Potable Water Conservation Best Management Practices for the Tampa Bay Region

TAMPA BAY WATER

David Bracciano
Project Manager

Updated November 2013

Tampa Bay Water
Potable Water Conservation
Best Management Practices

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Chapter 1 Non-Potable Irrigation Source Replacement or Rebates

Definition: Programming providing reclaimed water or rebates to the single-family and multi-family residential sectors and/or the non-residential sector.

Categories:

(1) Reclaimed Water- Customers are provided reclaimed water service to replace potable water as their irrigation source.

(2) Groundwater from Wells- Customers are given a rebate for changing their irrigation source water from potable to groundwater by installing a groundwater well.

(3) Other Irrigation Sources- Customers are given a rebate for changing their irrigation source water from potable to a non-potable source other than reclaimed or groundwater. Other sources include cisterns, gray-water systems, drip irrigation of septic tank effluent and surface water pumping. Although cisterns and gray water systems are included, cisterns are uncommon in the Tampa Bay region and gray-water systems are currently not permitted by local health departments. Cisterns and drip irrigation are approved on a case-by-case basis as innovative or experimental systems.

Applicable sectors: Single-family residential, multi-family residential and non-residential.

Location of Use: Outdoor water use.

SWFWMD Consolidated WUP Conditions: 5A(4), 5B(7), 5B(8), 5B(11) and 8E.

BMP Life: 25 years.

Implementation Background: The objective of this BMP is to offer reclaimed water or rebates to customers that change irrigation source water from potable to a non-potable (NP) source to save potable water. Only customers that use an in-ground irrigation system qualify for the rebate.

1.1 Number of Applicable Accounts

Based upon Tampa Bay Water analysis in its updated Demand Management Plan, estimates of the number of irrigators are provided for each member, and numbers of surplus irrigators are also identified (table 1-1). Surplus irrigation in the top 25% of users consume about 412 gpad. Accounts targeted should not include deficit irrigators, total use less than 258 gpad, for maximum efficiency. The number of applicable accounts in each sector is the number of accounts with in-ground irrigation systems that use potable water for irrigation and consumes more than 258 gpad.

Table 1-1 Estimated Single-Family Surplus and Deficit Irrigators for Sample Households by WDPA (WY 2008)

WDPA	TBW	PAS	NPR	NWH	SCH	COT	PIN	STP
Total Households	502,474	83,416	7,898	46,737	87,407	107,872	90,163	78,982
Households (*sample*)	424,422	72,961	6,326	33,006	78,728	100,969	75,493	56,939
Total Irrigators	223,866	33,311	2,651	22,882	50,853	59,609	36,632	17,928
Deficit	184,841	26,639	2,368	18,628	40,880	48,149	30,767	17,410
Surplus	39,025	6,672	283	4,254	9,973	11,460	5,865	518
% of Total Households	84%	87%	80%	71%	90%	94%	84%	72%
% of Total Irrigators	53%	46%	42%	69%	65%	59%	49%	31%
% Deficit	83%	80%	89%	81%	80%	81%	84%	97%
% Surplus	17%	20%	11%	19%	20%	19%	16%	3%

1.2 Interactions

There are no interactions between this BMP and other BMPs that would affect the number of applicable accounts. When a non-residential customer is offered a NP irrigation source rebate (NP Rebate) in conjunction with an ICI Evaluation, the costs and savings attributed to the NP Rebate BMP must be reported under this BMP and not the ICI BMP.

1.3 Water Savings Rates

Water savings for each sector are applied to all categories in that sector as discussed below.

1.3.1 Single Family Water Savings; All Categories

A savings rate of 258 gallons per account per day (gpad) for the single-family (SF) sector is determined by the 2013 Demand Management Plan. This savings rate applies to a customer with an in-ground irrigation system changing from irrigating with potable water to irrigating with reclaimed water (Category 1). Since the savings rate is based on the amount of potable water used to irrigate and the number of irrigation events per year, the potable offset is assumed to be 258 gpad for Category 2 and Category 3 as well. Although a customer may use more water to irrigate if the source water is not potable water, this BMP is concerned only with the potable water-savings offset. Expanding an alternative incentive program to include irrigators using less than that of the 258 gpad DQ3 irrigation average was found to not be cost effective.

1.3.2 Multi-Family Water Savings; All Categories

Due to the variability of irrigable area within this sector, evaluation of potable water use should be undertaken based on actual data or on a site by site basis.

1.4 Public Awareness and Education

In order for a program to be successful and focused on specific water users, qualifying candidates must be made aware of the program's existence. This could be accomplished by informing them through the use of post cards, water-bill inserts, or through specific homeowner association newsletters in those areas identified as water users of interest. If a utility currently has a successful Non-Potable Irrigation Source Rebate program in place, program money may be better spent on providing rebates rather than on advertising. However, if a utility is implementing a Non-Potable Irrigation Source Rebate program for the first time, or is offering the program to a certain focused sector for the first time, some form of advertising will be necessary.

The program may also include public education by identifying the benefits of saving water in the advertising campaign. The MF and NR sectors may be recognized through media or by providing a poster or plaque to be displayed in a high-visibility area. Such recognition incentives serve as education to others and could be the impetus for increased program participation. .

