California Urban Water Conservation Council

# Utility Operations
# BMP Implementation Guidebook

# Contents

# Introduction

In December 2008, the California Urban Water Conservation Council (Council) updated the Best Management Practices (BMPs) required under the Memorandum of Understanding Regarding Urban Water Conservation in California (MOU)[1], incorporating a broader approach to achieving water savings, improving water use efficiency, and measuring progress.

As a Foundational Best Management Practice (BMP), Utility Operations is an essential water conservation activity for all water utilities and is adopted for implementation by all signatories to the Memorandum of Understanding as an ongoing practice.

Water utilities throughout California are implementing water conservation programs and providing essential services to their customers. Water conservation includes traditional demand management measures, but also includes important utility-management based conservation measures. An important component of utility water conservation is assessing the efficiency of how water is delivered to customers. There are four subcategories that comprise signatory utility operation program responsibilities:

1. Operational Practices;
2. Water Loss Control;
3. Metering and Billing; and
4. Retail Conservation Pricing.

A subset of the reporting organizations who contract with the U.S. Bureau of Reclamation (Reclamation) for water deliveries are mandated to report to the Council by their Reclamation contract and water management plan. In Council terms, these are named “Reclamation Contractors.” They do not always, in this case, have a relationship with the Council other than their use of the database for reporting. Once the agency has completed its report, an e-mail goes to the Reclamation area- and regional-offices . Reclamation staff verify the report includes what is necessary per agency requirements. The BMP implementation, reporting, and data provision requirements are the same as those specified in the MOU.

[1] The Memorandum of Understanding and Best Management Practices, as amended September 14, 2011, are available in the Resource Center at www.cuwcc.org.

# BMP 1.1: Operational Practices

This subcategory includes key actions that utilities can take to better enable the implementation of conservation programs; to supplement conservation incentives with regulations where appropriate; and to assist one another through the wholesaler-retailer relationship.

***Conservation Coordinator:*** Designate one person as the agency's responsible conservation coordinator for program management, tracking, planning, and reporting on BMP implementation. Alternatives to the designation of one person for one agency include agency sharing (part-time for two or more agencies); recruiting support from an agency's wholesaler for BMP implementation; or outsourcing tasks to a consultant.

The designation of a conservation coordinator should include the following steps:

1. Review all BMP requirements and associated implementation and reporting responsibilities;
2. Establish job duties for personnel (e.g., conservation, billing, maintenance and operations, etc), which should include an organizational conversation regarding structure and how to implement the MOU (BMP implementation, Flex Track, or GPCD);
3. Establish upper management and Board support;
4. Develop budget;
5. Adopt job description (see examples below);
    a. EID Water Conservation Coordinator
    b. SSWD Water Conservation Coordinator
6. Recruit and fill the position;
7. Send the Council contact information, and;
8. Offer ongoing training opportunities, including Council workshops, conservation conferences, and cross-training with other relevant departments and duties (such as customer service, operations, and legal/policy).

In planning and establishing the water conservation coordinator position within an agency, and even when doing an organizational assessment, it may be helpful to review the American Water Works Association Manual M52 on the topic of planning water conservation programs. The chapters within this reference cover everything from why water conservation is important and recruiting public input to setting goals and developing and implementing a formal water conservation plan. It can be purchased through the AWWA website:

http://www.awwa.org/store/productdetail.aspx?productid=6740.

Another helpful reference is Amy Vickers' book: "Handbook of Water Use and Conservation."[2] This reference provides an exhaustive look at the variety of ways to conserve water in homes, landscapes, businesses, industries, and small agricultural areas. It also provides a snapshot of "The Water Conservation Network" in Chapter 6; which is a good way to start the search for alternative and progressive water conservation practices.

***Water Waste Prevention and Prohibition:*** The California State Constitution prohibits the waste and unreasonable use of water (Cal. Const., Art X Section 2). The Legislature has declared that, "the general [State] welfare requires . . . that the waste or unreasonable use or unreasonable method of use of water be prevented, and that the conservation of such water is to be exercised . . . ." (Cal. Water Code Section 100).[3]

The implementation of a water waste ordinance, regulation, terms of service, or other means within an agency's authority should take into consideration the difference between new development, existing users, and water shortage measures (drought).

**New development** – utilities shall use means within their authority to prevent single-pass cooling systems, vehicle and laundry wash systems that do not reuse water, non-recirculating fountains, and landscape design inefficiencies.

**Existing users** – utilities shall adopt means within their authority to **prohibit** water waste such as irrigation or CII inefficiencies and other misuses of water.

**Water shortage measures** – utilities shall adopt means within their authority to implement response measures during times of drought or other water emergencies.

**Customer Outreach and Education**:

a. Websites are a great and inexpensive way of getting the word out regarding the prevention of water waste. El Dorado Irrigation District has a webpage devoted to the agency's water waste prevention regulation:

[2] Vickers, Amy. Handbook of Water Use and Conservation. Amherst, Massachusetts; WaterPlow Press, 2001.

[3] The text and reference material provided within this document is meant for information purposes only – the California Urban Water Conservation Council makes no representation of legal counsel. Agencies and other organizations should consult their own legal counsel for appropriate actions and interpretation.

http://www.eid.org/about-us/forms/report-running-water-waste. The City of Pasadena outlines the definition of water waste through a bulleted, easily-read list on its webpage: http://ww2.cityofpasadena.net/waterandpower/watershortage/default.asp#water_waste.

b. Customers are sometimes unaware that they're using more water than their budget/allocation or that their usage is higher than is normal for their neighborhood. A letter is a useful and inexpensive way to inform the customer of this. It's important to offer aid in correcting the problem to reinforce the concept of the water agency as a partner rather than an enforcer. An example of IRWD's water waste enforcement letter is available here: IRWD_Outreach_2010.

c. Eastern Municipal Water District provides all new customers with an informative letter regarding the state of water supply in the region. Immediate contact with new customers provides an excellent opportunity for water agencies to create an open, informative, and collaborative foundation with customers. The letter is available here: EMWD Sample New Customer Letter.

d. It is also important to ensure that staff at the water agency fully understands their responsibilities. Different staff have different skills and the ability to work a variety of outreach and education efforts into their normal workday. Approaches to reporting and enforcing water waste vary: online forms, a water waste hotline, follow-up protocols for the reporter and the offender, documentation requirements, fee schedules and methods for fining, the protocol for waiving the fine (e.g., water waste school for first offense), and using AMR reporting to notify customers. These all present different opportunities of getting information to the customer. A water agency needs to assess the best method for its particular service area and staff set.

**Examples of water waste ordinances and water shortage regulations**:

a. Santa Rosa City Code 14-21.020: "(A) Water use in outdoor areas resulting in runoff; or (B) Breaks or leaks in the water delivery system." This ordinance is available here:

   http://ci.santa-rosa.ca.us/doclib/Documents/waterwasteordinance.pdf.

b. Long Beach Water Department has a water waste and shortage ordinance available here: http://www.lbwater.org/pdf/conservation/wtr_consrv_shortage_plan.pdf.

c. Santa Monica's ordinance is available here:

   http://www.qcode.us/codes/santamonica/index.php?topic=7-7_16-7_16_020&frames=on.

d. El Dorado Irrigation District has a regulation available here:

   www.eid.org/reportwaterwaste.

e. The City of Burbank has integrated their water waste ordinance with a conservation ordinance, including drought stages:

http://www.burbankwaterandpower.com/download/Sustainable-Water-Use-Ordinance-June-8-2009.pdf.

f. The City of San Diego also integrates their water waste prohibition with conservation guidelines, available on a user-friendly website here:

http://www.sandiego.gov/water/conservation/drought/enforcement.shtml.

***Wholesale Agency Assistance:*** Assistance may be provided, when mutually agreeable and beneficial, from large-scale wholesalers to regional wholesalers or from regional wholesalers to retail agencies. The assistance may include:

a. Financial investments or incentives;
b. Technical support;
c. Program management and/or support;
d. Water shortage allocation agreements;
e. Non-signatory reporting;
f. Regional partnerships, and;
g. Encouragement and/or financial assistance in joining the Council.

Wholesale agencies are required to offer assistance to retail agencies, but retail agencies are not required to accept this assistance. In addition, wholesale agencies are not required or obligated to financially support retail agencies' programs. When reporting, the retail and wholesale agencies must communicate regarding which organization is reporting the program implementation data. If a wholesale agency reports for all of its retail agencies, the individual retail agency cannot report the same data. This avoids errors regarding double-counting of BMP data.

A good example of this regional partnership for conservation program implementation is provided by the Bay Area Water Supply and Conservation Agency's regional water conservation programs (http://bawsca.org/water-conservation/). The Sacramento Regional Water Authority's Water Efficiency Program provides another example:

http://www.rwah2o.org/rwa/programs/wep/.

## *Documenting BMP Implementation:*

**Conservation Coordinator:** provide the name and contact information of the person serving as an agency's coordinator.

**Water Waste Prevention and Prohibition:** provide the following to the Council:

1. Description of, or electronic link to, the ordinance, regulation, or terms of service adopted by the water agency to meet the requirements of this BMP;
2. Description of, or electronic link to, any ordinances or requirements adopted by local jurisdictions or regulatory agencies within the water agency's service area;
3. Description of any water agency efforts to cooperate with other entities in the adoption or enforcement of local requirements consistent with this BMP; and
4. Description of agency support positions with respect to adoption of legislation or regulations consistent with this BMP.

**Wholesale Agency Assistance:** Throughout California, wholesale water agencies provide financial, administrative, and programmatic support to their retail agencies. Examples of this include the Metropolitan Water District of Southern California and Sonoma County Water Agency. The following list includes example of how to report different types of assistance:

1. Financial investments and building partnerships: provide these lists to the Council:
   a. total monetary amount of financial incentives and equivalent resources provided to retail members to assist with, or to otherwise support, implementation of BMPs;
   b. regional partnerships developed to encourage resource conservation and maximize economies of scale benefits ; and
   c. NOTE: This information should be available through an agency's financial records and through the person doing the regional partnering; usually the conservation coordinator;
2. Technical support: supply a summary of the types of technical support provided to retail agencies;
3. Program management: if the wholesale agency has assumed reporting responsibility, BMP implementation, or is sharing a position with/among its retail agency(ies), list the programs and positions managed on behalf of the associated retail agencies;
4. Water shortage allocation: if a water shortage allocation plan or policy has been developed, provide the date of adoption and electronic link to the document or a hard copy;
5. Regional partnerships: provide a list of the partners; and
6. Encourage Council membership: describe any efforts

**Water Savings Assumptions:** These are not quantified directly by the Council for this particular BMP; however, the savings may be realized by the agency and calculated in a number of ways.

1. Wholesalers may use the Council's BMP Costs and Savings Study[4] to assess the total amount of water savings achieved by each wholesaler-supported BMP.
2. Other statistically validated sources may be also used to demonstrate water savings.
3. Water savings from enforcement of legislation and regulations may be projected based on anticipated savings from device(s) applied to the population subject to the policy or regulation (like the SBx7-7 (2009) water conservation legislation: http://www.water.ca.gov/wateruseefficiency/sb7/).
4. Estimated water savings from the implementation of water waste prevention measures may be used with backup information and assumptions provided.

