the differences between contractors and are flexible enough to allow each contractor to develop and implement the types of programs that will best accomplish improved water management within their boundaries. In some cases, the contractors may choose to pool their resources and implement joint programs. The Criteria allows and encourages joint efforts toward program implementation.

Wholesalers are responsible for their subcontractor's water conservation compliance. Wholesalers may include subcontractors in a single Plan containing data on each subcontractor or require each retailer to prepare their own Plans. If retailers prepare their own Plan, the wholesaler should be involved to the extent necessary to ensure it is found to meet the Criteria. These wholesalers and subcontractors have been notified to adjust their Plan due date to align the submittal of the subcontractors' Plans to the year prior of when the wholesaler's Plan is due. For those wholesalers that include their subcontractors' information such as supplies, demographics, and water conservation Plan and activities; no adjustment is needed.

Review Process

Contractors are required to submit draft Plans to the Area Office for review. Once forwarded to the Regional Office, contractors will receive notification of Reclamation's acceptance or request for modification. Following notification by Reclamation that the Plan conditionally meets the requirements of the Criteria, contractors submit an electronic copy of the complete Plan. A resolution by the contractor's Board of Directors formally adopting the Plan must also be submitted. A "Notice of Availability" regarding your Plan will be published in the *Federal Register*.

Congress established the *Federal Register* publication system as a method of informing the public of the regulations affecting them. The official agency actions published in the Federal Register are available to the public and subject to the Freedom of Information Act. The Federal Register and archives can be accessed at *http://www.gpo.gov/fdsys/browse/collection.action?collectionCode=FR*. Once published in the Federal Register, the public is given 30 days in which to view and comment on the Plan. If no significant comments are received within 30 days, the review process is officially completed and the Plan will be posted on the Reclamation WaterShare web site: *http://www.usbr.gov/mp/watershare/*. If public comments are received, additional changes to the Plan may be required. For planning purposes, it is anticipated that a Federal Register will be processed around the Spring and Fall of each year.

Annual BMP Updates

Pursuant to water service, repayment, and settlement contract terms, most contractors must report on Plan implementation annually. Consistent with the provision of the water service contract, the Contractor shall include a summary of all its surface water deliveries in the annual BMP reporting.

Agricultural contractors complete annual updates by filling in the information for BMPs on the Agricultural Water Management Council (AWMC) web site at *http://www.agwatercouncil.org*.

Urban contractors complete annual updates by filling in the information for Urban BMPs on the CUWCC web site at *http://www.cuwcc.org*.

For clarification, Urban and Agricultural Annual BMP Updates are due April 30th of each year unless specified in writing by Reclamation. Annual BMP Updates are also due the year the Plan is due. If a Plan takes longer than a year to complete, this would create a gap in the BMP information.

Five-Year Plan Revision Procedure

Pursuant to water service and settlement contract terms, most contractors are required to submit an updated Plan every five years. Contractors must use the most recently adopted Criteria for an updated Plan. Contractor's Plan are due every five years, independent of when the last Plan was completed or approved. For example, if a Plan was due in 2015 and it took four years to get approved, in 2019, the next Plan will be due the following year in 2020.

Deadline date for a final Plan is Dec. 31st of the year the Plan is due. This is a final Plan that has gone through the Federal Register, not the initial submittal of a Plan. It is recommended that a draft Plan be submitted in January or February of the year the your plan is due, if not earlier, to allow time for review and processing through the Federal Register.

The contractor must continue to file an annual update every year to report implementation actions taken.

Consequences of Non-Compliance

Consistent with provisions of the water service contract, continued project water delivery is dependent upon the contractor implementing an approved water conservation program. Water deliveries will occur providing the contractor cooperates with Reclamation in determining that its water conservation plan meets Federal conservation and efficiency criteria. It is important that an adequate Plan be deemed acceptable through the Federal Register process by Reclamation before Reclamation approves certain discretionary contract actions such as, benefits of financial and technical assistance and the following examples:

- Reclamation grant program requests
- Rescheduling requests
- Water banking requests
- Water transfer or exchange requests
- Inclusion and exclusion requests

Multiple noncompliance letters could impact Reclamation's contract renewals in future years.

Verification

All information is subject to verification and Reclamation may review plan implementation in coordination with the contractor.

PLAN CONTENTS

Section I. Description of the District

Intent

To describe general physical information about the district so that a basis can be formed to evaluate improvements by and within the district, as well as provide the reader with information about the district's physical aspects that may affect the potential for improved water management.

A. History

Give a historical overview of the district. Provide a timeline that includes the formation of the district, date the district was formed, population served, original size, water supplies, contract information with Reclamation and others, and changes in land use. For agricultural districts describe the changes in irrigated acreages, cropping patterns, and evolving irrigation methods.

B. Location and Facilities

Describe the district's incoming flow measurement method and locations, water conveyance and delivery system (unlined canals, lined canals, pipelines, etc.), and storage facilities (reservoirs, regulating reservoirs, etc.). Agricultural contractors should describe district outflow points, spill recovery systems, and whether the delivery system is on-demand (e.g. no lead time or scheduling necessary); scheduled (e.g. water order 24 hours in advance); rotation (e.g. farmer receives water every ten days); or other. Describe any restrictions on the contractor's water source(s) and proposed changes that will be implemented during the next five years.

C. Topography and Soils

Describe the topography and terrain of the district (e.g. hilly, flat, sloping to a water course, etc.). Discuss the effect of topography on water operations and management within the district. Describe major soil classifications and corresponding acreages within the district that affect the use of water (e.g. salinity or high-water table, high or low infiltration rates, etc.).

D. Climate

Describe the general climate of the district. Include average precipitation, maximum and minimum temperatures, and frost-free days. If there are areas within the district known to have significantly different microclimates, describe how these affect water management decisions and operations. Also include climate data source(s).

E. Natural and Cultural Resources

Describe any known natural resources (wetlands, rivers, streams, lakes, etc.) within the district. Indicate if any of these resources were managed (past or present) by the contractor. Describe any known recreational and/or cultural resources (specifically structures on the National Register of Historic Places) within the district.

F. Operating Rules and Regulations

Attach a copy of the contractor's operating rules and regulations which describe information on water allocation policies, lead time necessary for water orders and water shut-off, policies regarding return flows and outflow leaving the district, and policies related to water transfers into or out of the district (by farmer and contractor).

G. Water Measurement, Pricing, and Billing

List the total number of connections/turn-outs, the number currently measured, and the percentage of measured water deliveries. List the types and quantity of measurement devices (meters, calibrated gates, weirs, etc.), level of accuracy (along with documentation verifying the accuracy of the devices), frequency of calibration, and maintenance and reading schedule.

Describe the basis for water charges for agricultural and urban uses. If details are complex, provide an overview and reference the page of the contractor's written operating rules and regulations that provides additional detail. Be sure the following information can be easily found: basis of charges for agricultural water (by quantity,

acre, crop, land assessment, other charges, etc.) and/or for urban (by customer class, quantity, flat rate, etc.).

For water use billed by quantity, describe the rate structure (e.g. declining, uniform or increasing block rate, etc.). Include the billing frequency (e.g. monthly, bimonthly, annually, etc.), a sample of each type of bill, and a description of the record management system.

H. Water Shortage Allocation Policies

Attach a copy of the contractor's agricultural and/or urban water shortage plan.

Describe how reduced water supplies, including hardship water, are allocated. Describe the contractor's policies that address wasteful use of water and describe enforcement methods.

I. Evaluate Policies of Regulatory Agencies Affecting the Contractor and Identify Policies that Inhibit Good Water Management

Evaluate policies of agencies that provide the contractor with water. Discuss possible modifications to policies and solutions for improved water management.

Section II. Inventory of Water Resources

Intent

This section shall include a description of contractor's surface water supply, groundwater supply, other water supplies, source water quality monitoring programs, water uses within the district, outflow from the district, urban waste-water disposal, and water budget. Provide this information for either the last complete calendar year or the last complete water year prior to preparation of each five-year Plan update. Indicate which data set(s) are used for preparing the Plan.

In addition to the data set(s), the contractor may choose to submit data from a different year, or a combination of different years, that better represent average water conditions. This may be necessary if the conditions in the district in the year preceding the five-year Plan update were a deviation from the norm (i.e., the district received either below or above normal precipitation).

These data are intended for planning purposes. For new Plan elements, if data are not available during the preparation of this Plan, the contractor shall describe how the information will be obtained for the next Plan update.

A. Surface Water Supply

Describe the acre-foot amounts delivered to the contractor by each of the contractor's surface sources (includes local/water rights water) for the specified years. Describe any water quality limitations or management concerns associated with the identified water sources. Provide the amount of water received for each of the last ten years.

B. Groundwater Supply

Describe the general characteristics of the groundwater basin(s) that underlie the district. Provide a map that includes contractor-operated water wells, and managed groundwater recharge areas. Describe groundwater recharge programs (direct, indirect, or in lieu), groundwater banking programs, surface water storage programs, and other similar programs detailing the amount of CVP and non-CVP water utilized annually for such programs. If there is conjunctive use of surface and groundwater, describe it. Attach a copy of the contractor's groundwater management plan or a description of the contractor's groundwater banking program.

C. Other Water Supplies

Identify any long-term water supplies not described above (drainage from upstream contractors, reclaimed urban waste water, transfer agreements, etc.).

D. Source Water Quality Monitoring Practices

Describe current water quality testing program (frequency of measuring and analyses performed) and which agencies conducted the water testing. Also, describe the contractor's role in the program.

E. Water Uses within the District

Agricultural

Describe the type and acreage of crops grown in the district; include seasonal ET amounts, water required for cultural practices, and the leaching requirement for each crop. List the types of irrigation systems used for each crop.

Urban

Describe the urban water use, by customer type, within the district. Describe where applicable, the waste water collection and treatment systems, recycled water uses, and methods of disposal.

Groundwater Management Plan/Banking Programs

List the quantity of water used for planned groundwater recharge, including method of recharge and retrieval. Do not include incidental recharge, such as canal seepage or deep percolation due to excess irrigation unless the quantity recharged and the method of retrieval is specified.

Transfers, Exchanges, Rescheduling, Purchases, or Sales

Describe the source and quantity of water in any transfer, exchange, reschedule, purchase or sale in or out of the district, and for what uses. Describe any other water transactions, such as trades, wheeling, wet year/dry year exchanges, etc.

Other

Describe any other water uses.

F. Outflow from the District

Identify where outflow leaves the district, how it is measured, the measurement accuracy, and where the outflow goes. Describe any water quality monitoring programs for outflow water (frequency of measuring and analyses performed). Identify any constituents (selenium, pesticides, salinity, etc.) that limit reuse of the outflow water and how. Also provide a brief discussion of the contractor's involvement in Central Valley Regional Water Quality Control Board programs or requirements for remediating or monitoring any contaminants that would significantly degrade water quality in the receiving surface waters.

Section 3405 of the CVPIA states that all new, amended, and renewed CVP contracts after October 31, 1992, requires that the contractor or agency be responsible for compliance with all State and Federal water quality standards applicable to surface and subsurface agricultural drainage discharge generated within its boundaries. Contractors included in the drainage problem area, as identified in "A Management Plan for Agricultural Subsurface Drainage and Related Problems on the Westside San Joaquin Valley (September 1990)," should also complete Addendum C.

G. Water Accounting

Develop a water inventory for the contractor based on the last calendar year or the last water year prior to preparation of each five-year Plan revision. Indicate which dataset(s) is used for the inventory. If a contractor so chooses, a representative water supply year can also be included. The inventory should include the following:

1. Quantify Contractors' Water Supplies
   a. Surface water supplies, imported and originating within the district, by month
   b. Groundwater extracted by the district, by month
   c. Estimated annual groundwater extracted by non-district parties (if records are not available, provide an estimate and basis for estimation)
   d. Recycled water by month (water originating from a municipal waste-water treatment plant)
   e. Other supplies by month
2. Quantify Water Used
   a. Conveyance losses, including seepage, evaporation, and operational spills
   b. Consumptive use by riparian vegetation
   c. Applied irrigation water, crop ET, water used for leaching and cultural practices (frost protection, soil reclamation, etc.)
   d. Urban water use
   e. Groundwater recharge
   f. Water exchanges, transfers and banking
   g. Estimated deep percolation within the district
   h. Flows to perched water table or saline sink
   i. Outflow water leaving the district
   j. Other
3. Overall Water Inventory. Compare total water estimated to be available for sale

within the district with the total water actually sold by the contractor.

Section III: BMPs for Agricultural Contractors

Intent

To develop an implementation plan for agricultural BMPs that is proven to accomplish improved (more efficient) water management.

For the purposes of the Criteria, the Plan needs to describe the program that the contractor determines will best accomplish each BMP. The success of some of the practices will depend on cooperative work with other entities. There may be constraints to successful implementation of planned programs. Monitoring and updating will allow the contractor to modify planned programs that do not accomplish the BMP as designed.

A. Critical BMPs for Agricultural Contractors

This section lists the BMPs that all contractors are to implement. Provide a description of how the BMP is being implemented and include time schedules, budgets, monitoring, and maintenance data for each BMP. The contractor must include the current year actual expenditures and a projected budget for the cost of implementing the BMPs for the five years following the Plan update.

Water Measurement

Measure the volume of water delivered by the contractor to each customer. Measurement is not required if a contractor receives only Class 2 water. Measure flows with devices that are operated and maintained to a reasonable degree of accuracy, under most conditions, to +/- 6 percent by volume. Three typical categories of measurement devices include: devices with totalizers, standard flow measurement devices, and non-standard but calibrated devices. Include frequency and date of last calibration.

Designate the Water Conservation Coordinator

Provide the job description and minimum qualifications. Job duties should include five-year Plan preparation, implementation and annual updates. Include the coordinator's title, business address, business phone number, and business email address.

Provide or Support the Availability of Water Management Services to Water Users

Develop and conduct individual programs or cooperative programs with other contractors in regional programs. Some contractors may want to contract or arrange program delivery through consulting firms, cooperative extension, or others. Services required include, but are not limited to:

1. On-farm evaluations
   a. On-farm irrigation and drainage system evaluations using a mobile lab type assessment, and/or
   b. Timely field and crop specific water use information to the water user.
2. Normal year and real-time irrigation scheduling and crop ET information (e.g., California Irrigation Management Information System (CIMIS)).
3. Surface, ground, and drainage water quantity and quality data.
4. Agricultural water management educational programs and materials for farmers and staff, and the public (e.g., soil moisture and salinity monitoring; in-school awareness programs; Agwater software; efficient irrigation techniques, crop water budget and other approaches; program delivery via workshops, seminars, newsletters, field days and demonstrations, websites, etc.)
5. Other - provide details

Pricing Structure

Adopt a water pricing structure based (at least in part) on the measured quantity delivered.

Evaluate and Improve Efficiencies of Contractor's Pumps

Many contractors operate booster pumps or groundwater pumps as part of their delivery facilities. A program to evaluate and improve the efficiencies of such pumps can result in energy savings or peak load reductions, or reveal capacity

limitations due to inefficient facilities. Over the long term, the contractor can reduce operational costs and improve operational efficiency.

B. Exemptible BMPs for Agricultural Contractors

Provide a description of how the BMP is being implemented and include time schedules, budgets, and monitoring results. Each contractor shall implement the following BMPs, unless the contractor has an approved exemption from Reclamation. The contractor is required to follow the exemption process (see Addendum A) to justify exemptions. Refer to Addendum B for example justifications for each exemptible BMP. Document the exemption in this section.

Facilitate Alternative Land Use

Facilitate alternative uses (voluntary or compensated) for lands with exceptionally poor production potential or whose irrigation contributes to significant problems such as drainage.

Facilitate Use of Available Recycled Water that Otherwise Would Not be Used Beneficially, Meets all Health and Safety Criteria, and Does Not Cause Harm to Crops or Soils

The use of recycled urban waste water for agricultural irrigation provides an opportunity for reuse of an available water supply. Reuse of urban waste water can be an important element in overall water management.

Facilitate the Financing of Capital Improvements for On-Farm Irrigation Systems

Financial aid to farmers may include cataloging available funding sources and procedures and/or obtaining funding, administering the program, and providing low-interest loans.

Incentive Pricing

Implement a pricing structure that promotes one or more of the following goals:

1. More efficient water use at the farm level
2. Conjunctive use of groundwater
3. Appropriate increase of groundwater recharge
4. Reduction in problem drainage
5. Improved management of environmental resources
6. Effective management of all water sources throughout the season by adjusting seasonal rates based on current conditions

Canal Lining/Piping and Regulatory Reservoirs

1. Line or pipe distribution systems to increase distribution system flexibility and capacity, decrease maintenance, and reduce seepage
2. Construct regulatory reservoirs to improve distribution system delivery flexibility

Increase Flexibility in Water Ordering By, and Delivery To, Water Users (within Operational Limits)

Modify distribution facilities and controls to increase the reliability, consistency, and flexibility of water deliveries.

Construct and Operate Contractor Spill and Tailwater Recovery Systems

Construct facilities to capture and reuse district operational spills.

Plan to Measure Outflow

Measure the volume outflow with methods or devices that are operated and maintained to a reasonable degree of accuracy, under most conditions, to +/- 20 percent. Identify spill locations, prioritize spill locations by quantity of spill, and determine best measurement method/cost. If outflow measurement has not yet been completed, submit funding proposal and provide the estimated cost and milestone schedule.

Optimize Conjunctive Use

Increase planned conjunctive use of surface and groundwater within the district. Conjunctive use usually includes a groundwater management Plan or banking program.

Automate Distribution and/or Drainage System Structures

Automation of distribution and/or drainage system structures may increase flexibility in water deliveries and increase the contractor's control over its water supplies, thus providing the opportunity to improve the efficiency of water use.

Facilitate or Promote Water User Pump Testing and Evaluation

Describe the program and number of pumps evaluated.

Mapping

Develop Geographic Information System (GIS) maps of the district's distribution system and drainage system. A comprehensive GIS database should include GPS locations of district facilities, inflow/outflow points, conveyance system, etc. as well as base datasets such as soils and hydrography. If digital mapping has not yet been completed, include the estimated cost and milestone schedule for implementing this BMP.

C. Provide a 5-Year Budget

Provide current year actual expenditures and a projected budget for the 4 years following the Plan implementation for the cost of implementing the BMPs.

Section IV: BMPs for Urban Contractors

Intent

To develop an implementation plan for urban BMPs proven to accomplish improved (more efficient) water management. These Criteria require contractors to implement BMPs under the CUWCC 2011 MOU.

This part of the Plan identifies contractor-specific programs to accomplish the BMPs. It is understood that programs developed by wholesale agencies may not be implemented at the retail customer level, except within the contractor's retail service area. For the purposes of the Criteria, the Plan needs to describe the program that best accomplishes the BMP.

The success of some of the practices will depend on cooperative work with other entities. It is recognized that there may be constraints to successful implementation of planned programs. Monitoring and updating will allow the contractor to modify any planned programs that do not accomplish the BMP as designed.

A. BMPs for Urban Contractors

This section lists the BMPs that contractors may implement. Refer to the CUWCC MOU for more information on the compliance options. Provide a description of which compliance option will be implemented (e.g. Traditional, Flex Track or GPCD). Describe how the BMP is being implemented and include time schedules, budgets and monitoring, and maintenance data for each BMP. Descriptions of the BMP targets and program designs are available at the CUWCC web site.

Foundational BMPs

1. Utility Operations Programs
    a. Operations Practices
        i. Conservation Coordinator
        ii. Water waste prevention
        iii. Wholesale agency assistance programs
    b. Water Loss Control
        i. Metering with Commodity Rates for All New Connections and Retrofit of Existing Connections
        ii. Retail Conservation Pricing
2. Education Programs
        i. Public Information Programs
        ii. School Education Programs

Programmatic BMPs

1. Residential
    a. Residential assistance program
    b. Landscape water survey
    c. High-efficiency clothes washers (HECWs)
    d. WaterSense Specification (WSS) toilets
    e. WaterSense Specifications for residential development
2. Commercial, Industrial, and Institutional (CII)
3. Landscape

Provide a 5-Year Budget

Provide current year actual expenditures and a projected budget for the 4 years following the Plan implementation for the cost of implementing the BMPs.

ADDENDUM A - EXEMPTION PROCESS

Intent

To demonstrate in a clear and concise manner that a BMP is not cost-effective, not financially feasible, and not legally or environmentally possible for a contractor to implement. Only the BMPs in Section III.B. are exemptible for agricultural contractors. For urban contractors, Foundational BMP 1.3 is the only non-exemptible BMP.

Evaluation

Some BMPs are not appropriate or possible for a contractor to implement. To document an exemption, the basis, rationale, and details for excluding a BMP must be provided. Such documentation must address, as appropriate, cost-effectiveness, financial feasibility, and environmental or legal constraints to BMP implementation. Urban BMP exemption requests should use the CUWCC exemption process. All urban and agricultural exemption requests will be reviewed for completeness, accuracy, and appropriateness by either Reclamation or an independent contractor.

Detail Expected in an Adequate BMP Exemption

Legal Constraints

Due to legal constraints, the following must be detailed in order to justify a BMP exemption:

1. A list of any known laws, regulations, court decisions, or other legal constraints that make it illegal for the contractor to implement the BMP.
2. A list of the steps required to remove these constraints.
3. A description of what steps the contractor has taken to remove these constraints.
4. Documentation of efforts by the contractor to work with other entities that have the legal authority to carry out the BMP within the contractor's service area.

Environmental Constraints

In order to justify an exemption due to known adverse environmental impacts, the Plan must document critical environmental issues and known (qualitative and/or quantitative) negative impacts of the BMP, and an explanation of why effective mitigation of these impacts is not possible. If mitigation of the environmental impacts is possible, the practice must be implemented unless it can be exempted by another exemption category. For example, if the mitigation costs make the project economically infeasible, a discussion of the mitigation plan and necessary mitigation costs should be included as part of the economic analysis.

Financial Constraints

In order to adequately justify an exemption due to financial constraints, the Plan must clearly document the following:

1. The contractor's funding needed to implement the BMP.
2. A discussion regarding why the contractor cannot finance the BMP through rate adjustments, assessments, etc.
3. A discussion of the contractor's reasonable efforts to secure funding from other entities that include, but are not limited to, lending institutions and bonding authorities, and an explanation of why these entities would not provide funding.
4. The required amount of a grant or subsidy necessary to feasibly implement the BMP if financing or partnerships could not be obtained. A benefit-cost analysis that demonstrates the costs to the contractor outweigh the benefits to the contractor over the life of the measure. The contractor must perform the analysis by comparing the present value of all benefits to the present value of all costs.

Document the projected/estimated benefits and costs and the methodology for analysis (benefits and costs should be quantified to the extent possible). The analysis performed for each excluded BMP (from the contractor's perspective) must include, but is not limited to, the following benefits and costs:

Benefits

1. All capital costs avoided by the contractor which include, but are not limited to, the costs associated with the development of new supplies (studies, construction, labor, etc.), transportation, the required increase in storage, distribution capacity, wastewater facilities and treatment capacity, etc.
2. Operation and maintenance (O&M) costs associated with the decrease in the production and distribution of water or the treatment and disposal of wastewater that include, but are not limited to, energy, labor, treatment, storage, drainage treatment and disposal, etc.
3. Water purchases avoided by the contractor.
4. Environmental costs avoided by the contractor.
5. Environmental enhancements.
6. Revenues from other entities that include, but are not limited to, revenue from the sale of water made available by the BMP, financial incentives received from other entities, etc.
7. Other benefits to the contractor customers that include, but are not limited to, hydropower, improved crop yields, improved crop quality, labor savings, fertilizer savings, increased farm income, etc.

Costs

1. Capital expenditures incurred by the contractor for implementation of the BMP that include, but are not limited to, equipment, supplies, materials, construction, etc.
2. O&M costs to plan, design, implement, enforce, and evaluate the practice.
3. Financial incentives to customers.
4. Costs to the environment (describe the nature of the negative impact(s) and potential losses to the environment).
5. Other costs to the contractor.

   Several accepted benefit-cost analysis methodologies exist (e.g., California Energy Commission's Integrated Resource Planning Methodology, Generally Accepted Accounting Principles, AWMC's Net Benefit Analysis, etc.). A contractor is considered to be the best suited to evaluate their own economic situation with an appropriate methodology.
6. A discussion and quantification, to the extent possible, of other benefits associated with the implementation of the BMP that may be of interest to potential partners, but are not the direct, sole responsibility of the contractor.

ADDENDUM B - APPLICABILITY PROCESS

To establish that a BMP is not applicable (NA) to the contractor, the Plan should explain why the BMP does not apply to the contractor. This justification must be consistent with Section I: Description of the District. Example justifications for each exemptible BMP are listed below. This list is not all inclusive.

Exemptible BMPs for Agricultural Contractors

1. **Facilitate alternative land use** - NA could include contractors without irrigable lands that have exceptionally high water duties or whose irrigation does not contribute to significant problems.
2. **Facilitate use of available recycled water that otherwise would not be used beneficially, meets all health and safety criteria, and does not cause harm to crops or soils** - NA could include completely piped systems that do not have delivery constraints.
3. **Facilitate the financing of capital improvements for on-farm irrigation systems** - None identified.
4. **Incentive pricing** - Contractor that receives only Class 2 water.
5. **Canal lining/piping and regulatory reservoirs** - NA could include completely piped systems, unlined canal systems, sections which are used as part of a planned conjunctive use program, or completely piped systems that do not have delivery constraints.
6. **Increase flexibility in water ordering by, and delivery to, the water users within operational limits** - None identified.
7. **Construct and operate contractor spill and tailwater recovery systems** - NA could include completely piped systems that do not have delivery constraints.
8. **Plan to measure outflow** - NA could include no spill or tailwater leaves the district.
9. **Optimize conjunctive use** - NA could include contractors who do not overlie a useable groundwater basin and thus neither the contractor nor their customers pump or use groundwater, and the contractor has no water supplies other than the contract supply.
10. **Automate canal structures** - NA could include completely piped systems which do not have delivery constraints.
11. **Facilitate or promote water user pump testing and evaluation** - NA could include districts that have no groundwater, lift or diversion pumps.
12. **Mapping** - None identified

This page intentionally left blank

ADDENDUM C - INFORMATION REQUIRED OF CONTRACTORS LOCATED IN DRAINAGE PROBLEM AREA

The contractors included in the drainage problem area, as identified in "A Management Plan for Agricultural Subsurface Drainage and Related Problems on the Westside San Joaquin Valley (September 1990)," are listed by subarea below. If future editions of the drainage report revise the boundaries of a drainage problem area, or other factors used to determine which contractors are in a drainage problem area, Reclamation will revise Addendum C to conform to the current drainage report.

1. Reclamation contractors in the **Grasslands Subarea**: Central California Irrigation District, Del Puerto Water District, Firebaugh Canal Water District, Mercy Springs Water District, Pacheco Water District, Panoche Water District, San Luis Canal Company, and San Luis Water District.
2. Reclamation contractors in the **Westlands Subarea**: James Irrigation District, Tranquillity Irrigation District, and Westlands Water District.
3. Reclamation contractors in the **Tulare Subarea**: Alpaugh Irrigation District, Atwell Island Water District, Lower Tule River Irrigation District, and Pixley Irrigation District.
4. Reclamation contractors in the **Kern Subarea**: Alpaugh Irrigation District.

The contractors listed above shall describe which recommendations prescribed in "*A Management Plan for Agricultural Subsurface Drainage and Related Problems on the Westside San Joaquin Valley (September 1990)*" have been incorporated in their water conservation programs to improve conditions in drainage problem areas. These recommendations include:

- Source Control
- Land Retirement
- Drainage Water Treatment
- Drainage Water Reuse
- Shallow Groundwater Pumping
- Evaporation Ponds

Provide a description and level of expenditure for each activity designed to address the recommendations of the San Joaquin Valley Drainage Program. Identify how implementation of the recommendations has or will substantially reduce deep percolation on drainage problem lands. Describe which recommendations have not been implemented and why.

This page intentionally left blank

2014 GUIDEBOOK

Which Reclamation water contractors should use this guidebook?

The preparation of a Water Management Plan is required by applicable Central Valley Project (CVP) water service contracts, settlement contracts, repayment contracts, or any contracts that specifically invokes the Standard Criteria for Evaluating Water Management Plans (Criteria).

Exceptions: The following are exempt from preparing a Plan using the Criteria:

- All contractors that receive **only** irrigation water from any Federal Reclamation project, and deliver water to less than a current five-year average of 2,000 acres of land.
- All contractors that receive less than a five-year average of 2,000 acre-feet per year (AFY) of **only** municipal and industrial (urban) water from any Federal Reclamation project.
- All contractors that receive any combination of irrigation and/or urban water amounting to less than a current five-year average of 2,000 acre-feet from any Federal Reclamation project.
- Sacramento River Settlement Contractors who have prepared a Regional Water Management Plan in accordance with the current, Regional Criteria for Evaluating Water Management Plans for the Sacramento River Settlement Contractors.

Section I: Description of the District

A. History

Provide district contact information and give a one page or less historical overview of the district. Record significant historical events leading to the current state of the district and identify trends that appear likely to influence the district's future.

Enter the following information in Section I of the Plan Format (Chapter 4 of the Planner)

Date District Formed and Original Size

Enter the date that the district was legally organized. Enter the date of the first contract with Reclamation. Enter the original size of the district in acres. (There are 640 acres in a square mile). Enter the current year (i.e., the last complete calendar year). This will be the year of the data entered in the Plan and Tables.

Size, Population, and Irrigated Acres

For the current year, enter the current size of the district (in acres), urban population served (i.e. the population who receives treated drinking water), and irrigated acres served.

Water Supplies Received

Enter the amount of water (in acre-feet) received by the district during the current year. Enter the actual amount of water received from each of the listed sources. This information will correspond with the data found in the indicated Water Inventory Tables (Chapters 5 – Ag Tables and 6 – Urban Tables) in the Planner.

- **Federal Urban Water (Table 1)** – Water that is provided for Municipal and Industrial (M&I) use.
- **Federal Agricultural Water (Table 1)** – Water that is provided for agricultural use.
- **State Water (Table 1)** – Water from the California State Water Project.
- **Other Wholesale (Table 1)** – For example, water purchased from Santa Clara Valley Water District.
- **Local Surface Water (Table 1)** – Santa Barbara's Gibraltar Reservoir is an example.
- **Water Transfers Entering the District (Table 1)** – The amount of water the district purchased or traded .
- **Upslope Drain Water (Table 1)** – Drain or spill water that leaves the district service area and is used outside of the district service area (applies only to agricultural districts).

- **District Groundwater (Table 2)** – Groundwater that the district pumps and supplies to customers through its distribution system.
- **Water Transfers Leaving the District (Table 6)** – The amount of water the district sold, or traded out of the district.
- **Recycled Water (Table 3)** – The amount of treated urban wastewater provided to district customers.
- **Other Water (Table 1)** – desalination water, etc.

Annual Entitlement Under Each Right and/or Contract

Provide information on the district's entitlement or contractual amount from each source (Reclamation, State Water Project (SWP), groundwater from adjudicated basins, drain water contracts, long-term transfer agreements, etc.). Please include each contract's identifying number and any contract restrictions that affect the district's water management. Examples of restrictions include time of delivery or amount of water available per month. Add rows to the table as necessary.

Describe Anticipated Land-Use Changes

Address land use changes (e.g., agricultural to urban, etc.) that may affect water use type or quantity due to possible, proposed, or current-zoning changes. Such changes might include: land annexation, increasing urbanization, or changes to the area's general plan.