1.5 Program Costs

There are two types of program costs: (1) internal costs and (2) outsourced costs. Internal costs include the cost of the utility's staff time and materials needed for program implementation. Outsourced costs would be the cost of a contractor or consultant. Program costs include labor, materials, public awareness/education and the cost of the rebates (for Category 2 and Category 3). If the utility chooses to outsource some of the program tasks, the relative costs associated with the outsourced tasks would be handled accordingly. If outsourcing is applied, the utility will typically also incur some internal costs to cover administrative time for meeting with the consultant/contractor and reviewing program implementation.

1.6 Program Cost Effectiveness

The cost effectiveness of the program is the total present worth of the cost of the program divided by the volume of water saved. Calculations for costs and savings and for cost effectiveness are provided below.

1.6.1 Calculating the Present Worth of Program Costs

The present worth of the total program cost is calculated by summing all costs associated with the number of measures applied during the proposed 5-year program duration. A measure is equivalent to a reclaimed-water connection or a rebate for another non-potable source. The interest rate used for the present worth analysis is defaulted at 7%, although 2013 rates are generally in the 4 to 5% range. The present worth costs for a program beginning in year 2013 is calculated as follows.

$$
\begin{aligned}
P_{2004} = \; & (M_{2013} \text{ x } C_{2013}) \\
& + (M_{2014} \text{ x } C_{2013}) \times (1 + i)^{-1} \\
& + (M_{2015} \text{ x } C_{2013}) \times (1 + i)^{-2} \\
& + (M_{2016} \text{ x } C_{2013}) \times (1 + i)^{-3} \\
& + (M_{2017} \text{ x } C_{2013}) \times (1 + i)^{-4}
\end{aligned}
$$

Where: P_{2004} = Total present worth cost of program in 2013 dollars
M_{2004} = Number of measures in 2013
C_{2004} = Cost per measure in 2013
i = Interest rate

1.6.2 Calculating the Total Water Savings

Savings potential is assumed to equal the estimated irrigation use prior to the intervention (258 gdp) or 94,034 gallons annually. With utility costs estimated at $750 per Intervention and a 25-year useful life of the technology. The average is $0.32 per 1000 gallons of water saved.

1.6.3 Calculating the Cost Effectiveness

Program cost effectiveness is defined as the cost per 1,000 gallons of water saved for implementing a BMP. It is calculated as follows.

$$C/E = (P_{2013} \div S_{25\text{-yr}}) \times 1{,}000$$

Where: C/E = Program cost effectiveness in dollars per 1,000 gallons
P_{2004} = Total present worth cost of program in 2013 dollars
$S_{20\text{-yr}}$ = Total 25-year water savings in MG

1.7 Program Implementation Options

As discussed in Section 1.5, rebate processing could be done by the utility (internally) or be outsourced. For reclaimed water system expansions, customers should be notified of the newly available system. Utilities should network with other utilities that have implemented similar programs to gain insight on program costs, savings and possible complications.

1.8 Evaluation of Customer Satisfaction and Program Effectiveness

Approximately one year after reclaimed has been provided or a rebate processed, the utility should follow-up with the participating customer. The objective of the customer-satisfaction evaluation is to gauge the participant's satisfaction with the program. This could be accomplished by use of a questionnaire sent as a post card. Survey questions could include the customer's satisfaction with new source water, satisfaction with utility personnel and/or utility-appointed contractors who processed the rebate and the customer's perceived change in their water bill. The questionnaire could also include information about new or ongoing programs and relevant maintenance tips.

In addition to gauging the participating customer's satisfaction with the program, an evaluation of the actual cost-effectiveness of the program should be conducted. Potable water savings attributed to the use of the new irrigation source can be estimated from pre- and post-program water use as indicated on the participant's water bill. A study of this nature would probably be best suited for customers who used a separate irrigation meter for their previously potable irrigation water.

Chapter 2 Landscape Irrigation Programs with Soil Moisture Sensor (SMS) and Evapotranspiration (ET) Irrigation Controllers

Definition: Programming providing water-efficient controllers to be added to in-ground irrigation systems. These systems have the potential to independently control watering devices for optimal conservation and efficiency

Categories: (1) Soil Moisture Sensor (SMS)
(2) Evapotranspiration (ET)

Applicable sectors: Single-family residential (Multi-family and Non-residential sector savings rates are excluded from this BMP due to difficulties quantifying the water savings. Savings estimates are on a case by case basis.)

Location of Use: Outdoor water use.

SWFWMD Consolidated WUP Conditions: 5B(6), 5B(7), 5B(10) and 5B(11).

BMP Life: 10 years.

Implementation Background: The use of these devices is aimed at meeting needs, rather than schedule savings consistent with pre-program input. The use of this BMP is targeted to the highest 25% of surplus irrigators, to achieve and use saving rates.

2.1 Number of Applicable Accounts

Applicable accounts are considered the highest 25% of surplus irrigators per member government. An irrigator is an account that consumes more than the 177 gpd on average. Water use rates (gpd) in excess of 589 are generally considered surplus irrigators in the Tampa Bay Region.