[4] A&N Technical Services for the California Urban Water Conservation Council. BMP Costs and Savings Study. Sacramento: CUWCC, 2000.

# BMP 1.2: Water Loss Control

Water loss, also known as non-revenue water, is a significant problem worldwide in potable water distribution systems. The savings potential inherent in implementing a water loss control program can be more than the savings achieved through many of the efforts from other BMPs combined. System losses vary by utility; however, water losses ranging from 15 to 70 percent are common. The Ontario Sewer and Water Association recently stated that in Canada up to 30 percent of treated water goes into the ground. The loss of as little as 8 percent of treated water in a city of 2.5 million is equal to 15 Olympic-sized swimming pools per day! This loss results in wasted energy, decreased efficiencies at pump stations and treatment plants, and it may create the need for new or increased storage facilities.[5, 6]

The goals of modern water loss control methods include both an increase in water use efficiency in the utility operations and proper economic valuation of water losses to support water loss control activities. In May 2009 the American Water Works Association (AWWA) published the 3rd Edition of its M36 Manual, *Water Audits and Loss Control Programs, (*http://www.awwa.org). BMP 1.2 (Water Loss Control) incorporates these new water loss management procedures for application in California. Council agencies are expected to use the AWWA Free Water Audit Software to complete their standard water audit and water balance. Definitions of key terms are also embedded in this software. You can find the software on the AWWA web site:

http://www.awwa.org/home/awwa-news-details/articleid/2641/awwa-free-water-audit-software-version-5-0-now-available.aspx

Water loss represents a significant loss in investment. A water agency has already paid to obtain, store, treat, and distribute the water that is lost.The water agency does not receive revenue for the water lost in distribution pipelines before it reaches the customer meter, and the water is not available for alternative uses (groundwater use notwithstanding). A water audit provides the foundation for determining whether an agency should implement a water loss control program. A water loss control program can include leak detection, pressure management, improved speed and quality of leak repair, or a better management of the customer meter population. This enables the utility to receive the adequate amount of revenue through accurately registering customer meters. Water system audits help an agency to recognize the relative customer uses and other system demands throughout an agency's service area, and provide necessary data for forecasting, pricing, determining investment needs, and targeting future conservation efforts.

[5] Clarke, B.V. Water Loss Reduction Through Pressure Management. Surrey, British Columbia, Canada.

[6] AWWA Water Loss Control Committee. (2003). Committee Report: Applying Worldwide BMPs in Water Loss Control. *AWWA Journal*. 95 (3), 65-79.

A component of water loss control that is not currently a part of the Council's BMPs is pressure management. A short description of this practice is included at the end of this section. More information can be found in the PBMP report on pressure management.

***Defining Water Supplier Losses***

*The International Water Association (http://www.iwahq.org/Home/) defines two major categories under which all types of supplier water loss occurrences fall:*

***1. Real Losses** are the physical escape of water from the distribution system, and include leakage and overflows prior to the point of end use, and*

***2. Apparent Losses** are the "paper" losses and consist of a customer use which is not recorded due to under-recording meters, incorrect assumptions or records of non-metered use, or unauthorized consumption/water theft.*

*Water agencies, in assessing the most cost effective method of reducing non-revenue water (water losses), should look at the marginal cost between the two types of water loss. Real losses' marginal cost is that of the avoided cost of additional water, which should include the cost of producing and treating water and include avoided capital cost (please refer to the Council's Avoided Cost Model for specifics). Different water agencies value apparent losses differently; some placing little to no value on apparent losses, others setting the marginal cost equal to the retail rate charged the customer. There are, of course, other costs that should be considered in a water loss study, including long term costs. These should always be included in a water loss optimization study.*

*In-depth information regarding water losses and how to control them is available in the Water Loss Control Manual by Julian Thornton. (*Thornton, Julian. Water Loss Control Manual. New York: McGraw-Hill, 2002.)

## *Water Audit Analysis*

**Standard Water Audit and Water Balance:** Agencies can quantify their current volume of apparent and real water loss through the use of the standard water audit and balance using the AWWA Water Loss software. The cost impact of these losses on utility operations can also be assessed using this software, and is useful for agencies on many levels. The software is available here:

http://www.awwa.org/resources-tools/water-knowledge/water-loss-control.aspx

**Figure 1 the AWWA Water Balance**

<table>
<tr><td rowspan="9">System Input Volume</td><td rowspan="4">Authorized Consumption</td><td rowspan="2">Billed Authorized Consumption</td><td>Billed Metered Consumption</td><td>Revenue Water</td></tr>
<tr><td>Billed Un-metered Consumption</td><td rowspan="8">Non Revenue Water (NRW)</td></tr>
<tr><td rowspan="2">Unbilled Authorized Consumption</td><td>Unbilled Metered Consumption</td></tr>
<tr><td>Unbilled Un-metered Consumption</td></tr>
<tr><td rowspan="5">Water Losses</td><td rowspan="2">Apparent Losses (Commercial Losses)</td><td>Unauthorized Consumption</td></tr>
<tr><td>Customer Meter Inaccuracies and Data Handling Errors</td></tr>
<tr><td rowspan="3">Real Losses (Physical Losses)</td><td>Leakage in Transmission and Distribution Mains</td></tr>
<tr><td>Storage Leaks and Overflows from Water Storage Tanks</td></tr>
<tr><td>Service Connections Leaks up to the Meter</td></tr>
</table>

**Validation:** Agencies may take up to four years to develop a validated data set for all entries of their water audit and balance. Data validation shall follow the methods suggested by the AWWA Software to improve the accuracy of the quantities for real and apparent losses.

a. An example validation can be found at the end of the AWWA Water Loss Control Manual, completed for the City of Philadelphia.

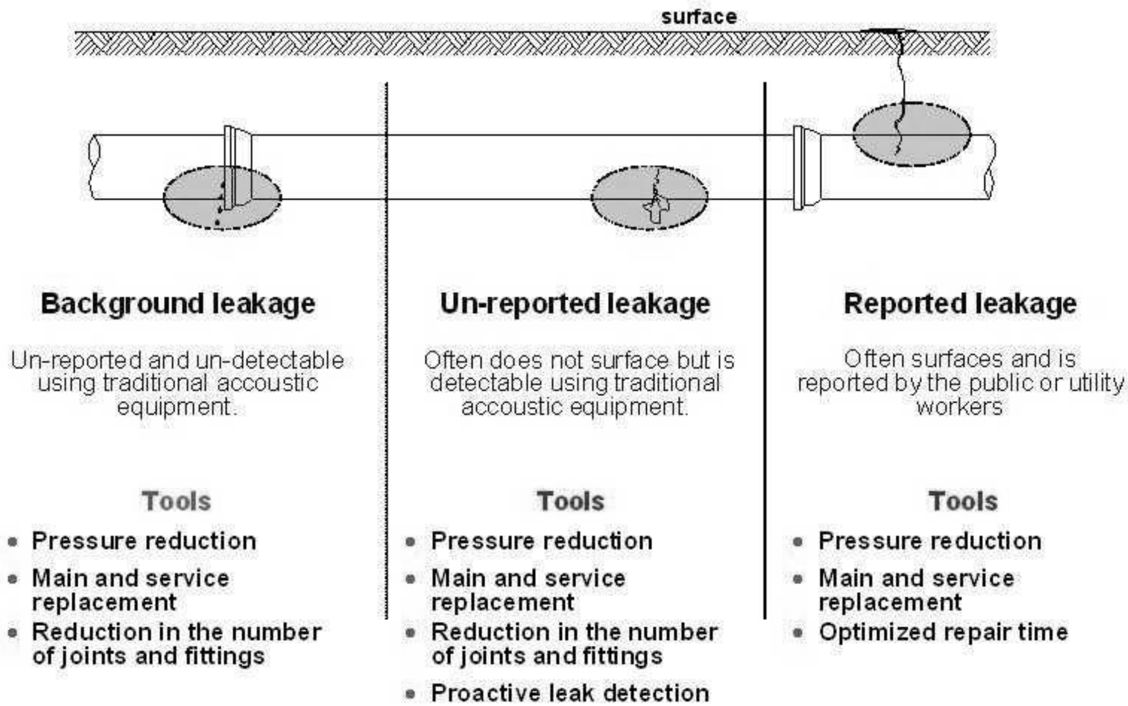
**Economic Values:** For purposes of this BMP, the economic value of real loss recovery is based upon the agency's avoided cost of water as calculated by the Council's adopted Avoided Cost Model or other agency model consistent with the Council's Avoided Cost Model.

a. the Council's Avoided Cost Model can be found here with a user login:

http://www.cuwcc.org/Login?returnurl=%2fResources%2fEktron-Pages%2fBMP-Tools-To-Download%2fBMP-Tools

**Component Analysis:** A component analysis is required at least once every four years. The goal is to identify volumes of water loss, the cause of the water loss and the value of the water loss for each component. The component analysis model then provides information needed to support the economic analysis and selection of intervention tools. An example is the "Breaks and Background Estimates Model" (BABE) which segregates leakage into three components: background losses, reported leaks, and unreported leaks.

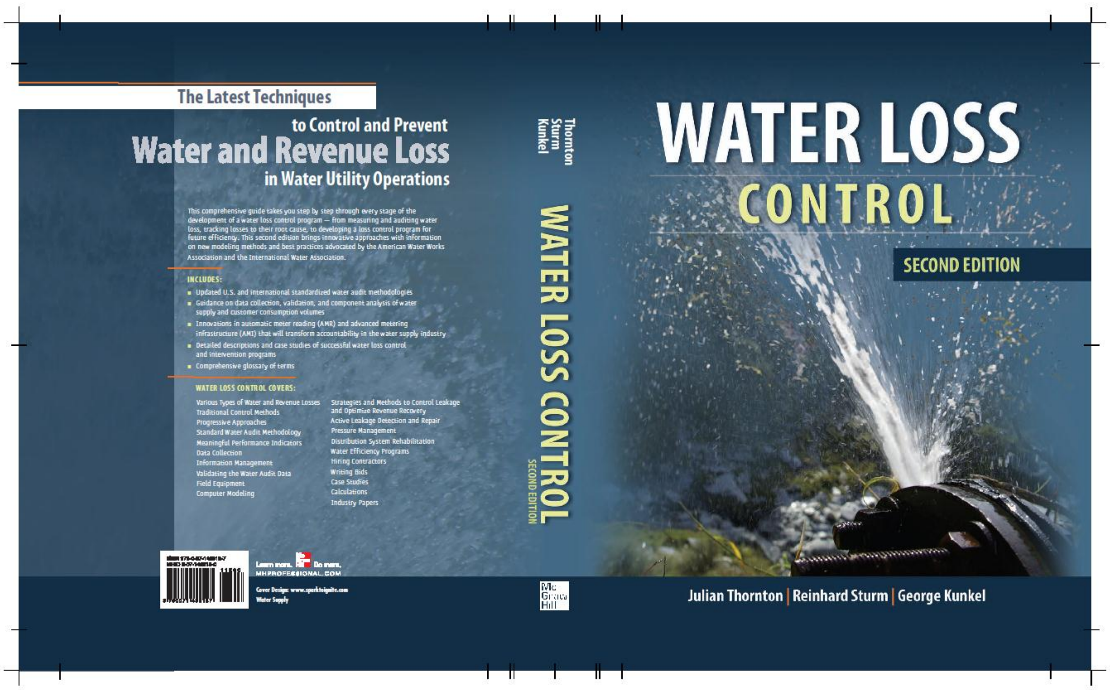
**Figure 2 Components of real losses**




**Interventions:** Agencies shall reduce real losses to the extent cost-effective. Agencies are encouraged to refer to the AWWA's 3rd Edition M36 Publication for specific methods to reduce system losses. Also helpful is *Water Loss Control* by Thorton, Sturm, and Kunkel, which takes the reader step-by-step through every stage of the development of a water loss control program-from measuring and auditing water loss, tracking losses to their root cause, to developing a loss control program for future efficiency.