Cropping Patterns (Agricultural Only)

For agricultural districts describe the changes in irrigated acreage, cropping patterns, and evolving irrigation methods. Identify crops that are grown on 5 percent or more of the district's irrigated acreage and provide the total number of acres for each of those crops. If there are a number of crops grown on small acreage, combine them into one group, and list the combined acreage on the Other (<5 percent) row in the table. Detailing this information for the periods identified in the table provides a perspective on how crop diversity has evolved over time. A crop list is provided in Addendum D. Add rows to the table as necessary.

Major Irrigation Methods (Agricultural Only)

List the major irrigation methods used on most acreage within the district for each of the specified years. Combine the acreage of the other irrigation methods into one group and list the combined acreage on the "Other" line in the table. Quantifying this information for the periods provided in the table provides a perspective on how irrigation methods have changed over time. Add rows to the table as necessary.

B. Location and Facilities

Attach maps depicting district facilities including: incoming flow locations (turnouts), conveyance system (identify pipelines, lined and unlined canals, etc.), outflow (spill) locations, storage facilities, regulating reservoirs, district wells and lift pumps, groundwater facilities, etc. Provide as Attachment A to your Plan.

Incoming Measurement Methods and Locations

Identify each incoming flow to the district (use the same names as shown on the facilities map and provide a physical location description), type of measurement device (flume, weir, propeller, acoustic, venturi, magnetic), and accuracy.

Current Agricultural Conveyance System

Enter the length (e.g., 1.2 miles) of unlined and lined canals and laterals, pipe, and other types of distribution facilities (such as natural channels).

Current Urban Distribution System

Enter the length (e.g., 1.2 miles) of asbestos concrete, steel, and cast iron pipe in the distribution system. Combine the total length of other types of pipes (e.g., plastic) in the "Other" category.

List Storage Facilities

Identify district storage facilities (use same names as shown on facilities map), including volume. Include tanks, reservoirs, etc.

Describe Agricultural Spill Recovery System

Describe the district's spill recovery system – where and how distribution system spill water is

collected and where it is re-used. Include outflow locations on the facilities map.

Agricultural Delivery System Operation

Describe how agricultural customers schedule water deliveries from the district. Identify whether the delivery system provides water:

1. On demand (i.e., no lead time or scheduling is necessary)
2. Scheduled (i.e., customer requests start time, flow rate and quantity)
3. On a rotation basis (e.g., customers get water every 10 days)
4. Some combination of methods

Describe Restrictions on the District's Water Source(s)

If the district's water supplies are constrained in some manner that limits water management and operations, explain. Restrictions might limit the amount of water or time of use. The cause of a restriction might be a contractual or physical limitation. Include information about operational constraints the restrictions impose on water management. Examples of operational constraints include receiving surface drainage from an upslope district with no control over quantity or timing, or the inability to supply the quantity of water needed by the growers due to insufficient canal capacity.

Describe Proposed Changes or Additions to District's Facilities and Operations for the Next 5 years

Examples include changes to service area, lining/piping of existing canals, and installation of measurement devices with improved accuracy, etc.

C. Topography and Soils

Describe Topography of the District and How It Effects Water Operations and Management

Describe the topography and terrain of the district (e.g., hilly, flat, sloping to a watercourse). Discuss the effect of topography on the district's water management. An example of how topography affects water management is when a section of gravity piped water distribution system is located in an area of lower elevation and as a result the system experiences excessive pressure while another section of the system is located at a slightly higher elevation and as a result has inadequate pressure. Topography may also affect capture and reuse of drainage water.

Describe District's Soils Associations (Agriculture Only)

Provide district's soil associations. A Natural Resources Conservation Service (NRCS) general soils map of the district service area will generally be the clearest way to present soils information. Include in Attachment A.

Where can soil classification information be obtained? *http://www.nrcs.usda.gov/*.

The NRCS has soil survey information for most agricultural regions in California. Recent surveys (within the last 25 years) contain a single map called the "General Soil Map." These maps group soils into what are called soil associations and are appropriate for this Plan. Soil groupings are made according to soil characteristic similarities, such as texture, depth, salinity, slope, flooding potential, impervious layers, etc. An awareness of these soil groupings can help target BMP programs - such as in areas where distribution canals might have high seepage rates or in areas of tailwater quality problems. Reclamation's soil classification system is based on projected economic return from different classes of soils and is NOT appropriate for this Plan.

Describe Limitations Resulting from Soil Problems (Agriculture Only)

Describe any limitations resulting from soil problems (e.g., salinity, high water table, high or low infiltration rates, etc.) within the district. If the district provides water to an area that has a high water table or any other water or drainage related problem, list the issue, the number of acres with the issue, and how the issue impacts water use. District staff and customers will have knowledge of soil limitations and the resulting impacts on water management. For instance, crops grown on poor soils may require more water than crops grown on good soils. If the district can identify terrain and soils that use more than average amounts of water, these areas can be targeted for improved management programs.

D. Climate

Describe the General Climate of the District Service Area

Describe the general climate of the district (available from the National Weather Service, etc.). Local newspapers or weather service companies may also provide a concise description of local weather patterns. For weather data, specify the period of record (30 years recommended) and reference (weather station) used. Historic weather data from the National Weather Service climatological stations provide all the requested data. Identify which station you selected and which years of data were available. The web site address is: *http://www.wrcc.dri.edu/summary/Climsmnca.html*.

Impact of Any Microclimates on Water Management Within the District

Where appropriate, relate climate to water use. Are there special microclimates in the district that require more (or less) water due to factors such as excessive wind or frost? The impact of climate may be similar to the impact of soil and terrain.

E. Natural and Cultural Resources

Identify Natural Resource Areas Within the District

Describe any known natural resources (wetlands, rivers, streams, lakes, etc.) within the district. Indicate if any of these resources were managed (past or present) by the contractor. A layer on your district facilities map (Attachment A) may be the clearest way to provide this information.

Describe Management of These Resources in the Past or Present by the District

If the district provides water to natural resource areas or manages them, describe the district's role. Describe how district staff work with the U.S. Fish and Wildlife Service, NRCS, U.S. Army Corps of Engineers, or the California Department of Fish and Wildlife to identify natural resource areas and threatened and endangered species in the district.

Identify Recreational and/or Cultural Resource Areas

Identify and describe recreational and/or cultural resource areas and size of each in acres. Examples of recreational resources are sites used for rafting, boating, water skiing, and fishing. Examples of cultural resources are structures listed on the National Register of Historic Places, Native American archeological sites, or other sites of historic significance. Identify areas on a map in Attachment A as necessary.

F. Operating Rules and Regulations

Attach a Copy of the District's Operating Rules and Regulations

Attach only the rules and regulations that apply to water supply and use. Provide as Attachment B.

Note: If the district supplies no agricultural water, write "No Ag" in Section I.F.2 to F.4 and skip to Section I.F.5.

Describe the District's Agricultural Water Allocation Policy (Agriculture Only)

Describe the district's agricultural water allocation policy, including the district's policy on allocations in times of shortage or drought. Identify the page number(s) of the relevant sections in the district's rules and regulations that were included as Attachment B.

Describe Official and Actual Lead Times Necessary for Water Orders and Shutoff (Agriculture Only)

Describe the water ordering system. Identify the page number(s) of the relevant sections in the district's rules and regulations that were included as Attachment B. Describe any differences between actual operations and the official rules, such as water delivery orders being filled in 12 hours when the rules state 24 hours is the minimum.

Describe the District's Policies Regarding Return Flows (Surface and Subsurface Drainage from Farms) and Outflow (Agriculture Only)

Describe how the district deals with surface and subsurface drainage and outflow. Identify the page number(s) of the relevant sections in the district's rules and regulations that were included as Attachment B.

Describe the District's Policy on Water Transfers by the District and Its Customers

Describe the district approach to water transfers within and between districts. Identify the page

number(s) of the relevant sections in the district's rules and regulations that were included as Attachment B.

G. Water Measurement, Pricing, and Billing

Accurate water delivery measurement is an effective water management tool. When both the water user and the district are aware of quantity, timing, and location of water use, refinements can be made to improve water management and reduce water waste.

Note: Section I.G.1 below addresses districts who serve agricultural customers and I.G.2 addresses districts who serve urban customers.

Agricultural Customers

A turnout is a water delivery point. Farms may have multiple water delivery points. All turnouts have some method of controlling water flow, but measured turnouts are those which can accurately measure the quantity of water delivered (under most conditions within +/- 6 percent).

Provide Total Number of Delivery Points (Turn-outs and Connections) The point at which water leaves the district delivery system and enters the customer distribution system is the delivery point.

Provide Total Number of Delivery Points Serving More Than One Farm This is when the district has delivery points at which water leaving the district delivery system can enter two or more separate farm distribution systems (e.g. community ditch). In this situation the customers are often responsible for determining how much water each of them receives.

Provide Total Number of Measured Delivery Points A measured delivery point is one with a device that is operated and maintained to a reasonable degree of accuracy (under most conditions within +/- 6 percent). Three categories of measurement devices that may meet this criterion are devices with totalizers, standard flow measurement devices, and non-standard but calibrated devices.

Provide Percentage of Delivered Water That Was Measured at a Delivery Point Provide the percentage of delivered water that was measured at a delivery point under most conditions within +/- 6 percent.

Provide Total Number of Delivery Points Not Billed by Quantity Provide the total number of delivery points where delivered water is not billed by quantity.

Complete Measurement Device Table Provide the number of each type of measurement device used by the district, the accuracy of that type of device (along with documentation verifying the accuracy of the devices), how often the device is read, and the calibration and maintenance schedule. The accuracy of the district's measurement devices may have been determined during installation, but periodic calibration is necessary to maintain accuracy. For the various devices, provide the maintenance interval that the district has determined necessary. See Chapter 9 for information on the Calibration and Maintenance of Measurement Devices. **Documentation verifying the accuracy of measurement devices must be submitted with the Plan and included as Attachment C**. Refer to Chapter 11 for an example of acceptable documentation procedures.

Urban Customers

Provide Total Number of Connections
Determine the number of connections at which water leaves the district delivery system and enters a separate distribution system. For instance, a city park may have one or more connections.

Provide Number of Metered Connections
Determine the number of connections that have installed meters. Connections with meter boxes but no meters are not metered connections. All connections have valves to control water flow, but measured connections also have meters.

Provide Number of Connections Not Billed by Quantity Determine the number of connections that are billed by quantity of water flowing through the meter. A city park which has a meter but which is not billed for water use is not billed by quantity.

Provide the Percentage of Water That Was Measured at Delivery Point This will require an estimate of the amount of water provided to unmeasured accounts.

Provide the Percentage of Water That was Billed by Quantity Some cities do not bill city departments (parks, sanitation, etc.) for water use. The quantity of water delivered but not billed should be determined and calculated as a percentage of the total.

Complete Measurement Device Table Provide the number of each size of displacement meters used by the district, the accuracy of those meters, how often the device is read and the calibration and maintenance schedule. Identify the number of other types of meters (turbo, compound, etc.), size, accuracy, reading schedule and the calibration and maintenance schedule

The manufacturer has determined the accuracy of their meters, but periodic calibration is necessary to maintain accuracy. For the various devices, provide the maintenance interval that the district has determined necessary. Add rows to the table as needed.

Agricultural and Urban Rates

Describe the District's Current Year Agriculture and/or Urban Water Charges
Describe the district's current year urban and/or agricultural water charges, including dollar amounts for fixed/stand-by fees and quantity charges. Describe the rate structure for urban water deliveries (flat rate, tiered rate, seasonal rate, etc.). Describe billing frequency and bill format.

Attachment B, Rules and Regulations, should contain the current year water charge ordinance. Identify the page number where the current year rate ordinance can be found in Attachment B.

Annual Charges Collected from Customers (Current Year Data) For fixed charges, identify the current year charge for each unit (cost per unit), charge unit (per acre per year, 1" monthly meter charge, etc.) and how many units were billed during the current year (acres, 1" meters times 12 months, etc.). Include the total dollar amount collected from each charge (charge x units billed during the year = total $ collected).

Complete this table for the current year and provide District Sample Bills as Attachment C.

For volumetric charges, identify the current year charge for each unit (cost per unit), charge unit (per AF, per HCF in tier 1, tier 2, etc.) and how many units were billed during the current year (AF, total HCF sold in tier 1, tier 2, etc.). Include the total dollar amount collected from each charge(charge x units billed during the year = total $ collected) .

Describe the Contractor's Record Management System Describe water use data accounting systems and procedures. Typical systems include standard computer software, contractor specific software, and ledgers. The description of the accounting procedures should document how customers access their water use history and how many years of historic data are available to them. Attachment D should contain examples of actual bills (for each customer category) and discuss how they provide customers with current water use data, comparative annual use data, and pricing signals.

H. Water Shortage Allocation Policies

Attach the District's Current Year Water Shortage Policies

Include the district water shortage allocation plan as Attachment E. It should detail how reduced water supplies will be allocated. If the district has different policies for various customer types (e.g., agricultural or urban), attach both plans.

Districts that deliver more than 2,000 AF of water are encouraged to have a water shortage contingency plan. To develop an urban Water Shortage Plan, assistance is available from DWR at *http://www.owue.water.ca.gov/urbanplan* and from Reclamation at *http://www.usbr.gov/mp/watershare/*. For assistance developing an agricultural water shortage plan, contact your local area office.

Attach the District's Current Year Policies That Address Wasteful Use of Water

Identify rules and regulations that address wasteful use of water. Include information on enforcement methods. Identify the page number(s) of the relevant sections in the district's rules and regulations that were included as Attachment B.

I. Evaluate Policies of Regulatory Agencies Affecting the Contractor and Identify Policies that Inhibit Good Water Management

Evaluate policies of agencies that provide the contractor with water. Water projects (CVP, SWP, etc.) and wholesale water agencies provide water based on policies that sometimes make retail water management more difficult. For instance, policies that require payment for unused entitlement, or that limit carry-over of unused water, can encourage unnecessary water use. Discuss possible modifications to policies and solutions for improved water management. As an example, several water districts, through negotiations with Reclamation, were able to change their water year so that the end of the water year could coincide with the end of the rainy season. Now their customers are better able to manage their water supplies to take advantage of effective precipitation.

Section II: Inventory of Water Resources

> ***Note***: If the requested information is not available, describe how that information will be obtained for the next Plan revision.

This section shall include a description of contractor's surface water supply, groundwater supply, other water supplies, source water quality monitoring programs, water uses within the district, outflow from the district, urban wastewater disposal, and water budget. Provide this information for either the last complete calendar year or the last complete water year prior to preparation of each five-year Plan update. Indicate which data set(s) are used for preparing the Plan.

A. Surface Water Supply

Acre-foot Amounts of Surface Water Delivered to the District by Each of the District's Sources

In Table 1 of the Water Inventory Tables, quantify all district surface water supplies. Specify the type of water (e.g., urban, agricultural, Class 2, spill, etc.) and the quantity of each delivered to the district by month. If you do not receive State water, local surface water, or other surface water then leave those columns blank. In Table 8, quantify the amount of each type of surface water the district received in each of the last 10 years. If the district has sources of surface water that are not listed in the table, add the necessary columns.

B. Groundwater Supply

Acre-foot Amounts of Groundwater Pumped and Delivered by the District

Quantify district groundwater supplies in Table 2. Specify the monthly amount of groundwater pumped by the district. The "Pumped by Customers" column asks only for an estimate of private groundwater pumping – either by month or year. If the district and/or private parties do not pump groundwater, leave these columns blank.

Groundwater Basin(s) That Underlie the District

Information necessary to describe groundwater basins can be found in California DWR Bulletin 118 at http://www.water.ca.gov/groundwater/bulletin118/bulletin118update2003.cfm. This comprehensive report on California's groundwater describes the general boundaries of each groundwater basin. It identifies which basins are subject to overdraft as well as describing areas of potential ground water storage. You can use this Bulletin to identify the groundwater basin(s) that underlie the district boundaries and the size, usable capacity, and safe yield of the basin(s). A large groundwater basin may underlie several districts. In a few cases, districts overlie more than one groundwater basin.

Map of Contractor Operated Wells and Managed Groundwater Recharge Areas

The Plan should provide a map of the district that locates district groundwater wells and any

managed groundwater recharge areas. Include in Attachment A.

If There is Conjunctive Use of Surface and Groundwater, Describe It

Information necessary to adequately describe groundwater conjunctive use programs includes:

1. Determination of the groundwater quality (i.e., is the groundwater quality adequate for direct use or is blending required?).
2. The amount of groundwater storage capacity currently available and how much additional storage could be available by extracting groundwater for use.
3. The location of existing and potential recharge sites (spreading basins, in-stream, or injection wells) and identification of the soil types and resulting recharge rates.
4. Determination of hydraulic continuity between the possible recharge and extraction areas.
5. Identification of possible sources of recharge water and the quantities, qualities, and period of availability for each source.
6. For districts without district-owned wells, describe how the district receives compensation from the beneficiaries of the recharged groundwater.

For Managed Groundwater Basins, Attach a Copy of the Management Plan

If the district or its customers use groundwater from a managed or adjudicated groundwater basin, attach a copy of the Plan (Attachment F).

For Participation in Groundwater Banking, Attach a Description of the Banking Agreement

If the district participates in groundwater banking, attach a description of when and how much water was banked, and when and how much is available for retrieval (Provide a copy of the banking agreement (Attachment G).

C. Other Water Supplies

Acre-foot Amounts of "Other" Water Used as Part of the District's Water Supply

Identify and quantify all surface and groundwater supplies in Tables 1 and 2. For instance, desalinated or Class 2 water that was delivered during the current year should be included as part of the year's water supply. Quantify long-term "Other" water supplies in Table 1 and define in the column title.

D. Source Water Quality Monitoring Practices

Potable Water Quality (Urban Only)

Attach the District Annual Potable Water Quality Report (Attachment H that is mailed to all customers. This report provides information on the quality of each of the district's water sources. If there are water quality concerns and/or problems, describe how they affect the district's water treatment process and its customers.

Agricultural Districts

Indicate if the district has any surface or groundwater quality issues that affect customer-use decisions. If there are water quality concerns and/or problems, describe the quality problems and how they affect the water's use.

Description of the Water Quality Testing Program and the Role of Each Participant in the Program

Describe the water quality testing program including which agencies are involved, the contractor's role, and how the program is funded.

Current Year Water Quality Monitoring Programs

For surface water, identify the analyses performed, the frequency of the tests and the results (concentration range and average).

For groundwater, identify the analyses performed, the frequency of the tests and the results (concentration range and average).

If there are no water quality issues, enter NA.

E. Water Uses within the District

Agricultural

In the Water Inventory Tables, Chapter 5 Table 5, list the crops grown in the district (use the crop list provided in the Addendum D). For each crop, list the irrigated acres of the crop, seasonal crop ET, leaching requirement, water used for cultural practices (frost protection, pre-irrigation, etc.),

and effective precipitation. The spreadsheet formulas will combine these values to determine the total water demand (AF) of each crop. You may wish to combine crops grown on less than 5 percent of the total irrigated acreage. To combine crops, determine an average crop ET, leaching and cultural requirement, and effective precipitation for this group of small acreage crops. The crop ET and effective precipitation for crops in your area can be obtained from a report prepared by the Irrigation and Training Research Center (ITRC) at Cal Poly. *California Crop and Soil Evapotranspiration* can be accessed at *http://www.itrc.org/reports/californiacrop.htm*. Another resource is the Center for Irrigation Technology's (CIT) Wateright web site at *http://www.wateright.org*. Crop ET can also be obtained from the DWR district office or the local Farm Advisor. Contact local UC Cooperative Extension County Farm Advisors at *http://ucanr.edu/County_Offices/*.

Types of Irrigation Systems Used for Each Crop

List the crops grown in the district and how many acres of each type of irrigation used on each crop. The types of irrigation systems used on each crop can help the district target customer assistance programs, workshops, and educational materials. If the district collects information from district farmers for a yearly crop census or Reclamation Crop Report, information can also be requested on the number of acres of different irrigation systems used on each crop. Expanding an existing report will minimize district and customer cost and paperwork. Use the seven general irrigation system types – basin, furrow, sprinkler, low-volume, drip, microsprinkler, and combination (sprinkler and furrow, etc.).

Urban

Quantify the number of connections and yearly water use for each of the following customer account types:

1. **Single-Family** - a connection that serves a single detached residence.
2. **Multi-Family** - a connection that serves a building containing multiple dwelling units or an individual unit in a building containing multiple units.
3. **Commercial** – a connection that serves businesses that provide or distribute a product or service, such as hotels, restaurants, office buildings, commercial businesses, or other places of commerce.
4. **Industrial** - a connection that serves primarily manufacturers or processors of materials.
5. **Institutional** - a connection that serves institutions dedicated to public service. This includes schools, courts, churches, hospitals, and government facilities. All public service facilities are to be considered institutional connections regardless of ownership.
6. **Landscape Irrigation** - a connection that serves an urban landscaped area.
7. **Wholesale** - a connection that provides water to a water agency.
8. **Recycled** - a connection that provides recycled urban wastewater.
9. **Other** - specify.
10. **Unaccounted** - the quantity of water that is treated but not sold - lost through leaks, breaks, slow meters, firefighting, line flushing, etc.

Urban Wastewater Collection and Treatment Systems Serving the District Service Area

Describe the wastewater collection and treatment systems serving the district service area. Include the level of treatment, quantity of water treated, and place of disposal of the treated water. Contractors that do not provide wastewater treatment services should request this information from the wastewater agency.

1. **Waste treatment plant** - provide the names of the wastewater plants serving the district service area.
2. **Treatment level (primary, secondary, tertiary)** - if there are different treatment streams, quantify the AF treated for each level during the current year.
3. **Disposal to** - identify where the treated wastewater is discharged (e.g., ocean, river, percolation ponds, etc.) and how the recycled water is used (e.g., landscape, toilet flushing, etc.)

4. **Total discharged to ocean/saline sink -** quantify the AF discharged to these areas during the current year.

Groundwater Recharge/Management/ Banking

Identify contractor operated groundwater recharge areas (as identified in Section II.B.). List the quantity of water used for planned groundwater recharge, including method of recharge and retrieval. The quantity listed will correspond to the data provided in Water Inventory Table 6.

A groundwater recharge program uses surface water to recharge a groundwater basin for later withdrawal or provides surface water to farmers that normally pump groundwater (in lieu of recharge) so that the groundwater is left in the ground. Describe each recharge location with respect to soil type, method of recharge, percolation or injection rate, and hydraulic continuity with the extraction areas. Include the AF recharged in the current year. Do not include incidental recharge, such as canal seepage or deep percolation resulting from excess irrigation, unless data relating to the above points has been developed.

If you participate in a defined groundwater banking system, describe it here or attach a description. In order to participate in a groundwater banking program, water must be able to be withdrawn at a later date. Describe how water that was percolated into the ground will be withdrawn for district or customer use.

Transfers and Exchanges into the District Service Area

Describe the source and quantity of water in any transfer, trade, exchange, carryover water, rescheduled water, purchase or sale, **into** the district. Provide the following information for the current year: from whom to whom, AF of each transaction and use. This information will correspond with the data you provide in Water Inventory Table 1. Information on transfers and exchanges within the district is not requested. Transfers refer to water exchanges, sales, or other agreements that transfer or exchange water between water districts or users, such as:

1. Agriculture to urban
2. Urban to agriculture
3. Agriculture to agriculture
4. Urban to urban
5. Agriculture to refuges
6. Urban to refuges

Transfers and Exchanges Out of the District Service Area

Describe the source and quantity of water in any transfer, trade, exchange, rescheduled to another year, purchase or sale, **out** of the district. Provide the following information for the current year: from whom to whom, AF of each transaction and use. This information will correspond with the data you provide in Water Inventory Table 6.

Wheeling or Other Transactions

List wheeling or other transactions not covered above that involve moving water out of the district. An example is water that is either moved into a groundwater bank or extracted and returned to the district from a groundwater bank. Provide the following information for the current year: from whom to whom, AF of each transaction and use. This information will correspond with the data you provide in Water Inventory Tables 1 and 6.

Any Other Uses of Water

If there were other uses of water not covered above, describe them (e.g. water for hydroelectric power, water used to meet water quality objectives, emergencies, environmental deliveries, etc.) and the quantities involved.

F. Outflow from the District (Ag only)

Surface and Sub-surface Drain/Outflow

Provide a description of each outflow point (shown on the facilities map, Attachment A) and include the quantity of outflow, the type of measurement and percent accuracy, the acreage of land drained, and where the outflow water goes. For example, if the district surface return flow is discharged into the Sacramento River, the Plan should state that irrigation runoff and operational spills are returned to the Sacramento River. In this case, specific downstream uses would be unknown.

Description of the Outflow

If the district conducts, participates, or funds any part of a drainage-testing program, describe those activities. Provide a description of the outflow drainage and spill water quality testing program,

the outflow subsurface drainage water quality testing program and the role of each participant in the program. Identify any constituents (e.g., selenium, pesticides, salinity, etc.) that limit reuse of the outflow water and how. If available, attach a copy of your State Water Resources Control Board summary water quality report prepared under a current Ag Waiver.

Outflow Quality Testing Program

Enter the type of analysis and the results performed on the outflow water. If the district has no surface or subsurface drain water, state "None" and leave the rest of this section blank.

Central Valley Regional Water Quality Control Board Involvement

Provide a brief discussion of the District's involvement in Central Valley Regional Water Quality Control Board programs or requirements for remediating or monitoring any contaminants that could significantly degrade water quality in the receiving surface waters.

Districts included in the drainage problem area, as identified in "A Management Plan for Agricultural Subsurface Drainage and Related Problems on the Westside San Joaquin Valley (September 1990)," are required to complete Water Inventory ***Table 7 in Chapter 5 and Addendum C (include in Plan as Attachment K)***

G. Water Accounting (Inventory)

Develop a water inventory, (using the accompanying spreadsheet developed in Excel format), for the contractor based on the last calendar year or the last water year prior to preparation of each five-year Plan revision. Indicate which dataset(s) is used for the inventory. The intent of the water inventory is for districts to quantify water supplies, uses, losses within the district and outflow.

Knowledge of the amount of water used for various purposes can lead to improved water management. A water inventory also identifies where a district lacks information. When analyzing BMPs, the potential and actual water savings resulting from an individual practice can be estimated based on the water inventory. Completing Tables 1 through 8 provides all the water inventory data. Refer to Chapter 5 for Ag tables and Chapter 6 for Urban tables.

Quantify District Water Supplies

To complete this section, enter the necessary data in the listed tables.

1. Surface water supplies, imported and originating within the district, by month (Table 1, completed in Section II.A.). Quantifying surface supplies by month will allow districts to show what supplies are used to meet water demands (including groundwater recharge).
2. Groundwater extracted by the district, by month (Table 2, completed in Section II.B.).
3. Effective precipitation by crop (Table 5). Information may be found at *http://www.fao.org/DOCREP/X5560E/x5560e03*.htm. The district will have to calculate this information based on when the crop was planted, the soil moisture profile and precipitation patterns and intensity. Information is available from ITRC and CIT (see p. 12-1 for web sites). DWR district office staff or local County Farm Advisors may also have information on the effective precipitation amounts for the crops grown in your district.
4. Estimated annual groundwater extracted by non-district parties (Table 2, completed in Section II.B.). If records are not available, provide an estimate and basis for estimation. Urban water wells are usually metered, and the information is generally available by contacting the pumpers. If the district does not have groundwater production records for private agricultural groundwater pumpers, use the following method to estimate the quantity pumped:
   a. (water needed for crop ET) + (water needed for leaching) - (effective precipitation) = crop water need
   b. (crop water need)/(irrigation efficiency) + (system losses) = estimate of applied water
   c. (estimate of applied water) - (amount of water delivered by the district) = estimate of private groundwater pumped

   A similar method can be used to estimate the private urban pumping.

5. Recycled water, by month (Table 3, completed in Section II.E.2.). Recycled water is urban wastewater that is treated and available for reuse.
6. Other supplies, by month (Table 1). To be defined by the district. Possible other sources of water include, but are not limited to: water transfers into the district or small miscellaneous flows.

Quantify Water Used

To complete this section, enter the necessary data in the listed tables.

1. Conveyance losses, including seepage, evaporation, and operational spills from canals; and leaks, breaks, fire, and flushing from pipes (Table 4). Types of canal losses include seepage, evaporation, and operational spills. Losses from piped distribution systems results from leaks, breaks, flushing, and firefighting.

   Canal seepage is the most difficult to calculate. Seepage from unlined canals is related to soil properties and can change over time, thus calculating the rate of loss per section requires ponding tests, accurate metering, or another similar method. Evaporation may be calculated by determining the surface area of the canals and regulating reservoirs and applying the local evaporation rate. Operational spills may be calculated if the end of the canal has a weir or other measurement device of suitable accuracy. Describe how conveyance loss values were determined or estimated. See the Canal Lining and Reservoir Lining documents in Chapter 11 for reference.

   Conveyance seepage is considered a loss of irrigation water, and sometimes, groundwater recharge. For example, when the Friant Unit's Class 2 water is available, conveyance seepage in some cases may be considered a groundwater recharge method. However, when water intended for irrigation is conveyed, seepage often results in increased pumping costs and degraded water quality. Practices that reduce seepage can help districts use water more efficiently, but may require new methods and locations for groundwater recharge.

   Losses from urban distribution systems can be calculated by conducting a system water audit. The American Water Works Association (AWWA) M36 Water Audit and Loss Control Programs Manual is available through AWWA (website awwa.org). The AWWA System Water Audit Software (v4.1) is available through the California Urban Water Conservation Council (website *http://www.cuwcc.org*).
2. Consumptive use by riparian vegetation (Table 6). Estimate the annual consumptive water use by riparian vegetation inadvertently or intentionally provided with district water. Do not include riparian vegetation located at an environmental or recreational resource. Estimate the total acres of incidental riparian vegetation and an overall use (based on ET during the months when water is available) to obtain an estimate of consumptive use. Information may also be available from local County Farm Advisors and neighboring districts.
3. Applied irrigation water, crop ET, water used for leaching and for cultural practices (e.g., frost protection, soil reclamation, etc.) (Table 5). This section quantifies crop water need. Crop water need includes crop ET and water used for leaching and cultural practices.

   One good resource is available at *http://www.fao.org/DOCREP/003/T0234E/T0234E02.htm*. Determine the total crop water need for each crop. The crop ET and effective precipitation for crops in your area can be obtained from a report prepared by the Irrigation and Training Research Center (ITRC) at Cal Poly. California Crop and Soil Evapotranspiration can be accessed at *http://www.itrc.org/reports/californiacrop.htm*. Another resource is the Center for

Irrigation Technology's (CIT) Wateright web site at *http://www.wateright.org*. Crop ET can also be obtained from the DWR district office or the local Farm Advisor. Contact local UC Cooperative Extension County Farm Advisors at *http://ucanr.edu/County_Offices/*.

4. Urban water use (Table 6). Determine total water sales and other authorized uses. Do not include losses, firefighting, and system flushing, as these were included in Table 4, Distribution System Losses.
5. Groundwater recharge (Table 6). Quantify water used by the district for the purposeful recharge of groundwater, including recharge ponds and water injected for recharge. Purposeful groundwater recharge is a program that determines when and where the water will be recharged and extracted – not just general deep percolation of surface water.
6. Water exchanges and transfers (Table 6). Quantify water transfers outside the district service area. If your district is reporting transfers out of the district, this will be a negative number. Do not include water transfers into the district as these were included in Table 1 and Table 8.
7. Estimated deep percolation within the district (Table 6). Deep percolation is usually estimated as the difference between applied water (minus any runoff leaving the district) and crop water use. Some deep percolation may be necessary for leaching. Excess deep percolation is considered an economic loss since unneeded groundwater is purchased, groundwater quality is degraded and energy is used for unnecessary pumping. Water applied for intentional recharge is not deep percolation. Table 6 calculates an estimate of the current year's deep percolation.
8. Agricultural flows to perched water table or saline sink (Table 7). Calculate, or if necessary, estimate the amount of deep percolation or drainage that flows to a saline sink (the ocean, Kesterson, etc.) or to a perched water table (within 5 feet of the soil surface).
9. Agricultural irrigation drain water leaving the district (Table 6). Calculate, or if necessary, estimate the total outflow leaving the district.
10. Other (Table 6). Quantify any other uses of water within the district. Include in the non-agricultural or non-urban row. This may be incidental urban use in an agricultural district or incidental agricultural use in an urban district.