2.2 Interactions

There are interactions between this bmp and other bmp's, as they work in conjunction to conserve water from the highest consumers. When a non-residential customer is offered and installs a soil moisture sensor and/or ET Controller in conjunction with an ICI Evaluation, the costs and savings attributed to this technology must be reported under this BMP and not the ICI BMP.

2.3 Single Family Water Savings Rates: All Categories

The watering savings rates are averaged at 155 gpd per Single Family accounts when implemented to surplus irrigators. The rebates on the SMS and ET did provide consumers with a lower consumption rate, but it must be implemented on Surplus irrigators to secure potential savings. The other consumers will not benefit due to their landscape being under watered, which this program would affect negatively concerning water savings. Any more potential water savings cannot be identified at this time.

The study takes place using the property appraiser data, which provides information pertaining to landscape size used for the landscape water requirement calculator. For a period of 12 months the single-family homes provided consumption data and estimates of irrigable area. In total there were 424,422 households in the sample, which yielded that more than half (53%) are assumed to irrigate based on the water consumption levels. The study concerned all irrigators in the program, so it was able to identify a targeted groups that would make the program very effective. The 2 different irrigators were the Surplus and Deficit irrigators. The customers received incentives to implement SMS and ET sensors into their irrigation systems.

2.4 Public Awareness and Education

In order for a program to be successful, the qualifying candidates must be made aware of the program's existence. Once the candidates are identified the member government must use direct contact due to the potentially negative outcome of applying the program to non-qualifying accounts or areas.

2.5 Program Costs

There are two types of program costs: (1) internal costs and (2) outsourced costs. Internal costs include the cost of the utility's staff time and materials needed for program implementation. Outsourced costs would be the cost of a contractor or consultant. Program costs include labor, materials, public awareness/education and the cost of rebates (for Categories 2 and 3). If the utility chooses to outsource some of the program tasks, the relative costs associated with the outsourced tasks would be handled accordingly. If outsourcing is applied, the utility will typically also incur some internal costs to cover administrative time for meeting with the consult-ant/contractor and reviewing program implementation.

2.5.1 Calculating the Present Worth of Program Costs

The present worth of the total program cost is calculated by summing all costs associated with the number of measures applied during the proposed 5-year program duration. A measure is equivalent to a reclaimed-water connection or a rebate for another non-potable source. The interest rate used for the present worth analysis is defaulted at 7%, although 2013 rates are generally in the 4 to 5% range. The present worth costs for a program beginning in year 2013 is calculated as follows.

$$
\begin{aligned}
P_{2004} \quad = \quad & (M_{2013} \text{ x } C_{2013}) \\
& + (M_{2014} \text{ x } C_{2013}) \times (1 + i)^{-1}
\end{aligned}
$$

$$+ (M_{2015} \text{ x } C_{2013}) \times (1 + i)^{-2}$$
$$+ (M_{2016} \text{ x } C_{2013}) \times (1 + i)^{-3}$$
$$+ (M_{2017} \text{ x } C_{2013}) \times (1 + i)^{-4}$$

Where: P_{2004} = Total present worth cost of program in 2013 dollars
M_{2004} = Number of measures in 2013
C_{2004} = Cost per measure in 2013
i = Interest rate

2.5.2 Calculating the Cost Effectiveness

Program cost effectiveness is defined as the cost per 1,000 gallons of water saved for implementing a BMP. It is calculated as follows.

$$C/E = (P_{2013} \div S_{10\text{-yr}}) \times 1{,}000$$

Where: C/E = Program cost effectiveness in dollars per 1,000 gallons
P_{2004} = Total present worth cost of program in 2013 dollars
$S_{20\text{-yr}}$ = Total 10-year water savings in MG

2.6 Program Cost Effectiveness

Utility cost to implement the program is estimated around $200. The program has a 10 year useful limited by the technology. The average cost of the SMS/ET controllers is $1.83 per 1000 gallons of water saved.

2.6.1 Total Water Savings

The targeted surplus irrigators account for savings potential of 55,645 gpy for the useful life of the technology, which dictates an average cost of $.35 per 1000 gallons.

2.7 Program Implementation Options

The program was evaluated to be implemented in either an 8 year program that is designed to reduce the total number of surplus irrigators by 20% prior to 2025, or the second program is to reduce the surplus irrigators by 40% prior to 2035.

2.8 Evaluation of Customer Satisfaction and Program Effectiveness

Approximately one year after installation, the utility should follow-up with the participating customer. In addition to gauging the participating customer's satisfaction with the program, tracking of water use should be undertaken and accounts tagged with data indicating technologies installed.

Chapter 3 High-Efficiency Clothes Washer Rebates

Definition: Programming providing rebates to the single-family and multi-family residential sectors and/or to the non-residential sector for high-efficiency clothes washers.

Categories: (1)High Efficiency Washers: Customers are provided with rebates to incentivize the exchange of old technology/ high consumption washers.