**Figure 3 Water Loss Control book cover**

Water Loss Control book cover.pdf




**Customer Leaks:** Agencies shall advise customers whenever it appears possible that leaks exist on the customer's side of the meter. The Council sells a small soft-cover publication called the "Practical Plumbing Handbook." It is available in English and in Spanish and provides easy-to-follow directions for everything from installing faucet aerators to hot water recirculation systems. To order copies of the Practical Plumbing Handbook, please contact office@cuwcc.org.

## *Leak Detection and Repair:*

### Developing a leak detection program:

a. Planning: Leak detection on its own is an investment in the longevity of the water agency's infrastructure. Programs like these will usually pay for themselves in the repair of leaks and correlated decrease in system water losses.

b. Budget: this variable largely depends on the location, age, and geology underlying an agency's infrastructure. An agency can get an idea of the general cost of a leak detection program by asking other agencies of similar size, age, and region, or by recruiting consultant proposals for leak detection efforts.

c. Records: The most important factor in a leak detection and repair program is the need for accurate, detailed records that are consistent over time and easy to analyze. In order to optimize these programs by allocating funds in such a way that results in the greatest net benefits, adequate information is needed on which to base decisions and determine needs. Three sets of records should be kept: (1) monthly reports on water loss comparing cumulative sales and production (for the last 12 months), to adjust discrepancies caused by the billing cycle; (2) leak-repair report forms; and (3) updated maps of the distribution system showing the location, type, and class of each leak. An agency will need to set up a system for tracking these data points before the program is implemented.

d. Prepare a preliminary leak detection and repair plan. This step should include discussions with other agencies regarding what measures worked and what did not work. Similar soils and water chemistry may have similar effects on plumbing in different locations. A leak detection and repair plan should include the method best suited to survey for and pinpoint the source of water loss, the equipment and staff requirements needed (does an agency want to use its own staff or a consultant?), and the estimated total cost. If a consultant is required, the agency should go through the process of soliciting qualifications, designing the scope of service, and requesting final bids from contractors.

***Testing and Refining a Leak Detection Program***

*In 2008 East Bay Municipal Utility District began a pilot program to test the cost effectiveness of permanent installation of acoustic data loggers. Other goals of the study were to learn more about the cause of leaks, how long they occur before being detected and potential water savings from doing more leak detection. EBMUD chose the City of Berkeley as a testing ground because of its wide variety of pipe sizes, types, and ages in both porous non-porous soils, as well as a history of leaks. The City has approximately 250 miles of pipe between 2 and 20-inches in size and represents about 6 percent of its total small pipe inventory as well as consumption. Larger pipes were not a part of this program.*

*…Continued on page 18*

**Testing and Refining a Leak Detection Program (Continued from page 17)**

After some technical difficulties in getting the project started, the installation was complete in April 2009 and data was collected for 18 months until November 2010. During the study over 200 repaired leaks were analyzed and the loggers were used to analyze noises heard by these leaks. Only 44 percent of the leaks were heard by the loggers. While, the majority of the leaks surfaced fairly quickly after the loggers started hearing them, the loggers did discover some rather large leaks that may have never surfaced and found some leaks in critical areas that allowed crews to fix the leaks before they became more expensive to fix blow outs. This project was done with a total inventory of 1,000 loggers, two correlators, and two ground microphones. At any one time 850 loggers were installed on the pipes with a spare inventory of 150. Data was collected by driving through the streets of the City and it took approximately three days to pick up the loggers. A two- person crew was able to install 30-40 loggers per day.

The conclusions of the study were that for EBMUD permanent installation only makes sense in critical areas or where leaks are very common and lift and shift methods should be used in other areas. Other findings include that logger installations require periodic inspection and maintenance, use shorter logger spacing, and accurate mapping is critical to getting accurate results.

## Implementing a leak detection program:

a. Determine total system water loss and convert into lost revenue. This important step provides a value for the total volume of non-revenue water (as opposed to water due to leakage only), providing the data for a cost effectiveness analysis. NOTE that non-revenue water is not equal to (real) water loss – non-revenue water also includes metered and unmetered un-billed authorized consumption (see "Figure 1 the AWWA Water Balance").

b. Perform a cost-benefit analysis looking at the value of the system water losses versus the cost of corrective measures. This allows for more informed decision-making. Basic analysis is a component of the AWWA spreadsheet.

   Doing a total analysis, including all leaks and analyzing the costs to repair each of them, is a multi-year and often a multi-million-dollar line item in most water agencies' capital improvement project list. This can be done on a lower level, with smaller budget amounts, by prioritizing leaks by size (based on the amplitude of the leak noise as an indicator of larger leaks) and addressing the larger ones first. Leak detection and repair is almost always a step-wise process over multiple years.

As part of this analysis, an agency must determine what has been done in the recent past; if an agency has recently completed a total meter replacement or overall meter testing and recalibration; the agency may assume that most of the water loss is due to leaks (though there is always the possibility of errors or discrepancies within the billing system). Likewise, if the agency has recently performed a leak detection and pinpointing survey, the agency may assume that most of the water loss is due to meter inaccuracies. In this way an agency can better determine the potential costs of the corrective measures needed.

If the cost of an agency's hidden losses (detectable unreported leaks running in the system) is less than the cost to undertake a leak detection program, it may not be cost-effective to undertake a leak detection program. However, in such a case it will likely be appropriate to look at undertaking a leak detection campaign for example every two or three years (i.e.: doing a cost benefit analysis with regularity). All of this can be calculated by performing a component analysis and an Economic Level of Leakage (ELL) analysis. Table 1 below shows an example of the results of an ELL analysis for the correct leak detection intervention frequency, annual leak detection budget and volume of economically recoverable real losses.

**Table 1 An example of an Economic Level of Leakage (ELL) analysis**

| | **Avoided Cost Valuation of Real Losses** |
|---|---|
| **Economic Intervention Frequency** | 16 month |
| **Percent of System to be Surveyed Annually** | 55% |
| **Annual Budget for Intervention** | $45,550 |
| **Economic Unreported Real Losses** | 21.8 MG/Year |
| **Total Real Loss Reduction Volume** | 123.5 MG/Year |

c. If a water agency desires to complete a leak survey with in-house staff, an inventory of essential agency-owned equipment is necessary. Rental of this equipment is often possible if an agency is not prepared to purchase it.

***Listening Devices***

*Several different listening devices are available from the California Urban Water Conservation Council for loan:*

*- Heath Aqua Scope*

*- Metrotech Electroacoustic Leak Locator*

*- Instrument Technology Corporation Amplifier (2 models)*

*In order to check out the equipment, an organization must be a member of the Council. While it is free to check out the equipment, the borrowing organization must pay the shipping costs and the equipment must be returned within a month. Contact the Council for more information and availability (916/552-5885 or http://cuwcc.org/). Also, there must be a staff member at the agency who has taken the Council's training class on water loss control or a similar training event.*

*In addition, implementing staff members should have a good knowledge of the water agency distribution system, meter types, and appropriate equipment for the identified purpose. If a water agency would like to rent or purchase equipment, training is sometimes provided. Equipment could also be shared between water agencies.*

d. If a water agency desires to complete a leak survey using a consulting group, then scope is very important. The contract could include location, or location and repair. It also needs to specify what type of equipment should be used (if known), and should always provide information on the age and type of materials uses in the infrastructure. Also, how a consultant is paid can help determine the outcome: paying by the mile encourages consultants to go faster (more mileage in less time means a more cost effective project for the consultant) but not necessarily more carefully.

The acoustic leak detection survey is probably the most common and familiar leak detection methodology. Different types of acoustic sounding equipment are used in two different levels of detail, general survey or comprehensive survey.

In a **general survey**, often referred to as a hydrant survey in the US and Canada, listening devices are used to survey fire hydrants and valves on distribution systems to detect any leak sounds. Fire hydrants can be found at more or less constant distances providing a good coverage in most areas. However, one shortfall is that service connection leaks often go undetected since service connections are not surveyed.

In a **comprehensive survey**, listening devices are used to all available fittings on mains and service connections. Geophones are used to sound above the mains in case contact points are far apart. Once a leak sound is detected, geophones and leak noise correlators may be used for pinpointing the exact location of the leak.

A general survey is faster and therefore cheaper but in many cases does not achieve the desired results and even might mislead a utility into believing that there are very few unreported leaks running in their system. General surveys can miss a significant amount of leaks on service lines and – if the contact points are too far apart and the pipe material does not have good sounds propagation characteristic – even leaks on distribution mains. A comprehensive survey when carried out with care and sufficient experience makes sure that the vast majority of detectable leaks are located.

e. Check nighttime flow rates within the agency's residential service areas. The nighttime residential flow rates should be quite low. It is usually possible for an agency to isolate a zone within its service area by shutting off valves and measuring any remaining flow with either a meter or by measuring decreases in local storage levels. From this measured number, subtract CII uses, reservoir filling, and an assumed "normal" value for nighttime residential use to determine the amount of water loss. This strategy should be used during winter months so that any irrigation uses will be minimized; however, avoid freezing nights as some customers may leave hoses or other fixtures running to prevent pipes from freezing.