Overall water inventory

Compare total water estimated to be available for sale within the district with the total water actually sold by the district (Table 6). Table 6 compares total water available for sale with total water sold. This water budget inventory can be used to identify areas where water management could be improved and thus helps the district to select and implement appropriate BMPs. Evaluation of several of the BMPs in Sections 3 and 4 requires an estimate of how much water may be conserved by each practice. Parts of this process are imprecise. However, the inventory process will help the district to estimate the amount of potential water savings and the costs of achieving those savings.

Section III: BMPs for Agricultural Contractors

Any Contractor that provides water to 2,000 farmed acres or more must complete this section.

If a primarily Agricultural Contractor provides some Urban Water, they are required to include Urban BMP 1.3, (Utility Operations, Metering) in their plan.

Once a Contractor annually provides 2,000 AF of municipal and industrial water or more, they are required to address all the BMPs in Section IV, BMPs for Urban Contractors.

In this section, describe the water management program the district determines will best accomplish each BMP. The success of some of the practices will depend on cooperative work with other entities. Monitoring implementation activities and results will allow the district to

modify planned programs that do not accomplish the practice as designed.

Some BMPs are considered universally applicable (critical) and others are considered generally applicable (exemptible). Under certain circumstances, one or more of the exemptible BMPs may not be appropriate for district implementation. The district will implement each exemptible BMP unless the district provides adequate documentation that supports an exemption or states the reason the BMP is not applicable in accordance with the exemption process (see Addendum A).

For each BMP, describe how the plan will be carried out, including actions and timelines, budgets, staff, and projected results (e.g., changes in water and energy use, improved water quality, improved yields, increased habitat). Identify how each BMP will be monitored to see if it is achieving the projected results.

A. Critical BMPs for Agricultural Contractors

Critical BMPs are those that every Reclamation agricultural district is required to implement. These BMPs are considered to be the basic elements of good water management. Select a program design for each critical BMP that will provide maximum benefit to the district and its customers.

Water Measurement

Measure the volume of water delivered by the district to each customer with devices that are operated and maintained to a reasonable degree of accuracy, under most conditions, to +/- 6 percent. Identify the number of turnout and connection delivery points, the number of delivery points that serve more than one farm, the number or delivery points that are measured, the percentage of water delivered to the contractor that was measured at a delivery point (of all of the water that has entered the distribution system, what percentage was sold and measured at the turnouts), the number of delivery points not billed by quantity, and complete the measurement device table. Three categories of measurement devices that may meet this criterion are devices with totalizers, standard flow measurement devices, and non-standard but calibrated devices.

The **first category** includes devices with totalizers that measure volume: Propeller meters, Venturi meters, magnetic meters, and acoustic meters. These have a high level of accuracy with proper installation and periodic maintenance and calibration.

The **second category** includes standard flow measurement devices that measure flow rate and also require accurate measurements of water level and delivery time to determine volumes: Replogle and Parshall flumes; rectangular, trapezoidal (Cipolletti), and V-Notch weirs; and canal meter gates. These devices require proper installation; continuous or sufficiently frequent recording of water levels and flow rates; delivery beginning and ending times; adjustments for approach velocity in some cases; and regular maintenance and calibration for good accuracy.

The **third category** includes non-standard, calibrated flow measurement devices. This category includes special measurement devices developed for a specific location. Typically, there are no published standard dimensions or flow tables for such devices. Consistent dimensions and installations; accurate determination of delivery time; local calibration and a verification of accuracy, based on a representative sample number of devices measured over time; and a proposed schedule for maintenance and calibration would be necessary for acceptability. This category also includes calibrated pumps when the suction side water level fluctuation is small when compared to the lift (+/- 6 percent) and the discharge pressure is not changed.

Refer to the Calibration and Measurement document, Planner, Chapter 10, for examples of installation, calibration, and maintenance of measurement devices that are described here.

Rough estimates of flow rate or volume, such as flow rate estimates at check structures, the sum of siphon tubes, or the use of occasional flow readings and multiplying by the time between readings (or other methods of measurement not specified here), are NOT acceptable as they do not provide a documented reasonable degree of accuracy. Estimates of flow rate or volume based on one moment of time and assumed continuous

over a period of more than an hour are **NOT** acceptable.

Water measurement at each turnout has many benefits. When customers know how much water they use for incremental time periods (monthly, per irrigation, etc.), they are able to make informed economic decisions. The distribution system can be correctly sized and operated to provide the water quantities and timing that customers need. Contractor costs for pumping, canal maintenance, and drainage can be controlled. Measurement devices (meters, flumes, weirs, sonic, etc.) should be selected based on the characteristics of the district's distribution system, water quality, and delivery requirements. It is important to implement a maintenance and/or replacement program in conjunction with the installation program because measurement devices become less accurate over time. Contractors that measure deliveries can provide customers with their historic water delivery records. Customers can then determine what quantities of water were applied to crops in previous years and evaluate their irrigation systems and operations.

An example of a measurement program is one implemented by Westlands Water District. The District installed flow meters at each lateral when the district's water distribution system was originally constructed. Each of the 3,075 original agricultural deliveries cost $1,400, in 1991 dollars, for a total of $4.3 million. District-wide meter accuracy is within plus or minus two percent as determined from calibration tests. Westlands' Meter Shop, located at the District's Five Points Shop and Field Office, is one of state's most modern facilities. Meters are calibrated in the shop on a fixed schedule and repaired as needed. Meters that fail or are inaccurate are repaired and recalibrated immediately. To ensure accuracy, meters are placed on a four-year preventive maintenance cycle ensuring that each is overhauled and recalibrated at least quadrennially.

Another example of a measurement program began in 2004 when the Solano Irrigation District implemented an Ag Meter Replacement Program which shares the meter and service conversion costs with the farmers. Since the original system was designed for flood or furrow irrigation, the agricultural services were constructed for high volume usage. As farmers converted their irrigation systems to drip or micro-spray systems, the original metered gate or propeller meter services did not accurately measure the lower flow rates. This program shares in the costs to convert the service to a low flow meter. This is accomplished by the farmer paying for only the material costs and the District paying for the labor and equipment costs including the engineering of the "new" service.

Designate a Water Conservation Coordinator

Provide the job description and minimum qualifications. Job duties should include five-year Plan preparation, implementation and annual updates. Include the coordinator's title, business address, business phone number, and business email address. For small districts, this could be a part-time responsibility. For larger districts, this may be a full-time responsibility with additional staff. If a consultant is hired to write this Plan, the district should designate a district staff member as conservation coordinator to manage the work and communicate with Reclamation. Reclamation offers workshops to assist with Plan development and will provide technical assistance to the district during Plan preparation and implementation. Upon request, Reclamation area office staff will meet with a district's conservation coordinator to assist with the preparation, implementation, and evaluation of the Plan.

Provide or Support the Availability of Water Management Services to Water Users

Develop and conduct individual district-wide programs or collaborate with other contractors to develop cooperative, regional programs. Some contractors may want to arrange program delivery through consulting firms, cooperative extension, or other entities. Services required include, but are not limited to:

On-farm Evaluations

On-farm irrigation and drainage system evaluations using a mobile lab type assessment

The Criteria states that districts shall provide or support on-farm irrigation system evaluations for their customers. The BMP is intended to provide

the water users with access to irrigation system performance information that will help them improve their irrigation systems and management. Water users may or may not take advantage of this service. The districts are not required to offer these services free of charge.

The following are examples of adequate programs:

- Offer to district water users a rebate/ discount of 25 percent off the fair market price of an evaluation.
- Annually provide evaluations to at least 5 percent of the district water users requesting this service.
- Actively advertise a district organized evaluation program to district water users.

This can be accomplished by providing financial support to mobile lab programs, consultants, university students, or others who can perform the evaluations. The district shall also make all district water users aware of the service through newsletters, bill stuffers, or other district publications. If the district can demonstrate that at least 5 percent of district customers currently have systems evaluations annually, the district does not have to provide the service. The district is still expected to maintain support for this service by providing information to district customers.

On-farm irrigation system evaluations provide information that growers need to make efficiency improvements to existing irrigation systems. Irrigation evaluations, such as those being provided by mobile labs and other consulting services, identify correctable problems such as worn nozzles, insufficient filtration, incorrect or irregular nozzle sizes, excessive run time, etc. Also, evaluations often identify when and where over or under irrigation are occurring.

In the Plan, provide information on the number of farms and acres that are projected to receive irrigation system evaluations in each of the next 3 years. Include:

- Total number of irrigated acres
- Number of irrigated acres to be surveyed per year by on-farm irrigation evaluations
- Total number of farms
- Number of farms to be surveyed per year by on-farm irrigation/drainage evaluations.

For those districts with irrigation specialists on staff, on-farm evaluations could be part of the district's overall program, thus supplementing the efforts of other services or mobile labs. Mobile Lab Programs may already be available in your area – contact your local Resource Conservation District or Reclamation Area Office Water Conservation Specialist for more information. Agricultural consultants may also be able to perform this service for district customers.

El Dorado Water District has developed an on-site irrigation evaluation and in field soil moisture analysis programs. These are free programs offered to the farmers as part of the District's water conservation effort. What started out as a part-time position has evolved into a full-time Irrigation Specialist position. In addition to the District staff, the District also hires summer intern to help with the program. Since its inception, the District has evaluated over 110 farms and has established 78 moisture monitoring stations on 39 farms. Many farmers are utilizing this information for their irrigation practices. Since most of the larger farmers cultivate several parcels, a single evaluation can have a positive impact on thousands of acres.

Timely Field and Crop-specific Water Use Information to the Water User There are several substantial benefits of accounting for water deliveries by crop and field. A water user having knowledge of the deliveries has real-time information on their individual irrigation events and the total of all irrigation on each field throughout the season. Comparison of per acre water usage of each crop by field within the district provides very meaningful water use information both to the water user and the district. Crop-specific and field-specific data allows development of a tiered water pricing system that is sensitive to crop type. It also provides accurate data for measuring the results of BMPs.

The district can prepare an annual report that summarizes water use by crop and by field, computes the unit water use per acre, and sorts these data in several ways-by water user, field number, crop type, and unit water use. This report

allows the water users to compare their crops' specific water use with others within the district. At the end of each year, these reports can either be mailed to district customers or posted at the district office.

These reports will also be the best source of information to identify anomalies in water use that are indicators of possible sources of excessive tailwater and deep percolation or inaccurate metering.

Normal Year and Real-time Irrigation Scheduling and Crop ET Information (i.e., CIMIS) Describe the district's irrigation scheduling assistance program, including methods of data dissemination, and list any cooperating agencies.

ET calculations and irrigation scheduling information is available from the DWR CIMIS network (at no charge) and the USBR Agrimet website at www.usbr.gov/pn/agrimet and from other irrigation service providers. Contractors will have to establish a program to disseminate the data collected at these stations (web site, newspapers, television, radio, telephone, e-mail, newsletter, etc.).

To assist growers to develop crop irrigation schedules, districts can establish programs to:

- Disseminate the data to interested district customers
- Provide technical assistance and instruction on scheduling techniques

Crop water need includes crop ET and water used for leaching and cultural practices. One good resource is available at *http://www.fao.org/docrep/X0490E/X0490E00.htm*. This report provides detailed information on calculating crop water requirements. Another report prepared by the Irrigation and Training Research Center (ITRC) at Cal Poly. California Crop and Soil Evapotranspiration can be accessed at *http://www.itrc.org/reports/californiacrop.htm*. Another resource is the Center for Irrigation Technology's (CIT) Wateright web site at *http://www.wateright.org*. Crop ET can also be obtained from the DWR district office or the local Farm Advisor. Contact local UC Cooperative Extension County Farm Advisors at *http://ucanr.edu/County_Offices/*. Washington State University has weather information at AgWeather.net. Their mobile app can be found at *weather.wsu.edu/is/ or weather.wsu.edu/awn.php*.

Historical climatologic data can be used to develop normal year crop ET rates that can assist:

- Contractors to determine approximate quantities of water that may be requested during any particular growing season.
- Growers to estimate the growing season ET requirements of crops.

For assistance in developing training workshops and seminars in irrigation scheduling, districts can contact local offices of the UC Cooperative Extension Farm Advisors. Consultants are also available to assist in the development of training courses or to provide direct technical assistance.

Solano Irrigation District maintains the Solano Agricultural Water Conservation Committee's (AWCC) weather website and weather station network. The web site provides ET rates for use in irrigation scheduling. The free web site also provides daily, weekly, and historical weather data from nine weather stations located in Solano County, a link to the CIMIS website, and a crop irrigation report. A weather forecast is also available to growers at a cost of $10/month. The forecast targets Solano County, and includes pest models such as degree days, chilling hours, powdery mildew levels, peach twig borer/codling moth levels, and two-spotted spider mite levels. The web address is *http://www.westernwx.com/sid*.

Surface, Ground, and Drainage Water Quantity and Quality Data Describe the district's surface, ground, and drainage water quality monitoring program; include methods of data dissemination and list any cooperating agencies.

If the district has water sources with a range of qualities that affects how much water is needed for leaching, providing water quality information to customers when sources change can assist them to use an appropriate amount of water. When the quality of delivered water changes, districts

should inform customers so that they can make appropriate irrigation adjustments (for leaching, etc.). Workshops can be designed to assist growers to make the best use of this information.

Agricultural Water Management Educational Programs and Materials for Farmers, Staff, and Public (Soil moisture and salinity monitoring; in-school awareness programs; Agwater software; efficient irrigation techniques, crop water budget, and other approaches; program delivery via workshops, seminars, newsletters, field days, and demonstrations, etc.) Describe the district proposed or supported educational programs and their goals. Attach the materials used in these programs (Attachment I).

The district should either sponsor or conduct educational seminars/workshops for district farmers and staff. Examples of workshop topics include: Information on weather, crop ET, soil moisture holding capacity, crop characteristics, irrigation scheduling, and water-use planning. Input from customers, neighboring districts, consultants, irrigators, and other technical experts will be important when determining the content of these seminars/workshops.

Educational seminars/workshops can serve districts in several ways. They can be used to:

- Communicate the importance of implementing efficiency programs.
- Describe conservation procedures that can be utilized by customers.
- Provide a forum for growers, industrial users, and others to exchange ideas and experiences. These meetings also provide districts an opportunity to exchange ideas.

Information included in the Plan should include:

- Name and description of each program
- Co-funders (if any) of each program
- Yearly participation targets
- How information or the program is disseminated to the farmers

Various local, State, and Federal agencies (USDA's Agricultural Research Service, the UCCE, resource conservation districts, etc.) offer technical assistance and will work with the district to provide educational seminars and workshops to water users.

Pricing Structure

Adopt a water pricing structure for district water users based at least in part on quantity delivered. Describe the proposed quantity-based water pricing structure and when it will become (or became) effective. Financial variables influence the way customers use water. For example, when agricultural customers pay for each AF of water received, they are more likely to order an amount closer to the actual crop water need. Ordering only what is needed can reduce demand on distribution system capacity, reduce tailwater, and increase supply reliability.

Evaluate and Improve Efficiencies of District's Pumps

Describe the pump efficiency evaluation program and the role of the district and participating local utilities in the program.

Many districts operate booster pumps or groundwater pumps as part of their delivery and spill recovery facilities. A program to evaluate and improve the efficiencies of such pumps may result in energy savings and peak load reductions, or reveal capacity limitations due to inefficient facilities. Over the long term, the district may be able to reduce operational costs and improve operational efficiency.

Provide information in the Plan on the district's pump testing program. Contact your local energy utility to determine if they offer pump-testing programs that can assist districts to minimize power costs.

Solano Irrigation District maintains an active pump testing program to monitor pump performance and determine repairs required to maximize pump efficiencies, minimize power consumption and enable managers to plan preventative maintenance procedures. The annual budget for the pump rehabilitation and maintenance is $100,000, and the annual budget for pump efficiency testing is $7,500. The testing program has allowed staff to establish baseline performance standards for most of the District's pumps. The District also participates in the

California Agricultural Pump Efficiency Program (APEP), which manages a rebate program with PG&E for pump tests and pump repairs for grower owned pumps.

Westlands tested 354 of its pumps in 2006. The District's pumps range in size from 15 Hp to 700 Hp and are on a triennial testing program. Overhauls are scheduled when pumps test out at less than 60% efficiency threshold. Of those tested, the District overhauled 35 pumps that fell below the 60% efficiency threshold.

B. Exemptible BMPs for Agricultural Contractors

Agricultural districts should implement the following BMPs unless the district demonstrates that the practice is not appropriate. Refer to exemption process in Addendum B. Some districts may spend time studying the most effective way to implement a BMP or conduct a pilot study to determine if a BMP is appropriate for that district. For appropriate BMPs, provide a description of the implementation plan and include time schedules, budgets, and monitoring plans. If a BMP is to be studied, or a pilot study conducted, provide details and schedules of the study. These studies must be completed expeditiously and before the next Plan revision. The contractor is required to follow the exemption process (see Addendum A) to justify exemptions. Refer to, Addendum B for example justifications for each exemptible BMP. Document the exemption in this section. Some Exemptible BMPs may not apply to the district. The purpose of preparing a Plan is for the district to implement the BMP programs developed during the planning process. Each year, districts report on the previous year's actual BMP activities, budget, and staffing. They also project expenditures and staffing levels for the coming year and provide information on planned activities.

Contractors should maintain regular records of BMP implementation activities to facilitate the completion of the annual update. The BMP records can be tracked in a variety of ways. Some methods are: conservation staff recording data by BMP on their time sheets, weekly schedules, and special BMP budget computer codes.

Facilitate Alternative Land Use

Facilitate alternative uses (voluntary or compensated) for lands with exceptionally poor production potential or whose irrigation contributes to significant problems (such as drainage).

This BMP applies only to districts that have irrigated lands with the following characteristics:

- High water table (<5 feet)
- Poor drainage
- Groundwater selenium concentration > 50 ppb
- Poor productivity

If a district does provide water to lands that have the above characteristics, describe the district program that will promote a voluntary, compensated change of use for those lands.

The decision to retire land usually includes other factors, such as alternative land use demand. Also, it may not preclude the option of reestablishing irrigated agriculture, if circumstances should change.

In response to ongoing water supply allocation shortages, Del Puerto Water District facilitated an effort with landowners to permanently retire less productive lands in order to utilize the water supply in more productive areas. Alternative uses on these retired lands currently includes dry land farming, grazing, and/or habitat mitigation. In addition to this permanent program, annual efforts of a similar nature are undertaken by growers who seek to utilize their limited surface supplies on the most productive land available while temporarily fallowing any lands that may be less productive.

Facilitate Use of Available Recycled Water that Otherwise Would Not be Used Beneficially, Meets All Health and Safety Criteria, and Does Not Cause Harm to Crops or Soils

The use of recycled urban wastewater for agricultural irrigation provides an opportunity for use of an available water supply. Reuse of urban wastewater can be an important element in overall water management.

Identify the source of recycled water and the yearly quantity that is available. Provide the cost of the recycled water and describe its quality in relation to the crops the water will irrigate. Describe the program that will promote the use of the recycled water by agricultural customers and identify the district role in the program.

Solano Irrigation District utilizes recycled water from the Fairfield Wastewater Treatment Plant to meet all the irrigation needs for the turf nursery located near the treatment plant. Currently, this is the only farm located in the vicinity of a treatment plant that is producing a non-consumable crop.

Del Puerto Water District is currently pursuing a feasibility study on the use of recycled water produced by the cities of Modesto and Turlock. This study will identify and evaluate any legal and institutional issues associated with the proposed project, analyze alternatives, identify a recommended delivery system, identify all environmental, permitting, design, construction, operations, maintenance, and financing requirements, as well as determine the approximate costs and assess the financial feasibility of the project.

Facilitate the Financing of Capital Improvements for On-farm Irrigation Systems

Identify district programs to facilitate and/or provide financial incentives for improved on-farm water management. Include information on the estimated amount of yearly financial assistance. Attach the funding information the district provided to water users.

Facilitating financial aid to farmers may include cataloging available funding sources and procedures or obtaining funding and administering the program or providing low-interest loans.

Often a grower can greatly improve water management if financing is available. For some growers, the ability to implement efficient management practices and install modern irrigation systems is hampered by the lack of capital. These individuals are willing to improve efficiency if long-term affordable financing is available.

Westlands Water District offers the Expanded Irrigation System Improvement Program (EISIP)/ Grant to District farmers and landowners farming drainage impaired lands. This program provides low interest rates to farmers for the lease-purchase of irrigation system equipment, and is supplemented by Reclamation grant funding. The grant offers eligible water users funding up to $65,000 or 50% of the total lease purchase, whichever is less, towards the purchase of irrigation system equipment. The EISIP/Grant continues to maintain the $130,000 purchase maximum. Eligible equipment includes: portable aluminum irrigation equipment and other improved irrigation systems, including but not limited to micro irrigation, linear move and center pivots. For an example of a successful cost share program for the purchase of new irrigation system equipment, go to *http://www.westlandswater.org*.

Del Puerto Water District currently facilitates landowner water management best practices by promoting and coordinating a low interest loan programs whereby customers can purchase and install high-efficiency irrigation and/or drainage return systems. The recently finalized SRF Loan program funded 81 projects throughout the District, funding the installation of $4 million worth of drip, micro, and sprinkler systems. This program was replaced in 2007 by the Agricultural Drain Loan Program, which thus far has funded 31 projects worth over $3.3 million.

Incentive Pricing

Implement a pricing structure that promotes one or more of the following goals:

- Encourages more efficient water use at the farm level
- Supports planned conjunctive use of groundwater
- Increases groundwater recharge
- Reduces problem drainage
- Improves management of environmental resources

Describe the incentive pricing structures that were considered, which were selected for implementation, and when it will become effective. Incentive pricing structures, such as increasing block rates, are those that encourage

appropriate water use. Incentive rates encourage customers to accurately determine and apply only the water a crop needs, thus reducing over-irrigation and the resulting drainage.

Examples and explanations of agricultural rate schedules can be found in *Incentive Pricing Handbook for Agricultural Water Districts* available from your Reclamation area office or at *http://www.usbr.gov/pmts/economics/reports/Pricing%20Handbook.pdf*. Also see Incentive Pricing Best Management Practice for Agricultural Irrigation Districts at *http://www.usbr.gov/mp/watershare/documents/files/managementplanning/incentive_pricing.pdf*.

Several districts have implemented incentive pricing structures for irrigation water and drainage water disposal. Because of area specific management needs (such as leaching requirements, potential supply shortages, crop types, and soil and climatologic conditions) districts incentive rate designs will vary.

Panoche Water District has in place a tiered water pricing system to promote water conservation. There are a pre-irrigation tier and seasonal tiers. The pre-irrigation tier is set at 9 inches of water. The grower is charged twice the rate for water used over the tier. The seasonal tiers are applied to all water delivered above the CVP allocation. This system is an incentive for increased on-farm water use efficiency, reducing deep percolation and the consequential drainage component that must be managed by the District.

Line or pipe ditches and canals

Line or pipe the distribution system to increase distribution system flexibility and capacity and decrease maintenance and seepage. Describe the program to line or pipe the distribution system reaches with the greatest loss per foot or those reaches that have the greatest negative impact on delivery flexibility and capacity. As water cost or demands increase, it will become cost effective to line/pipe more sections of the distribution system.

Seepage and evaporation losses in earthen canals and laterals can be minimized by replacement with pipelines or lining with bentonite clay, pour-in-place concrete or plastics/textile membranes. To reduce on-farm seepage losses, districts may wish to consider helping growers to line their ditches or install pipelines.

In 2007, Pelger Mutual Water Company received a Reclamation grant to line approximately 5,280 feet of a sandy loam, earthen canal with a nonporous geomembrane liner. The canal was experiencing water losses due to transpiration through vegetation along the canal bed, seepage, and soil erosion. Based on pre-project and post-project ponding tests, Pelger Mutual Water Company estimates that lining this section of canal saves 300 acre feet of water per year. In addition to conserving water, the project provides other benefits such as improved conveyance, energy savings from reduced pumping costs, weed control and reduced pesticide applications, rodent control, and labor savings.

Regulatory Reservoirs

Construct regulatory reservoirs to improve distribution system delivery flexibility. The construction and/or lining of regulatory reservoirs can provide improved system operation and distribution flexibility, additional supply storage, reduced operational losses, and increased flexibility in the reception of surface and/or aqueduct supplies.

Imperial Irrigation District constructed six regulatory reservoirs as part of its program to improve the operation efficiency of its distribution system. Although the combined storage capacity of these reservoirs is only approximately 2,300 AF, some of the more significant benefits of the reservoirs include:

- Storing water normally held with less efficiency in the district's canals and laterals or released to the Salton Sea (when growers are unable to use ordered water due to unexpected rainfall).
- The ability to meet customer water delivery requests
- Increased distribution system operational efficiency

Tranquillity Irrigation District is planning to investigate the feasibility of a reservoir ("Railroad Reservoir") on Tranquillity Irrigation District owned property located in Fresno Slough Water District for the purpose of regulation, storage of

high flows off of the Kings River, and temporary storage of groundwater for flow peaking needs. Surplus high flows and off-peak flows would be able to be stored in the reservoir for future use. The reservoir would also reduce energy costs since stored groundwater would be pumped into the reservoir during off-peak periods (nights and weekends). It is estimated that the proposed reservoir will be about 300 acre-feet in size and could be filled and emptied 3 times per year for a total 900 acre-feet of storage in a year.

James Irrigation District investigated the feasibility of using the distribution canal to the existing

Lateral K Recharge Basin as a regulatory reservoir. In 2007, the District completed the design and construction to modify the turnout to the Lateral K recharge basin site so that the delivery canal and smallest cell could be used as regulation reservoir as well as provide spill protection for the Main Canal. The project resulted in a combined storage increase of approximately 90 acre-feet.

Increase Flexibility (within operational limits) in Water Ordering by, and Delivery to, Water Users

Modify distribution facilities and controls to increase the reliability, consistency, and flexibility of water deliveries. Describe measures you plan to implement to change from a rotation to an on-demand delivery system, and improve delivery flexibility and system capacity. Describe measures you plan to implement to increase delivery flexibility available to farmers, and describe obstacles for further flexibility improvements.

Many factors influence the effectiveness of irrigation. Among these are soil texture and uniformity, surface gradient, length of irrigation run, weed growth, debris from previous plant growth, irrigation water quality, root zone soil chemistry, depth of the unsaturated zone, wind velocity, humidity, air temperature, grower's expertise, and the design, condition, and operation of the irrigation system.

If all of the above factors are optimum, but the irrigation water is not available at the necessary time or in the appropriate quantities, irrigation effectiveness will be adversely affected. Weather unpredictability often does not allow a grower sufficient lead time to order water. Unlike urban water systems, agricultural districts often do not have systems that can provide water on demand.

Increased flexibility allows growers to irrigate only when necessary, but growers must be sure that the water will be there when needed.

Provide a copy of a water order form (Attachment J).

In 2001, Delano-Earlimart Irrigation District (DEID) began working with the Irrigation Training and Research Center (ITRC) at Cal Poly, San Luis Obispo on a research project to evaluate how a new turnout design could be modified to address water hammer concerns, provide for greater stability in ordered flow rate at each turnout, and move the District toward a "grower-demand" operating model. After a number of prototypes and extensive field testing, the ITRC developed the "DEID float valve assembly system." The float valve assembly system includes a frame, float, guide for the float valve linkage and a butter fly valve. The system also requires the grower to install his/her own operating valve on the downstream side of the District.

The system has proved very popular with DEID growers since it allows growers to turn water service on and off without having to wait for the availability of District personnel. In addition, growers experienced immediate water and energy savings since they are able to curtail their irrigation sets. Water and energy savings also accrue to the District. An annual water savings of 20,000 acre-feet have been estimated in a normal water year.

Construct and Operate District Spill and Tailwater Recovery Systems

Construct facilities to capture and reuse district operational spills. The design and operation of a district's conveyance system has a significant role in the quantity of annual operational spills. A district should measure the annual spill from each canal and determine the percentage that could be captured for beneficial use. This data is essential

to correctly site and size spill and tailwater recovery systems.

Interceptor systems can be designed to capture and transport operational spills throughout a conveyance system. One design adds lateral-connector canals. In this design, a secondary canal is constructed at the terminus point of a series of laterals to capture operational spill. The system is designed to either pump spills back into the laterals or transport them to a reservoir for storage.

Fresno Irrigation District has installed a new regulating structure for controlling spills during late fall and winter and occasionally during the irrigation season. The structure enhances the District's capabilities to distribute storm and nuisance flows between the Herndon and Dry Creek systems. Previously this water flowed down the Herndon Canal and only a small portion was captured downstream before leaving the District. Along with keeping the Herndon Canal dry when maintenance or construction is occurring downstream, the spill structure helps maximize the flows to three of the district's banking facilities.

Plan to Measure Outflow

Measure the volume outflow with methods or devices that are operated and maintained to a reasonable degree of accuracy, under most conditions, to +/- 20 percent by volume. Identify spill locations, prioritize spill locations by quantity of spill, and determine best measurement method/cost. If outflow measurement has not yet been completed, submit funding proposal, and provide the estimated cost and milestone schedule.

Optimize Conjunctive Use of Surface and Groundwater

Increase planned conjunctive use of surface and groundwater within the district. Describe the potential for increased conjunctive use and identify programs to achieve this potential. If feasible, districts should prepare and implement long-range plans to conjunctively use surface water and groundwater to meet current and future demands. Conjunctive use programs store surplus imported and local surface water in groundwater basins. When surface water is inadequate to meet demand, groundwater can then be pumped and distributed.

Arvin-Edison Water Storage District has had an active conjunctive use program since 1966. In order to regulate a highly variable water supply AEWSD develops water management programs based on the concept of delivering imported water in years of above average water supplies to 1) spreading ponds for groundwater recharge or, 2) transfers and exchanges water to other agencies that can in turn provide return water in subsequent years. During below average or dry years, AEWSD extracts previously stored groundwater and/or accepts return of water from water transfers and exchanges to meet its agricultural demands when surface supplies are adequate. AEWSD maintains various spreading basins to percolate water in to the aquifer for storage. Gravity and pressure feed ponds (totaling approximately 1,500 acres) are filled from surface water supplies in "wet" years, while groundwater wells (76 District owned) are used to extract stored water in "dry" years to meet surface water service demands. As of 2011, the District stored approximately 2 million AF of water in the groundwater basin underlying AEWSD. Historically, AEWSD has also used its idle facilities to generate water management benefits for other water agencies.

Westlands Water District, in addition to testing approximately 1,000 District meters annually, the District also tests and calibrates an additional 250 meters installed by farmers on well discharges in conjunction with Westlands' Pumped Groundwater Exchange and Groundwater Integration Programs. However, operation and maintenance of all wells is the farmers' responsibility.

Conjunctive use programs such as this one maximize the use of farmers' groundwater wells during drought periods.

Automate Distribution and/or Drainage System Structures

Automation of distribution and/or drainage system structures may increase flexibility in water deliveries and increase district control over its water supplies, thereby providing the opportunity to improve the efficiency of water use.

Identify locations for automated distribution structures and other distribution or drainage system improvements. Estimate annual water savings (AF/Y) resulting from the evaluated

projects. Describe program to automate distribution or distribution system.