Applicable sectors: Single-family residential, multi-family residential and non-residential. The residential sectors consist of the single-family (SF) and multi-family (MF) sectors. The multi-family sector consists of two sub-sectors: multi-family with an in-unit washing machine (MF_{in}) and multi-family with a common laundry area (MF_{com}). The non-residential (NR) sector for this BMP applies to coin laundries only. The clothes washers used by the SF sector and the MF_{in} sub-sector typically operate with the same volume of water per load on the average. Likewise, the clothes washers used by the MF_{com} sub-sector and the NR sector are comparable.

Location of Use: Indoor water use.

SWFWMD Consolidated WUP Conditions: 5B(4) and 5B(11).

BMP Life: 12 years.

Implementation Background: The objective of this BMP is to encourage customers, through rebate incentives, to replace their high water-use clothes washers with high-efficiency clothes washers, which reduce the volume of clothes-washing water by 15gpd .

3.1 Number of Applicable Accounts

The number of rebate eligible accounts estimated by Tampa Bay Water in the updated Demand Management Plan is 451,278 for single family homes and 208,720 for multi-family homes. These numbers represent a total of 87 and 88% respectively of the market of inefficient washers.

3.2 Interactions

There are no interactions with this BMP and other BMPs that would affect the number of applicable accounts.

3.3 Water Savings Rates

The water savings rates are applied as savings per account for the SF sector and as a savings per unit for the MF sector. Since a SF home would typically have only one washer, savings in gallons per day (gpd) per account (gpad) is the same as savings per rebated washer (gprd). Likewise, for the MF the savings in gallons per day per unit (gpud) is the same as the savings per rebate (gprd).

3.3.1 Water Savings for the SF Sector and the MF Sub-sector with In-unit Washers

Potential savings per machine is assumed to be 15 gpd in SF homes. This is with the assumption that SF will average 0.96 loads per day and a weighted average savings of 5.91 gallons per cubic foot (gpcf). Multi-family average water savings of 12 gpd is to be assumed. The total loads per day averages .073 with a weight average savings of .064 gpcf. These values were averaged using daily household water savings for an HE conversion, then estimated by multiplying the clothes washer capacity assumption (2.7 cubic feet per load) and the frequency of use assumption. Application of the weighted average savings estimates for each sector.

3.3.2 Water Savings for the MF Sub-sector with Common Laundry Areas

For the MF_{com} sub-sector, pre-rebate water use is based on 0.31 lpd per unit and 32 gpl for a conventional commercial washer (NRC, 2002). The machines in common-laundry areas for the NRC study were vertical-axis (v-axis) washers only. A study that compared conventional horizontal-axis (h-axis) washers to efficient h-axis washers found that older h-axis washers use 32 gpl compared to efficient h-axis washers which use approximately 20 gpl (Schuldt, et. al., 2003). The savings potential between a conventional (v- or h-axis) and an efficient commercial washer is therefore 12 gpl. The savings per unit is calculated as:

$$MF_{com}\text{ Savings} = 0.31\text{ lpd per unit} \times 12\text{ gpl} = 3.7\text{ gpud}$$

3.4 Public Awareness and Education

In order for a rebate program to be successful, the qualifying candidates must be made aware of the program's existence. This could be accomplished by informing them through the use of post cards, water-bill inserts, radio public service announcements, a television or billboard advertising campaign, or by posting notices in home improvement and plumbing retail stores or on a utility's website. If a utility currently has a well-known clothes washer rebate program in place, program money may be better spent on providing rebates rather than on advertising. However, if a utility is implementing a clothes washer rebate program for the first time, or is offering the rebate to a certain sector or sub-sector for the first time, some form of advertising will be necessary.

The program may also include public education by identifying the benefits of saving water in the advertising campaign. Multi-family complexes and non-residential facilities may be recognized through media or by providing a poster or plaque to be displayed in a high-visibility area. A poster may include pre- and post-program water use. Such recognition would serve as education to property owners and facility managers and could be the impetus for increased program participation.

3.5 Program Costs

At a unit cost of $125 per incentive and a 12-year useful life, the estimated average cost of the clothes washer program is $1.86 and $2.41 per 1000 gallons of water saved, for the single-family and multi-family sectors, respectively. There are two types of program costs: (1) internal costs and (2) outsourced costs. Internal costs include the cost of the utility's staff time and materials needed for program implementation. Outsourced costs would be the cost of a contractor or consultant. Program costs include labor, materials, public awareness/education and the cost of rebates. If the utility chooses to outsource some of the program tasks, the relative costs associated with the outsourced tasks would be handled accordingly. If outsourcing is applied, the utility will typically also incur some internal costs to cover administrative time for meeting with the consultant/contractor and reviewing program implementation. Rebates offered by other utilities across the country range from $50 to $450 per washer. For information on entering into rebate partnerships with power utilities and manufacturers see Section 3.7.4

3.6 Program Cost Effectiveness

The cost effectiveness of the program is the total present worth of the cost of the program divided by the volume of water saved. Calculations for costs and savings and for cost effectiveness are provided below.