**Figure 4 Nighttime flow rates**

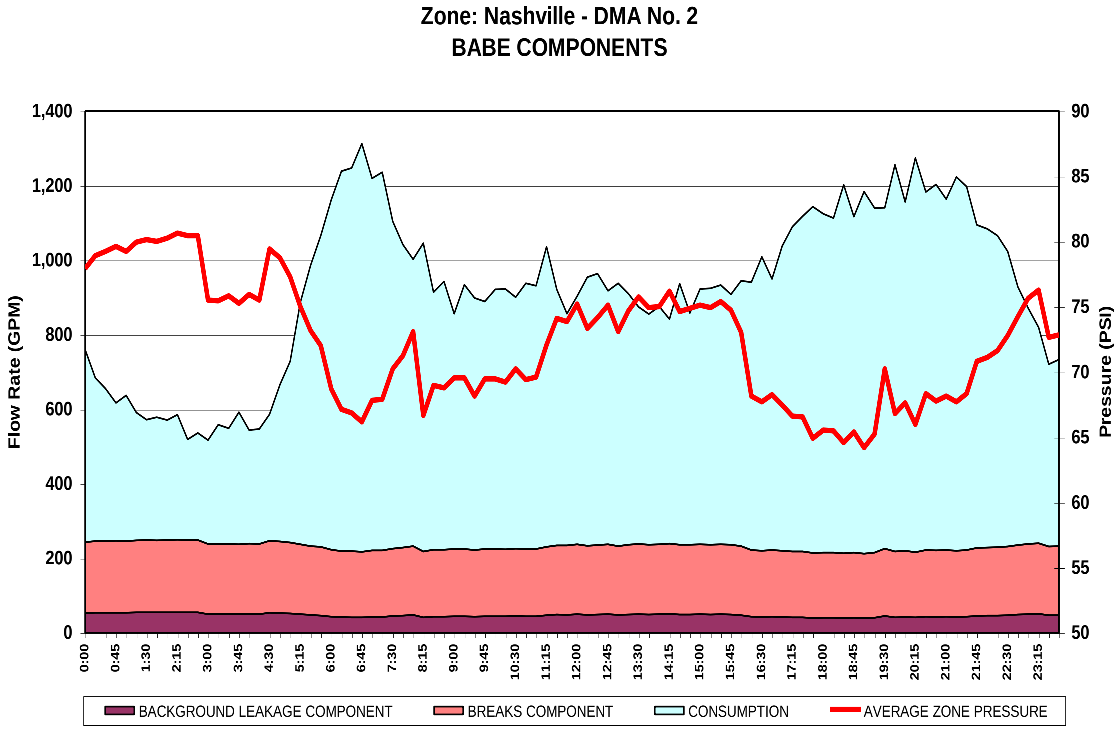



Figure 4 displays the nighttime flow rates within a zone of a water agency in Nashville, TN. Notice that the flow rates drop significantly between midnight and 4:30 a.m. – this means less interference from associated noise (flowing faucets, sprinklers, etcetera, and the corresponding increase in pressure can make leaks more audible.

f. It is important to check the customer meters to ensure that the correct size meter is being used for the particular diameter pipe and customer use patterns, unless this is done when meters are placed into a service connection. It can also be important to re-check each site on a rotating basis to see whether the site use has changed. Please reference AWWA Manual M22 on sizing water service lines for help on this topic. The manual also has a section on meter accuracy that can help in the development of a meter test program. More information on meter repair programs can be found in the "How to Implement a Meter Program" section of this guidebook.

g. Checklist for leak detection

1. complete a pre-survey review of the water distribution system
2. use sound-intensifying instruments to listen for leaks

3. if leak sounds are heard, conduct a details investigation
4. if meters are widely spaced, listen over the main
5. have meter readers listen on services
6. inspect sewer manholes and catch basins for excessive water which might signify a water leak going directly into the drainage system
7. check all stream crossings
8. check all sudden increases on zone and production meters
9. investigate complaints from customers who report hearing water running or surfacing
10. investigate complaints of low pressure in the distribution system
11. maintain a database of leaks detected and repaired
12. check for unmetered CII use
13. check for unmetered fire use
14. install meters anywhere unmetered water is used
15. measure discharge from all blowoffs and all hydrant use
16. monitor real losses to measure program effectiveness

h. Note that Reclamation routinely offers cost-share grants for system optimization reviews (SORs). When available, announcements can be found at www.grants.gov.

## *Pressure Management*

**Pressure Reduction:** Pressure regulation comes in many forms, such as surge control, level control, pressure relief, pressure reduction or pressure sustaining. Pressure management (PM) as it is commonly referred to, is a method that is usually applied to water distribution networks by leakage reduction practitioners to reduce water losses. It is the only tool that can be deployed to existing infrastructure which reduces all types of leakage (background, reported, and unreported). In some countries, notably Japan and the United Kingdom, PM has been recognized for over 20 years as the essential foundation of effective leakage management. PM reduces leakage levels in two ways:

1. Reducing the flow rate through existing leaks, and
2. Reducing the frequency of new breaks.

The frequency of new breaks is reduced because PM reduces average and maximum pressures, reduces diurnal pressure variations, and can filter out pressure transients. More information on PM may be found in the Council's PBMP report on pressure management.

**Conducting a Residential Pressure Survey:**

1. Review distribution system maps - an agency can work with its operations staff to identify areas of high pressure within the system, often due to changes in elevation and/or high concentration of storage tanks and/or pumping plants.
2. Target residential subdivisions - because demands are the most predictable in residential customers, this is a good place to start with pressure management testing. If the subdivision doesn't already have pressure reducing valves as part of its design, complete a random sampling of pressure checks throughout the area.
3. Determine locations of water mains - the location of the water mains in relation to different elevations within the subdivision can show a pattern of high and low pressure zones. Obtaining a sampling of pressures at homes in the various high and low pressure zones will help an agency to create a pressure map of the target area.
4. Determine where pressure reducing valves are needed - a review of the data recorded from the above activities will assist an agency in placing pressure reducing valves.

***Documenting BMP Implementation:*** The list below provides an outline of what is needed for reporting and back-up purposes. Note that water savings assumptions are to be determined by the agency through the process outlined below.

1. Submit the completed AWWA Standard Water Audit and Water Balance worksheets in the BMP 1.2 report form for every year (submitted each "reporting period," or every 2 years).
2. Keep and make available validation for any data reported for each reporting period.
3. Maintain in-house records of audit results, methodologies, and worksheets for each completed audit period.
4. Keep records of each component analysis performed and incorporate results into future annual standard water balances.
5. For the purpose of setting the benchmark:
    a. Keep records of intervention(s) performed, including:
        1. standardized reports on leak repairs (if possible, including approximated water losses);
        2. the economic value assigned to apparent losses and to real losses;
        3. miles of system surveyed for leaks;

4. pressure reduction undertaken for loss reduction;
5. infrastructure rehabilitation and renewal;
6. volumes of water saved, and;
7. costs of intervention(s).

b. Prepare an annual summary of this information for submission to the Council during years two through five of implementation, unless extended by the Council.

# BMP 1.3: Metering and Billing

For consistency with California Water Code Section 525b, this BMP refers to potable water systems. A water meter is defined as a device that measures the actual volume of water delivered to an account in conformance with the guidelines of the American Water Works Association. See also CA Water Code Section 516 ("'Water meter' includes any suitable water measuring device or facility which measures or determines the volumetric flow of water."). Water meters are now mandatory for all Reclamation contractors (installed system-wide by 2013) and for all urban water agencies with 3,000 connections or more *or* annual deliveries of 3,000 acre-feet or more (installed system-wide by 2025).

Metering is an essential element of any water agency's conservation program, as it helps both the agency and the end-users determine how much water is being used. Metering also provides end use customers a strong financial incentive to encourage conservation. Without meters, utilities do not have a means of charging customers for the amount of water they use. In such instances, utilities must rely on fixed charges that encourage over-consumption and fail to align the cost customers pay for water with the long-term marginal costs of securing future water supplies. Metering also allows agencies to track water production and deliveries – which facilitates the location and repair of leaks on both the utility and customer side of the meter.

As part of program design, it is much easier and less expensive to install meters during construction rather than performing retrofits later. Labor costs are the largest portion of the expense, with retrofitting costing upwards of $1200 per meter. Meter installation with new development can be less than $350 per meter.

## *Implementation Requirements:*

1. For agencies signing the MOU before December 31, 1997:
   i. initiate volumetric billing for all metered customers no later than July 1, 2008; and
   ii. complete meter installation for all connections no later than July 1, 2009.
2. For agencies signing the MOU after December 31, 1997:
   i. initiate volumetric billing for all metered customers no later than July 1, 2008 or within one year of signing the MOU if later than July 1, 2008; and
   ii. complete meter installation for all service connections no later than July 1, 2012 or within six years of signing MOU, but in no case later than one year prior to the requirements of state law.

3. For unmetered service areas newly annexed, acquired, or newly operated by otherwise metered agencies, meter installation shall be completed in these service areas within six years of the annexation, acquisition, or operational agreement.
4. A feasibility study examining incentive programs to move landscape water uses recorded through mixed-use meters to dedicated landscape meters is to be completed by the end of Year 4, following the date implementation was to commence.
5. A written plan, policy or program to test, repair and replace meters shall be completed and submitted electronically by July 1, 2008 or within one year of signing the MOU if later than July 1, 2008, whichever is later.

## *How to Implement a Meter Program*

**Develop a water metering regulation:** Develop and adopt a regulation or ordinance for meter installation and volumetric-based billing on all water deliveries. Even water provided free of charge to public entities should be metered to facilitate the development of a water budget, if used, to track for leaks, and to quantify this water as metered-non-revenue (for the use of the AWWA water audit software data inputs). Meters should be installed at points of import, export, diversion, customer service connections, large landscapes, and at all points at which an agency would want to track its water use and be aware of potential leakage.

**Define customer classes:** General customer classes can include:

- single-family residential;
- multi-family residential;
- commercial and institutional;
- industrial;
- large landscape (or public landscape);
- agricultural (if served), and;
- other.

Service-line sizes will generally vary with the customer class and size of customer’s facility (e.g. a small restaurant vs. a large college cafeteria). Separating customers by class and geographic area can also be helpful.

The more finely an agency can define its customer classes – especially when it comes to the commercial sector (possibly using North American Industry Classification System (NAICS) codes

(NAICS Codes graphic)) – the more accurate the customer class rate structures will be. For example, rather than simply having an "institutional" class, an agency may want to have a subclass for hospitals, a subclass for grade schools, and a subclass for universities. This will help the agency to more accurately define the use patterns for a smaller and more homogeneous group. For more information on NAICS codes and customer classification, see the CII Guidebook section on *Defining Commercial, Industrial and Institutional Water use*.

**Installation strategy:** When installing meters, it is helpful to estimate costs based either on the cost for an entire customer class or the cost for different geographic regions of an agency's service area. Keep in mind that these may be different based on different locations within the service area and the different sized lines going to each customer connection. A few test runs or a pilot project done by one of the agency's meter installation crews will give a more accurate estimate of the labor and materials costs involved with meter installation. In addition, a representative sample size of new meters should be tested for accuracy before they are installed.

Prioritize your meter installation program by area of your water agency and/or by customer class (commercial/institutional versus residential). It is beneficial, efficient, and cost effective to install meters in geographic sections, but an agency must keep in mind the impact on the neighborhood. Assign meter routes to meter readers as these new areas become metered. Alternately, you could input automated meter reading technology (AMR or AMI – see sidebar).

Examples:

- The Otay Water District has found the installation of AMR meters to be complimentary to its business and conservation planning: Otay AMR Case Study l.
- The City of Sacramento is installing AMI technology throughout its service area: City of Sac AMI.