Patterson Irrigation District continues to maintain its existing automated facilities which utilize supervisory control and data acquisition (SCADA) to monitor and control its main canal and reservoir projects based on level and flow demands. Additionally, PID continues to incorporate automation in new capital improvement projects implemented within the district. For example, the District's 2008 pipeline project included automation of two of the District's laterals and the District's main canal system. The lateral automation included transducers, a rectangular orifice gate, actuators, and radio equipment to remotely control and regulate deliveries on the District's 5-South and M-Laterals. Additionally, automation and controls on four of the five pump stations lifts on the District's main canal were calibrated and improved to incorporate a 35 cfs pump station, and five new pumps operating with variable frequency drives.

Facilitate or Promote Water User Pump Testing and Evaluation

Describe the program to facilitate or promote customer pump testing and evaluation. State the number of pumps to be evaluated annually. Attach the materials used in these programs (Attachment I). A district and the local utility can develop a cooperative pump testing service program for their customers. The program will benefit all involved parties by cutting down on energy demand while providing groundwater or pressurized low-volume systems at the lowest possible price.

Pacific Gas and Electric is partnering with the Center for Irrigation Technology at Fresno State University on the Advanced Pump Efficiency Program. The program provides $200 for evaluating pumps that have not been tested in the last four years and $100 per pump if it has not been tested in the last two years. More information on this program is located at: *http://www.pumpefficiency.org*.

Mapping

Develop Geographic Information System (GIS) maps of the district's distribution system and drainage system. A GIS is a system designed to capture, integrate, store, manipulate, analyze, manage and present all types of geographically referenced data for informing decision making. A comprehensive GIS database should include GPS locations of district facilities, inflow/outflow points, conveyance system, etc. as well as base datasets such as soils and hydrography. If digital mapping has not yet been completed, include the estimated cost and milestone schedule for implementing this BMP.

Glenn Colusa Irrigation District (GCID) has been using a GIS for District service area mapping and land use inventory for the past 15 years. The development of GCID's GIS evolved out of a need to analyze an increasingly wide scope of data and to present and communicate that data both visually and in summary. The foundation of the District's GIS is an ortho-rectified digital aerial photo base map of the entire District service area. The gathering of field data involves the collection of reference coordinates using a hand held Trimble GPS unit. The data is then downloaded into the GIS and can used along with other databases, spreadsheets, and polygons. The field data polygons created based on the data collected by the GPS can then be mapped and layered over the base map. Digital pictures can also be obtained at the site and later linked to the spatial data. The GIS provides a platform for the integration of information with ongoing operation and maintenance of District facilities as well as for the planning and design for future improvements and for other projects where a GIS can be a valuable tool. GCID currently uses Arc GIS 9.2 software.

The following is a list of the various capabilities of the District's GIS:

- Inventory of the water distribution and drainage system, including conduits, structures. and water delivery and recapture facilities
- Land ownerships and assessed acreages
- Field parcel identification numbers, acreages and crops
- Water Operator Service Areas and Lateral Service Areas
- Water applications and accounting
- Soil and land use classification maps.
- Surface hydrology and sub-surface geology

- Regional and interregional planning and project mapping
- Assist landowners with mapping needs and requirements

GCID utilizes its GIS as a valuable decision making and management tool. It is used to visually display its distribution system and to efficiently organize data which facilitates operations and management decisions.

C. Provide a 5-year Budget for BMPs

(For the current year and for the 4 years following the Plan update for all BMPs in expenses, hours or both. Do not include maintenance costs.)

5-Year Budget Summary

Amount Actually Spent During Current Year

Year 2015 or Year 1 BMP #	BMP Name	Budgeted Expenditure (not including staff time)	Staff Hours
A1	Measurement	$0	0
A2	Conservation staff	$0	0
A3	On-farm evaluations/water delivery info	$0	0
	Irrigation scheduling	$0	0
	Water quality	$0	0
	Agricultural education program	$0	0
A4	Quantity pricing	$0	0
A5	Contractor's pumps	$0	0
B1	Alternative land use	$0	0
B2	Urban recycled water use	$0	0
B3	Financing of on-farm improvements	$0	0
B4	Incentive pricing	$0	0
B5	Line or pipe canals/install reservoirs	$0	0
B6	Increase delivery flexibility	$0	0
B7	District spill/tailwater recovery systems	$0	0
B8	Measure outflow	$0	0
B9	Optimize conjunctive use	$0	0
B10	Automate canal structures	$0	0
B11	Customer pump testing	$0	0
B12	Mapping	$0	0
	Total	$0	0

Projected Budget Summary for the Next Year

Year 2016 or Year 2 BMP #	BMP Name	Budgeted Expenditure (not including staff time)	Staff Hours
A1	Measurement	$0	0
A2	Conservation staff	$0	0
A3	On-farm evaluations/water delivery info	$0	0
	Irrigation scheduling	$0	0
	Water quality	$0	0
	Agricultural education program	$0	0
A4	Quantity pricing	$0	0
A5	Contractor's pumps	$0	0
B1	Alternative land use	$0	0
B2	Urban recycled water use	$0	0
B3	Financing of on-farm improvements	$0	0
B4	Incentive pricing	$0	0
B5	Line or pipe canals/install reservoirs	$0	0
B6	Increase delivery flexibility	$0	0
B7	District spill/tailwater recovery systems	$0	0
B8	Measure outflow	$0	0
B9	Optimize conjunctive use	$0	0
B10	Automate canal structures	$0	0
B11	Customer pump testing	$0	0
B12	Mapping	$0	0
	Total	**$0**	**0**

Projected Budget Summary for the 3rd Year

Year 2017 or Year 3 BMP #	BMP Name	Budgeted Expenditure (not including staff time)	Staff Hours
A1	Measurement	$0	0
A2	Conservation staff	$0	0
A3	On-farm evaluations/water delivery info	$0	0
	Irrigation scheduling	$0	0
	Water quality	$0	0
	Agricultural education program	$0	0
A4	Quantity pricing	$0	0
A5	Contractor's pumps	$0	0
B1	Alternative land use	$0	0
B2	Urban recycled water use	$0	0
B3	Financing of on-farm improvements	$0	0
B4	Incentive pricing	$0	0
B5	Line or pipe canals/install reservoirs	$0	0
B6	Increase delivery flexibility	$0	0
B7	District spill/tailwater recovery systems	$0	0
B8	Measure outflow	$0	0
B9	Optimize conjunctive use	$0	0
B10	Automate canal structures	$0	0
B11	Customer pump testing	$0	0
B12	Mapping	$0	0
	Total	**$0**	**0**

Projected Budget Summary for the 4th Year

Year 2018 or Year 4 BMP #	BMP Name	Budgeted Expenditure (not including staff time)	Staff Hours
A1	Measurement	$0	0
A2	Conservation staff	$0	0
A3	On-farm evaluations/water delivery info	$0	0
	Irrigation scheduling	$0	0
	Water quality	$0	0
	Agricultural education program	$0	0
A4	Quantity pricing	$0	0
A5	Contractor's pumps	$0	0
B1	Alternative land use	$0	0
B2	Urban recycled water use	$0	0
B3	Financing of on-farm improvements	$0	0
B4	Incentive pricing	$0	0
B5	Line or pipe canals/install reservoirs	$0	0
B6	Increase delivery flexibility	$0	0
B7	District spill/tailwater recovery systems	$0	0
B8	Measure outflow	$0	0
B9	Optimize conjunctive use	$0	0
B10	Automate canal structures	$0	0
B11	Customer pump testing	$0	0
B12	Mapping	$0	0
	Total	**$0**	**0**

Projected Budget Summary for the 5th Year

Year 2019 or Year 5 BMP #	BMP Name	Budgeted Expenditure (not including staff time)	Staff Hours
A1	Measurement	$0	0
A2	Conservation staff	$0	0
A3	On-farm evaluations/water delivery info	$0	0
	Irrigation scheduling	$0	0
	Water quality	$0	0
	Agricultural education program	$0	0
A4	Quantity pricing	$0	0
A5	Contractor's pumps	$0	0
B1	Alternative land use	$0	0
B2	Urban recycled water use	$0	0
B3	Financing of on-farm improvements	$0	0
B4	Incentive pricing	$0	0
B5	Line or pipe canals/install reservoirs	$0	0
B6	Increase delivery flexibility	$0	0
B7	District spill/tailwater recovery systems	$0	0
B8	Measure outflow	$0	0
B9	Optimize conjunctive use	$0	0
B10	Automate canal structures	$0	0
B11	Customer pump testing	$0	0
B12	Mapping	$0	0
	Total	**$0**	**0**

Section IV: BMPs for Urban Contractors

Any Contractor that annually provides 2,000 AF of municipal and industrial water or more is required to complete this section. Any Contractor receiving 2,000 AF or more for a combination of municipal and industrial, and agricultural purposes is required to submit an urban water management plan.

If a primarily Urban Contractor provides some Agricultural Water, they are required to include Agricultural BMP 1 (Water Measurement) and BMP 4 (Pricing Structure) in their plan.

Once a Contractor provides water to 2,000 farmed acres or more they are required to address all the BMPs in Section III, BMPs for Agricultural Contractors.

The BMPs listed below will be evaluated based on the CUWCC's current MOU Exhibit 1, amended September 14, 2011 (BMP Definitions, Schedules, and Requirements). Please check the CUWCC website (www.cuwcc.org) to verify that this is the current version. The CUWCC MOU lays out requirements for implementation, coverage, and documentation. Required coverage is determined based on annual reports submitted to the CUWCC. The CUWCC analyzes data and sends coverage reports to the contractor. It is the contractor's responsibility to provide the data forms and the coverage reports to Reclamation as their annual BMP reporting and as an attachment to the Plan.

A. BMP Definitions, Schedules, and Requirements

Updated September 14, 2011

The Council's 14 BMPs are now organized into five categories. Two categories, Utility Operations and Education, are "Foundational BMPs", because they are considered to be essential water conservation activities by any utility and are adopted for implementation by all signatories to the MOU as ongoing practices with no time limits. The remaining BMPs are "Programmatic BMPs" and are organized into Residential, Commercial, Industrial, and Institutional (CII), and Landscape categories. The minimal activities required of each signatory are encompassed within each list, except for activities from which a utility is exempt from completing under section IV.5 of the MOU and for which the utility has filed an exemption with the Council.

BMP Naming Changes

The following table provides the new BMP categories as revised on September 14, 2011.

Old BMP Number and Name	New BMP Category
1. Water Survey Programs for Single-Family Residential and Multi-Family Residential Customers	Programmatic: Residential
2. Residential Plumbing Retrofit	Programmatic: Residential
3. System Water Audits, Leak Detection and Repair	Foundational: Utility Operations – Water Loss Control
4. Metering with Commodity Rates for All New Connections and Retrofit of Existing Connections	Foundational: Utility Operations – Metering
5. Large Landscape Conservation Programs and Incentives	Programmatic: Landscape
6. High-Efficiency Clothes Washing Machine Financial Incentive Programs	Programmatic: Residential
7. Public Information Programs	Foundational: Education – Public Information Programs
8. School Education Programs	Foundational: Education – School Education Programs
9. Conservation Programs for Commercial, Industrial, and Institutional (CII) Accounts	Programmatic: Commercial, Industrial, and Institutional
10. Wholesale Agency Assistance Programs	Foundational: Utility Operations – Operations
11. Retail Conservation Pricing	Foundational: Utility Operations – Pricing
12. Conservation Coordinator	Foundational: Utility Operations – Operations
13. Water Waste Prohibition	Foundational: Utility Operations – Operations
14. Residential ULFT Replacement Programs	Programmatic: Residential

BMP, Flex Track and Gallons per Capita per Day Options

Compliance with the BMP water savings goals can be accomplished in one of three ways including: accomplishing the specific measures as listed in Section A of each BMP; accomplishing a set of measures which achieves equal or greater water savings, referred to in the CUWCC MOU document as the Flex Track Menu; and accomplishing set water savings goals as measured in gallons per capita per day consumption. A CUWCC signatory may elect to adopt additional or alternative measures, in part or in any combination, as described in the Flex Track Menus, provided that the demonstrated water savings in the Flex Track Menu activities are equal to or greater than the water savings that would be achieved by the BMP measures.

A CUWCC signatory may elect to adopt additional or alternative measures, in part or in any combination, as described in the Flex Track Menus provided that the demonstrated water savings in the Flex Track Menu activities are equal to or greater than the water savings that would be achieved by the BMP measures.

"Demonstrated water savings" represent unit water savings for individual BMP or Flex Track Menu conservation technologies and activities as established by either: (a) a water utility; (b) independent research studies; or (c) CUWCC-adopted savings as reviewed by the Research and Evaluation Committee and approved by the Steering Committee.

Another alternative method to satisfying the BMP requirements is "GPCD (gallons per capita per day) Compliance". Agencies which choose a GPCD Compliance approach will be counting overall water savings of the quantifiable measures from the BMP list or Flex Track Menu plus additional savings achieved through implementation of the Foundational BMPs. Savings goals and methodology will be updated in the CUWCC MOU Compliance Policies from time to time based upon data and studies.

Exhibit 1of the CUWCC MOU lists BMPs that urban contractors may implement. Refer to the CUWCC 2011 MOU for more information on the compliance options. Provide a description of which compliance option will be implemented (BMP list, Flex Track, or GPCD). Describe how the BMP is being implemented and include time schedules, budgets and monitoring, and maintenance data for each BMP. The contractor must include the current year actual expenditures and a projected budget for the cost of implementing the BMPs for the three years following the Plan update.

Contractors who are wholesalers must insure that their retailers have Plans that meet the Criteria. Wholesalers may include their retail water districts in a single Plan or require each retailer to prepare a separate Plan. If retailers prepare their own Plans, the wholesaler should be involved to the extent necessary to insure all Plans meet the Criteria.

The purpose of preparing a Plan is for the Contractor to implement the BMP water efficiency programs. Each year, Contractors report on actual BMP activities during the previous year. Contractors should maintain records of BMP implementation activities to facilitate the completion of the Annual Update. The BMP records can be tracked in a variety of ways. Some methods are: conservation staff recording BMP data on their time sheets, weekly schedules, and special budget BMP computer codes.

The BMPs are intended to reduce long-term urban demands and improve water management in an effort to maximize the limited water resources available. These BMPs are in addition to programs that may be instituted during water supply shortages.

Note: Annual reporting is completed on the Internet at *http://www.cuwcc.org/*.

B. Provide a 5-year Budget for BMPs

(For the current year and for the 4 years following the Plan update for all BMPs in expenses, hours or both. Do not include maintenance costs.)

Amount Actually Spent During Current Year

Year 2015 or Year 1 BMP #	BMP Name	Budgeted Expenditure (not including staff time)	Staff Hours
1	Utilities Operations	$0	0
	- Operations Practices	$0	0
	- Water Loss Control	$0	0
	- Metering	$0	0
	- Pricing	$0	0
2	Education	$0	0
	- Public Information Programs	$0	0
	- School Education	$0	0
3	Residential	$0	0
4	CII	$0	0
5	Landscape	$0	0
	Total	**$0**	**0**

Projected Budget Summary for the Next Year

Year 2016 or Year 2 BMP #	BMP Name	Budgeted Expenditure (not including staff time)	Staff Hours
1	Utilities Operations	$0	0
	- Operations Practices	$0	0
	- Water Loss Control	$0	0
	- Metering	$0	0
	- Pricing	$0	0
2	Education	$0	0
	- Public Information Programs	$0	0
	- School Education	$0	0
3	Residential	$0	0
4	CII	$0	0
5	Landscape	$0	0
	Total	**$0**	**0**

Projected Budget Summary for the 3rd Year

Year 2017 or Year 3 BMP #	BMP Name	Budgeted Expenditure (not including staff time)	Staff Hours
1	Utilities Operations	$0	0
	- Operations Practices	$0	0
	- Water Loss Control	$0	0
	- Metering	$0	0
	- Pricing	$0	0
2	Education	$0	0
	- Public Information Programs	$0	0
	- School Education	$0	0
3	Residential	$0	0
4	CII	$0	0
5	Landscape	$0	0
	Total	**$0**	**0**

Projected Budget Summary for the 4th Year

Year 2018 or Year 4 BMP #	BMP Name	Budgeted Expenditure (not including staff time)	Staff Hours
1	Utilities Operations	$0	0
	- Operations Practices	$0	0
	- Water Loss Control	$0	0
	- Metering	$0	0
	- Pricing	$0	0
2	Education	$0	0
	- Public Information Programs	$0	0
	- School Education	$0	0
3	Residential	$0	0
4	CII	$0	0
5	Landscape	$0	0
	Total	**$0**	**0**

Projected Budget Summary for the 5th Year

Year 2019 or Year 5 BMP #	BMP Name	Budgeted Expenditure (not including staff time)	Staff Hours
1	Utilities Operations	$0	0
	- Operations Practices	$0	0
	- Water Loss Control	$0	0
	- Metering	$0	0
	- Pricing	$0	0
2	Education	$0	0
	- Public Information Programs	$0	0
	- School Education	$0	0
3	Residential	$0	0
4	CII	$0	0
5	Landscape	$0	0
	Total	**$0**	**0**

Addendum A. Exemption Process

Intent: To demonstrate in a clear and concise manner that a BMP is not cost-effective, not financially feasible, and not legally or environmentally possible for a contractor to implement. Only the BMPs in section III.B. are exemptible for agricultural contractors. For urban contractors, Foundational BMP 1.3 is the only non-exemptible BMP.

Evaluation: Some BMPs are not appropriate or possible for a contractor to implement. To document an exemption, the basis, rationale, and details for excluding a BMP must be provided. Such documentation must address, as appropriate, cost-effectiveness, financial feasibility, and environmental or legal constraints to BMP implementation. Urban BMP exemption requests should use the CUWCC exemption process. All urban and agricultural exemption requests will be reviewed for completeness, accuracy, and appropriateness by either Reclamation or an independent contractor.

Detail Expected in an Adequate BMP Exemption

Legal Constraints - Due to legal constraints, the following must be detailed in order to justify a BMP exemption:

1. A list of any known laws, regulations, court decisions, or other legal constraints that make it illegal for the contractor to implement the BMP.
2. A list of the steps required to remove these constraints.
3. A description of what steps the contractor has taken to remove these constraints.
4. Documentation of efforts by the contractor to work with other entities that have the legal authority to carry out the BMP within the contractor's service area.

Environmental Constraints - In order to justify an exemption due to known adverse environmental impacts, the Plan must document critical environmental issues and known (qualitative and/or quantitative) negative impacts of the BMP, and an explanation of why effective mitigation of these impacts is not possible. If mitigation of the environmental impacts is possible, the practice must be implemented unless it can be exempted by another exemption category. For example, if the mitigation costs make the project economically infeasible, a discussion of the mitigation plan and necessary mitigation costs should be included as part of the economic analysis.

Financial Constraints - In order to adequately justify an exemption due to financial constraints, the Plan must clearly document the following:

1. The contractor's funding needed to implement the BMP.
2. A discussion regarding why the contractor cannot finance the BMP through rate adjustments, assessments, etc.
3. A discussion of the contractor's reasonable efforts to secure funding from other entities that include, but are not limited to, lending institutions and bonding authorities, and an explanation of why these entities would not provide funding.
4. The required amount of a grant or subsidy necessary to feasibly implement the BMP if financing or partnerships could not be obtained. A benefit-cost analysis that demonstrates the costs to the contractor outweigh the benefits to the contractor over the life of the measure. The contractor must perform the analysis by comparing the present value of all benefits to the present value of all costs.

Document the projected/estimated benefits and costs and the methodology for analysis (benefits and costs should be quantified to the extent possible). The analysis performed for each excluded BMP (from the contractor's perspective) must include, but is not limited to, the following benefits and costs:

Benefits

1. All capital costs avoided by the contractor which include, but are not limited to, the costs associated with the development of new supplies (studies, construction, labor, etc.), transportation, the required increase in storage, distribution capacity, wastewater facilities and treatment capacity, etc.
2. Operation and maintenance (O&M) costs associated with the decrease in the production and distribution of water or the treatment and disposal of wastewater that include, but are not limited to, energy, labor, treatment, storage, drainage treatment and disposal, etc.
3. Water purchases avoided by the contractor.
4. Environmental costs avoided by the contractor.
5. Environmental enhancements.
6. Revenues from other entities that include, but are not limited to, revenue from the sale of water made available by the BMP, financial incentives received from other entities, etc.
7. Other benefits to the contractor customers that include, but are not limited to, hydropower, improved crop yields, improved crop quality, labor savings, fertilizer savings, increased farm income, etc.

Costs

1. Capital expenditures incurred by the contractor for implementation of the BMP that include, but are not limited to, equipment, supplies, materials, construction, etc.
2. O&M costs to plan, design, implement, enforce, and evaluate the practice
3. Financial incentives to customers.
4. Costs to the environment (describe the nature of the negative impact(s) and potential losses to the environment).
5. Other costs to the contractor.

Several accepted benefit-cost analysis methodologies exist (e.g., California Energy Commission's Integrated Resource Planning Methodology, Generally Accepted Accounting Principles, AWMC's Net Benefit Analysis, etc.). A contractor is considered to be the best suited to evaluate their own economic situation with an appropriate methodology.

A discussion and quantification, to the extent possible, of other benefits associated with the implementation of the BMP that may be of interest to potential partners, but are not the direct, sole responsibility of the contractor.

Addendum B. Applicability Process - Exemptible BMPs for Agricultural Contractors

To establish that a BMP is not applicable (NA) to the contractor, the Plan should explain why the BMP does not apply to the contractor. This justification must be consistent with Section I: Description of the District. Example justifications for each exemptible BMP are listed below. This list is not all inclusive.

Exemptible BMPs for Agricultural Contractors

1. *Facilitate alternative land use* - NA could include contractors without irrigable lands that have exceptionally high water duties or whose irrigation does not contribute to significant problems.
2. *Facilitate use of available recycled water that otherwise would not be used beneficially, meets all health and safety criteria, and does not cause harm to crops or soils* - NA could include no recycled water sources available.
3. *Facilitate the financing of capital improvements for on-farm irrigation systems* - None identified.
4. *Incentive pricing* – NA could include contractor receives Class 2 water only.
5. *Canal lining/piping and regulatory reservoirs* - NA could include completely piped systems, unlined canal systems, sections which are used as part of a planned conjunctive use program, or completely piped systems that do not have delivery constraints.
6. *Increase flexibility in water ordering by, and delivery to, the water users within operational limits* - None identified.
7. *Construct and operate contractor spill and tailwater recovery systems* - NA could include completely piped systems that do not have delivery constraints.
8. *Plan to measure outflow* - NA could include no spill or tailwater leaves the district.
9. *Optimize conjunctive use* - NA could include contractors who do not overlie a useable groundwater basin and thus neither the contractor nor their customers pump or use ground water, and the contractor has no water supplies other than the contract supply.
10. *Automate canal structures* - NA could include completely piped systems which do not have delivery constraints.
11. *Facilitate or promote water user pump testing and evaluation* - NA could include districts that have no groundwater, lift or diversion pumps.
12. *Mapping* - None identified

Addendum C. Information Required of Contractors Located in a Drainage Problem Area

Contractor's included in the drainage problem area, as identified in "A Management Plan for Agricultural Subsurface Drainage and Related Problems on the Westside San Joaquin Valley" (September 1990), are listed by subarea below. If future editions of the drainage report revise the boundaries of a drainage problem area or other factors used to determine which districts are in a drainage problem area, Reclamation will revise this Addendum to conform with the current drainage report.

1. Reclamation districts in the **Grasslands subarea**: Central California Irrigation District, Del Puerto Water District, Firebaugh Canal Water District, Mercy Springs Water District, Pacheco Water District, Panoche Water District, San Luis Canal Company, and San Luis Water District.
2. Reclamation districts in the **Westlands subarea**: James Irrigation District, Tranquillity Irrigation District, and Westlands Water District.
3. Reclamation districts in the **Tulare subarea**: Alpaugh Irrigation District, Atwell Island Water District, Lower Tule River Irrigation District, and Pixley Irrigation District.
4. Reclamation districts in the **Kern subarea**: Alpaugh Irrigation District.

Contractors listed above shall describe which recommendations prescribed in "A Management Plan for Agricultural Subsurface Drainage and Related Problems on the Westside San Joaquin Valley" (September 1990) have been incorporated in their water conservation programs to improve conditions in drainage problem areas. These recommendations include:

1. Source control
2. Land retirement
3. Drainage water treatment
4. Drainage water reuse
5. Shallow groundwater pumping
6. Evaporation ponds

Provide a description and level of expenditure for each activity designed to address the recommendations of the San Joaquin Valley Drainage Program. Identify how implementation of the recommendations has or will substantially reduce deep percolation on drainage problem lands. Describe which recommendations have not been implemented and why. Include a copy of the Drainage Problem Area Report as Attachment K.

Addendum D. Crop List

barley
corn - field
oats
rice
sorghum
wheat
other cereals

alfalfa
irrigated pasture
other hay
silage
other forage

cotton
safflower
sugar beets
soybeans
other field crops

asparagus
beans
broccoli
cabbage
carrots
cauliflower

celery
corn
cucumbers
garlic
greens
lettuce
melons
onions
peas
peppers
potatoes
squash
tomatoes
other vegetables

grasses

apples
apricots
avocados

berries (all kinds)
cherries
grapefruit
lemon/limes
oranges/tangerines
dates
grapes
olives
peaches
pears
prunes/plums
strawberries
other fruits

almonds
pecans
pistachios
walnuts
other nut trees

other

This page intentionally left blank

(District Name)
Water Management Plan
2014 Criteria

Date of First Draft - (date)
Date of Final - (date)

This page intentionally left blank

TABLE OF CONTENTS

SECTION I. DESCRIPTION OF THE DISTRICT 4-5
SECTION II. INVENTORY OF WATER RESOURCES 4-13
SECTION III: BMPS FOR AGRICULTURAL CONTRACTORS 4-19
SECTION IV: BMPS FOR URBAN CONTRACTORS 4-29

This page intentionally left blank

SECTION 1 - DESCRIPTION OF THE DISTRICT

District Name:	
Contact Name:	
Title:	
Telephone:	
Email:	
Web Address:	

A. History

1. Date District Formed: _____ Date of First Reclamation Contract: _____
   Original Size Acres: _____ Current Year (last complete calendar year) _____

2. Current size, population, and irrigated acres

	(Enter Data Year)
Size (acres)	
Population Served (Urban Connections)	
Irrigated Acres	

3. Water supplies received in current year

Water Source	**AF**
Size (acres)	
Population Served (Urban Connections)	
Irrigated Acres	
Federal urban water (Tbl 1)	
Federal agricultural water (Tbl 1)	
State water (Tbl 1)	
Other Wholesaler (define) (Tbl 1)	
Local surface water (Tbl 1)	
Upslope drain water (Tbl 1)	
District groundwater (Tbl 2)	
Banked water (Tbl 1)	
Transferred water (Tbl 1)	
Recycled water (Tbl 3)	
Other (define) (Tbl 1)	
Total	

4. Annual entitlement under each right and/or contract

	AF	Source	Contract #	Availability Period(s)
Reclamation Urban AF/Y				
Reclamation Agriculture AF/Y				
Other AF/Y				
Other AF/Y				

5. Anticipated land-use changes. For Ag contractors, also include changes in irrigated acres

6. Cropping patterns (Agricultural only)

List of current crops (crops with 5% or less of total acreage) can be combined in the 'Other' category

Original Plan (enter date)		Previous Plan (enter date)		Current Plan (enter date)	
Crop Name	**Acres**	**Crop Name**	**Acres**	**Crop Name**	**Acres**
Other (<5%)		Other (<5%)		Other (<5%)	
Total		**Total**		**Total**	

(See Planner, Chapter 3, Addendum D for list of crop names)

7. Major irrigation methods (by acreage) (Agricultural only)

Original Plan (enter date)		Previous Plan (enter date)		Current Plan (enter date)	
Irrigation Method	**Acres**	**Irrigation Method**	**Acres**	**Irrigation Method**	**Acres**
Level basin		Level basin		Level basin	
Furrow		Furrow		Furrow	
Sprinkler		Sprinkler		Sprinkler	
Low-volume		Low-volume		Low-volume	
Multiple		Multiple		Multiple	
Other		Other		Other	
Total		**Total**		**Total**	

B. Location and Facilities

See Attachment A for maps containing the following: incoming flow locations, turnouts (internal flow), and outflow (spill) points, conveyance system, storage facilities, operational loss recovery system, district wells and lift pumps, water quality monitoring locations, and groundwater facilities.

1. Incoming flow locations and measurement methods

Location Name	Physical Location	Type of Measurement Device	Accuracy

2. Current year Agricultural Conveyance System

Miles Unlined - Canal	Miles Lined - Canal	Miles Piped	Miles - Other

3. Current year Urban Distribution System

Miles AC Pipe	Miles Steel Pipe	Miles Cast Iron Pipe	Miles - Other

4. Storage facilities (tanks, reservoirs, regulating reservoirs)

Name	Type	Capacity (AF)	Distribution or Spill

5. Description of the agricultural spill recovery system and outflow points

6. Agricultural delivery system operation (check all that apply)

Scheduled	Rotation	Other (Describe)

7. Restrictions on water source(s)

Source	Restriction	Cause of Restriction	Effect on Operations

8. Proposed changes or additions to facilities and operations for the next 5 years

C. Topography and Soils

1. Topography of the district and its impact on water operations and management

2. District soil association map (Agricultural only) - See Attachment A, District Soils Map

3. Agricultural limitations resulting from soil problems (Agricultural only)

Soil Problem	Estimated Acres	Effect on Water Operations and Management
Salinity		
High-water table		
High or low infiltration rates		
Other (define)		

D. Climate

1. General climate of the district service area

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Avg Precip.													
Avg Temp.													
Max. Temp.													
Min. Temp.													
ETo													

Weather station ID _____ Data period: **Year** _____ **to Year** _____

ET Station ID _____ Average annual frost-free days: _____

Frost Free Days - According to National Oceanic and Atmospheric Administration (NOAA), frost free days are days with temperatures greater than 28 degrees Fahrenheit.

2. Impact of microclimates on water management within the service area

E. Natural and Cultural Resources

1. Natural resource areas within the service area

Name	Estimated Acres	Description

2. Description of district management of these resources in the past or present

3. Recreational and/or cultural resources areas within the service area

Name	Estimated Acres	Description

F. Operating Rules and Regulations

1. Operating rules and regulations

See Attachment B, District Rules and Regulations (water related)

2. Water allocation policy (Agricultural only)

See Attachment B, Page (insert page number here)

Summary -

3. Official and actual lead times necessary for water orders and shut-off (Agricultural only)

See Attachment B, Page (insert page number here)

Summary -

4. Policies regarding return flows (surface and subsurface drainage from farms) and outflow (Agricultural only)

See Attachment B, Page (insert page number here)

Summary -

5. Policies on water transfers by the district and its customers

See Attachment B, Page (insert page number here)

Summary -

G. Water Measurement, Pricing, and Billing

1. Agricultural Customers

Refer to BMP A.1. Information on water measurement for agricultural contractors is completed under BMP A.1 on page 4-15.

2. Urban Customers
   a. Total number of connections _____
   b. Total number of metered connections _____
   c. Total number of connections not billed by quantity _____
   d. Percentage of water that was measured at delivery point _____
   e. Percentage of delivered water that was billed by quantity _____
   f. Measurement device table _____

Meter Size and Type	Number	Accuracy* (+/- percentage)	Reading Frequency (Days)	Calibration Frequency (Months)	Maintenance Frequency (Months)
5/8” - 3/4”					
1”					
1-1/2”					
2”					
3”					
4”					
6”					
8”					
10”					
Compound					
Turbo					
Other (define)					
Total					

* Documentation verifying the accuracy of measurement devices must be submitted with Plan and included as Attachment C.