3.6.1 Calculating the Present Worth of Program Costs

The present worth of the total program cost is calculated by summing all costs associated with the number of rebates issued during the proposed 5-year program duration. The interest rate used for the present worth analysis is 7%. The present worth costs for a program beginning in year 2013 is calculated as follows.

$$
\begin{aligned}
P_{2004} = \; & (M_{2013} \times C_{2013}) \\
& + (M_{2014} \times C_{2013}) \times (1 + i)^{-1} \\
& + (M_{2015} \times C_{2013}) \times (1 + i)^{-2} \\
& + (M_{2016} \times C_{2013}) \times (1 + i)^{-3} \\
& + (M_{2017} \times C_{2013}) \times (1 + i)^{-4}
\end{aligned}
$$

Where: P_{2004} = Total present worth cost of program in 2013 dollars
M_{2004} = Number of measures (or rebates issued) in 2013
C_{2004} = Cost per rebate in 2013
i = Interest rate

3.6.2 Calculating the Total Water Savings

To determine total water savings over twenty years, it is assumed that the cumulative number of rebates issued in the final year of the 5-year program duration would continue to save water on an annual basis for an additional 12 years. However, the water savings are calculated by this BMP over a 20-year horizon; therefore, the savings in the fifth year are multiplied by 16 years. The water saved over a 20-year period is calculated as follows.

$$S_{12\text{-yr}} = [S_{2013} + S_{2014} + S_{2015} + S_{2016} + (S_{2017} \times 8 \text{ years})] \times 365$$

Where: $S_{12\text{-yr}}$ = Total 12-year water savings in million gallons (MG)
S_{2013} = Water savings in 2013 in million gallons per day (MGD)

3.6.3 Calculating the Cost Effectiveness

Program cost effectiveness is defined as the cost per 1,000 gallons of water saved for implementing a BMP. It is calculated as follows.

$$C/E = (P_{2013} \div S_{12\text{-yr}}) \times 1{,}000$$

Where: C/E = Program cost effectiveness in dollars per 1,000 gallons
P_{2004} = Total present worth cost of program in 2013 dollars
$S_{20\text{-yr}}$ = Total 12-year water savings in MG

3.7 Program Implementation Options

Utilities should network with other utilities that have implemented similar programs to gain insight on program costs, savings and possible complications. When considering SF rebates, a determination of relocation potential should be quantified. Other implementation considerations are discussed in the following sections.

3.7.1 In-house Versus Out-sourcing

As discussed in Section 3.5, rebate processing could be done by the utility (internally) or be out-sourced. For the non-residential sector, another option is to use or recommend water-based performance contractors. Performance contracting is an innovative financing technique that uses cost savings from reduced utility (water and sewer) consumption to repay the cost of installing water conservation measures. Normally offered by water service companies (WASCOs), this technique allows for the development of a water-savings program without significant up-front capital expenses on the part of the user. Instead, the cost of water-efficiency improvements are borne by either the WASCO or a third party lender who recoups cost and shares water savings profits with the user.

3.7.3 Approved Washer Selection

The utility should rebate all ENERGY STAR qualifying washers because ENERGY STAR washers generally use 35-50% less water and 50% less energy per load than new non-qualifying models. Or a utility may compose an approved list of ENERGY STAR washers (generally less than 4.5 gpcf) that are eligible for rebate, focusing on the most water-efficient models and including models with additional manufacturers' rebates (see Section 3.7.4).

3.7.4 Partnerships

Utilities should consider proposing a cost-share program with local power utilities in their service area as high-efficiency clothes washers also save energy. Energy savings are attributed to efficient use of hot water, better moisture removal (resulting in less drying time) and increased energy-efficiency compared to non-energy conserving machines. Also, several manufacturers across the country partner with water and energy utilities to offer customers an additional rebate up to $50 per machine. This interest should be mutual to both entities, as hot water use reduction also reduces electric usage. Alternatively, if there are requirements or expectations to reduce greenhouse gas emissions, this program provides electric and water utilities, along with their customers, that opportunity.

An example of a clothes-washer rebate co-operative funding relationship is Puget Sound Energy in Washington State. The utility provides a $50 rebate to its customers and the customer can receive two additional rebates. Puget Sound Energy has eight partnering manufacturers that offer $50 rebates and seven partnering water utilities that offer rebates from $50 to $100.

At a minimum, utilities interested in a clothes-washer rebate program should become an ENERGY STAR Partner. ENERGY STAR claims that by using ENERGY STAR tools and strategies, "organizations can reduce program costs and implementation timelines while increasing the efficacy of their programs" (www.energystar.gov). Currently, there are 325 Utilities (including water utilities), States and Regional Energy-Efficiency Groups that are ENERGY STAR Partners.

3.8 Evaluation of Customer Satisfaction and Program Effectiveness

Approximately one year after a rebate is processed, the utility should follow-up with the participating customer or customer group. The objective of the customer-satisfaction evaluation is to gauge the participant's satisfaction with the program. This could be accomplished by use of a questionnaire sent as a post card. Survey questions could include the customer's satisfaction with new equipment, satisfaction with utility personnel and/or utility-appointed contractors who processed the rebate and the customer's perceived change in their water bill. The questionnaire could also include information about new or ongoing programs and relevant maintenance tips.

In addition to gauging the participating customer's satisfaction with the program, an evaluation of the actual cost-effectiveness of the program should be conducted. Water savings attributed to rebates can be estimated from pre- and post-rebate water use as indicated on the participant's water bill.