***Automated Meter Technology***

*Automatic Meter Reading, or AMR, is the technology of automatically collecting consumption, diagnostic, and status data from metering devices (water, gas, electric) and transferring that data to a central database for billing, troubleshooting, and analyzing. This advance mainly saves utility providers the expense of periodic trips to each physical location to read a meter. Another advantage is that billing can be based on near-real-time consumption rather than on estimates based on previous or predicted consumption. This timely information coupled with analysis, can help both utility providers and customers better control the use and production of potable water. AMR technologies include handheld, mobile, and network technologies based on telephony platforms (wired and wireless), radio frequency (RF), or power line transmission.*

*Advanced Metering Infrastructure, or AMI, describes the networking technology of fixed network meter systems that go beyond AMR into remote utility management. The meters in an AMI system are often referred to as smart meters, since they often can use collected data based on programmed logic. AMI "raises the bar" with regard to traditional AMR in that it enables two-way communications with the meter. Traditional systems which were only capable of meter readings do not qualify as AMI systems.*

*The Water Research Foundation completed an AMR study in 2011 that provides a road map for decision-making, project success, and demonstrable business success for utilities considering AMR projects. This research can help utilities plan for the future by providing guidance on investment decisions and other issues related to the implementation and long-term management of automated-meter-reading technology. The link to this study's project summary is:*
*http://www.waterrf.org/ExecutiveSummaryLibrary/4000_ProjectSummary.pdf.*

**Financing meter installation:**

Meter installation is an expensive project, as described above. There are mechanisms for financing that will spread the burden among more than one stakeholder. Agencies should consult with their financial departments, board of directors, and general manager before embarking on a meter installation or retrofit program in order to identify the best course of action.

- Grant financed: grants are sometimes available Reclamation, the California Department of Water Resources (DWR), or the State Water Resources Control

Board (SWRCB). These grants generally require a cost-share, sometimes as high as 50 percent. That 50 percent can be provided directly by customers, an agency's capital improvement project (CIP) budget, or shared amongst several agencies having a stake in the conservation of water by a particular agency.

- Information on Reclamation grants can either be found on the www.grants.gov website, or directly through Reclamation: http://www.usbr.gov/mp/watershare/grants/index.html.
- Information regarding State grants for water infrastructure can be found on the DWR website: http://www.grantsloans.water.ca.gov/.

- Customer financed: this can be done in several ways, either through a meter surcharge for a number of billing cycles (often years), or even a bill for the straight amount. Billing the amount to customers is more feasible if a cost share is involved to defray the amount.
- Agency financed (CIP): water agencies have known about the meter installation requirement for several years, now, and some have been saving money to implement meter installation. This could also be debt-financed.
- Regional partnerships and wholesaler support: some agencies are able to work with their regional partners to defray the cost of meter installation. This cost is usually extended out on a meter-by-meter basis in order to better calculate the cost-share for grants or for billing customers the balance.

**Converting billing software:** This could potentially be very expensive and time-consuming, but is likely an essential component for installing meters in a service area. In looking for billing software, research the program's abilities, including comparison billing (compared to last month, last year, or customer's neighbors), allocation-based billing, billing messaging, and the inclusion of water use graphics.

**Establish a fixed-interval meter reading program:** Determine the number of staff people necessary to read the new meters, how these meters will be read, and, if necessary, the number of vehicles and recording devices necessary to implement the program. An agency may choose to implement the automated meter reading technology described above, thereby eliminating the need for the same level of staff for meter reading. Or an agency may choose to have its meters read visually or by a hand-held scanner. A water agency will have to investigate the costs and benefits, both up-front and long-term, in order to make the best choice for its area.

**Meter Testing and Repair:** Any number of meters within an agency's service area may need attention and/or repair, new or old. In addition, testing is an important component of a universal metering program to ensure accuracy and fairness to all customers. Meters that have been in use for more than 10 years should be tested on a regular basis. That testing can be sent to an outside consultant or could be completed at a maintained test bench within the water agency. Testing new meters is an important component of meter installation – the concern is generally with meters registering low flows – this could result in lost water and lost revenue. There are published AWWA standards for meter testing available online: http://www.awwa.org/store/productdetail.aspx?productid=28471.

Placer County Water Agency has an in-house meter test and replacement program: PCWA Meter Test Program.

Because there are so many customer meters, testing each one each year is not feasible for most water agencies. Instead, an agency can target testing all meters having a two-inch or larger diameter every year (or at least every 2 years), and choose to randomly sample a subset of small meters annually. Testing can also be motivated by customer complaints. Another approach is to look at the revenue generated by the meter versus the cost to test the meter; it can often pay to test some meters on a 6-month cycle. Interesting results from the Utah Water Research Laboratory's Assessment of Commercially Available Flow Meters for Secondary Water Applications in Utah will likely be coming out in the next year or two:

http://uwrl.usu.edu/researchareas/waterconveyance/assessment.html.

Some agencies may choose to recover costs associated with meters under-reporting; this cost recovery can sometimes pay for a substantial portion of the meter testing program.

**Meter Replacement Cycle:** In order to calculate the age at which a meter should be replaced, the cost of meter replacement and cumulative revenue lost (unrecorded water) over a specific number of years are added, and the sum is divided by the number of years that the meter has been in the system. The optimal replacement age is when the average annual cost is at a minimum; lost revenue due to inaccurate metering will increase with a meter's age. Where brass meters have a 30-year lifetime, the plastic-component meters that now dominate the market generally have a lifetime of approximately 15 years. Other standards for replacement include the amount of flow through the meter or the soil/geology of the area – for example, sand in groundwater can be an issue leading to increased inaccuracies sooner in the meter's life.

**Establish Annual Budget:** In order to ensure that an agency's meter reading program is funded over the long term, it is important to be realistic regarding the staffing and materials costs for meter upkeep and long-term replacement. In the establishment of the program, other agencies in the same region can be helpful in determining general costs of the program (advising regarding the number of meter readers, vehicle maintenance costs, etcetera), and staggering the testing and replacement efforts will help to avoid huge budget impacts. After the first year of a meter program an agency should have a good idea of the annual costs of operation. After these costs have been established, an agency can determine how to fund all facets of the metering program.

**Mixed-Use to Dedicated Landscape Irritation Meter Study:** BMP 1.3.B.4 requires agencies to complete a feasibility study "examining incentive programs to move landscape water uses on mixed-use meters to dedicated landscape meters." This is a one-time requirement and should be reported as part of most agencies' 2011 reports. The Utility Operations Committee has developed a beta feasibility study tool which is available as a resource for meeting this requirement. To download this tool, see BMP 1.3 Feasibility Study Tool under BMP Reporting Resources.

***Submetering***

*In many cases, water deliveries to multi-user communities, including apartment complexes, strip malls, condominium towers, and mobile home parks, are master-metered with one meter recording the use of every tenant within the community. Submetering is the practice of installing separate meters on each of the individual dwelling units within a multi-user community. It ensures equitability between tenants and owners with regard to their water use habits, makes individuals accountable for their own actions of water conservation, and allows landlords and building managers control over something they otherwise wouldn't: their monthly water bill. In addition, the smaller meters used on an individual-unit basis are more sensitive to the smaller leaks and drips of indoor fixtures, and if tenants themselves are paying the cost of a leak they are more likely to have it fixed.*

*Submetering can be as simple as individual meters placed on individual units of a building/community, or as complex as flow sensors hardwired with a telemetry system to a computer control station miles away, where load-shedding control monitor are programmed to shut down non-critical loads to achieve peak shaving of the utility's demand. It can also be implemented by a third party (not the landlord or water utility) called a "submetering supplier." The cost of submetering varies, of course, with the technology implemented, and can be borne by the water agency, the landlord/building manager, or the tenants/owners themselves. An agency will have to evaluate the situation on a case-by-case basis and under the individual budgetary conditions. More in-depth information regarding submetering can be found in the following resources:*

*- the National Submetering and Allocation Billing Program Study (2004): Mayer2004NationalSubmeteringStudy, and*

*- the Council's PBMP on submetering.*

*There are many examples of successful submetering in California:*

*1. EBMUD completed a submetering study in 2004; it is available here: http://www.ebmud.com/sites/default/files/pdfs/submeter_report[2].pdf.*

*2. Santa Clara Valley Water District completed a study in 2007 regarding the submetering of mobile homes and multi-family units (SCVWD2007SubmeteringStudy), and currently offers incentives for placing submeters on mobile homes and condominium complexes: http://www.valleywater.org/Programs/SubmeterRebateProgram.aspx.*

*A study done with the City of San Diego perhaps says it best: "[s]tudies have shown that water submeters are associated with decreased water usage. A 2004 Aquacraft Inc. study cited in Report to the Planning Commission PC-10-001 showed water savings of 15.3 percent when comparing submetered properties with rental properties that do not bill water separately from rent ("in-rent" properties). Another comparative study showed water usage in submetered properties to be 18 to 39 percent less than in-rent properties ("Submetering, RUBS, and Water Conservation," prepared by Industrial Economics, Inc., June 1999). "However, no study can guarantee future savings that will occur at any property or in any area."*[1]

[1] http://www.sandiego.gov/iba/pdf/10_23.pdf

## *Documenting BMP Implementation:*

1. Confirm that all new service connections are metered and are being billed by volume of use and provide:

a. Number of metered accounts;

b. Number of metered accounts read;

c. Number of metered accounts billed by volume of use;

d. Frequency of billing (i.e. six or twelve times per year) by type of metered customer (e.g. single-family residential, multiple-family residential, commercial, industrial, and landscape irrigation); and

e. Number of estimated bills per year by type of metered customer (e.g. single-family residential, multiple-family residential, commercial, industrial, and landscape irrigation) vs. actual meter readings.

2. Number of unmetered accounts in the service area. For the purposes of evaluation, this shall be defined as the baseline meter retrofit target, and shall be used to calculate the agency's minimum annual retrofit requirement.

3. Number of unmetered service connections retrofitted during the reporting period.

4. Estimated number of CII accounts with mixed-use meters.

5. Number of CII accounts with mixed-use meters retrofitted with dedicated irrigation meters during reporting period.

Water agencies may assume that meter retrofits and volumetric rates combined will result in a 20% reduction in demand for retrofitted accounts.[7]

[7] Maddaus, W. O. 1984. *Residential Water Conservation Projects: Summary Report.* U. S. Department of Housing and Urban Development. Office of Policy Research.

# BMP 1.4: Retail Conservation Pricing:

***Introduction and General Purpose:*** Conservation pricing provides utilities with a means of managing consumer demand. It recognizes that demand is not inevitable or uncontrollable but rather can be influenced through efficient price signals. California Water Code, Section 100 states: "Water metering and volumetric pricing are among the most efficient conservation tools, providing information on how much water is being used and pricing to encourage conservation. Without water meters, it is impossible for homeowners and businesses to know how much water they are using, thereby inhibiting conservation, punishing those who conserve, and rewarding those who waste water."