3. Agricultural and Urban Rates
   a. Current year agricultural and /or urban water charges - including rate structures and billing frequency

   See Attachment B, Page (insert page number here), for current year rate ordinance

   b. Annual charges collected from agricultural customers

Fixed Charges			
Charges ($ by unit)	**Charge Units ($/AF, etc.)**	**Units Billed During Year (AF, etc.)**	**Total $ Collected ($ Times Units)**

Please refer to the guidebook for information when completing the table.

Volumetric Charges			
Charges ($ by unit)	Charge Units ($/AF, etc.)	Units Billed During Year (AF, etc.)	Total $ Collected ($ Times Units)

Please refer to the guidebook for information when completing the table

c. Describe the contractor's record management system

H. Water Shortage Allocation Policies

1. Current year water shortage policies or shortage response plan - specifying how reduced water supplies are allocated

See Attachment D, page (insert page number here), District Water Shortage Plan

2. Current year policies that address wasteful use of water and enforcement methods

See Attachment B, page (insert page number here)

I. Evaluate Policies of Regulatory Agencies Affecting the Contractor and Identify Policies that Inhibit Good Water Management

Discuss possible modifications to policies and solutions for improved water management

SECTION 2 - INVENTORY OF WATER RESOURCES

A. Surface Water Supply

1. Surface water supplies in acre feet, imported and originating within the service area, by month (Table 1)

See Chapter 5, Water Inventory Tables, Table 1

2. Amount of water delivered to the district by each of the district sources for the last 10 years

See Chapter 5, Water Inventory Tables, Table 8

B. Groundwater Supply

1. Groundwater extracted by the district and delivered, by month (Table 2)

See Chapter 5, Water Inventory Tables, Table 8

2. Groundwater basin(s) that underlies the service area

Name	Size (Square Miles)	Usable Capacity (AF)	Safe Yield (AF/Y)

3. Map of district-operated wells and managed groundwater recharge areas

See Attachment A, for District Map of Groundwater Facilities

4. Description of conjunctive use of surface and groundwater

(Please review Guidebook definition of conjunctive use)

5. Groundwater Management Plan

See Attachment F, Groundwater Management Plan

6. Groundwater Banking Plan

See Attachment G, Groundwater Banking Plan

C. Other Water Supplies

1. "Other" water used as part of the water supply – Describe supply

See Chapter 5, Water Inventory Tables, Table 8

D. Source Water Quality Monitoring Practices

1. Potable water quality (Urban only)

See Attachment H – District Annual Potable Water Quality Report

2. Agricultural water quality concerns: [ ] Yes [ ] No

(If yes, describe)

3. Description of the agricultural water quality testing program and the role of each participant, including the district, in the program

4. Current water quality monitoring programs for surface water by source (Agricultural only)

Analyses Performed	Frequency	Concentration Range	Average

Current water quality monitoring programs for groundwater by source (Agricultural only)

Analyses Performed	Frequency	Concentration Range	Average

E. Water Uses Within the District

1. Agricultural

See Chapter 5, Water Inventory Tables, Table 5 - Crop Water Needs

2. Types of irrigation systems used for each crop in current year

Crop Name	Total Acres	Level Basin - Acres	Furrow - Acres	Sprinkler - Acres	Low Volume - Acres	Multiple Methods - Acres	Acres
Total							

3. Urban use by customer type in current year

Customer Type	Number of Connections	AF
Single-family		
Multi-family		
Commercial		
Industrial		
Institutional		
Landscape irrigation		
Wholesale		
Recycled		
Other (specify)		
Other (specify)		
Other (specify)		
Unaccounted for		
Total		

4. Urban Wastewater Collection/Treatment Systems serving the service area

Treatment Plant	Treatment Level (1, 2, 3)	AF	Disposal to/Uses
	Total		
Total discharged to ocean and/or saline sink			

5. Groundwater recharge in current year (Table 6)

Recharge Area	Method of Recharge	AF	Method of Retrieval
	Total		

6a. Transfers and exchanges **into** the service area in current year – (Table 1)

From Whom	To Whom	AF	Use
	Total		

6b. Transfers and exchanges **out** of the service area in current year – (Table 6)

From Whom	To Whom	AF	Use
	Total		

7. Wheeling, or other transactions in and out of the district boundaries – (Table 6)

From Whom	To Whom	AF	Use
	Total		

8. Other uses of water

Other Uses	AF

F. Outflow from the District (Agricultural only)

See Facilities Map, Attachment A, for the location of surface and subsurface outflow points, outflow measurement points, outflow water-quality testing locations

1. Surface and subsurface drain/outflow

Outflow Point	Location Description	AF	Type of Measurement	Accuracy (%)	% of Outflow	Acres Drained

Outflow Point	Where the Outflow Goes (Drain, River, or Other Location	Type Reuse

2. Description of the Outflow (surface and subsurface) water quality testing program and the role of each participant in the program

3. Outflow (surface drainage & spill) Quality Testing Program

Analyses Performed	Frequency	Concentration Range	Average	Reuse Limitation

Outflow (subsurface drainage) Quality Testing Program

Analyses Performed	Frequency	Concentration Range	Average	Reuse Limitation

4. Provide a brief discussion of the District's involvement in Central Valley Regional Water Quality Control Board programs or requirements for remediating or monitoring any contaminants that would significantly degrade water quality in the receiving surface waters.

Districts included in the drainage problem area, as identified in "A Management Plan for Agricultural Subsurface Drainage and Related Problems on the Westside San Joaquin Valley (September 1990)," should also complete Water Inventory Table 7 and Addendum C (include in plan as Attachment J)

G. Water Accounting (Inventory)

Go To Chapter 5 for Agricultural Water Inventory Tables and Instructions.

Go To Chapter 6 for Urban Water Inventory Tables and Instructions.

SECTION 3 - BEST MANAGEMENT PRACTICES (BMPs) FOR AGRICULTURAL CONTRACTORS

A. Critical Agricultural BMPs

1. Measure the volume of water delivered by the district to each turnout with devices that are operated and maintained to a reasonable degree of accuracy, under most conditions, to +/- 6%

   a. Number of delivery points (turnouts and connections) _____

   b. Number of delivery points serving more than one farm _____

   c. Number of measured delivery points (meters and measurement devices) _____

   d. Percentage of water delivered to the contractor that was measured at a delivery point _____

   e. Total number of delivery points not billed by quantity _____

   f. Delivery point measurement device table _____

Measurement Type	Number	Accuracy* (+/-%)	Reading Frequency (Days)	Calibration Frequency (Months)	Maintenance Frequency (Months)
Orifices					
Propeller meter					
Weirs					
Flumes					
Venturi					
Metered gates					
Acoustic doppler					
Other (define)					
Total					

* Documentation verifying the accuracy of measurement devices must be submitted with Plan and included in Attachment C.

2. Designate a water conservation coordinator to develop and implement the Plan and develop progress reports

Name _____ Title _____

Address _____

Telephone _____ Email _____

Provide the job description and minimum qualifications

3. Provide or support the availability of water management services to water users

a. See Attachment H, Notices of District Education Programs and Services Available to Customers.

1. On farm irrigation and drainage system evaluations using a mobile lab type assessment

	Total in District	# Surveyed Last Year	# Surveyed in Current Year	# Projected for Next Year	# Projected 2nd Year in Future
Irrigated Acres					
Number of Farms					

2. Timely field and crop-specific water delivery information to the water user

b. Real-time and normal irrigation scheduling and crop ET information

c. Surface, ground, and drainage water quantity and quality data provided to water users

d. Agricultural water management educational programs and materials for farmers, staff, and the public

Program	Co-Funders (If Any)	Yearly Targets

See Attachment H for samples of provided materials and notices

e. Other

4. Pricing structure - based at least in part on quantity delivered

Adopt a water pricing structure based on the measured quantity delivered

5. Evaluate and improve efficiencies of district pumps

Describe the program to evaluate and improve the efficiencies of the contractor's pumps

	Total in Districts	# Surveyed Last Year	# Surveyed in Current Year	# Projected for Next Year
Wells				
Lift Pumps				

B. Exemptible BMPs for Agricultural Contractors

(See Planner, Chapter 2, Addendum B for examples of exemptible conditions)

1. Facilitate alternative land use

Drainage Characteristic	Acreage	Potential Alternate Uses
Drainage Characteristic		
High water table (<5 feet)		
Poor drainage		
Groundwater Selenium concentration > 50 ppb		
Poor productivity		

Describe how the contractor encourages customers to participate in these programs

2. Facilitate use of available recycled urban wastewater

Sources of Recycled Urban Waste Water	AF/Y Available	AF/Y Currently Used in District

3. Facilitate the financing of capital improvements for on-farm irrigation systems

Program	Description

4. Incentive pricing

Describe incentive rate structure or other programs and purpose

5a. Line or pipe ditches and canals

Canal/Lateral (Reach)	Types of Improvement	Number of Miles in Reach	Estimated Seepage (AF/Y)	Accomplished/ Planned Date

5b. Construct/line regulatory reservoirs

Reservoir Name	Location	Describe Improved Operational Flexibility and AF Savings

6. Increase flexibility in water ordering by, and delivery to, water users

See Attachment I, contractor 'agricultural water order' form

7. Construct and operate district spill and tailwater recovery systems

Distribution System Lateral	Annual Spill (AF/Y)	Quantity Recovered and Reused (AF/Y)
Total		

Drainage System Lateral	Annual Drainage Outflow (AF/Y)	Quantity Recovered and Reused (AF/Y)
Total		

Describe facilities that resulted in reduced spill and tailwater

8. Plan to measure outflow

Total # of outflow (surface) locations/points _____

Total # of outflow (subsurface) locations/points _____

Total # of measured outflow points _____

Percentage of total outflow (volume) measured during report year _____

Identify locations, prioritize, determine best measurement method/cost, submit funding proposal

Location & Priority	Estimated Cost (in $1,000s)				
	Year 1	Year 2	Year 3	Year 4	Year 5

9. Optimize conjunctive use of surface and groundwater

Describe the potential for increasing conjunctive use of surface and groundwater

10. Automate distribution and/or drainage system structures

Identify locations where automation would increase delivery flexibility and reduce spill and losses. Describe program to achieve these benefits and estimate the annual water savings

11. Facilitate or promote water customer pump testing and evaluation

See Attachment H, Notices of District Education Programs and Services Available to Customers

12. Mapping

GIS Maps	Estimated Cost (in $1,000s)				
	Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Layer 1 – Distribution system					
Layer 2 – Drainage system					
Suggested layers:					
Layer 3 – Groundwater information					
Layer 4 – Soils map					
Layer 5 – Natural & cultural resources					
Layer 6 – Problem areas					

C. Provide a 5-Year Budget for Implementing BMPs

1. Amount actually spent during current year

Year 2015 or Year 1 BMP #	BMP Name	Budgeted Expenditure (not including staff time)	Staff Hours
A 1	Measurement	$0	0
A2	Conservation staff	$0	0
A3	On-farm evaluation/water delivery info Irrigation Scheduling Water quality Agricultural Education Program	$0 $0 $0 $0	0 0 0 0
A4	Quantity pricing	$0	0
A5	Contractor's pumps	$0	0
B1	Alternative land use	$0	0
B2	Urban recycled water use	$0	0
B3	Financing of on-farm improvements	$0	0
B4	Incentive pricing	$0	0
B5	Line or pipe canals/install reservoirs	$0	0
B6	Increase delivery flexibility	$0	0
B7	District spill/tailwater recovery systems	$0	0
B8	Measure outflow	$0	0
B9	Optimize conjunctive use	$0	0
B10	Automate canal structures	$0	0
B11	Customer pump testing	$0	0
B12	Mapping	$0	0
	Total	**$0**	**0**

2. Projected budget summary for the next year

Year 2016 or Year 2 BMP #	BMP Name	Budgeted Expenditure (not including staff time)	Staff Hours
A 1	Measurement	$0	0
A2	Conservation staff	$0	0
A3	On-farm evaluation/water delivery info Irrigation Scheduling Water quality Agricultural Education Program	$0 $0 $0 $0	0 0 0 0
A4	Quantity pricing	$0	0
A5	Contractor's pumps	$0	0
B1	Alternative land use	$0	0
B2	Urban recycled water use	$0	0
B3	Financing of on-farm improvements	$0	0
B4	Incentive pricing	$0	0
B5	Line or pipe canals/install reservoirs	$0	0
B6	Increase delivery flexibility	$0	0
B7	District spill/tailwater recovery systems	$0	0
B8	Measure outflow	$0	0
B9	Optimize conjunctive use	$0	0
B10	Automate canal structures	$0	0
B11	Customer pump testing	$0	0
B12	Mapping	$0	0
	Total	**$0**	**0**

3. Projected budget summary for the 3rd year

Year 2017 or Year 3 BMP #	BMP Name	Budgeted Expenditure (not including staff time)	Staff Hours
A 1	Measurement	$0	0
A2	Conservation staff	$0	0
A3	On-farm evaluation/water delivery info Irrigation Scheduling Water quality Agricultural Education Program	$0 $0 $0 $0	0 0 0 0
A4	Quantity pricing	$0	0
A5	Contractor's pumps	$0	0
B1	Alternative land use	$0	0
B2	Urban recycled water use	$0	0
B3	Financing of on-farm improvements	$0	0
B4	Incentive pricing	$0	0
B5	Line or pipe canals/install reservoirs	$0	0
B6	Increase delivery flexibility	$0	0
B7	District spill/tailwater recovery systems	$0	0
B8	Measure outflow	$0	0
B9	Optimize conjunctive use	$0	0
B10	Automate canal structures	$0	0
B11	Customer pump testing	$0	0
B12	Mapping	$0	0
	Total	**$0**	**0**

4. Projected budget summary for the 4th year

Year 2018 or Year 4 BMP #	BMP Name	Budgeted Expenditure (not including staff time)	Staff Hours
A 1	Measurement	$0	0
A2	Conservation staff	$0	0
A3	On-farm evaluation/water delivery info Irrigation Scheduling Water quality Agricultural Education Program	$0 $0 $0 $0	0 0 0 0
A4	Quantity pricing	$0	0
A5	Contractor's pumps	$0	0
B1	Alternative land use	$0	0
B2	Urban recycled water use	$0	0
B3	Financing of on-farm improvements	$0	0
B4	Incentive pricing	$0	0
B5	Line or pipe canals/install reservoirs	$0	0
B6	Increase delivery flexibility	$0	0
B7	District spill/tailwater recovery systems	$0	0
B8	Measure outflow	$0	0
B9	Optimize conjunctive use	$0	0
B10	Automate canal structures	$0	0
B11	Customer pump testing	$0	0
B12	Mapping	$0	0
	Total	**$0**	**0**

5. Projected budget summary for the 5th year

Year 2019 or Year 5 BMP #	BMP Name	Budgeted Expenditure (not including staff time)	Staff Hours
A 1	Measurement	$0	0
A2	Conservation staff	$0	0
A3	On-farm evaluation/water delivery info Irrigation Scheduling Water quality Agricultural Education Program	$0 $0 $0 $0	0 0 0 0
A4	Quantity pricing	$0	0
A5	Contractor's pumps	$0	0
B1	Alternative land use	$0	0
B2	Urban recycled water use	$0	0
B3	Financing of on-farm improvements	$0	0
B4	Incentive pricing	$0	0
B5	Line or pipe canals/install reservoirs	$0	0
B6	Increase delivery flexibility	$0	0
B7	District spill/tailwater recovery systems	$0	0
B8	Measure outflow	$0	0
B9	Optimize conjunctive use	$0	0
B10	Automate canal structures	$0	0
B11	Customer pump testing	$0	0
B12	Mapping	$0	0
	Total	**$0**	**0**

SECTION 4 - BEST MANAGEMENT PRACTICES FOR URBAN CONTRACTORS

A. Urban BMPs

Foundational BMPs

1. Operations Programs

    1.1. Operations Practices

        A.1) Conservation Coordinator

        A.2) Water waste prevention

        A.3) Wholesale agency assistance programs

    1.2. Water Loss Control

1.3. Metering with Commodity Rates for All New Connections and Retrofit of Existing Connections

1.4. Retail Conservation Pricing

2. Education Programs

    2.1. Public Information Programs

    2.2. School Education Programs

Programmatic BMPs

3. Residential

    A.1) Residential assistance program

    A.2) Landscape water survey

    A.3) High-efficiency clothes washers (HECWs)

    A.4) WaterSense Specification (WSS) toilets

    A.5) WaterSense Specifications for residential development

4. Commercial, Industrial, and Institutional (CII)

5. Landscape

B. Provide a 5-Year Budget for Expenditures and Staff Effort for BMPs

1. Amount actually spent during current year

Year 2015 or Year 1 BMP #	BMP Name	Budgeted Expenditure (not including staff time)	Staff Hours
1	Utilities Operations		
	1.1 Operations Practices	$0	0
	1.2 Water Loss Control	$0	0
	1.3 Metering	$0	0
	1.4 Retail Conservation Pricing	$0	0
2	Education Programs		
	2.1 Public Information Programs	$0	0
	2.2 School Education Programs	$0	0
3	Residential	$0	0
4	CII	$0	0
5	Landscape	$0	0
	Total	**$0**	**0**

2. Projected budget summary for 2nd year

Year 2016 or Year 2 BMP #	BMP Name	Budgeted Expenditure (not including staff time)	Staff Hours
1	Utilities Operations		
	1.1 Operations Practices	$0	0
	1.2 Water Loss Control	$0	0
	1.3 Metering	$0	0
	1.4 Retail Conservation Pricing	$0	0
2	Education Programs		
	2.1 Public Information Programs	$0	0
	2.2 School Education Programs	$0	0
3	Residential	$0	0
4	CII	$0	0
5	Landscape	$0	0
	Total	**$0**	**0**

3. Projected budget summary for 3rd year

Year 2017 or Year 3 BMP #	BMP Name	Budgeted Expenditure (not including staff time)	Staff Hours
1	Utilities Operations		
	1.1 Operations Practices	$0	0
	1.2 Water Loss Control	$0	0
	1.3 Metering	$0	0
	1.4 Retail Conservation Pricing	$0	0
2	Education Programs		
	2.1 Public Information Programs	$0	0
	2.2 School Education Programs	$0	0
3	Residential	$0	0
4	CII	$0	0
5	Landscape	$0	0
	Total	**$0**	**0**

4. Projected budget summary for 4th year

Year 2018 or Year 4 BMP #	BMP Name	Budgeted Expenditure (not including staff time)	Staff Hours
1	Utilities Operations		
	1.1 Operations Practices	$0	0
	1.2 Water Loss Control	$0	0
	1.3 Metering	$0	0
	1.4 Retail Conservation Pricing	$0	0
2	Education Programs		
	2.1 Public Information Programs	$0	0
	2.2 School Education Programs	$0	0
3	Residential	$0	0
4	CII	$0	0
5	Landscape	$0	0
	Total	**$0**	**0**

5. Projected budget summary for 5th year

Year 2019 or Year 5 BMP #	BMP Name	Budgeted Expenditure (not including staff time)	Staff Hours
1	Utilities Operations		
	1.1 Operations Practices	$0	0
	1.2 Water Loss Control	$0	0
	1.3 Metering	$0	0
	1.4 Retail Conservation Pricing	$0	0
2	Education Programs		
	2.1 Public Information Programs	$0	0
	2.2 School Education Programs	$0	0
3	Residential	$0	0
4	CII	$0	0
5	Landscape	$0	0
	Total	**$0**	**0**

AGRICULTURE WATER INVENTORY TABLES AND INSTRUCTIONS (as Requested in Criteria Section II.G)

The Agricultural Water Inventory should be entered on the MS Excel tables located at *http://www.usbr.gov/mp/watershare/documents/Water_mgmt/index.html*. Enter data in the white cells on the spreadsheets. Shaded cells are locked and cannot be changed.

Start by entering the data year (either the last complete calendar year or the last complete water year) in cell D1.

Table 1. Surface Water Supply (requested in Criteria Section II.A. and II.C.)

The numbers in this table should be the best information available on how much surface water actually entered the district distribution system. Make sure all the incoming surface water flows are represented. If necessary, define each water source with a descriptive title (e.g. San Joaquin River, DMC). Water transferred in, water returned from groundwater banks outside the district and small miscellaneous flows may be lumped together in the "Other" column and should also be defined. This table should not include urban recycled water or agricultural return water pumped back into the canals.

Year of Data 2014 **Enter Data Year Here**

2014 Month	Federal Ag Water (acre-feet)	Federal non-Ag Water (acre-feet)	State Water (acre-feet)	Local Water (define) (acre-feet)	Other Water (acre-feet)	Transfers Into District (acre-feet)	Upslope Drain Water	Total (acre-feet)
Method								
January	0	0	0	0	0	0	0	-
February	0	0	0	0	0	0	0	-
March	0	0	0	0	0	0	0	-
April	0	0	0	0	0	0	0	-
May	0	0	0	0	0	0	0	-
June	0	0	0	0	0	0	0	-
July	0	0	0	0	0	0	0	-
August	0	0	0	0	0	0	0	-
September	0	0	0	0	0	0	0	-
October	0	0	0	0	0	0	0	-
November	0	0	0	0	0	0	0	-
December	0	0	0	0	0	0	0	-
Total	-	-	-	-	-	-	-	-

Measured numbers for the water quantities detailed in these tables are expected. Select a method below that best describes the measurement method for each supply. Fill in the row marked "Method" with the appropriate measurement method type. If two methods are used for one supply, select the predominant one. If there is no flow rate or volumetric measurement, fill in the appropriate estimation method.

Method Definitions:

M1	Measured summation from calibrated measuring devices, accurate to within +/- 6 percent
M2	Measured summation from calibrated measuring devices
M3	Measured summation from measuring devices
C1	Calculated (more than summation) using information from calibrated devices (such as the difference between measurements upstream and downstream of diversion)
C2	Calculated using information from measuring devices
C3	Calculated using estimates from pump run-times and pump efficiency
E1	Estimated using measured information from similar conditions
E2	Estimated using historical information
E3	Estimated using observation
O1	Other (attach a note with descriptions of other methods used)

Table 2. Ground Water Supply (requested in Section II.B.)

The numbers in this table for district pumping should be measured or calculated. For private pumping, an estimate of the volume pumped is normally used. If a yearly total is the best estimate available, it should be distributed over the months based on experience. Choose the appropriate measurement method from the definitions provided on page 5-1, and fill in the row marked "Method". The difference between district and private ground water is determined by how it was delivered. If the water is pumped from private wells into the district distribution system, and sold by the district, then it should be included as district ground water.

2014 Month	District Groundwater (acre-feet)	Private Agric Groundwater (acre-feet)*
Method		
January	0	0
February	0	0
March	0	0
April	0	0
May	0	0
June	0	0
July	0	0
August	0	0
September	0	0
October	0	0
November	0	0
December	0	0
Total	**0**	**0**

* normally estimated

Table 3. Total Water Supply (requested in Section II.A., II.B., and II.C.)

Except for "Recycled M&I Wastewater" the information in this Table was entered in Tables 1 and 2. If you are using the supplied spreadsheet, all the numbers previously entered are automatically copied to this table, as indicated by light gray boxes. The "Recycled M&I Wastewater" column should be filled out only for M&I recycled wastewater that is delivered into a District Distribution System. Fill in the measurement method type using the definitions provided on page 5-1.

2014 Month	Surface Water Total (acre-feet)	District Groundwater (acre-feet)	Recycled M&I Wastewater (acre-feet)	Total District Water Supply (acre-feet)
Method				
January	-	-	0	-
February	-	-	0	-
March	-	-	0	-
April	-	-	0	-
May	-	-	0	-
June	-	-	0	-
July	-	-	0	-
August	-	-	0	-
September	-	-	0	-
October	-	-	0	-
November	-	-	0	-
December	-	-	0	-
Total	**-**	**-**	**-**	**-**

* Recycled M&I Wastewater is treated urban wastewater that is used for agriculture.

Table 4. Distribution System (requested in Section II.G., part 2)

Enter the monthly precipitation for the current year in the Precipitation Worksheet, column C rows 71-82. Enter the monthly evaporation for the current year in the Evaporation Worksheet, column W rows 71-82.

	2014 Precipitation Worksheet					2014 Evaporation Worksheet			
	inches precip	ft precip	acres	AF/Year		inches evap	ft evap	acres	AF/Year
Jan	0.0	-	-	-	Jan	-	-	-	-
Feb	0.0	-	-	-	Feb	-	-	-	-
Mar	0.0	-	-	-	Mar	-	-	-	-
Apr	0.0	-	-	-	Apr	-	-	-	-
May	0.0	-	-	-	May	-	-	-	-
Jun	0.0	-	-	-	Jun	-	-	-	-
Jul	0.0	-	-	-	Jul	-	-	-	-
Aug	0.0	-	-	-	Aug	-	-	-	-
Sept	0.0	-	-	-	Sept	-	-	-	-
Oct	0.0	-	-	-	Oct	-	-	-	-
Nov	0.0	-	-	-	Nov	-	-	-	-
Dec	0.0	-	-	-	Dec	-	-	-	-
Total	**0.0**	**0.00**			**Total**	**0**	**0.00**		

Table 4. Agricultural Distribution System

The first column should have the name or number of part of the distribution system, such as Canal T-2, or Section 4 laterals. In the “Length” and “Width” columns, enter the length and average width of those canals and the reservoirs and the surface area will be automatically calculated. The “Precipitation” and “Evaporation” columns will also auto fill. In the “Spillage” column, enter the estimated amount of unrecovered spillage from those canals. Spillage is recovered if it reenters the distribution system later. Enter estimated annual seepage for each unlined portion of the distribution system, storage or regulating reservoir.

2014 Canal, Pipeline, Lateral, Reservoir	Length (feet)	Width (feet)	Surface Area (square feet)	Precipi-tation (acre-feet)	Evapo-ration (acre-feet)	Spillage (acre-feet)	Seepage (acre-feet)	Total (acre-feet)
	0	0	0	0.0	0.0	0	0	0
	0	0	0	0.0	0.0	0	0	0
	0	0	0	0.0	0.0	0	0	0
	0	0	0	0.0	0.0	0	0	0
	0	0	0	0.0	0.0	0	0	0
	0	0	0	0.0	0.0	0	0	0
	0	0	0	0.0	0.0	0	0	0
	0	0	0	0.0	0.0	0	0	0
	0	0	0	0.0	0.0	0	0	0
	0	0	0	0.0	0.0	0	0	0
	0	0	0	0.0	0.0	0	0	0
Total				**0.0**	**0.0**	**0**	**-**	**0**

Table 5. Crop Water Needs

The first column should list the crops grown in the district (use the crop list provided in Attachment D of the Planner). For each crop, provide the irrigated acres, crop evapotranspiration (ETcrop), leaching requirement, and water used for cultural practices (frost protection, pre-irrigation, etc.). Table 5 will combine these values to determine the total water demand of each crop. You may wish to combine crops grown on less than 5% of the total irrigated acreage. To combine crops, determine an average ETcrop leaching and cultural requirement for this group of small acreage crops. It is possible for the total irrigated acres to exceed the size of the district due to double cropping. The ETcrop for crops in your area can be found using the California Irrigation Management Information System (CIMIS) at *http://www.cimis.water.ca.gov/cimis/info.jsp*, Department of Water Resources (DWR) CIMIS Database, www.wateright.org, or obtained from the local farm advisor. The University of California Cooperative Extension (UCCE) can also provide information on coefficients required to determine ETcrop and estimating water used for leaching and cultural practices.

2014 Crop Name	Area (crop acres)	Crop ET (AF/Ac)	Leaching Require-ment (AF/Ac)	Cultural Practices (AF/Ac)	Effective Precipitation (AF/AC)	Appl. Crop Water Use (acre-feet)
	0	0.0	0.0	0.0	0.0	0
	0	0.0	0.0	0.0	0.0	0
	0	0.0	0.0	0.0	0.0	0
	0	0.0	0.0	0.0	0.0	0
	0	0.0	0.0	0.0	0.0	0
	0	0.0	0.0	0.0	0.0	0
	0	0.0	0.0	0.0	0.0	0
	0	0.0	0.0	0.0	0.0	0
	0	0.0	0.0	0.0	0.0	0
	0	0.0	0.0	0.0	0.0	0
	0	0.0	0.0	0.0	0.0	0
	0	0.0	0.0	0.0	0.0	0
	0	0.0	0.0	0.0	0.0	0
	0	0.0	0.0	0.0	0.0	0
	0	0.0	0.0	0.0	0.0	0
	0	0.0	0.0	0.0	0.0	0
	0	0.0	0.0	0.0	0.0	0
	0	0.0	0.0	0.0	0.0	0
	0	0.0	0.0	0.0	0.0	0
	0	0.0	0.0	0.0	0.0	0
	0	0.0	0.0	0.0	0.0	0
	0	0.0	0.0	0.0	0.0	0
	0	0.0	0.0	0.0	0.0	0
Crop Acres	**0**			**0.0**	**0.0**	**0**

Total Irr. Acres _____ (If this number is larger than your known total, it may be due to double cropping.

Table 6. 2014 District Water Budget (requested in Section 2)

Much of the data for this table is copied from the previous tables.

- **Riparian ET** - Estimate the annual consumptive use by riparian vegetation inadvertently or intentionally supplied with district water. Do not include riparian vegetation located at an environmental or recreational resource. Estimate the total acres of riparian vegetation and an average water-use rate to obtain an estimate of consumptive use (based on ET during the months when water is available). Information may also be available from local farm advisors and neighboring districts.
- **Groundwater Recharge** - Quantify water used by the contractor for the purposeful recharge of groundwater, including recharge ponds and injection wells.
- **Transfers/trades/wheeling** – The amount of water the district sold or traded outside the district service area, not listed in Table 1. This will be a negative number.
- **Non-Agricultural Deliveries** - Quantify water delivered that was not used for commercial agricultural practices. This includes deliveries to homes and ranches for residential use, deliveries for commercial and industrial uses, and deliveries to municipal water districts.
- **Actual Agricultural Water Sales** - From district records, quantify the water that was delivered for application to the land. Compare this number with the "Water Available for Sale to Agricultural Customers" calculated on the previous line. If there is significant difference, look for data gaps.
- **Drain Water Outflow** - Quantify the drainwater that leaves the district boundaries from surface ditches or through drainpipes. While an estimate is acceptable, if the estimate exceeds 100 AF per year per outflow location, installation of an outflow measurement device is highly recommended. Reliable outflow data is a best management practice and one of the key components of an accurate water inventory. Districts are now required to begin planning for outflow measurement.
- **Percolation from Agricultural Land** - A rough estimate of the amount of water applied to the land that continues down past the root zone (deep percolation). This value is calculated by the formulas in the spreadsheet.

Water Supply	Table 3		-
Riparian ET	(Distribution and Drain)	minus	-
Groundwater recharge	intentional - ponds, injection	minus	-
Seepage	Table 4	minus	-
Evaporation - Precipitation	Table 4	minus	-
Spillage	Table 4	minus	-
Transfers out of District		minus	-
Water Available for sale to customers			-
Actual Agricultural Water Sales 2014	From District Sales Records		-
Private Groundwater	Table 2	plus	-
Crop Water Needs	Table 5	minus	-
Drainwater outflow	(tail and tile, not recycled)	minus	-
Percolation from Agricultural Land	(calculated)		0
Unaccounted for Water	(calculated)		0

Table 7. Influence on Ground Water and Saline Sink

The first part of this table compares the estimated influence on groundwater levels from the district with the actual change in the groundwater storage. There may be a large difference in the quantities. The comparison indicates the impact of district operation on groundwater.