Chapter 4 High Efficiency Toilets (HET)Toilet Rebates

Definition: Programming providing ULF toilet rebates to the single-family and multi-family residential sectors and/or the non-residential sector.

Categories: None.

Applicable sectors: Single-family residential, multi-family residential and non-residential.

Location of Use: Indoor water use.

SWFWMD Consolidated WUP Conditions: 5B (1), 5B (2) and 5B (11).

BMP Life: 25 years.

High Efficiency Toilets (HET)

Implementation Background: The objective of this BMP is to encourage customers, through incentives like rebates, to replace high water-use toilets with high efficiency toilets (HET's), which reduce the volume of toilet-flush water to 1.28 gallons per flush (gpf) or less. This results in significant water savings over older, less efficient non-EPACT toilets, which use from 3.5 to 7.0 gpf, depending on the age of the toilet.

The U.S. Energy Policy Act of 1992 (EPACT) became effective on January 1, 1994, and required manufacturers to produce water-conserving plumbing fixtures (i.e., ULF or more efficient toilets and urinals, low-flow showerheads, and low-flow faucets and aerators). Since all toilets installed or replaced after 1995 conform to these guidelines, this BMP is applicable to all accounts existing or constructed before 1995.

WaterSense is a partnership program sponsored by the Environmental Protection Agency. Its mission is to protect the future of our nation's water supply by promoting and enhancing the market for water-efficient products and programs. WaterSense promotes the value of water and helps customers and organizations make smart choices regarding water use and water-using products. Consumers can recognize water-efficient products with the WaterSense label which are about 20 percent more water-efficient than the average product in the same category, which includes HET's

4.1 Number of Applicable Accounts

Rebate-eligible toilets are estimated for each forecast year. The number of rebate eligible fixtures diminishes over the forecast horizon as the number of 5.0 and 3.5 gpf toilets remaining after passive replacement diminishes through time. In 2015, 22 percent of total single-family toilets are considered rebate eligible. However, due to natural replacement activity only 8 percent of total single-family toilets are estimated to have flush volumes greater than 1.6 gpf by 2035, which is the target.

4.2 Interactions

There are interactions between this BMP and the ULF toilet BMPs affecting the number of applicable accounts. Provision of savings cannot occur in this analysis from both a ULF incentive and an HET incentive. This could occur but savings would only be from 1.6 gpf to 1.28, still a 20% reduction in flow. Although a non-residential customer may be offered HET toilet rebates subsequent to a water-use evaluation (via the ICI BMP), the costs and savings must be reported under the ICI BMP and not this BMP.

4.3 Water Savings Rates

There is an estimated natural replacement rate (nrr) of 4 percent annually for each fixture type. Because fixtures are replaced at a constant annual rate over the entire forecast horizon, the proportion of remaining 3.5 and 5.0 gpf fixtures is constant over the forecast horizon. Therefore, the number of fixtures can be used to weight the average savings rates estimated at 2.87 gpf for the single-family sector and 2.82 gpf for the multifamily sector.

4.3.1 Residential Water Savings

Average daily water savings per single-family toilet are estimated by multiplying the weighted average water savings, assumed number of persons per household for each sector and the estimated intensity of single retrofit flushes (4.2 flushes per person per day).

Table 4-1
Estimation of Daily Flushes on Rebated Toilets

Toilets Rebated	Estimated Percent Reduction	Proportion of Total Savings/Flushes	Daily Flushes per Person
Single	10.8%	84.4%	4.22
Multiple	12.8%	15.6%	0.78
Average Flushes per Person Per Day			5.0

■ At 2.61 pph, single-family toilet savings are estimated at 32 gpd (11,578 GPY).

■ At 1.9 pph multifamily average water savings per toilet is of 22 gpd (8,111 GPY).

4.3.2 Program implementation

Two implementation scenarios which assess regional savings potential over separate timeframes are considered for both the single-family and multifamily sectors. **Error! Reference source not found.** summarizes the total number of available and planned interventions associated with each scenario. The first scenario is a 10-year program which assesses the savings potential associated with reducing the total number of eligible toilets by 50 percent prior to 2025, while the second scenario would reduce the total number of eligible toilets by 75 percent by 2035.

Table 4-2

Single-Family and Multifamily HET Market Potential and Intervention Scenarios

Program Length	Start Year	Final Year	Sector	Flow Rate	Penetration Rate	Interventions		
						Market Potential	Total Planned	Annual Planned
10-year	2015	2024	SF	3.5	50%	94,069	47,034	4703
				5.0	50%	72,166	36,083	3608
			MF	3.5	50%	61,208	30,604	3060
				5.0	50%	41,240	20,620	2062
21-year	2015	2035	SF	3.5	75%	62,540	46,905	2345
				5.0	75%	47,978	35,984	1799
			MF	3.5	75%	40,693	30,520	1526
				5.0	75%	27,418	20,563	1028

4.4.1 Program Cost Effectiveness

The cost effectiveness of the program is the total present worth of the cost of the program divided by the volume of water saved. Calculations for costs and savings and for cost effectiveness are provided below.