The water industry has recognized the importance of conservation-oriented rate designs. The CPUC, for instance, has called for utilities to implement such measures as increasing block rates, water revenue adjustment mechanisms, rebates, and rationing programs (CPUC, Order Instituting Investigation to Consider Policies to Achieve the Commission's Conservation Objectives for Class A Water Utilities, I07-01-022 (January 2007)). California legislation also requires volumetric pricing associated with all new meter installation by 2025, though meters and volumetric billing are required for Bureau contractors by 2013.

The Council, for its part, has adopted BMP 1.4, which promotes conservation pricing. The Council recognizes, though, that each agency or water enterprise fund has a unique rate setting system and history. When creating a rate case, professional judgments are made to determine whether costs are accounted to a variable or fixed cost center by the staff of the agency. The final water rate case is an accumulation of all the decisions and judgments made by staff and supplemented by the financial projections leading an agency to establish its final water rate recommendation. BMP 1.4 is not intended to supplant this process, but rather to reinforce the need for water agencies to establish a strong nexus between volume-related costs and volumetric commodity rates.

***How Conservation Pricing Works:*** Conservation pricing requires volumetric rates. While this BMP defines a minimum percentage of water sales revenue from volumetric rates, the goal of this BMP is to recover the maximum amount of water sales revenue from volumetric rates that is consistent with utility costs (which may include utility long run marginal costs), financial stability, revenue sufficiency, and customer equity. In addition to volumetric rates, conservation pricing may also include service connection charges, ongoing meter or service charges and special rates or temporary charges. A good resource for understanding and implementing conservation pricing is the Council's webpage: Sample Spreadsheets for Conservation Rate Structures.

***Quantifying Conservation:*** A conservation rate design may satisfy BMP 1.4 in one of two ways. First, a rate design will be sufficiently conservation-oriented if at least 70 percent of annual revenue from ongoing meter and service charges comes from volumetric charges.

$$V / (V + M) \geq 70\%$$ [8]

A utility can also satisfy the BMP by using the Municipal Water and Wastewater Manual the Canadian Water & Wastewater Association has published. The model can be downloaded at the Council website.[9] It provides:

$$V / (V + M) \geq V' / ( V' + M')$$ [10]

Both calculations include only utility revenues from volumetric rates and monthly or bimonthly meter/service charges. They do not include utility revenues from new service connection charges; revenue from special rates and charges for temporary service, fire protection, or other irregular services; revenue from grants or contributions from external sources in aid of construction or program implementation; or revenue from property or other utility taxes.

***Volumetric Pricing:*** The BMP requires utilities to adopt volumetric rates. In fact, in many respects volumetric rates are key to conservation pricing. Historically, utilities often relied on flat rates. Such rates were simpler to calculate and collect. They offered tremendous rate stability to utilities that did not have the technology to accurately and inexpensively measure water usage and that did not have the resources to develop complicated pricing and revenue models. Further, some in the business community believed subsidized water could foster economic growth.

Flat rates were inefficient in that they encouraged customers to use an unlimited amount of water and provided no financial incentive to restrain usage. They were inequitable in that they forced customers who used little water to subsidize those who used large amounts. And as

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[8] "V" stands for the total annual revenue from volumetric rates. "M" stands for total annual revenue from customer meter / service (fixed) charges.

[9] http://www.cuwcc.org/resources-center/technical-resources/bmp-tools.aspx.

[10] "V'" refers to the uniform volume rate based on the signatory's long-run incremental cost of service. "M'" refers to the associated meter charge.

metering technology has improved, most water utilities in California have shifted, at least for single-family homes, to rates that charge customers based on the volume of water consumed. Customers who use more water must pay more; those who use less can pay less.

But many utilities can further develop their volumetric rate structures. Multi-family dwellings, in particular, could benefit from sub-metering that allows individual units to be charged for the amount they consume and that gives landlords greater flexibility in unbundling water costs from rent.

***Conservation Pricing Enhancements:*** There are four enhancements that can improve the conservation potential of volumetric rate structures: (1) adjusted seasonal pricing; (2) inclining block rates; (3) allocation based pricing; and (4) staggered hookup fees.

**Seasonal Pricing:** On the supply side, water is generally scarcer and more expensive to provide during periods of peak demand. On the demand side, the increase in usage during peak periods is generally discretionary and relatively elastic. To adjust demand in a way that leads to more efficient supply-demand equilibriums, utilities can pass through the higher costs of water they face during peak periods.

In California, the peak demand period is the summer, when variations in temperature, precipitation, and evapotranspiration prompt property owners to use more water for irrigation. At the same time, meeting this demand imposes disproportionate costs on utilities. Water systems must have additional capacity that may go unused the rest of the year. Accommodating peak demand thus requires greater infrastructure and imposes additional capital costs.

Additionally, conveyance and treatment systems require large amounts of energy, making electricity the single largest determinant of the cost utilities must pay for water. Energy costs increase during the summer, as demand peaks, and electric utilities pass that cost on to water utilities.

Some water utilities could pass these higher seasonal costs on to customers, as electric utilities long have. But many have opted instead to charge the same rates throughout the year and spread the higher summertime energy costs across unchanging monthly rates. Such moves bury natural price signals and insulate consumers from actual costs of summer water. Adjusting rates seasonally could more closely align the costs that customers must pay with the costs utilities must pay.

Still, utilities must design seasonal rates in a way that conveys signals effectively. The difference between peak and off-peak prices must be significant enough that consumers will notice and have incentive to adjust their consumption patterns.

**Inclining Block Rates:** Inclining block rates act much like marginal tax brackets. They charge a certain amount for one level of consumption, and at the next level, the rate amount increases. A rate structure that includes multiple blocks can send strong price signals to customers who use greater amounts of water. In effect, inclining block rates establish incentives for all customers to reduce consumption but allow utilities to preserve affordable rates for essential water uses while targeting discretionary and highly elastic uses. Note that to encourage conservation block rates must incline; declining block rates will serve the contrary purpose of creating incentives to consume additional water.

Block rates can prove effective for all customer classes but are perhaps the simplest to implement for the residential sector. Although residential customers are not perfectly homogenous, they tend to have broadly consistent water needs. Utilities can consider these needs when determining the break points between blocks, and the resulting rates will be fair and efficient for most residential customers. Commercial and industrial classes, by contrast are more diverse and do not lend themselves as readily to rate structures based upon common consumption patterns.

In designing block rate structures, utilities must make three key decisions: how many blocks to have, where to insert break points between those blocks, and what rates to charge at each of the blocks.

**i. Number of Blocks**

Having too few blocks could prevent the rate structure from offering adequate incentives. Having too many blocks could confuse consumers and increase administrative costs for utilities. An ideal block rate structure would probably include three or four blocks for residential customers. The amount for CII customers varies, and depends on the type and range of CII uses/customers in your area.

- *Block 1*: This block would be for essential indoor uses like cooking and sanitation. A utility could calculate the break point between this and the next block by reviewing median usage in the winter, when there is little need for irrigation and when total consumption could serve as a rough but reliable proxy for essential indoor needs. The utility could then set the break point at a percentage of average past winter consumption levels that does not subject customers to undue hardship but that encourages watchful indoor use and investment in efficiency.

- *Block 2*: The second block would cover outdoor uses like basic irrigation. It would convey to customers that potable water is a scarce and expensive resource and that maintaining water-hungry landscapes can prove costly. A utility could calculate the volumes that would fall within the second block by comparing average summer and winter usage and assuming that outdoor use accounts for the difference. The utility could then set a rate for this block that is high enough to discourage inefficient outdoor use and that prevents customers who use water only for indoor essential purposes from subsidizing those who use it for irrigation.

- *Block 3*: The third block would apply to excessive outdoor uses, like watering vast lawns or allowing sprinklers to direct water onto sidewalks and streets. Because such uses are the most elastic and the least essential, they are in effect the kinds of uses that increase marginal demand and compel utilities to procure more supplies. To align marginal demand and supply, the block rates could be set at the marginal long-term cost of water. Charging the long-term marginal cost rather than the short-term marginal cost, as utilities have often done in the past, is key because of the low variable costs and substantial capital costs of providing water.

**ii. Break Points**

Once utilities have settled on the number of blocks to include in their rate structures, they must identify the appropriate break points between those blocks. The hypothetical blocks above include break points that correspond to general types of consumption – essential indoor use, standard outdoor use, and wasteful or unusually high outdoor use. These break points encourage customers to reduce consumption, particularly for irrigation, but recognize that a basic standard of living requires a fundamental amount of water.

Block rates are more challenging for other customer classes like commercial and industrial because there is so much heterogeneity among those classes in terms of scale and nature of operation. Residential units may vary in property and household size, but the standard deviation is not nearly as great as for commercial and industrial properties. A corner restaurant and a factory may, for instance, both fall into the same customer class, despite using vastly different amounts of water.

Still, utilities have crafted effective block rates for non-residential classes. These rates have at times been simpler than for residential customers, with fewer blocks, but they have nonetheless managed to reconcile the diversity of customers with the need to send conservation price signals. Some utilities have launched residential block rates first with the intention of learning from those and applying the lessons to the more difficult task of developing commercial and industrial block rates.

#### iii. Rate Setting

Finally, utilities must calculate the rates for each block. These rates, like all rates, must balance considerations like equity and rate stability. But they must also send price signals. To do that, they must catch the attention and influence the behavior of customers. A price increase of 10 or even 25 percent between blocks may be too minor for customers to notice; the resulting bump in monthly charges could come across as inconvenient but negligible, like a small and unavoidable new regulatory fee.

A stout price increase – like a 100 percent jump between blocks – could reach customers further down the elasticity curve and give them incentive to assess their water usage patterns and to distinguish between different types of use. An even greater increase for the highest block could further drive home the message that marginal cost of water is significant and often greater than the cost of saved water.

Having higher rates for higher blocks could promote equity by helping to eliminate the subsidies that water efficient households often provide high use households. At the same time, it could protect households that only use water for basic needs from having to pay the steep costs associated with obtaining new water supplies.

Rates are highly dependant upon regional/local politics. Keep in mind that any pricing structure an agency settles on will likely include compromise with numerous interests, including the Board of Directors and various factions of customers and other stakeholders.

**Allocation-Based Pricing:** Allocation-based conservation pricing was popular in the 1980's, after several periods of extended drought. This pricing mechanism allows a utility to build more flexibility onto its rate design. Under allocation pricing, consumption tiers and corresponding volumetric rates for a particular property are functions of the water use norms and delivery costs associated with that property. In 2008, California passed AB 2882, codified at Cal. Water Code Section 370-374, which allows publicly-owned utilities to use allocation pricing to encourage conservation. It defines allocation pricing as the use of structures that provide customers with a "basic use allocation" for a "basic charge" and then charge conservation fees for water used in excess of that basic allocation. *Id*. at 372.

The law gives utilities flexibility to determine basic allocations. It provides that "[f]actors used to determine the basic use allocation may include, but are not limited to, the number of occupants, the type of classification of use, the size of lot or irrigated area, and the local climate data for the billing period." *Id*. at 372(a)(2). These guidelines are broad enough to allow utilities to build water for landscaping and similar purposes into basic allocations.