The second part estimates the water that flows to a perched water table or saline sink and is no longer available for use. Examples are flows to evaporation ponds, saline groundwater, or perched water tables where the water is not reused. Implementing BMPs could minimize this "lost" water. In some cases, this lost water may be beneficial in some other way. Districts should provide a statement about how much of this lost water may be "savable" if improvements were funded. This statement will help Reclamation and the district find the most effective areas to apply conservation program funds.

2014	
Agric Land Deep Perc + Seepage + Recharge - Groundwater Pumping = District Influence on	0
Estimated actual change in groundwater storage, including natural recharge	0
Irrigated acres (from Table 5)	0
Irrigated acres over a perched water table	0
Irrigated acres draining to a saline sink	0
Portion of percolation from agri seeping to a perched water table	0
Portion of percolation from agri seeping to a saline sink	0
Portion of On-Farm Drain water flowing to a perched water table/saline sink	-
Portion of Dist. Sys. seep/leaks/spills to perched water table/saline sink	-
Total (AF) flowing to a perched water table and saline sink	-

Table 8. Annual Water Quantities Delivered Under Each Right or Contract (requested in Section II.A. and II.C.)

Quantify the amount of each type of surface water the District actually received in each of the last 10 years. If the District has sources of surface water that are not listed in the table, add the necessary data in the "Other" column.

Year	Federal Ag Water (acre-feet)	Federal Non-Ag Water (acre-feet)	State Water (acre-feet)	Local Water (acre-feet)	Water (define) (acre-feet)	Transfers into District (acre-feet)	Upslope Drain Water (acre-feet)	Total (acre-feet)
2005	0	0	0	0	0	0	0	0
2006	0	0	0	0	0	0	0	0
2007	0	0	0	0	0	0	0	0
2008	0	0	0	0	0	0	0	0
2009	0	0	0	0	0	0	0	0
2010	0	0	0	0	0	0	0	0
2011	0	0	0	0	0	0	0	0
2012	0	0	0	0	0	0	0	0
2013	0	0	0	0	0	0	0	0
2014	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0
Average	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

This page intentionally left blank

URBAN WATER INVENTORY TABLES AND INSTRUCTIONS

The Urban Water Inventory should be entered on the MS Excel tables located at http://www.usbr.gov/mp/watershare/documents/Water_mgmt/index.html. Enter data in the white cells on the spreadsheets. Shaded cells are locked and cannot be changed.

Start by entering the data year (either the last complete calendar year or the last complete water year) in cell D1.

Table 1. Surface Water Supply (requested in Criteria Section II.A. and II.C.)

The numbers in this table should be the best information available on how much surface water actually entered the district distribution system. Make sure all the incoming surface water flows are represented. If necessary, define each water source with a descriptive title (e.g. San Joaquin River, DMC). Water transferred in, the return of water banked outside the district and small miscellaneous flows may be lumped together in the "Other" column and defined. This table should not include urban recycled water.

Year of Data 2014 **Enter Data Year Here**

2014 Month	Federal Urban Water (acre-feet)	Federal Ag Water (acre-feet)	State Water (acre-feet)	Local Water (define) (acre-feet)	Transfers Into District (acre-feet)	Other Water (define) (acre-feet)	Total (acre-feet)
Method							
January	0	0	0	0	0	0	-
February	0	0	0	0	0	0	-
March	0	0	0	0	0	0	-
April	0	0	0	0	0	0	-
May	0	0	0	0	0	0	-
June	0	0	0	0	0	0	-
July	0	0	0	0	0	0	-
August	0	0	0	0	0	0	-
September	0	0	0	0	0	0	-
October	0	0	0	0	0	0	-
November	0	0	0	0	0	0	-
December	0	0	0	0	0	0	-
Total	-	-	-	-	-	-	-

Measured numbers for the water quantities detailed in these tables are expected. Select a method below that best describes the measurement method for each supply. Fill in the row marked "Method" with the appropriate measurement method type. If two methods are used for one supply, select the predominant one. If there is no flow rate or volumetric measurement, fill in the appropriate estimation method.

Method Definitions:

M1	Measured summation from calibrated measuring devices, accurate to within +/- 6 percent
M2	Measured summation from calibrated measuring devices
M3	Measured summation from measuring devices
C1	Calculated (more than summation) using information from calibrated devices (such as the difference between measurements upstream and downstream of diversion)
C2	Calculated using information from measuring devices
C3	Calculated using estimates from pump run-times and pump efficiency
E1	Estimated using measured information from similar conditions
E2	Estimated using historical information
E3	Estimated using observation
O1	Other (attach a note with descriptions of other methods used)

Table 2. Ground Water Supply (requested in Section II.B.)

The quantities in this table for the district pumping should be measured or calculated. For private pumping, an estimate of the volume pumped is normally used. If a yearly total is the best estimate available, it should be distributed over the months based on experience. Choose the appropriate measurement method from the definitions provided above, and fill in the row marked "Method."

2014 Month	District Groundwater (acre-feet)	Private Urban Groundwater (acre-feet)*
Method		
January	0	0
February	0	0
March	0	0
April	0	0
May	0	0
June	0	0
July	0	0
August	0	0
September	0	0
October	0	0
November	0	0
December	0	0
Total	**0**	**0**

* normally estimated

Table 3. Total Water Supply (requested in Section II.A., II.B., and II.C.)

Except for "Recycled M&I Wastewater" the information in this Table was entered in Tables 1 and 2. If you are using the supplied spreadsheet, all the numbers previously entered are automatically copied to this table, as indicated by light gray boxes. The "Recycled M&I Wastewater" column should be filled out only for M&I recycled wastewater that is delivered into a district distribution system. Fill in the measurement method type using the definitions provided on page 6-1

2014 Month	Water Total (acre-feet)	District Groundwater (acre-feet)	Recycled M&I Wastewater (acre-feet)	Total District Water Supply (acre-feet)
Method				
January	-	-	0	-
February	-	-	0	-
March	-	-	0	-
April	-	-	0	-
May	-	-	0	-
June	-	-	0	-
July	-	-	0	-
August	-	-	0	-
September	-	-	0	-
October	-	-	0	-
November	-	-	0	-
December	-	-	0	-
Total	**-**	**-**	**-**	**-**

* Recycled M&I Wastewater is treated urban wastewater that is used for agriculture.

Table 4. Distribution System Losses (requested in Section II.G., part 2)

The first column should have the name or number of part of the system, such as 16" main. In the "Length" column, enter the length of all lines listed in the "Area or Line" column. In the "Leaks" column, enter the estimated amount of water lost through leaks. In the "Breaks" column, enter the estimated amount of water lost through breaks. In the "Flushing/Fire" column, enter the estimated amount of water used for line flushing and fire fighting.

2014 Area or Line	Length (feet)	Leaks (acre-feet)	Breaks (acre-feet)	Flushing/Fire (acre-feet)	Total (acre-feet)
				0	0
				0	0
				0	0
				0	0
				0	0
				0	0
				0	0
				0	0
				0	0
				0	0
				0	0
Total				**0**	**0**

Table 5. District Water Budget (requested in Section II.G.)

Much of the data for this table is copied from the previous tables. Definitions are only provided for water uses that have not been entered previously.

- **Environmental Consumptive Use** - The annual water delivered to an environmental or recreational resource.
- **Groundwater Recharge** - The water used for the purposeful recharge of groundwater, including recharge ponds and injection wells.
- **Water Exchanges or Transfers** - The amount of water the district sold or traded outside the district service area, not listed in Table 1. This will be a negative number.
- **Non-Urban (Agricultural) Deliveries** - The water delivered to commercial agricultural customers. If 2,000 acre-feet a year or more is delivered to agricultural, the district is considered an agricultural water supplier and will also complete an agricultural water management plan and implement agricultural BMPs.
- **Actual M&I Water Sales** - From district billing records, quantify the water that was sold as M&I. Compare this quantity with the "Water Supply Available for Sale" calculated on the previous line. If there is a significant difference, look for data gaps.
- **Inside Use** - The water billed as M&I during the month of February multiplied by 12. Outside water use during February is assumed to be minimal. February usage provides an estimate of water use inside homes and businesses, and it is assumed to be very consistent regardless of season.

The final line on this table is an estimate of the amount of outdoor water use.

Water Supply	Table 3		-
Environmental Consumptive Use		minus	-
Groundwater recharge	Perc ponds & recharge wells	minus	-
Transfers Out of District		minus	-
Flushing/Fire	Table 4b	minus	-
Distribution System Leaks & Breaks	Table 4b	minus	-
Water Available for sale to customers			-
Actual Water Sales 2014	From District Records		-
Inside Use	Fed Urban Use x12		-
Landscape/Outside Use	(calculated)		0
Unaccounted for Water	(calculated)		0

Table 6. Annual Water Quantities Delivered Under Each Right or Contract (requested in Section II.A. and II.C.)

Quantify the amount of each type of water the contractor actually received in each of the last 10 years. If the contractor has sources of surface water that are not listed in the table, add the necessary data in the "Other" column.

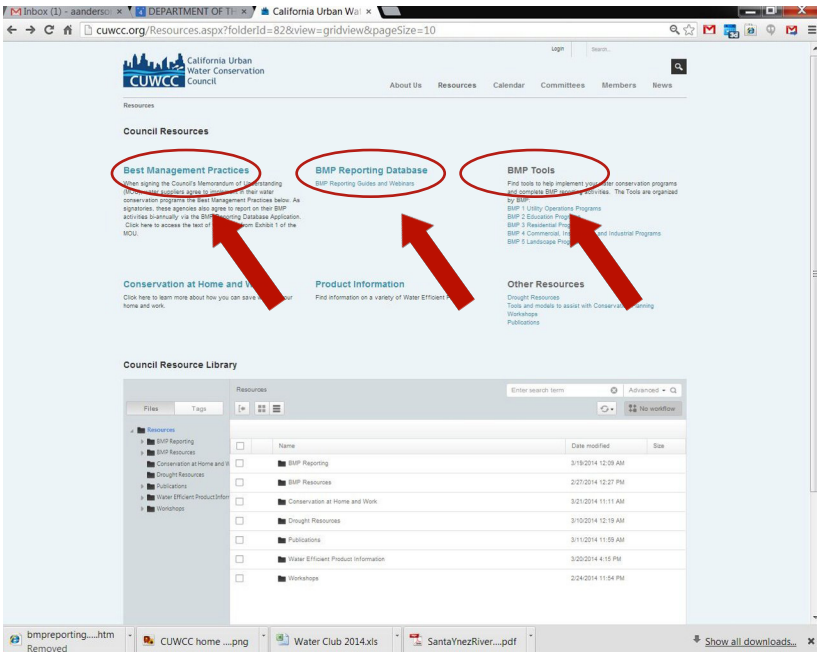
Year	Federal Urban Water (acre-feet)	Federal Ag Water (acre-feet)	State Water (acre-feet)	Local Water (acre-feet)	Transfers into District (acre-feet)	Water (define) (acre-feet)	Total (acre-feet)
2005	0	0	0	0	0	0	0
2006	0	0	0	0	0	0	0
2007	0	0	0	0	0	0	0
2008	0	0	0	0	0	0	0
2009	0	0	0	0	0	0	0
2010	0	0	0	0	0	0	0
2011	0	0	0	0	0	0	0
2012	0	0	0	0	0	0	0
2013	0	0	0	0	0	0	0
2014	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0
Average	**0**	**0**	**0**	**0**	**0**	**0**	**0**

URBAN BEST MANAGEMENT PRACTICES

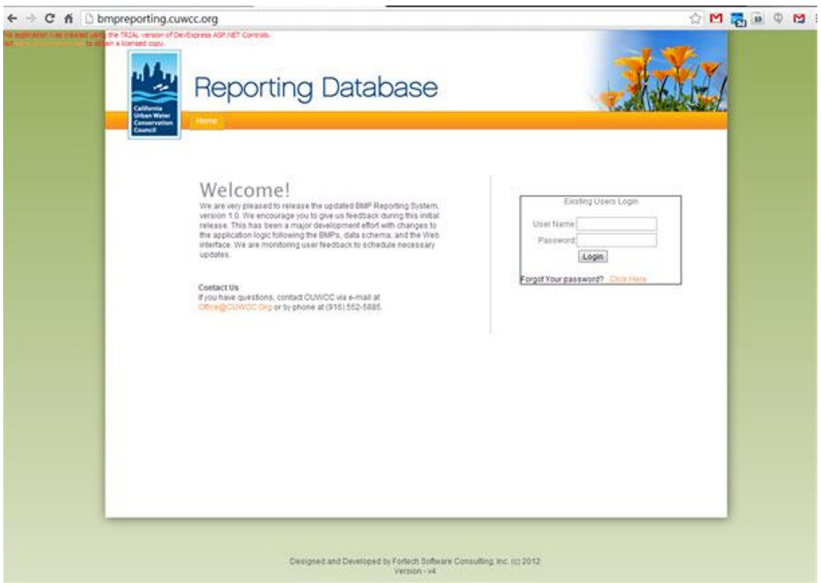
CUWCC has updated their website with a new look and a search engine function to help find information. The URL for the CUWCC website is *http://www.cuwcc.org*.

Helpful information can be found by clicking on the Resources link at the top of the page and under the BMP Reporting link, located at the top middle of the page. And the BMP Reporting Application link can be found on the middle of the page on the right.

From the Resources link provides information regarding the MOU, BMP Tools, and a link to the Reporting Database.



The Reporting Database has a new look. If you are having problems with accessing the database, please contact CUWCC at office@cuwcc.org or call 916-552-5885.



FEDERAL AND STATE PLAN SUBMITTALS

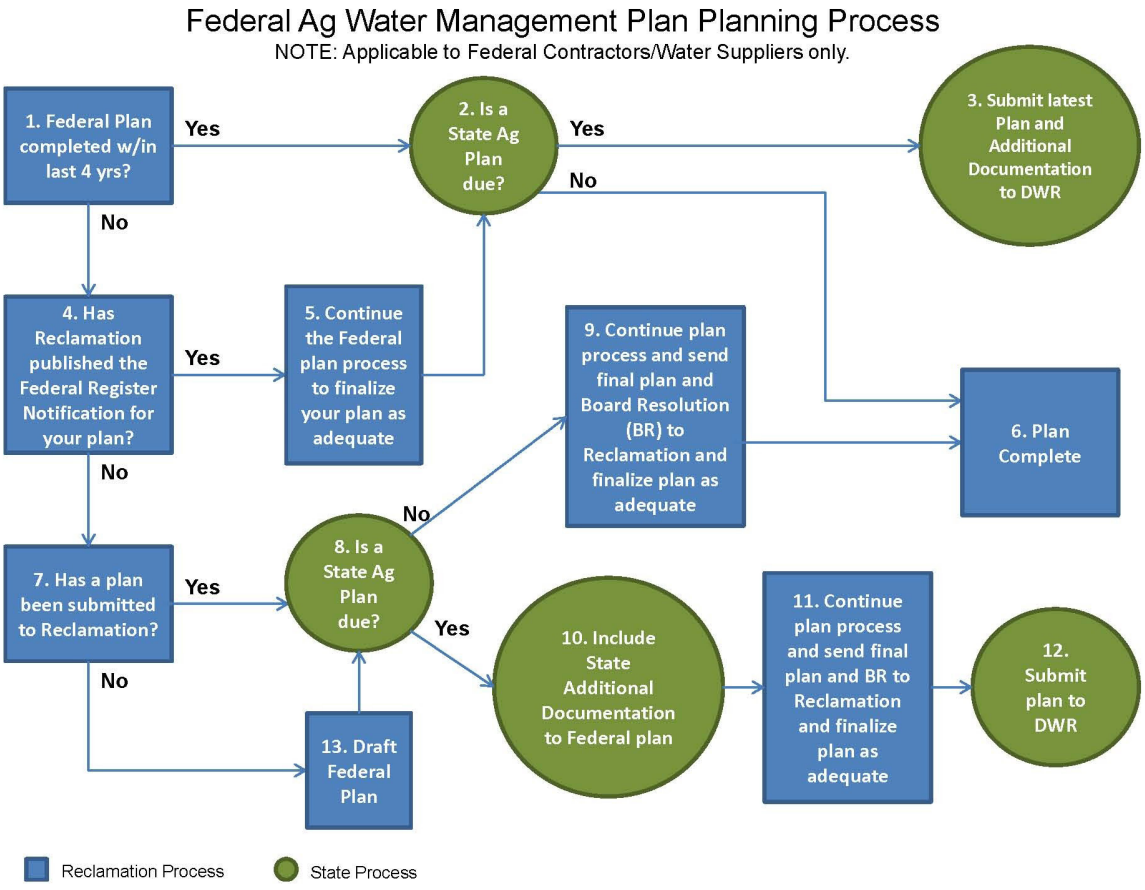
Introduction

The Bureau of Reclamation (Reclamation) and the California Department of Water Resources (DWR) have been working together to consolidate the Agricultural Water Management Plan for water service contractors' Federal and State plan requirements. State plans are due in years ending in zero and five for agricultural water districts servicing over 10,000 irrigated acres. For districts serving from 10,000 to 25,000 irrigated acres, a plan is due depending on the availability of funding for the plan. Federal plans are due every five years.

When both the Federal and State plan due dates coincide, in years ending in zero or five, draft your plan following the Standard Criteria along with the additional documentation for your State plan and submit them to Reclamation. Once the plan is deemed adequate by Reclamation, the contractor can submit the completed plan to DWR for their State plan requirement.

When both plan due dates do not coincide, DWR is willing to accept plans that have been deemed adequate by Reclamation no more than four years prior to when the State plan is due along with the additional documentation that is required by the State.

The following flow diagram will help water service contractors determine what to submit and to whom:



Path (by blocks and circles)		Description
A	1,2,3	Was the **Federal plan finalized as adequate** no more than 4 years ago? For 2012 State plan due date, did the Federal Register notification on your plan close on or after Jan 1, 2009, without any significant public comments? If **yes**, is a State Ag plan due? If **yes**, your district must **submit the latest Federal plan along with the State's additional documentation to DWR**.
B	1,2,6	**Was the Federal plan finalized as adequate** no more than 4 years ago? For 2012 State plan due date, did the Federal Register notification on your plan close on or after Jan 1, 2009, without any significant public comments? If **yes**, is a State Ag plan due? If **no**, your **Federal plan is complete** until the next time the 5-year plan is due.
C	1,4,5,2,3	If your **Federal plan is not complete**, then has Reclamation published the Federal Register notification for your plan? If **yes**, then continue with the Federal plan process to finalize your plan for adequacy. Is a State Ag plan due? If **yes**, your district must **submit the latest Federal plan along with the State's additional documentation to DWR**.
D	1,4,5,2,6	If your Federal plan is not complete, then has Reclamation published the Federal Register notification for your plan? If **yes**, then continue with the Federal plan process to finalize your plan for adequacy. Is a State Ag plan due? If **no**, your **Federal plan is complete** until the next time the 5-year plan is due.
E	1,4,7,8,9,6	**If your Federal plan is not complete and has not been published in the Federal Register**, has your district submitted a draft plan to Reclamation? If **yes**, is a State Ag plan due? If **no**, continue with the Federal process to finalize your plan as adequate. Once your plan is considered adequate, your Board or City Council must adopt the plan. Then send final plan and Board or City Council resolution to Reclamation. When the Federal Register notification is closed without any significant public comments, your **Federal plan is complete and finalized as adequate** and is finished until the next time the 5-year plan is due.
F	1,4,7,8,10, 11,12	**If your Federal plan is not complete and has not been published in the Federal Register**, has your district submitted a draft plan to Reclamation? If **yes**, is a State Ag plan due? If **yes**, your district should complete and **submit the State's additional documentation with the Federal plan**. Then continue with the Federal process to finalize your plan as adequate. Once your plan is considered adequate, your Board or City Council must adopt the plan. Then send plan and Board or City Council resolution to Reclamation. When the Federal Register notification is closed without any significant public comments, your **Federal plan is complete and finalized as adequate.** Your district shall **submit the Federal plan to DWR which includes the additional documentation**.
G	1,4,7,13,8, 9,6	If you have not submitted a plan to Reclamation, you need to draft a plan. Is a State Ag plan due? If **no**, continue with the Federal process to finalize your plan as adequate. Once your plan is considered adequate, your Board or City Council must adopt the plan. Then send final plan and Board or City Council resolution to Reclamation. When the Federal Register notification is closed without any significant public comments, your **Federal plan is complete and finalized as adequate** and is finished until the next time the 5-year plan is due.
H	1,4,7,13,8, 10,11,12	If you have not submitted a plan to Reclamation, you need to draft a plan. Is a State Ag plan due? If **yes**, your district should complete and **submit the State's additional documentation with the Federal plan draft**. Then continue with the Federal process to finalize your plan as adequate. Once your plan is considered adequate, your Board or City Council must adopt the plan. Then send plan and Board or City Council resolution to Reclamation. When the Federal Register notification is closed without any significant public comments, your **Federal plan is complete and finalized as adequate.** Your district shall **submit the Federal plan to DWR which includes the additional documentation**.

Federal and State plan policies

The following policies have been agreed upon between Reclamation and DWR:

Although the additional documentation for the state is being submitted to Reclamation, Reclamation will accept the documentation as an informational documentation, but Reclamation cannot review it for adequacy due to jurisdiction authority. Note: This issue will be up for discussion and may change during the next standard criteria revision.

The district or contractor is responsible for submitting the plan and any other state required documentation to DWR.

The federal review process which includes the public review process is acceptable to DWR provided the process meets all of the state law, which includes the following:

1. Notification of AWMP preparation: notifying all city or county that receives water from the district that the district will be preparing a plan or amendments to a plan.
2. Public participation: Prior to adopting a plan, make the plan available for public inspection and hold a public hearing on the plan.
3. Plan Adoption, Submittal and Availability:
   a. Adoption: the inclusion of the resolution with the plan
   b. Submittal: submittal of the plan and all associated documents to DWR
   c. Availability: the plan must be available for public review on a website or electronic submittal to DWR for posting.
4. Plans will be accepted early by Reclamation and DWR to allow for flexibility for the districts. Due dates for the plan may not coincide, so if a federal plan is due 2017 and a state plan is due 2015, Reclamation will accept the 2015 plan as the 2017 plan. Or the state will accept the 2017 plan for their 2020 plan.

More information regarding the State plan requirements can be found at DWR's website: *http://www.water.ca.gov/wateruseefficiency/agricultural/agmgmt.cfm*.

This page intentionally left blank

PLAN REVIEW FORM

Evaluation Form for the Reclamation Water Conservation Plan 2011 Criteria

Contractor _____

Response categories: A = adequate, E = exemptible, NA = not applicable, MI = needs more information. Each of the items listed below must be rated A, E, or NA for a plan to be considered consistent with the criteria.

Section I: Description of the District

Contact information ..... A NA MI

A. History

1. Date district formed, first Reclamation contract, original size, current year ... A NA MI
2. Current size, population, and irrigated acres ..... A NA MI
3. Water supplies received in current year ..... A NA MI
4. Annual entitlement under each right and/or contract..... A NA MI
5. Anticipated land-use changes ..... A NA MI
6. Cropping patterns (Ag only) ..... A NA MI
7. Major irrigation methods (by acreage) (Ag only)..... A NA MI

B. Location and Facilities

1. Incoming flow locations and measurement methods ..... A NA MI
2. Current year Agricultural Conveyance System..... A NA MI
3. Current year Urban Distribution System ..... A NA MI
4. List storage facilities ..... A NA MI
5. Description of agricultural spill recovery system ..... A NA MI
6. Agricultural delivery system operation..... A NA MI
7. Restrictions on the District's water source(s) ..... A NA MI
8. Proposed changes or additions to facilities & operations (next 5 yrs)..... A NA MI

C. Topography and Soils

1. Topography of District and impacts on water operations & management..... A NA MI
2. District soil association map (Ag only) ..... A NA MI
3. Agricultural limitations resulting from soil problems (Ag only)..... A NA MI

D. Climate

1. General climate of the District service area
   a. Period of record and weather station ID used ..... A NA MI
   b. Average precipitation (by month and annual)……... A NA MI
   c. Average, maximum and minimum temperatures (by month and annual).. A NA MI
   d. Wind velocity and frost – free days ..... A NA MI
2. Impact of any microclimates on water management within the District ..... A NA MI

E. Natural and Cultural Resources

1. Identify natural resources within the District..... A NA MI
2. Describe mgmt of resources, past or present, by District ..... A NA MI
3. Identify recreational and/or cultural resources areas within the District. ..... A NA MI

F. Operating Rules and Regulations

1. Attach a copy of the District's operating rules and regulations ..... A NA MI
2. Describe agricultural water allocation policy ..... A NA MI
3. Describe lead times for water orders and shut-off (Ag only) ..... A NA MI
4. Describe policies surface & subsurface drainage from farms (Ag only)..... A NA MI
5. Describe policies on transfers by District and its customers ..... A MA MI

G. Water Measurement, Pricing, and Billing

1. Agricultural Customers
   a. Total number of farms..... A NA MI
   b. Total number of delivery points ..... A NA MI
   c. Total number of delivery points serving more than 1 farm..... A NA MI
   d. Total number of measured delivery points..... A NA MI
   e. Percent of delivered water measured at delivery point…… ..... A NA MI
   f. Measurement device table..... A NA MI
2. Urban Customer
   a. Total number of connections ..... A NA MI
   b. Number of metered connections …… ..... A NA MI
   c. Number of connections not billed by quantity..... A NA MI
   d. Percent of water that was measured at delivery point ..... A NA MI
   e. Percent of water that was billed by quantity ..... A NA MI
   f. Measurement device table ..... A NA MI
3. Ag and Urban Customers
   a. Describe/attach current year water charges..... A NA MI
   b. Annual charges collected from customers (fixed and volumetric)..... A NA MI
   c. Describe or attach water-use data accounting procedures ..... A NA MI

H. Water Shortage Allocation Policies

1. a. Attach District's current year water shortage policies..... A NA MI
   b. Describe how reduced water supplies are allocated ..... A NA MI
2. Attach District's current year policies that address wasteful use of water and enforcement ..... A NA MI

I. Evaluate Policies of Regulatory Agencies

1. Discuss modifications and solutions for improved water management..... A NA MI

Section II: Inventory of Water Resources

A. Surface Water Supply

1. AF amounts of surface water delivered to the District by each of the Districts sources (see tables 1 & 8) ..... A NA MI

B. Groundwater Supply

1. AF amounts of groundwater pumped and delivered (see table 2) ..... A NA MI
2. Description of groundwater basin(s) that underlie the District..... A NA MI
3. Map of District operated wells and groundwater recharge areas..... A NA MI
4. Description of conjunctive use of surface & groundwater ..... A NA MI
5. For managed ground water basins, attach groundwater mgmt plan ..... A NA MI
6. For participation in groundwater banking, attach water banking mgmt plan .. A NA MI

C. Other Water Supplies
1. Long term water supplies not described above (see table 1) ..... A NA MI

D. Source Water Quality Monitoring Practices
1. Potable Water Quality - attach current Water Quality Rpt (Urban only) ..... A NA MI
2. Water quality concerns (Ag only) ..... A NA MI
3. Water quality testing program and the role of each participant (Ag only) ..... A NA MI
4. a. Water quality monitoring programs, surface (Ag only) ..... A NA MI
   b. Water quality monitoring programs, groundwater (Ag only) ..... A NA MI

E. Water Uses Within the District
1. Agricultural (see table 5) ..... A NA MI
2. Types of irrigation systems used by crop type and acre (Ag only)..... A NA MI
3. Urban use by customer type in current year ..... A NA MI
4. Urban wastewater collection & treatment systems ..... A NA MI
5. Groundwater recharge/management/banking ..... A NA MI
6. Transfers and exchanges into or out of the service area ..... A NA MI
7. Trades, wheeling, wet/dry exchanges or other transactions..... A NA MI
8. Any other uses of water ..... A NA MI

F. Outflow from the District (Ag only)
1. Provide a description of each surface and subsurface outflow point..... A NA MI
2. Description of outflow water quality testing program ..... A NA MI
3. Analysis of outflow water ..... A NA MI
4. Involvement in Water Quality Control Board requirements ..... A NA MI

G. Water Accounting (Inventory)
Table 1 ..... A NA MI
Table 2 ..... A NA MI
Table 3 ..... A NA MI
Table 4 ..... A NA MI
Table 5 (Ag only) ..... A NA MI
Table 6 ..... A NA MI
Table 7 (Ag only) ..... A NA MI
Table 8 ..... A NA MI

Section III: Best Management Practices (BMPs) for Agricultural Contractors

A. Critical Agricultural BMPs
1. Water measurement..... A NA MI
2. Designate water conservation coordinator..... A NA MI
3. Provide or support the availability of water mgmt services to water users ..... A NA MI
   a1. On-farm evaluations..... A NA MI
   a2. Crop and field water use info to customers..... A NA MI
   b. Normal year and real-time irrigation scheduling and crop ET info..... A NA MI
   c. Surface, ground and drainage water quantity and quality data ..... A NA MI
   d. Educational programs/materials for farmers, staff, public (attach samples)A NA MI
   e. Other ..... A NA MI
4. Pricing structure ..... A NA MI
5. Evaluate and improve efficiencies of the District's pumps..... A NA M

B. Exemptible Best Management Practices for Agricultural Contractors

1. Alternative land use	A	E	NA	MI
2. Facilitate use of available recycled water	A	E	NA	MI
3. Facilitate the financing of on-farm irrigation systems	A	E	NA	MI
4. Incentive pricing	A	E	NA	MI
5. a. Line or pipe ditches and canals	A	E	NA	MI
b. Regulatory reservoirs	A	E	NA	MI
6. Increase flexibility in ordering and deliveries	A	E	NA	MI
7. Spill and tailwater recovery systems (distribution and drainage)	A	E	NA	MI
8. Plan to measure outflow	A	E	NA	MI
9. Optimize conjunctive use	A	E	NA	MI
10. Automate canal structures	A	E	NA	MI
11. Facilitate or promote customer pump testing and evaluation	A	E	NA	MI
12. Mapping	A	E	NA	MI

C. Provide a 5Year Budget Best Management Practices	A	NA	M

Section IV: Best Management Practices for Urban Contractors

A. Urban BMPs

Foundational BMPs

1. Utilities Operations				
1.1 Operations Practices	A	E	NA	MI
1.2 Water loss control	A	E	NA	MI
1.3 Metering	A		NA	MI
1.4 Retail Conservation Pricing	A	E	NA	MI
2. Education Programs				
2.1 Public Information Programs	A	E	NA	MI
2.2 School Education Programs	A	E	NA	MI

Programmatic BMPs

3. Residential	A	E	NA	MI
4. CII A	E		NA	MI
5. Landscape	A	E	NA	MI

B. Provide a 5-Year Budget for Implementing BMPs	A	NA	MI

Attachments

Attachment A - District Maps	A	NA	MI
Attachment B - District Rules and Regulations	A	NA	MI
Attachment C - Measurement Device Documentation	A	NA	MI
Attachment D - District Sample Bills	A	NA	MI
Attachment E - District Water Shortage Plan	A	NA	MI
Attachment F - Groundwater Management Plan (if applicable)	A	NA	MI
Attachment G - Groundwater Banking Plan (if applicable)	A	NA	MI
Attachment H - Annual Potable Water Quality Report – Urban	A	NA	MI
Attachment I - Notices of District Education Programs Available to Customers	A	NA	MI
Attachment J - District Agricultural Water Order form (if applicable)	A	NA	MI
Attachment K - Drainage Problem Area Report (if applicable)	A	NA	MI
Attachment L - Other	A	NA	MI

FLOW MEASUREMENT CALIBRATION AND MEASUREMENT

Flow measurement for agricultural irrigation delivery can be accomplished with four general approaches. These categories are generalized below.