4.4.2 Calculating the Present Worth of Program Costs

The present worth of the total program cost is calculated by summing all costs associated with the number of rebates issued during the proposed 5-year program duration. The interest rate used for the present worth analysis is 7%. The present worth costs for a program beginning in year 2013 is calculated as follows.

$$
\begin{aligned}
P_{2004} = \; & (M_{2013} \times C_{2013}) \\
& + (M_{2014} \times C_{2013}) \times (1 + i)^{-1} \\
& + (M_{2015} \times C_{2013}) \times (1 + i)^{-2} \\
& + (M_{2016} \times C_{2013}) \times (1 + i)^{-3} \\
& + (M_{2017} \times C_{2013}) \times (1 + i)^{-4}
\end{aligned}
$$

Where: P_{2004} = Total present worth cost of program in 2013 dollars

M_{2004} = Number of measures (or rebates issued) in 2013
C_{2004} = Cost per rebate in 2013
i = Interest rate

4.4.3 Calculating the Total Water Savings

To determine total water savings over twenty years, it is assumed that the cumulative number of rebates issued in the final year of the 5-year program duration would continue to save water on an annual basis for an additional 12 years. However, the water savings are calculated by this BMP over a 20-year horizon; therefore, the savings in the fifth year are multiplied by 16 years. The water saved over a 25-year period is calculated as follows.

$$S_{25\text{-yr}} = [S_{2013} + S_{2014} + S_{2015} + S_{2016} + (S_{2017} \times 13 \text{ years})] \times 365$$

Where: $S_{25\text{-yr}}$ = Total 12-year water savings in million gallons (MG)
S_{2013} = Water savings in 2013 in million gallons per day (MGD)

4.4.4 Calculating the Cost Effectiveness

Program cost effectiveness is defined as the cost per 1,000 gallons of water saved for implementing a BMP. It is calculated as follows.

$$C/E = (P_{2013} \div S_{25\text{-yr}}) \times 1{,}000$$

Where: C/E = Program cost effectiveness in dollars per 1,000 gallons
P_{2004} = Total present worth cost of program in 2013 dollars
$S_{20\text{-yr}}$ = Total 25-year water savings in MG

4.4.5 Program Implementation Options

Utilities should network with other utilities that have implemented similar programs to gain insight on program costs, savings and possible complications. When considering SF rebates, a determination of relocation potential should be quantified. Other implementation considerations are discussed in the following sections.

4.4.6 Program Costs

At a unit cost of $100 per single-family incentive and $75 per multifamily incentive and a 25-year useful life, the estimated average cost of each program is $0.35 and $0.37 per 1000 gallons of water saved.

Table4-3
Single-family and Multifamily HET
Water Savings Estimates and Average Cost Assumptions

Variable	SF Estimate	MF Estimate
Water Savings (gpy)	11,542	8,111
Useful Life (years)	25	25
Savings Over Useful Life	288,549	202,782
Incentive ($/measure)	$100	$75
Average Cost ($/1000 gallons)	$0.35	$0.37

Chapter 5 Urinal Rebates

Definition: Programming providing urinal rebates to the non-residential sector.

Categories: Rebates for high efficiency urinals (HEU).

Applicable sector: Non-residential.

Location of Use: Indoor water use.

SWFWMD Consolidated WUP Conditions: 5B(1), 5B(2) and 5B(11).

BMP Life: 30 years.

Implementation Background: The objective of this BMP is to encourage customers, through rebate incentives, to replace their high water-use urinals with High Efficiency Urinals. Replacing a conventional urinal with a HEU reduces the volume of urinal-flush water to about one gallon per flush (gpf). This results in significant water savings over older, less efficient urinals, which use from 1.0 to 5.0 gpf, depending on the age of the urinal (Vickers, 1996).

The U.S. Energy Policy Act of 1992 (EPACT) became effective on January 1, 1994, and required manufacturers to produce water-conserving plumbing fixtures (i.e., ULF toilets and urinals, low-flow showerheads, and low-flow faucets and aerators). WaterSense label fixtures are industry suggested, making guidelines for water conservation efficiency in HEU's. Since all urinals installed or replaced after 1995 conform to EPACT guidelines, this BMP is applicable to all accounts existing or constructed before 1995 and improvements to conform to WaterSense specifications are suggested.

5.1 Number of Applicable Accounts

Nonresidential rebate-eligible fixtures are estimated for each forecast year as the number of 3.0 and 1.0 gallon per flush urinals remaining after passive replacement has occurred. Accounts that have previously received an incentive should not be considered in this program.

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5.2 Interactions

There are no interactions between this BMP and other BMPs that would affect the number of applicable accounts. Although a non-residential customer may be offered urinal rebates subsequent to a water-use evaluation (via the ICI BMP), the costs and savings must be reported under the ICI BMP and not this BMP.

5.3 Water Savings Rates

The water savings rates (gpad) for replacing conventional urinals with HEU are based on distribution of urinals across re-bate eligible efficiency levels, which are used to estimate weighted average flush volumes as well as the number of flushes per employee and flushes per visitor assumed to occur each day. Table 5-1 shows a distribution of flushes among non-residential location that corroborate information for implementation calculations and savings.