The Irvine Ranch Water District (IRWD), which sponsored AB 2882, introduced allocation pricing in the early 1990s and has since witnessed a striking reduction in water consumption. Between 1992 and 2005, its average landscape water usage decreased by 54 percent. IRWD customers now have an average per day water usage 52 percent less than that in the rest of Orange County.

**Staggered Hookup Fees:** Many utilities charge hookup fees that are meant to cover the cost of adding new properties. Hookup fees are based upon the marginal cost of securing additional supplies to serve the new customers. Fee amounts range tremendously between utilities. This is in part because some utilities have greater existing capacity to serve new customers.

There are two ways to modify hookup fees and encourage conservation. The first is to introduce block rate structures that shift the burden of paying the long-term marginal cost of water from new customers who may use conservative amounts of water to existing customers who use large amounts of water. Such a reform would recognize the inevitability and in many cases the desirability of population and economic growth and would prevent new residents and businesses from having to subsidize the excessive use of existing customers, as often happens under prevailing fee structures.

A utility could also charge hookup fees that encourage developers to install an extra measure of efficiency improvements. Property owners can often save money in the long-term by using efficient fixtures rather than conventional ones. Developers, however, generally try to minimize building costs before selling properties and have no stake in long-term cost savings. Reduced or staggered hookup fees for properties that are built to be extra efficient could create incentives for developers to take up-front steps that will later yield reductions in water consumption.

***Water Neutral Development***

*Water neutral development is the concept that all new development will "pay their way" with water resources conservation within the new development and (possibly) through investment in older developments in order to save as much water as the new development will use. California Water Code sections support this type of activity through the following sections:*

*- Sections 375-377: authorize local districts to require water conservation devices and enforce water conservation programs upon finding of necessity;*

*- Section 1009: authorizes local districts to prepare water conservation plans that can require retrofit conservation devices be installed as a condition of service, including water reclamation devices, and;*

*- Sections 350-359: allow that emergency conditions of water shortage authorize local districts to restrict consumption.*

*One of the leading agencies implementing innovative water conservation measures in California, the EBMUD, found it necessary to include the capacity to require water neutrality in the early 2000s. An example of the regulation used by EBMUD can be found in Regulation 3D on the District's website: http://www.ebmud.com/sites/default/files/pdfs/service_in_the_camino_tassajara.pdf. A general water conservation regulation adding in the flexibility to apply additional measures, can be found in Section 31, paragraph A, of EBMUD's Regulations Governing Water Service to Customers (https://www.ebmud.com/customers/new-service-installations/regulations-governing-water-service). These regulations allowed EBMUD to serve additional new development without impacting existing customers through increased rates or fees, as well as avoiding additional investment in infrastructure.*

*An option for compliance for new development is contribution towards a "conservation mitigation fund." In this case, a developer will contribute the amount of money needed to invest in the infrastructure as well as the staff time of water agency conservation professionals to administer a rebate or replacement program throughout the district. This is a good way for water agencies to fund their conservation programs, as well as an excellent way to enhance and promote conservation for older portions of a growing district.*

*Lessons learned from EBMUD's program include:*
*1. communicate early with land use agencies and developers;*
*2. emphasize proven technologies to achieve expected water savings, and;*
*3. interact with applicants to educate them regarding options.*

*For more information on the EBMUD program, call their conservation phone number: 1-866-40-EBMUD.*

## *Implementing Conservation Pricing*

**Revenue Requirements:** A utility will generally want to begin implementation by determining its revenue requirement and breaking that requirement down into appropriate component revenue sources like commodity fees, service fees, and special fees. The utility can then determine block and seasonal rates with these revenue considerations in mind. But increasing rates at higher blocks could result in total revenues that exceed revenue requirements; in that case, utilities may have an opportunity – and even a need – to reduce charges in the lowest block below current levels or potentially even below cost. A good resource for implementing conservation pricing is the Council's webpage: Sample Spreadsheets for Conservation Rate Structures.

**Resources:** To use conservation pricing, a utility must have adequate resources. The most important resource is meters, which are discussed in detail earlier in this guide and without which volumetric pricing will prove impossible. Additionally, utilities need computer systems capable of processing usage data and billing accordingly. The more finely systems can mine data, the more precisely the utility can set rates and the more accurately utilities can send price signals.

**Conveying Information through Billing:** Price signals will not be effective unless they reach customers and customers understand them. To that end, utilities must strive to format bills so that they present usage and rate information in a simple and visually inviting manner. Bills must include line items showing block rates and seasonal charges and perhaps also footnotes explaining the reasoning behind the higher rates. Such explanations would help convey to customers the higher costs of providing water for outdoor use and would allow customers to make more informed decisions about their water consumption.

If bills do not include this sort of information – if, for instance, the bills simply state the amount due and do not break that down into its component charges – the price signals might not actually reach customers. Similarly, if the bills do not include adequate explanations, customers may not be able to make sense of the blocks and break points. If that happens, the price signals could be lost or at least muffled.

Good design principles could further ensure that customers read and understand their bills. These principles include such basic concepts as having font sizes and spacing that enhances readability and that draws in the eye. Eastern Municipal Water District's bills provide a graph at the lower left corner of the bill so that customers can compare their use across a calendar year.

**Figure 5 EMWD Sample Tiered Bill**

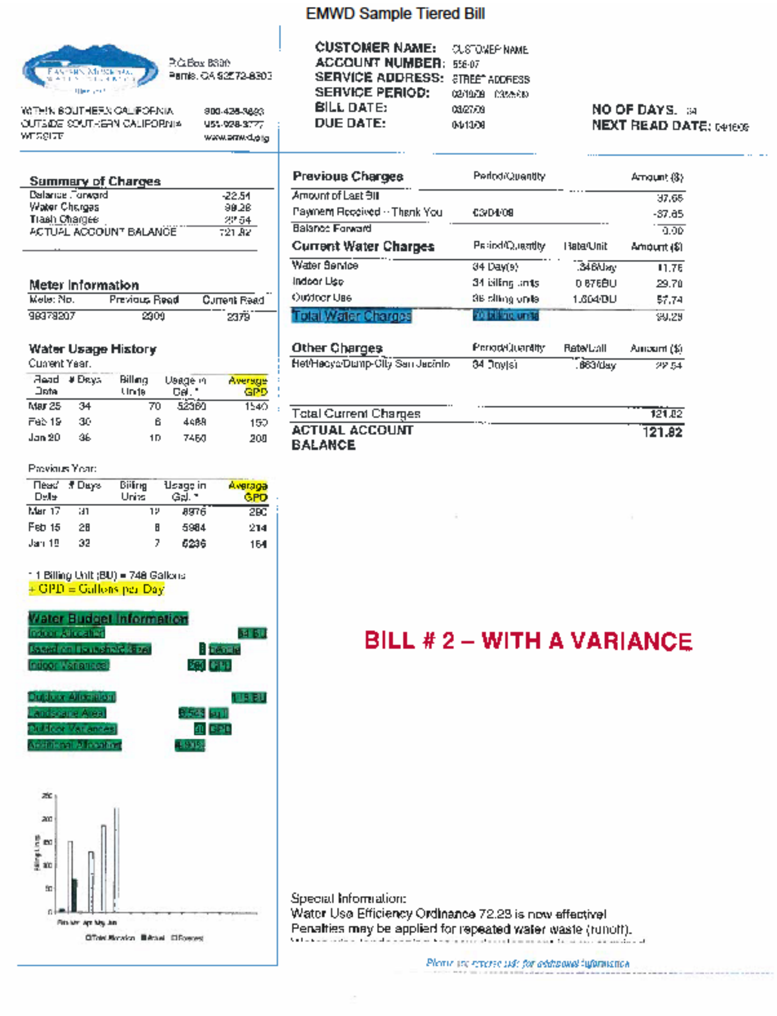


Figure 5: Eastern Municipal Water District offers variances to their customers who may need more water as a consequence of a larger family, small business, or other consideration. Their standard bill, presented above, displays the amount of water used inside the home, outside the home, and details regarding the water budget amount. Notice that the variance is listed as the last line of text on the left side of the bill.

Likewise, utilities must train customer service employees to explain rates and to offer information on how customers can achieve lower charges through reduced water consumption. A great way to do this is through targeting new homeowners within the service area: EMWD Sample New Customer Letter.

## *Other Issues*

**Legal Authority and Proposition 218:** California law allows water charges based on volume, Cal. Water Code Section 371(b) (defining a “basic charge” as a “volumetric unit charge for the cost of water”); 372 (allowing billing “based on metered water use”). Still, Proposition 218 imposes certain procedural requirements and substantive limits on those charges.

Proposition 218 is a an amendment that California voters added to the State constitution in 1996 to limit the ability of public entities, like publicly owned water utilities, to raise or impose fees and other charges on property owners (CA Constitution, article XIIID). Courts have found that, while initial hookup fees do not fall within the reach of Proposition 218, commodity and ongoing connection fees do (for case background, see: *Paland v. Brooktrails Township Cmty. Serv. Dist. Bd.*, 179 Cal. App. 4th 1358 (2009); *Bighorn-Desert View Water Agency*, 39 Cal. 4th 205, 217 (2006); *Richmond v. Shasta Cmty. Serv. Dist.*, 32 Cal. 4th 409 (2004)). That is true even if commodity fees are "calculated according to the quantity of water delivered . . . ." *Bighorn-Desert*, 39 Cal. 4th at 216-17.

Still, the proposition permits conservation pricing. In 2008, the legislature passed AB 2882, codified at Cal. Water Code Section 370-374, which clarifies that conservation pricing is compatible with Proposition 218. The law provides:

"A conservation charge shall be imposed on all increments of water used in excess of the basic use allocation. The increments may be fixed or may be determined on a percentage or any other basis, without limitation on the number of increments, or any requirement that the increments or conservation charges by sized, or ascend uniformly, or in a specified relationship. The volumetric prices for the lowest through the highest priced increments shall be established in an ascending relationship that is economically structured to encourage conservation and reduce the inefficient use of water, consistent with Section 2 of Article X of the California Constitution."

*Id*. at Section 372(a)(4). At the same, Proposition 218 requires publicly owned utilities to abide by certain requirements:

a. <u>Procedures</u>: Before imposing a new rate structure, a publicly owned utility must "provide written notice by mail of the proposed fee or charge to the record owner of each identified parcel upon which the fee or charge is proposed for imposition, the amount of the fee or charge proposed to be imposed upon each, the basis upon which the amount of the proposed fee or charge was calculate, the reason for the fee or charge, together with the date, time, and location of a public hearing on the proposed fee or charge." Cal. Const., art XIIID Section 6(a)(1). The agency must conduct that hearing no earlier than forty-five days after mailing notices. "At the public hearing, the agency shall consider all protests against the proposed fee or charge. If written protests against the proposed fee or charge are presented by a majority of owners of the identified parcels, the agency shall not impose the fee or charge." *Id*. at Section 6(a)(2).