1. Standard pipeline measurement
2. Standard open channel measurement
3. Non-standard open channel measurement
4. Other measurements

Category I

The first category includes devices with totalizers that measure volume. These devices might measure velocity, flow rate or volume directly. All of these devices will provide a direct volumetric reading. The devices in Category I include:

- Propeller meters
- Venturi meters with flow recorders
- Magnetic meters
- Acoustic meters

These have a high level of accuracy with proper installation and periodic maintenance and calibration.

Category II

The second category involves devices used for open channels. The second category includes:

1. Standard flow measurement devices that measure flow rate and also require accurate measurements (hourly or more frequently) of water level or,
2. The same standard devices combined with excellent canal water level control using positive means such as flap gates, long-crested weirs, or properly designed PLC-controlled water level control gates.

In all cases, the total delivery time must be accurately known to give a final volumetric answer within +/- 6%. The following devices, if properly designed, installed, calibrated, and maintained, can qualify as "standard" flow measurement devices:

1. Replogle and Parshall flumes
2. Rectangular or trapezoidal (Cipolletti) or V-Notch weirs
3. Canal meter gates (canal meter gates only qualify if both upstream and downstream water levels can be measured at the proscribed locations)
4. Various orifice devices

Category III

The third category includes non-standard, individually calibrated flow measurement devices. These are often special measurement devices developed by an irrigation project. Typically, there are no published standard dimensions or flow tables for such devices. Requirements for acceptability would include:

1. Consistent dimensions and installations
2. Accurate determination of delivery time
3. Local calibration and a verification of accuracy, based on a representative sample number of devices measured over time (see guidelines later in this document)
4. A proposed schedule for maintenance and calibration

Devices in this category also require:

1. Accurate measurements of water level (taken hourly or more frequently), or
2. Excellent water level control using positive means such as flap gates, long-crested weirs, or properly designed PLC-controlled water level control gates, along with delivery time to determine volumes, or

3. Adequate delivery pools for accurate deliveries (demonstrated with a verification procedure)

This category also includes calibrated pumps in cases where the suction-side water level fluctuation is small when compared to the total lift (+/- 5 percent) and the discharge pressure does not change with time.

Category IV

A fourth category includes using rough estimates of flow rate or volume, such as flow-rate estimates at check structures or the sum of siphon tubes (or other methods of measurement not specified here). These approaches are NOT acceptable since they do not provide a documented reasonable degree of accuracy.

Table 1 on the following pages shows a general outline of the devices and the expected accuracy of the devices. This table shows that many of the devices used for irrigation flow measurement can have a good accuracy if installed correctly. The table also provides the references for the potential maximum accuracy of irrigation measurement devices.

Table 1. Device flow rate accuracy values (to aid with developing CWD XX10608.48(i) regulations)
(Note: The information entered below will be posted on a public website)

		Potential Flow Rate Accuracy Assuming Proper Installation and Maintenance				
Device Category	**Example Types**	**USBR Lab (Flow Rate)**	**ILRI20 Lab (Flow Rate)**	**Reference & Notes (see footnotes for links to references)**	**ITRC Field (Flow Rate)**	**Reference and Notes**
Pipeline		**%**			**%**	
Propeller meters		2%	5%	USBR - Section 14-4, pg. 14-12. ILRI20-Table 3.1, Section 9.7. Must have at least 8-10 diameters upstream and 4 diameters downstream. Meters must be maintained and checked for accuracy at least every 5 years. See the link below from the USBR-MPR for the maintenance and protocol requirements. ITRC notes: It is possible to place customized flow conditioning upstream that minimizes errors due to rotating flow and non-symmetric flow. Propeller meters are sensitive to trash accumulation. Some models have serious bearing problems with sand/silt.	5%	Estimated by ITRC
Magnetic Meters	Full bore	1%	-	USBR - Section 14-6, pg. 14-18. Recommended to have at least 2 diameters upstream and 1 diameter downstream. Major differences between manufacturers. Some have built-in flow conditioning. One of the most accurate flow measurement devices.	3%	Estimated by ITRC
	Insert	-	-	ITRC notes: Insert meters must have an excellent straight section of pipe upstream and downstream; accuracy is limited. Not recommended for turnouts.	?	
Acoustic Meters	Transit Time	2%	-	USBR - Section 11-1, pg. 11-3. ITRC notes: Results with “dry” transducers can be variable	5%	Estimated by ITRC
	Doppler	2%	-	USBR - Section 11-8, pg. 11-15. Highly dependent on the canal section to obtain good accuracy. ITRC notes: There are huge differences in quality among the manufacturers. Some are excellent; some are very undependable and have been abandoned by irrigation districts.	5%	Estimated by ITRC

		Potential Flow Rate Accuracy Assuming Proper Installation and Maintenance				
Device Category	**Example Types**	**USBR Lab (Flow Rate)**	**ILRI20 Lab (Flow Rate)**	**Reference & Notes (see footnotes for links to references)**	**ITRC Field (Flow Rate)**	**Reference and Notes**
Differential head meters	Venturi	1%	-	USBR - Section 14-3	5%	Estimated by ITRC
	Orifice	1%	-	USBR - Section 14-3. ITRC notes: Few orifice meters used in agricultural irrigation turnouts because of narrow range of flow rate accuracy, head loss, and difficulty in measuring the difference in head. Not recommended for turnouts.	?	
Electricity KWH meter				ITRC notes: Not recommended. Some users will use flow rate from a pump test and extrapolate a value for AF/KWH. This approach is very inaccurate.	50+%	Estimated by ITRC
Open Channel						
Metergates		2.5%	6%	USBR - Section 9-14, pg. 9-23. ILRI20 - Table 3.1, Section 8.6. Main issue is that the standard conditions used to create the flow tables must be met. In addition, the following specific conditions must be met: - "Zero" height is when the gate starts to leak and must be verified for each gate. - Always pull up on shaft to take a reading. - Keep the bottom of the gate entrance clean/clear to maintain a constant flow characteristic. - A water level in the downstream pool is not the same as a properly set stilling well 12-in behind the gate - Eddies or vortexing at the gate entrance will generally cause an overestimation of the flow rate - The accuracy is poor if the gate is more than 70% open. If installed according to a manufacturer's specifications, with a well-calibrated chart provided by the manufacturer, results can be good.	5%	Estimated by ITRC
Calibrated slide or sluice gates		2%	-	Estimated by ITRC. ITRC notes: Numerous conditions for calibration must be met, as with metergates. Standard textbook calibrations are rarely satisfactory. Calibration must correspond to the specific dimensions and inlet/outlet conditions. Must constantly be in either free flow or submerged conditions.	5%	Estimated by ITRC
Pipelines		**%**			**%**	
Constant Head Orifice		3%	7%	USBR - Section 9-11b, pg. 9-14. ILRI20 - Table 3.1, Section 8.3. The poor accuracy reported by ILRI20 was based on information from the 1980s, and because of inherent dislike of CHOs that were inappropriately used in foreign projects. The 2nd gate simply maintains a submerged condition on the first gate. Same accuracy as calibrated slide or sluice gates.	5%	Estimated by ITRC

		Potential Flow Rate Accuracy Assuming Proper Installation and Maintenance				
Device Category	**Example Types**	**USBR Lab (Flow Rate)**	**ILRI20 Lab (Flow Rate)**	**Reference & Notes (see footnotes for links to references)**	**ITRC Field (Flow Rate)**	**Reference and Notes**
Weirs	Rectangular	1%	1%	USBR - Section 7-17. ILRI20 - Table 3.1, Section 5.1. ITRC notes: In general, there is insufficient head in California for widespread usage of these.	5%	Estimated by ITRC
	V-notch	1%	1%	USBR - Section 7-17, Section 7-11, pg. 7-20. ILRI20 - Table 3.1, Section 5.2. ITRC notes. In general, there is insufficient head in California for widespread usage of these.	5%	Estimated by ITRC
	Cipoletti	1%	5%	USBR - Section 7-17. ILRI20 - Table 3.1, Section 5.3. ITRC notes: In general, there is insufficient head in California for widespread usage of these.	5%	Estimated by ITRC
Acoustic Meters	Transit Time	2%	-	USBR - Section 11-1, pg. 11-3. Must be maintained and field verified weekly. ITRC notes: Generally not applicable to turnouts.	5%	Estimated by ITRC
	Doppler	2%	-	USBR - Section 11-8, pg. 11-15. Highly dependent on the canal section to obtain good accuracy. ITRC notes: There are huge differences in quality among the manufacturers. Some are excellent, some are very undependable and have been abandoned by irrigation districts.	5%	Estimated by ITRC
	Doppler with Control Section	-	-	New structure design by ITRC. Uses a structure to straighten the stream lines in combination with an uplooking doppler. http://cedb.asce.org/cgi/wwwdisplay.cgi?267867. With a high quality of doppler, this can be an excellent technique	3%	Estimated by ITRC
Flumes	Parshall	2%	3%	USBR - Section 8-10, pg. 8-21. Not recommended by USBR for new installations (pg. 8-40). ILRI20-Table 3.1, Section 7.4	5%	Estimated by ITRC
	Replogle Flumes, aka "Ramp flume," "broadcrested weir"	2%	3%	USBR - Section 8.8a, pg. 8-21. ILRI20 - Table 3.1, Section 7.1. ITRC notes: These can be excellent if designed and maintained properly. Very sensitive to incorrect design, not using as-built dimension in rating tables, incorrect positioning of "zero" on staff gauge, and poor downstream conditions that cause submergence at high or low flows. Nevertheless, can be excellent in the correct situation	3%	Estimated by ITRC
	Cutthroat flumes	-	-	ITRC notes: Not recommended. Although they received considerable attention in Colorado, subsequent work indicates they have poor accuracy		
Radial Gate		-	5%	USBR - Section 9.13. Reported as complex to evaluate. ILRI20 - Table 3.1, Section 8.4. Rarely, if ever, used for turnouts.	5%	Estimated by ITRC

USBR Reference (9mB)

http://www.usbr.gov/pmts/hydraulics_lab/pubs/wmm/wmm.html
Water Measurement Manual, A Water Resources Technical Publication\
U.S. Department of the Interior, Bureau of Reclamation, Third Edition - 2001

ILRI20 Reference (18.6 mB):

http://content.alterna.wur.nl/Internet/webdocs/ilri-publicaties/publicaties/Pub20/pub20.pdf
Discharge Measurement Structures (third edition), 1976/1989

Calibration and Measurement

Category I - Pipeline

There are four types of meters that can be used for velocity, flow rate, and volume measurements in pipelines. These devices, when placed at the correct location with a known area, can be very accurate with proper installation and periodic maintenance and calibration.

1. Propeller – Flow Meters
2. Venturi Meters
3. Magnetic Meters
4. Acoustic Meters

Table 2. Pipelines Meter Details

Meters	Installation	Maintenance	Calibration
Propeller Flow Meters	The inside diameter of the pipe (see Figure 2) must be known and supplied to the manufacturer. The meter must be centered in the pipelines in order to be accurate. Meters should be operated at greater than 1 foot/second.	Remove trash before it gets to the meter or frequently clean the propellers. Also, sand and normal wear can cause the propeller to not spin freely. The problem may show up as a more erratic needle movement.	Calibration is typically done by sending the unit back to the manufacturer on a regular maintenance cycle (every 2-5 years depending on experience). Field checks of meters can be done using a portable acoustic meter (transit time type).
Venturi Meters	Manufacturers of the Venturi meters should be requested to furnish the rating tables for the unit purchased. These meters are susceptible to turbulence.	The tubes used to measure the pressure can easily become plugged so they must be checked periodically.	Field calibration can be done using an insert pitot tube or a portable acoustic meter (transit time type).
Magnetic Meters	Spool type magnetic meters can be very accurate even with turbulence in the pipeline. A spool meter is one that comes with a factory section of pipeline. These can be more accurate since the inside diameter is controlled by the manufacturer. Insert magnetic meters should follow propeller meter installation guidelines.	Low maintenance on spool magnetic meters. Insert meter sensors must be periodically cleaned.	Field checks of meters can be done using a portable acoustic meter (transit time type).
Acoustic Meters	Acoustic meters can be used in both pipelines and channels. Acoustic meters should follow propeller meter installation guidelines.	Transducers (see Figure 4) must be periodically cleaned. It is important to avoid multipath interference and signal bending from solar heating.	Normally, these devices are not field calibrated.

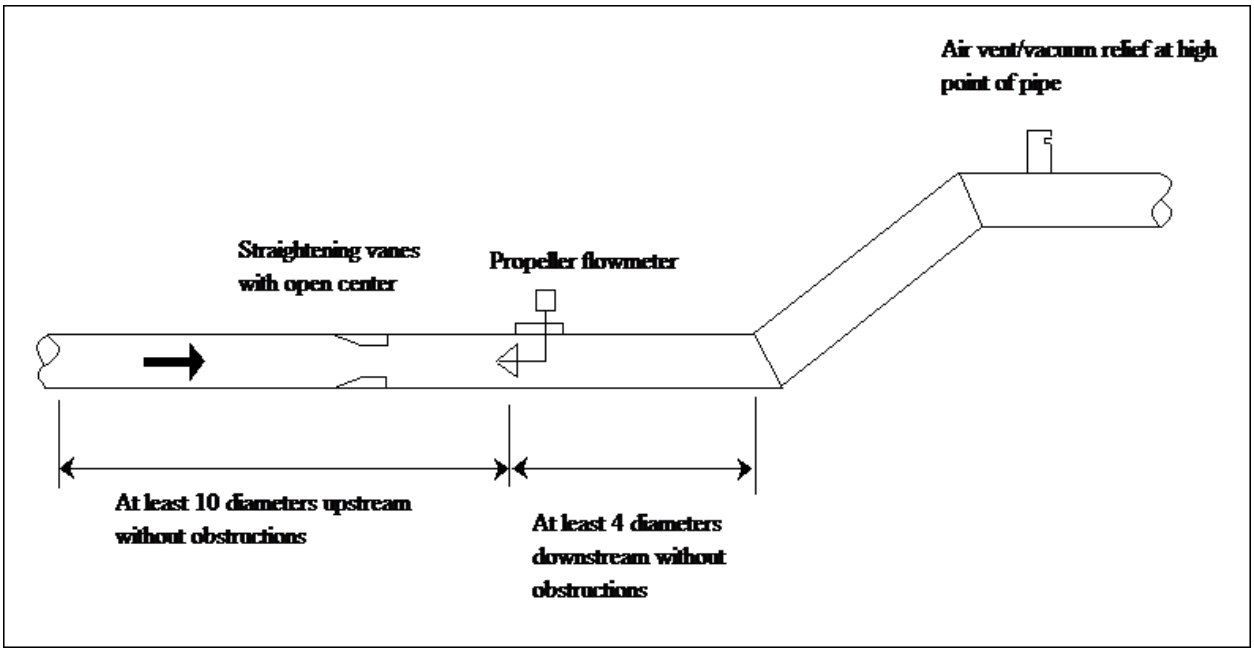


Figure 1. Example of a propeller meter measurement device

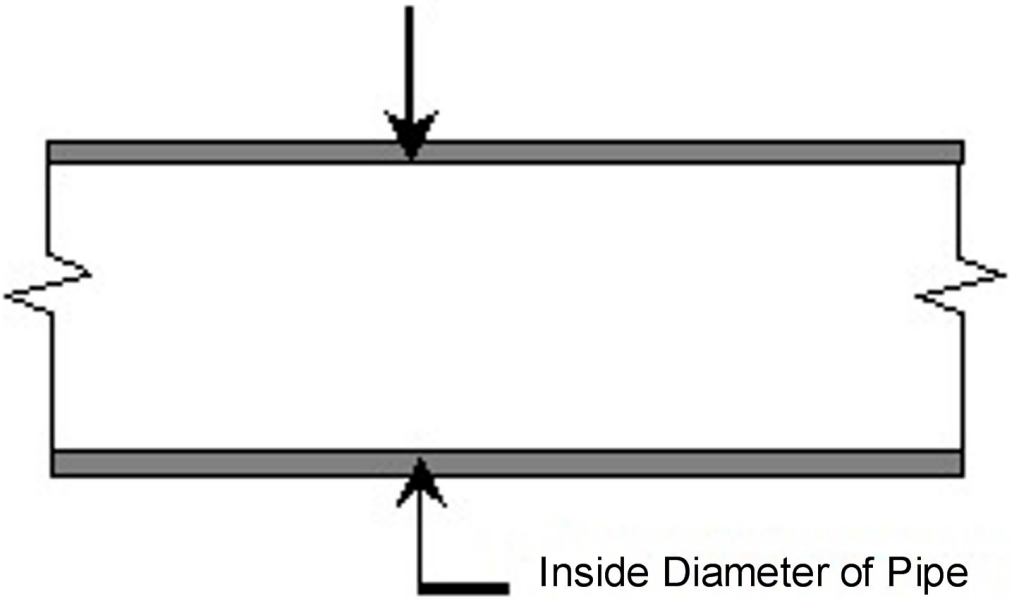


Figure 2. Inside Diameter (ID) of a pipe

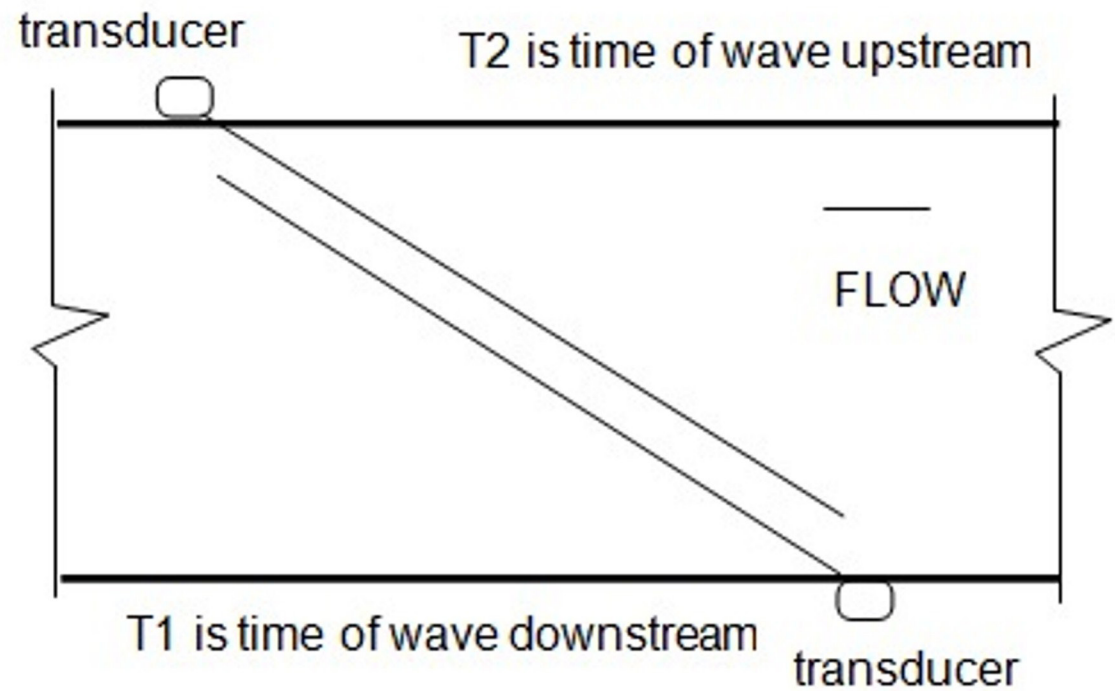


Figure 3. Acoustic Meter (Transit time style in pipeline)

Category II – Standard Open Channel
The second category includes standard flow measurement devices that measure flow rate and also require accurate measurements of delivery time to determine volumes:

1. Replogle and Parshall Flumes
2. Rectangular, Trapezoidal (Cipolletti), and V-Notch Weirs
3. Canal Meter Gates
4. Acoustic Meters

These devices require proper installation, regular recording of flow rates and delivery times, adjustments for approach velocity (in some cases such as the weirs), regular maintenance and calibration for good accuracy.

Table 3. Standard Open Channel Device Details

Flumes, Weirs and Gates	Installation	Maintenance	Calibration
Replogle and Parshall Flumes	It is essential that the entrance of the control section of the flume be level in the direction of the flow. Water must be moving "straight" toward the flume. The flume should be located about 10 times the average channel width downstream of checks, gates, or bends in the channel. Staff gages must be zero stage referenced. Staff gauges set too high will underestimate the actual flow rate.	It is important to keep the stilling wells (see Figure 4) from being plugged or partially plugged. The surfaces of the flume must be kept relatively clear of moss and sediment buildup. Limits of submergence should be checked at high and low-flow rates.	Can be installed with an accuracy of +/- 5 percent. The rating curve used for the flume can be field-verified using a current meter.

Flumes, Weirs and Gates	Installation	Maintenance	Calibration
Rectangular and Trapezoidal Weirs (Cipolletti)	It is important that the weir crest be horizontal and level and for the sides of the rectangular weir to be vertical. The water must be moving straight into the weir, and the face of the weir must be vertical.	It is important to keep the stilling wells from being plugged or partially plugged. Flow into and out of the weir should be as smooth as possible. Sediment accumulation below the weir crest should be removed.	Rating tables must be adjusted to account for the **velocity of approach** for calibration. Rating tables must be checked for the correct weir (i.e., contracted weir vs. suppressed weir). Rating tables must be adjusted for submergence or slanted conditions.
V-Notch Weir	It is important to determine which size of notch (how many degrees) is being used so that the correct flow-rate table can be used. It is also important to determine if there are any errors in the construction of the notch. The water must be moving straight into the weir, and the face of the weir must be vertical.	Same as the rectangular and trapezoidal weirs above.	Same as the rectangular and trapezoidal weirs above.
Canal Meter Gates	1. "Zero" height of the stem is when the flow starts to leak through the gate (see Figure 5). 2. Always pull up on shaft (via the turning wheel) before taking measurement. 3. Keep the bottom of the gate entrance clean. 4. A change in pipe material several diameters downstream of the gate will not affect the accuracy. 5. A water level in the downstream pool is not the same as a water level measured in a whistle pipe (see Figure 6). 6. Eddies at the gate entrance will generally cause an overestimation of the flow rate. 7. The accuracy is poor if the gate is more than 70 percent open.	Flow toward and into the structure should be as smooth as possible. Obstructions should be removed to improve the entrance conditions. Remove accumulations of sediment, because they may reduce the actual area of orifice. Debris, such as weeds, should also be removed.	Manufacturer's specifications must be followed precisely in order to obtain accurate flow rate measurements.
Acoustic Meters	Acoustic meters can be used in both pipelines and channels. Acoustic meters in canals are generally the Doppler style meters.	Transducers must be periodically cleaned. The units need to be free of moss/algae to operate.	For calibration by current-meter measurement, it is essential to place the device in a cross section that will not change significantly. If the transducers are placed out in the channel, the triangular side areas not measured must be accounted for in the calibration.

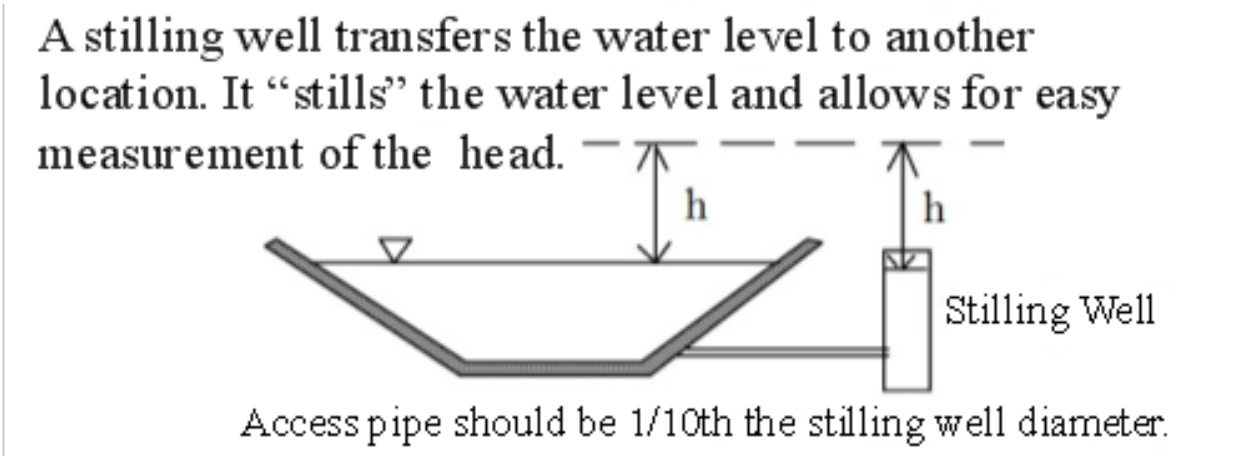


Figure 4. Stilling well used for open channel flow

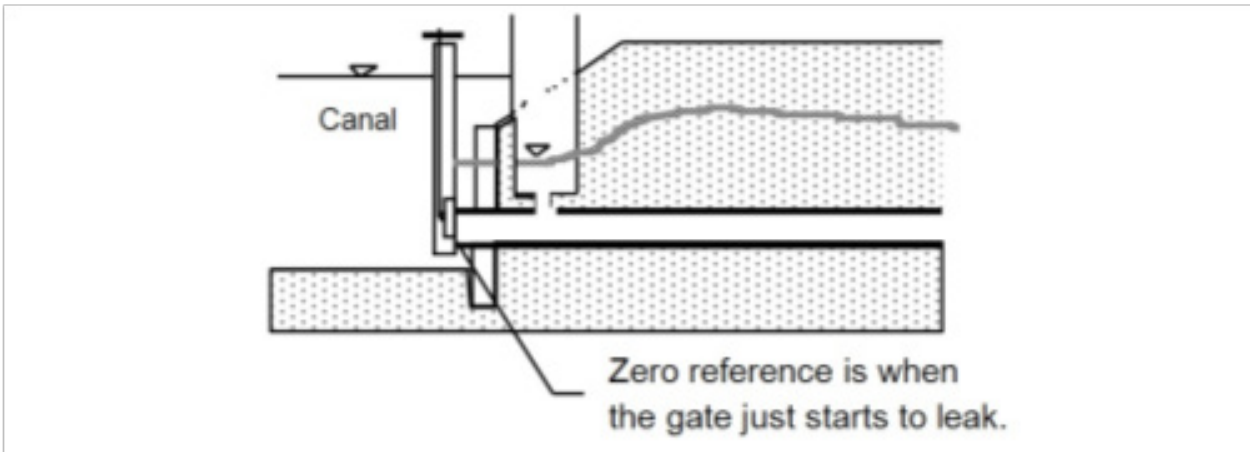


Figure 5. "Zero" reference for a meter gate

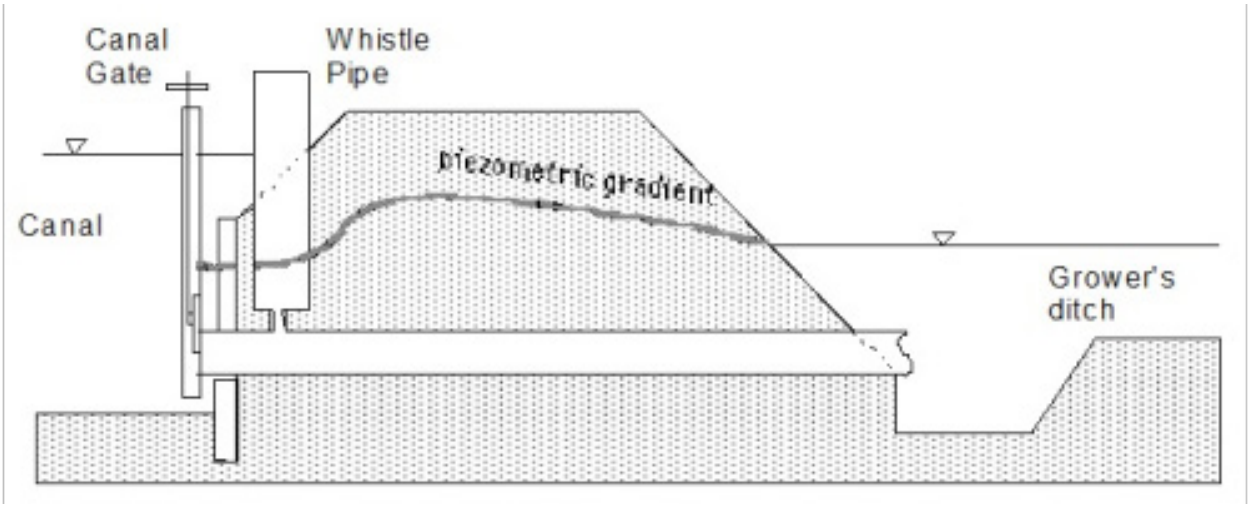


Figure 6. Cross section of a meter gate showing the water pressure through the pipe.

Category III – Non-Standard Open Channel

The third category includes non-standard, calibrated flow measurement devices. This category includes special measurement devices developed by a district. Typically, there are no published standard dimensions or flow tables for such devices. Acceptability for devices in this category would require: consistent dimensions and installations; accurate determination of delivery time; local calibration and a verification of accuracy, based on a representative sample number of devices measured over time; and a proposed schedule for maintenance and calibration.

The following steps can be used to calibrate a non-standard structure:

1. Use a current meter to calibrate the non-standard structures. The individuals who will perform the current metering need to demonstrate proficiency in the required skills to perform the measurements. They need to follow manufacturers' guidelines for the in-situ field measurements.
2. The individuals making current meter measurements will need to use an established site such as a calibrated Replogle flume to verify their proficiency in making good current meter readings.
3. Non-standard structures have certain requirements that must be met in order to be calibrated. If these conditions cannot be met, it is useless to spend time calibrating the structure. These required conditions include:
   a. Good entrance conditions with a low velocity (Froude number less than 0.5).
   b. If the device to be calibrated is located right next to a supply canal (within 10 feet or so), the supply canal must have a fairly constant velocity.
   c. The staff gauge must be "zeroed."
   d. There must be no moss/algae buildup. That is, the conditions must not change with time.
4. The recommended calibration procedure for a non-standard site that meets the above conditions is as follows:
   a. A wide spread in the measured flow rate for calibration is required. At least a 2:1 ratio in the flow rates should be used to create the table.
   b. A **minimum of 10** values should be measured across the flow rate range.
   c. Data should be plotted on a graph. See **Figure 7** on the next page. Such a graph is a standard option in programs such as Microsoft Excel.
   d. The data should be plotted as a line. A program such as Microsoft Excel can be used to determine the calibration or the flow equation. For open channel devices, the equation should be of the form: $H = KQx$, where "x" is a value between 0.4 and 0.7.
   e. The regression coefficient (R2) must be reported as well as the standard deviation. The USBR Water Measurement standard details the calculation for uncertainty. **Table 4** can be used as a guide to rate the quality of the calibration.

Verification of Errors in Volumetric Measurement

After a flow rate is measured and adjusted, turnout flow rates can vary with time due to changes in canal water level. The magnitude of the flow rate change will depend upon:

- The average change in water level across the turnout.
- The magnitude of the canal water level change.

The verification continues as follows:

1. Provide documentation of data obtained and computations used, to verify the volumetric errors that occur due to the canal water level changes.
2. Compute the errors with the time-averaged change in canal water level at each of the 15 monitored turnouts.
3. Compute the error in volume using Table 5.

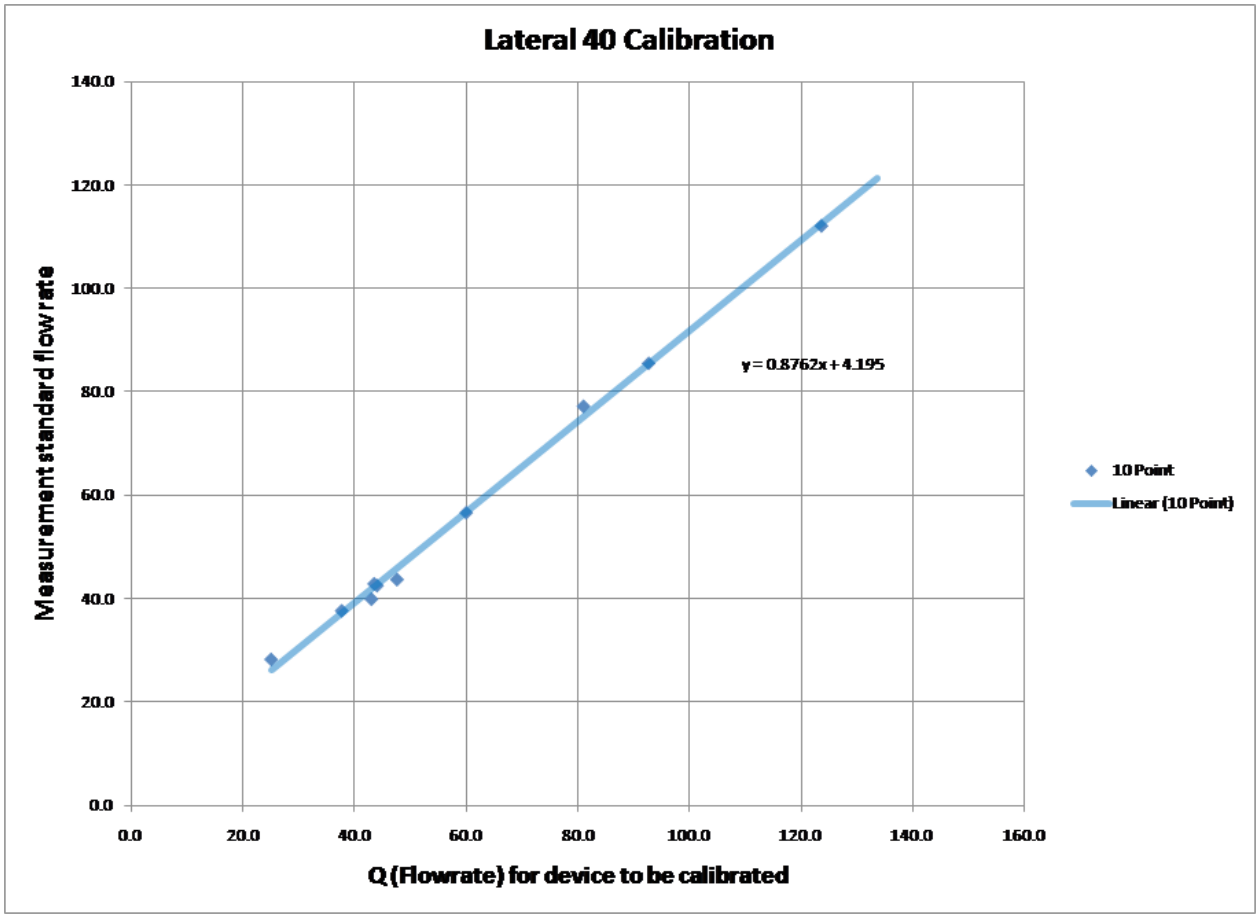


Figure 7. Plot of the calibration data

Table 4. Statistical evaluation of a calibrated site

Uncertainty Based on: 1 Standard Deviation

“Excellent” means ≤ 2%
“Good” means ≤ 5%
“Fair” means ≤ 8%
“Poor” means ≥ 8%

The following is an example of how the table is used:

If the head loss across the turnout was 0.5' when the flow rate was set and measured and the average water level during the delivery raised by 0.2', then the error in the volume measurement was 14.4% – assuming a perfectly accurate flow measurement and no other cause of error. Because this exceeds the 6% allowable variation even with a perfect instantaneous flow measurement device, the cell for the 14.4% is shaded.

Only those **unshaded** cells qualify for acceptable conditions – with a perfect instantaneous flow measurement device.

4. Include the following documentation for this time-related error, for each turnout:

   a. Both tabular and graphical data showing the recorded canal water levels during turnout deliveries, with a recording frequency. Clearly show the time(s) of flow measurement.
   b. A description of the turnout.
   c. The computations used to determine the average change in canal water level.
   d. The corresponding error (from Table 5) in volume measured.

Table 5. Evaluation of the impact of water level fluctuation

Average Error in Volume Measurement, %								
	Average **rise** in the pool water level after the initial flow measurement, ft.							
Initial Head across the turnout, ft.	0.10	0.15	0.20	0.25	0.30	0.35	0.40	0.45
0.1	32.0	44.3	55.2	65.1	74.1	82.5	90.4	97.8
0.2	17.6	25.1	32.0	38.3	44.3	49.9	55.2	60.2
0.3	12.2	17.6	22.7	27.4	32.0	36.2	40.3	44.3
0.4	9.3	13.6	17.6	21.4	25.1	28.6	32.0	35.2
0.5	7.6	11.1	14.4	17.6	20.7	23.6	26.5	29.3
0.6	6.4	9.3	12.2	14.9	17.6	20.2	22.7	25.1
0.7	5.5	8.1	10.6	13.0	15.3	17.6	19.8	22.0
0.8	4.8	7.1	9.3	11.5	13.6	15.6	17.6	19.5
0.9	4.3	6.4	8.4	10.3	12.2	14.0	15.8	17.6
1.0	3.9	5.7	7.6	9.3	11.1	12.8	14.4	16.0
1.2	3.3	4.8	6.4	7.9	9.3	10.8	12.2	13.6
1.4	2.8	4.2	5.5	6.8	8.1	9.3	10.6	11.8
1.6	2.5	3.6	4.8	6.0	7.1	8.2	9.3	10.4
1.8	2.2	3.3	4.3	5.3	6.4	7.4	8.4	9.3
2	2.0	2.9	3.9	4.8	5.7	6.7	7.6	8.5
2.5	1.6	2.4	3.1	3.9	4.6	5.4	6.1	6.8
3.0	1.3	2.0	2.6	3.3	3.9	4.5	5.1	5.7

Average Error in Volume Measurement, %								
	Average **drop** in the pool water level after the initial flow measurement, ft.							
Initial Head across the turnout, ft.	0.10	0.15	0.20	0.25	0.30	0.35	0.40	0.45
0.1	100.0	n/a	n/a	n/a	n/a	n/a	n/a	n/a
0.2	24.2	42.6	100.0	n/a	n/a	n/a	n/a	n/a
0.3	15.0	24.2	35.6	51.2	100.0	n/a	n/a	n/a
0.4	10.9	17.1	24.2	32.5	42.6	56.5	100.0	n/a
0.5	8.5	13.3	18.5	24.2	30.7	38.2	47.5	60.2
0.6	7.0	10.9	15.0	19.4	24.2	29.5	35.6	42.6
0.7	6.0	9.2	12.6	16.2	20.1	24.2	28.7	33.8
0.8	5.2	8.0	10.9	13.9	17.1	20.6	24.2	28.2
0.9	4.6	7.0	9.6	12.2	15.0	17.9	21.0	24.2
1.0	4.1	6.3	8.5	10.9	13.3	15.8	18.5	21.3
1.2	3.4	5.2	7.0	8.9	10.9	12.9	15.0	17.1
1.4	2.9	4.4	6.0	7.6	9.2	10.9	12.6	14.4
1.6	2.5	3.9	5.2	6.6	8.0	9.4	10.9	12.4
1.8	2.3	3.4	4.6	5.8	7.0	8.3	9.6	10.9
2	2.0	3.1	4.1	5.2	6.3	7.4	8.5	9.7
2.5	1.6	2.4.	3.3	4.1	5.0	5.9	6.7	7.6
3.0	1.3	2.0	2.7	3.4	4.1	4.8	5.6	6.3

Combining Volumetric Measurement Error with Canal Water Level Fluctuation

Present the following information in a summary table for each turnout:

1. Turnout
2. Turnout design
3. Location of turnout (ID)
4. Previously computed flow measurement error, % (note: these are rarely more accurate than +/- 3%)
5. Computed volumetric error due to changes in canal level, %
6. Combined volumetric error. This last number is computed as follows:

$$\text{Combined \% error} = \sqrt{(\text{\% flow meas. error})^2 + (\text{\% volumetric error})^2}$$

For example, if the flow measurement error of a device is 4%, and the volumetric error caused by canal water level fluctuation is 4.5%, then:

$$\text{Combined error} = \sqrt{4^2 + 4.5^2} = 6.02\% = 6\%$$

For more information and support on measurement and calibration, please contact the Cal Poly Irrigation Training and Research Center at (805) 756-2434.

References

Bureau of Reclamation Water Measurement Manual - 3rd Edition(2001)

Cal Poly Irrigation Training and Research Center - Flow Measurement (2011)

This page intentionally left blank

RECOMMENDED DOCUMENTATION

Velocity, Flow Rate, Volumetric Accuracy

This procedure involves providing documentation to verify the accuracy of the **instantaneous flow measurement** at individual turnouts. The documentation includes the following four key points:

1. **Turnout calibration equations**
   a. If all similar turnouts (such as meter gates of a specific size) use the same equation of discharge, provide a description of all such similar groups along with their discharge equations and calibration coefficients.
   b. If turnouts have been individually calibrated, provide a list of turnouts, locations, equations, and various calibration coefficients that have been developed.
2. **Standardization of inlet and valve conditions**. Provide photos of at least 10 devices of each of the same design showing verification that the inlet, valve placement, etc. conditions are the same within each group (e.g., if there are four different designs (not sizes), there would be four groups of photos, each group with 10 turnouts).
3. **Procedures and equipment for flow rate verification**. Provide documentation of field procedures and equipment used to verify instantaneous flow rates for discharge equation calibration purposes, through at least 15 turnouts that span the range of possible designs and conditions of turnouts in the district. This verification procedure has to be conducted with accurate flow measurement verification equipment to avoid errors.
4. **Equations for flow measurement verification**. Provide well-explained computations and equations used for verification of flow measurement accuracy for each type of turnout (e.g., what % accuracy, on what percentage of delivered volumes).
   a. Combine this accuracy with the inaccuracy in volume measurement that is inherent with varying canal water levels or pipeline pressures (described in Chapter 10) to compute the overall accuracy of the volumetric measurements of the district.
   b. Show all equations and values in a neatly organized, well-explained procedure.

The following is an example of the documentation completed by an irrigation district. This was done following the protocol above. This documentation also meets with the criteria developed for the SBx7-7.

Example: Required Flow Measurement Accuracy

Computations

The required flow measurement accuracy was computed as:

Max. acceptable device flow rate error =

$$\sqrt{\left(1-\frac{VA}{100}\right)^2 - ARD^2 - CBP^2 - CWLF^2}$$

where

VA = Volumetric accuracy required (88%)

ARD = errors due to improper recording of durations, %/100

CBP = errors due to a change in "backpressure" on the metergate, %/100

CWLF = errors due to canal water level fluctuations, %/100

Of these, good data only exists on the CWLF (errors due to canal water level fluctuations). The other errors are recognized by districts as existing, but in general the districts believe that the errors are minor or cancel out over time. Therefore, the

other errors are not factors with even minimal documentation. Nevertheless, the district has made a reasonable attempt to quantify these errors, and spent considerable effort in documenting them.

ARD

The error of the recording of the deliveries is estimated based on the following:

- Typical duration of an irrigation event = 68.6 hours
- Likely average discrepancy in recording the duration properly = 0.5 hours. If the farmers shut off the turnouts, they call the operators by cell phone right away to inform them. An examination of the delivery records showed large numbers of recorded final day irrigations with numbers such as 7.6 hours, 18.3 hours, etc., all indicating that the shutoff time is well recorded.

  % error for a single event/100 = (0.5/68.6) = **.007**

CBP

The error due to changes in backpressure on the metergates must be assessed considering three items:

- The average head across the gates (water level-water level). This was measured in the sample of metergates that was used for the canal level fluctuation test. The average head across the tested metergates was 1.25 feet. However, for this analysis, *a worse average case of 1.00 feet was used*.
- The possible change in the downstream water level with time or variation in head. This is estimated to average about *0.3 feet* between the first and second set- with an average impact on the flow for only 25% the set duration because the flow is checked by the operators on the average 2 times per delivery, and the backpressure usually only changes once (as the sets move down the field). *For this example, a value of -0.3 ft was used for variation in head*.
- The percent of time is based on the time that a fluctuation might affect the reading over a set duration. This calculation assumed a 48-hour irrigation duration. Because typical furrow irrigation set times are about 12 hours, this means that there would be an error for 1/2 of the first day, or approximately *25 % of the time*

  Mathematically, a change in downstream backpressure is treated differently than a change in canal (supply) water level. This is because if the water level in the farm ditch changes, it will not appreciably influence the water level in the supply canal. If the water level in the supply canal changes, it will also influence the level in the farm ditch (see the CWLF discussion, below)

CBP (%/100) = (0.25, or 25% of time) ×ABS[((total head + variation in head)/total head)^.5 - 1]

= 0.25 × ABS[(1.0 - 0.3/1.0)^.5-1]
= **.041**

CWLF

The error due to canal water level fluctuations. The turnout flow rates are typically checked once per day, and a new flow rate is either noted on the records, or the flow rate control device is re-adjusted to provide the target flow rate. During any 24-hour period, the canal water levels will fluctuate, resulting in a delivery of more or less flow rate than was originally set.

The district collected the data described here, to be used to determine if the hourly fluctuations cancel out over the course of an irrigation season. The data was collected from multiple locations throughout the district, over a time period from June 8 to July 11, 2012. Canal levels were recorded automatically on an hourly basis. The total change in water level across the turnout [(water surface in the canal) - (water surface in the downstream ditch)] was also recorded at the start of each datalogging session. The irrigation district has typical flashboard check structures to maintain water levels in the majority of its locations.

A series of 22 sites were analyzed for 48-72 hours. It is believed that these sites are representative of the range of conditions throughout the district. No special management of the check structures was involved; the canal operators were unaware that the levels were being recorded.

In order to assess the error of volumetric flow rate measurement in the canal system, first the fluctuations in water level must be computed. A model was constructed by ITRC to measure the percent error of the water level over a 24-hour period from a given starting point in the sample set.

The raw data was normalized so that canal fluctuations would be represented as a percentage of the head difference. In this way, all the data points could be accumulated to create a contiguous set of hourly fluctuations for the model data set. The resulting model contained a total of 5500 hourly data points.

A sample set was generated from the model. The sample set contained three different blocks. Each block had 30 different seasons with varying numbers of irrigations events per season. Block 1 had 30 seasons of ten 24-hour irrigations, Block 2 had 30 seasons of twenty 24-hour irrigations, and block 3 had 30 seasons of thirty 24-hour irrigations.

The starting points for the irrigation events in each season were selected by a random number generator. The error was recorded for each hour from the starting point for a total 24 hours. Thus, each irrigation event consisted of 24 data points, resulting in a total of 21,600 data points sampled for all of the seasons in all 3 blocks.

If the present water level for a moment during an irrigation event in the model is equal to the starting water level for that event, then the percent error at that moment is zero. The percent error at each recorded time during an irrigation is calculated by the following equation:

$$\text{\% Error at a moment} = \frac{\text{Present Water Level - Initial Water Level}}{\text{Initial Change in Head}} \times 100$$

Where "Initial Water Level" is the water level when the 24-hour irrigation began.

The characteristics of the population of "errors" in water level are shown in Figure 2.

The variation in relative water levels over time is interesting, but of more interest is the impact on turnout flow rates. There are two possible situations, described below:

1. The flow measurement device is operated under "free flow". That is, the water jets out from it, and the flow rate through the orifice device is not affected by changing downstream water levels. The variation in flow rate over time can be computed, based solely on the upstream water level change. In this case, the sensitivity of the turnout flows to canal water levels is computed as:

   $$\text{Free Flow Error} = (1 + \text{Level Error})^{0.5} - 1$$

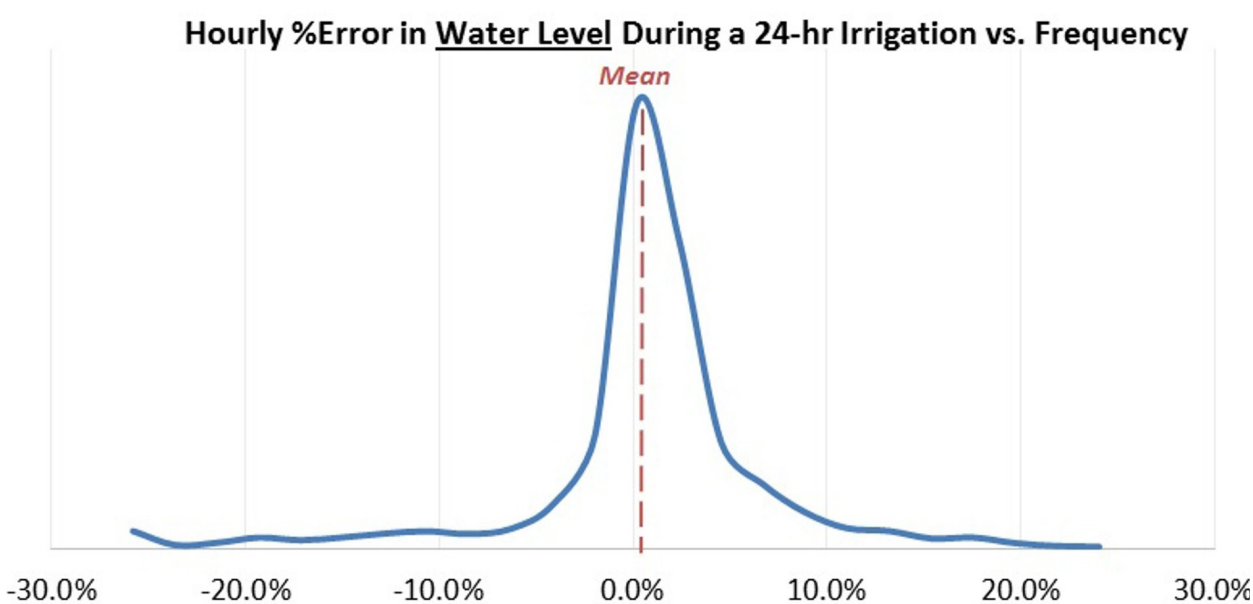


Figure 2. Distribution for hourly % error in water level vs. frequency

2. The flow measurement device operates under a "submerged" condition. In this case, what happens is that if the canal water level changes, the flow through the measurement device increases. But that also results in a rise in the downstream water level. This provides a "pressure compensating" effect. The total head change is less than the change in the canal water level. ITRC has examined a number of possible downstream channel conditions, and uses the following equation to estimate the effect of a change in canal water level:

$$\text{Submerged Flow Error} = (1 + \text{Level Error})^{0.38} - 1$$

For each block (group of 30 randomly selected seasonal irrigation cycles), the mean and standard deviation of the error were computed. Figure 3 shows the results of the analysis. The mean error is plotted for each block along with the standard deviations. The red bars are 1 standard deviation above the mean, and the green bars are 1 standard deviation below the mean.

For the condition of 10 irrigations per season, the seasonal flow rate error due to fluctuating canal water levels averages less than 0.2%, regardless of whether the turnout is free flow or submerged flow. The average seasonal error for 20-30 irrigations per season is almost 0.0%. Therefore, for this district, the % error used for **CWLF = 0.2%= .002**

Summary of Acceptable Device Flow Rate Error

As stated earlier,

$$\text{Max. acceptable device flow rate error} = 100 \times \sqrt{\left(1 - \frac{VA}{100}\right)^2 - ARD^2 - CBP^2 - CWLF^2}$$

where

VA = Volumetric accuracy required (**88%**)
ARD = errors due to improper recording of durations, **.007**
CBP = errors due to a change in "backpressure" on the metergate, **.041**
CWLF = errors due to canal water level fluctuations, **.002**

Max. acceptable average error of the instantaneous flow rate measurement = 11.3%

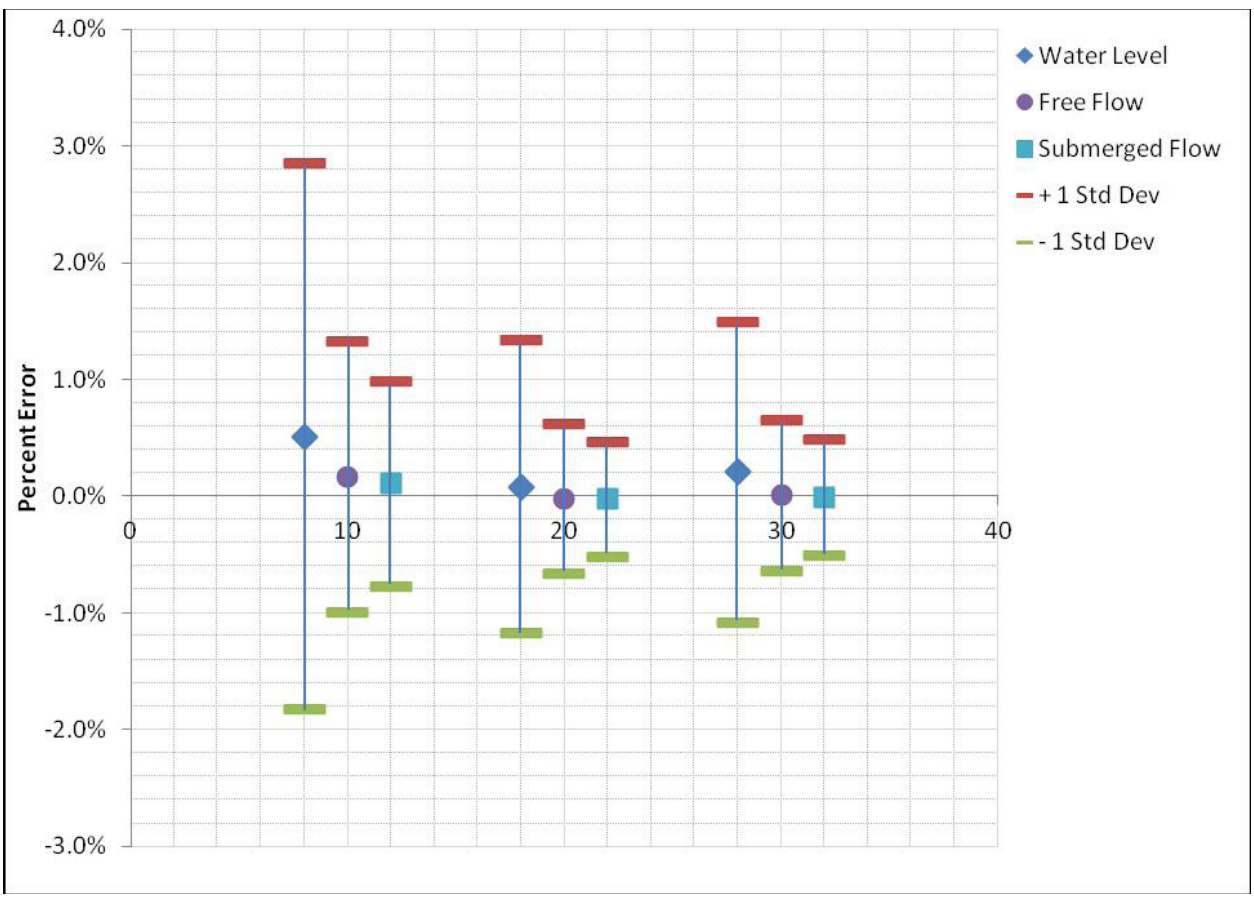


Figure 3. Means and standard deviations for each block

HELPFUL WEBSITES

- **Ag Annual Update**
  http://www.agwatercouncil.org/
- **Agrimet**
  http://www.usbr.gov/pn/agrimet/
- **Bureau of Reclamation Water Share**
  http://www.usbr.gov/mp/watershare/
- **Cal Poly ITRC**
  http://www.itrc.org
- **California Crop and Soil Evapotranspiration Report**
  http://www.itrc.org/reports/californiacrop.htm
- **Center for Irrigation Technology's Wateright**
  http://www.wateright.org
- **CIMIS ETo data**
  http://www.cimis.water.ca.gov/cimis/welcome.jsp
- **CSU Chico Irrigation Training Facility**
  http://www.csuchico.edu/ag/farm/ITF/index.shtml
- **Dept of Water Resources**
  http://www.water.ca.gov
- **EID**
  http://www.eid.org
- **Fresno State CIT**
  http://www.fresnostate.edu/jcast/cati/
- **Historic Weather Data**
  http://www.wrcc.dri.edu/summary/climsmnca.html
- **Kings River Conservation District**
  http://www.krcd.org
- **Landscape water use**
  http://www.water.ca.gov/wateruseefficiency/docs/wucols00.pdf
- **Measurement of effective rainfall**
  http://www.fao.org/DOCREP/X5560E/x5560e03.htm
- **Quantifiable Objectives(QO)**
  http://www.calwater.ca.gov/content/Documents/library/WUE/qo_detail.pdf
- **Salinity problems**
  http://www.fao.org/DOCREP/003/T0234E/T0234E02.htm
- **Solano Irrigation District: Weather Info**
  http://www.westernwx.com/sid
- **UC Cooperative Extension**
  http://sfp.ucdavis.edu/research/coopextcontacts.html
- **Urban Annual Update**
  http://www.cuwcc.org/
- **Washington State University: Weather info**
  http://www.AgWeather.net; mobile app: weather.wsu.edu/is/ or weather.wsu.edu/awn.php
- **Water Measurement Manual**
  http://www.usbr.gov/pmts/hydraulics_lab/pubs/wmm/cover.html
- **Westlands**
  http://www.westlandswater.org
- **Winflume (Repogle flume design)**
  http://www.usbr.gov/pmts/hydraulics_lab/winflume/index.html

This page intentionally left blank

OTHER BMP DOCUMENTS

This chapter contains documents that you may find useful in preparing your Water Management Plan. The first page of each document is provided here. The complete documents are provided in a printable format on the included CD and on the Reclamation website at www.usbr.gov/mp/watershare. The (MOU) is available through the CUWCC website at *http://www.cuwcc.org*.

1. Crop Survey Form
2. Canal Lining
3. Reservoir Lining
4. Incentive Pricing
5. Memorandum of Understanding (MOU) Regarding Urban Water Conservation in California

Crop Survey Form

Water District Name
Street Name
City, CA 9xxxx
Phone Fax Email

Name Joe Farmer Date 21 March 2005

Address 000 Winchester Canyon Road Acct # 700000

2005 CROP REPORT

Each water user is required to file a crop report each year. The 1999 Crop Report Form lists each field by APN and acreage as listed on your RRA Form. Please indicate each crop, irrigation method, the percentage of well water used (if any) and if a field was double cropped or fallowed. If you farm any land within the District that is not listed on the Crop Report Form please add it to the list. Please pick from the crop and irrigation system lists on the back of this page when completing the form.

APN	Acres	Crop	Crop Acres	Irrigation Method	% Well Use	Double Cropped Acres
79-000-00	160.0	avocados	45.0	micro	0	0
		lemons	100.0	micro	0	0
		misc. (creek)	10.0	-	-	-
		roads, house	5.0	-	-	-
		Total	160.0			0

1. Canal Lining

Methodology for Determining Applicability/ Implementation of the Canal Lining/Piping

The purpose of this methodology is to provide an analytical process for determining the applicability and potential implementation of the canal lining and/or piping as part of the Lining/ Piping best management practice (BMP) for Central Valley Project (CVP) districts. The U.S. Bureau of Reclamation's (Reclamation) criteria for CVP Water Management Plans requires the consideration of lining or piping unlined conveyance systems as a water management practice.

Many of the districts in the CVP were formed for the purpose of providing surface water from major California river systems to over-drafted or water-short areas in California. The allocation of surface water to many of the districts is based on the practice of conjunctive use of surface water and groundwater supplies.

This methodology provides a streamlined analytical method for balancing the needs of CVP conjunctive use districts while giving due consideration to the canal lining and/or piping. This methodology has been developed to facilitate the evaluation of the Lining/Piping by the district and Reclamation's review, but there may be cases where additional information may be requested. This methodology provides one method of addressing canal lining/piping and does not invalidate or eliminate other acceptable methods.

Part 1 - Level of Implementation

Is the district's distribution system already fully lined or piped?
YES [ ] NO [ ]

[If the district's distribution system is already fully lined or piped, this in itself is sufficient to justify canal lining/piping as being fully implemented. Lined sections of canals or pipelines that have aged or been damaged beyond their intended purpose should be considered equivalent to unlined canals. Supporting information should include a statement declaring that the district's distribution system is already fully lined or piped and in good repair.]

Does the district already have an on-going canal lining/piping program?
YES [ ] NO [ ]

[If the district has already implemented a canal lining or canal-piping program, the district is already in compliance with requirements of this portion of the BMP. Supporting information should include a description of the program that has been implemented, the expected timeline of the program, and the estimated district costs]

If any of the answers above is YES, then provide supporting information. No further analysis of this methodology is required. The implementation of canal lining/piping is complete or ongoing if the district is currently implementing a canal lining or piping program, then the program is considered ongoing at an adequate level of implementation and reporting will be required in the annual update reports.

If all of the answers above are NO, then go to Part 2.

2. Reservoir Lining

Methodology for Determining Applicability/ Implementation of Reservoir Lining

The purpose of this methodology is to provide a streamlined analytical process for determining the applicability and potential implementation of the reservoir lining as part of Lining/Piping best management practice (BMP) for Central Valley Project (CVP) districts. The U.S. Bureau of Reclamation's (Reclamation) criteria for CVP Water Management Plans requires the consideration of lining unlined reservoirs.

This methodology provides a streamlined analytical method for balancing the needs of CVP conjunctive use districts while giving due consideration to the reservoir lining. This methodology has been developed to facilitate the evaluation of the reservoir lining by the district and Reclamation's review, but there may be cases where additional information may be requested. This methodology provides one method of addressing the reservoir lining and does not invalidate or eliminate other acceptable methods.

Part 1 - Level of Implementation

Is the district's regulating system already fully lined?
YES [ ] NO [ ]

[If the district's regulating system is already fully lined, this in itself is sufficient to justify this element of the *Lining/Piping BMP* as being fully implemented. Lined reservoirs, which have aged or been damaged beyond their intended purpose should be considered equivalent to unlined reservoirs. Supporting information should include a statement declaring that the district's regulating reservoirs already fully lined and in good repair.]

Does the district already have on-going reservoir lining program?
YES [ ] NO [ ]

[If the district has already implemented a reservoir-lining program, the district is already in compliance with requirements of this element of Lining/Piping BMP. Supporting information should include a description of the program that has been implemented, the expected timeline of the program, and the estimated district costs]

Is the district's conveyance system fully piped and does the district experience very infrequent to no operational spills? (Reservoirs were constructed for and are used principally for groundwater recharge purposes.)
YES [ ] NO [ ]

[Many fully piped distribution systems do not require the use of a regulating reservoir except for infrequent use or under non-typical conditions. A groundwater recharge reservoir might be used during the low demand winter season to reverse flow water using gravity. Demands may be such that pumping costs could be substantially reduced by the use of an up-slope recharge basin to store water and reverse flow to meet irrigation demands. Recharge reservoirs may also be used to store water during a non-routine shutdown or de-watering of a main source canal.]

3. Incentive Pricing

INCENTIVE PRICING

BEST MANAGEMENT PRACTICE FOR AGRICULTURAL IRRIGATION DISTRICTS

June 1998

Prepared by

Resource Consultants

4. CUWCC Memorandum of Understanding (MOU)

MEMORANDUM OF UNDERSTANDING REGARDING URBAN WATER CONSERVATION IN CALIFORNIA

Please Check the CUWCC Website at *http://www.cuwcc.org* for Current Version