   The California Public Utilities Commission (PUC) oversees the operations of private water companies throughout the State.

b. Cost of Service: Fees cannot exceed the cost of providing service. *Id*. at Section 6(b)(1). Agencies commonly prepare cost of service studies to ensure fees represent the cost of service. Some agencies have suggested the proposition requires such studies, though the text of the proposition does not mention them. *For example the* San Diego Office of the Independent Budget Analyst Report, *Proposition 218 Noticing of Proposed Water and Sewer Rate Adjustments*, Jan. 5, 2007 states, "The purpose of the Cost of Service Study is to examine the various cost components of providing water and sewer service, and to determine how those costs are allocated across all utility customers." The City of Modesto, *Final Report: Water Utility Cost of Service Rate Study*, Sept. 3, 2004, states that one of the main purposes of the study is to "ensure that new rates are consistent with the generally accepted water rate cost-of-service principles and are legally defensible."

c. Fee Only for Service Provided: An agency may put revenues raised from the fee only toward the purpose for which it imposed the fee. *Id*. at Section 6(b)(2). The revenue cannot go toward governmental services that benefit the general public. *Id*. at Section 6(b)(5).

d. Proportionality: The fee amount imposed on any particular parcel must be in proportion to the services that parcel used. *Id*. at Section 6(b)(3). A cost of service study may help to ensure proportionality. San Diego at b ("On this basis, different users may then be charged in relation to their proportionate share of total costs, as required by Proposition 218.").

The Council considers the conservation principles of BMP 1.4 to be compatible with the cost of service requirements of Proposition 218. However, should a case arise in which a water agency's good faith efforts were unable to meet this BMP's requirements due to legal constraints (e.g. Proposition 218), this would be grounds for exemption, as specified in MOU Section 4.5.

**Equity:** A rate structure could send sharp price signals while maintaining affordability by having large differentials between blocks and deriving a greater percentage of the revenue requirement from high-volume users. The structure could then charge at or even below-cost rates for the lowest water block, representing a base amount for essential uses. The resulting rates could still prove unaffordable for low-income customers; however, particularly as the wholesale cost of water rises due to dwindling supplies and mounting demand. Low income programs could help to address such equity issues. When developing or modifying low income programs to compliment conservation rate designs, utilities should consider the following:

a. **Eligibility**: Utilities must first determine who can participate. One method for doing this is to establish income guidelines. Several Class A utilities open their programs to households with incomes that are 200 percent of the federal poverty level, for instance. There may be existing criteria through a local planning department or within the city or county or through the local energy provider that already sets out criteria. It is good to be consistent with other local programs. The California PUC produced a study regarding the provision of services to low-income customers; it is available here: http://www.cpuc.ca.gov/NR/rdonlyres/159B7FB3-D717-41C3-9BCE-27FFE7530AD5/0/dwa_lowincome_research_paper_112507.pdf.

b. **Multi-Family Residential**: The PUC must consider and may implement programs that "provide rate relief for low-income ratepayers" while "provid[ing] appropriate incentives and capabilities to achieve water conservation goals." Cal. Pub. Util. Code Section 739.8. Because the owners of multifamily properties generally pay rates, the residents of those properties cannot qualify for low-income programs. Sub-metering, under which residents pay directly for their water usage, could overcome that disconnect. In the meantime, multi-utility providers like Los Angeles Department of Water and Power could provide water rate assistance through its power billing; but other single-purpose utilities may have to settle for offering conservation rebates and other programs that offer only indirect help.

c. **Certification**: Utilities must develop procedures under which customers can initially apply for low-income programs and subsequently prove continued eligibility for those programs. In the application phase, utilities may require proof of income, like 1040 tax forms, or proof of enrollment in other government assistance programs, like California Alternate Rates for Energy (CARE). Customers may then have to establish their ongoing qualification for the low-income program once a year or at some other interval.

d. **Baseline Allowance**: Utilities must calculate how much water customers can use at discounted rates under the low income program. One option is to create an inclining block structure that parallels the default structure but that has lower rates for each consumption level. Another option is to apply the low-income reduction only to a basic amount of water. In defining the first block or baseline allowance, utilities have to balance the goal of establishing conservation incentives even among low-income customers with equitable considerations. For instance, low-income customers may live in high occupancy households that are water efficient on a per capita basis but overall use large amounts of water. Similarly, low-income customers may be more likely to live in properties with leaking pipes and outdated fixtures.

e. **Magnitude of Assistance**: Low income programs could provide varying forms of assistance. On one hand, the programs could reduce rates by a certain amount, like

25 or 50 percent. On the other hand, the programs could provide a flat subsidy, like a $20 reduction in monthly charges. The size of the assistance may vary depending on income levels and water costs in a particular service area.

f. **Planning**: To succeed, a low income program must reach all intended customers and provide them with adequate assistance. Utilities may wish to identify potential applicants through referrals from other utilities and social service agencies and through outreach. At the same time, to ensure proper planning, utilities must develop reasonable estimates regarding the number of customers who will enroll. Participation rates could be influenced by the voluntary nature of the program, the economy, customer mobility, recertification requirements, and inter-utility data-sharing regulations.

g. **Distributing_Costs**: Utilities typically fund for low-income programs by having their market rate customers pay surcharges. Utilities must determine how to calculate and allocate these surcharges. This may require utilities to consider questions like to what extent non-residential customer classes should subsidize low-income residential customers.

h. **Scale**: Utilities may operate distinct low-income programs for individual service areas or may operate single overarching low-income programs that reach into all service areas. The multi-program approach may allow greater local flexibility. The single-program approach, in turn, may offer greater administrative ease. A single-program approach may also offer utilities that have service areas that are predominately low-income a more reliable and equitable means of levying surcharges.

**Debt Obligations:** The terms of existing debt instruments may restrict the kind of rate structures that utilities can implement. Bond rate covenants, for instance, frequently require that utilities set rates sufficient to yield a certain amount of revenues. Such factors would likely be addressed at the revenue requirement rather than rate design phase of rate-setting but could nonetheless influence the shape of a rate design. Volumetric pricing generally offers less rate stability than flat fee pricing, and utilities must account for the risk that revenue fluctuations could push financial ratios below threshold levels.

**Retail Wastewater Rates:** In much of the United States, utilities charge volumetric rates for wastewater. In California – because of the proliferation of special purpose entities and the frequency with which different utilities provide water and wastewater services, particularly in suburban and inland areas – only about 30 percent of customers pay consumption-based wastewater fees (usually estimated based on December, January, and/or February potable water demand, under the assumption that landscape demands should be at their lowest during these months). The rest pay flat fees. Such flat wastewater pricing results in some customers being overcharged relative to the amount of services they need and others undercharged. Further, it buries price signals that would naturally complement the price signals water fees send and that could effectively act as one half of the conservation pricing equation.

The same concepts that apply to conservation pricing for water would apply to wastewater. California law leaves utilities with the authority to charge volumetric wastewater rates, and the federal Clean Water Act (CWA), 33 U.S.C. Section 1251, *et seq*., encourages it. CWA implementing regulations require recipients of sewer works grants to charge proportionate rates for wastewater treatment services and provide that recipients may consider volume when determining proportionality. 40 C.F.R. 35.929-1(a). *See also Hotel Employers Assoc. of San Francisco v. Gorsuch*, 669 F.2d 1305 (9th Cir. 1982) (implicitly approving of volumetric pricing).

A key distinction between water and wastewater; however, is that utilities can determine water usage through metering but have no similar means of gauging wastewater. For that reason, utilities have often calculated wastewater services based on the assumption that they correspond to some percentage of water services. But such calculations depend on data showing the amount of water customers consume. If the same utility provides water and wastewater services, that information should be readily available. If different utilities provide water and wastewater, though, the wastewater utilities must obtain it.

California law allows and in some cases mandates data-sharing. The Public Records Act, Cal. Gov. Code Section 6250 *et seq*., requires public agencies to release such information as "the name, credit history, utility usage data, home address, [and] telephone number of utility customers . . .[t]o an officer or employee of another governmental agency when necessary for the performance of its official duties." *Id*. at 6254.16(b). The act would thus require a publicly owned water utility to share customer data with a publicly owned wastewater utility if the latter needs that information to institute equitable and efficient rates.

Similarly, the CPUC has found allowed privately owned water utilities to share customer data with wastewater utilities that agree to nondisclosure and confidentiality terms. Precedent for this information sharing practice was set in Resolution No. W-4834, 3-4 (July 9, 2010),where the commission recognized that "[t]he nexus between water use and waste-water volumes can assist in the efficient management of waste-water systems through the sharing of customer-use data [sic] with local government agencies." The commission found that a privately owned utility could release customer name, service address, and water consumption data "for purposes of calculating local taxes, sewer fees, miscellaneous city fees and water conservation efforts . . ."[11] Private water utilities may request the authority to share customer data by filing an advice letter with the CPUC requesting to amend their tariffs by adding a rule and non-disclosure form. The entity receiving the data must enter into a confidentiality and nondisclosure agreement. The agreement should identify the specific data to be disclosed and the reason it is being sought. The agreement should also define what information is confidential and what enforcement options the disclosing utility may have in the event that the wastewater utility breaches.

***Documenting BMP implementation:*** The Council BMP requires utilities to document their implementation of conservation pricing. To satisfy this documentation requirement, utilities must:

1. Report the rate structure in effect for each customer class for the reporting period.

2. Report the annual revenue derived from volume charges for each retail customer class, as defined in Section A. (Note: Compliance with BMP 1.4 will be determined based on the Agency's total revenue from all retail customer classes.)

3. Report the annual revenue derived from monthly or bimonthly meter/service charges for each retail customer class, as defined in Section A.

4. If agency does not comply with Option 1 in Section A, report V' and M' as determined by the Canadian Water & Wastewater Association rate design model described in Section A. (If using Option 2, agency still must report 1-3.)

5. If agency does not comply with Option 1 in Section A, submit to the Council the completed Canadian Water & Wastewater Association rate design model available at the Council's website: http://cuwcc.org/resource-center/technical-resources/bmp-tools.aspx (described as "BMP 1.4 Rate Design Model).

BMP 1.4 requires agencies to meet the Coverage Requirements by year four of their implementation period. At year four and afterward agencies may meet the coverage requirement by satisfying Option 1 or 2 using data from the most recent year, as specified in Section A. If an agency cannot satisfy the requirement using the data from the most recent year, an average of the most recent three years will be used to satisfy this requirement, as

[11] California Public Utilities Commission. Resolution No. W-4834: *Golden State Water Company. Order Approving Request To Amend Its Tariffs By Adding Rule 22, Customer Information Sharing, And Form No. 24, Confidentiality And Non-Disclosure Agreement*. Issued July 9 2010.

specified in Section C. For more information on Option 2, see BMP 1.4 Option 2 ALAEA Rate Model.

**Water Savings Assumptions:** These are not quantified directly by the Council for this particular BMP. However, water agencies may assume meter retrofits and volumetric rates combined will result in a 20% reduction in demand for retrofitted accounts.