HE Urinals: Water consumption with HEU in gallons per employee per day (gped) = .5 gpf × 4 flushes/employee/day = 2 gped

Weighted average savings estimates are derived by:

1. Subtracting *weighted annual average flush volume* from *baseline flush volume* to estimate ***weighted average savings per flush***

2. Multiplying the weighted average savings per flush by the assumed number of employee/visitor flushes day to estimate ***savings per employee/visitor per day***

3. Dividing the estimated daily water savings by fixtures per employee/visitor to estimated ***water savings per retrofit per day***

4. Multiplying the assumed number of employee/visitor days per year by the water savings per retrofit per day to estimate ***annual water savings per toilet***

Table 5-1

Valve-Type ULFT / Tank-Type HET / 1/2 Gallon HEU Employee / Visitor Assumptions

Key Sector	Occupancy				Employee Intensity[1]			Visitor Intensity[2]		
	2010 Employees	Visitation	Employee Days	Visitation Days	Female Toilet Flushes	Male Toilet Flushes	Male Urinal Flushes	Total Flushes	Toilet Flushes	Urinal Flushes
Hotels	47,267	20,286	250	365	2.5	1.0	1.5	5.0	4.83	0.17
Churches	24,289	24,289	250	0	2.5	1.0	1.5	0.5	0.33	0.17
Health	72,445	72,445	250	250	2.5	1.0	1.5	0.5	0.33	0.17
Office	193,547	193,547	250	250	2.5	1.0	1.5	0.5	0.33	0.17
Government	119,546	119,546	250	250	2.5	1.0	1.5	0.5	0.33	0.17
Education	98,738	783,819	180	180	1.875	0.75	1.125	1.17	0.86	0.31
Industrial	236,189	0	250	0	2.5	1.0	1.5	0.5	0.33	0.17
Retail	155,351	328,506	250	250	2.5	1.0	1.5	0.2	0.13	0.07
Restaurant	30,848	131,300	250	365	2.5	1.0	1.5	0.2	0.13	0.07
Other	226,757	226,757	250	250	2.5	1.0	1.5	0.2	0.13	0.07

Table 5-2 provides the assumptions used to evaluate the average cost for the nonresidential fixture replacement programs. At a unit cost of $125 per measure and a 30-year useful life, the estimated average cost of the nonresidential fixture replacement programs ranges between $0.22 and $.032 per 1000 gallons of water saved.

Table 5-2

Water Savings Estimates and Average Cost Assumptions

Variable	ULFT	HET	HEU
Water Savings (gpy)	17,970	12,843	18,928
Useful Life (years)	30	30	30
Savings Over Useful Life	539,100	385,303	567,840
Incentive ($/measure)	$125	$125	$125
Average Cost ($/1000 gallons)	$0.23	$0.32	$0.22

[1] *Assumes 6 hr day in education and 8 hr day in other sectors; base assumption of 5.1 flushes/person/day (REUWS) during a 16 hr period. 60% of male flushes are assumed to be associated with urinals.*

[2] *Waste Not Want Not: The Potential for Urban Water Conservation in Florida, Appendix D. (Pacific Institute, 2003). Visitor intensity for Retail, Restaurant and Other is reduced to reflect 40 percent fixture use.*

5.4 Public Awareness and Education

In order for a rebate program to be successful, the qualifying candidates must be made aware of the program's existence. This could be accomplished by informing them through the use of post cards, water-bill inserts, radio public service announcements, a television or billboard advertising campaign, or by posting notices in home improvement and plumbing retail stores or on the utility's website. If a utility currently has a successful urinal rebate program in place, program money may be better spent on providing rebates rather than on advertising. However, if a utility is implementing a urinal rebate program for the first time, some form of advertising will be necessary.

The program may also include public education by identifying the benefits of saving water in the advertising campaign. Participating facilities may be recognized through media or by providing a poster or plaque to be displayed in a high-visibility area. A poster may include pre- and post-program water use. Such recognition would serve as education to other facilities and could be the impetus for increased program participation.

5.5 Program Costs

There are two types of program costs: (1) internal costs and (2) outsourced costs. Internal costs include the cost of the utility's staff time and materials needed for program implementation. Outsourced costs would be the cost of a contractor or consultant. Program costs include labor, materials, public awareness/education and the cost of the rebates. If the utility chooses to outsource some of the program tasks, the relative costs associated with the outsourced tasks would be handled accordingly. If outsourcing is applied, the utility will typically also incur some internal costs to cover administrative time for meeting with the consultant/contractor and reviewing program implementation.

5.6 Program Cost Effectiveness

The cost effectiveness of the program is the total present worth of the cost of the program divided by the volume of water saved. Calculations for costs and savings and for cost effectiveness are provided below.

5.6.1 Calculating the Present Worth of Program Costs

The present worth of the total program cost is calculated by summing all costs associated with the number of rebates issued during the proposed 5-year program duration. The interest rate used for the present worth analysis is 7%. The present worth costs for a program beginning in year 2013 is calculated as follows.

$$\begin{aligned} P_{2004} = \; & (M_{20013} \times C_{2013}) \\ & + (M_{2014} \times C_{2013}) \times (1 + i)^{-1} \\ & + (M_{2015} \times C_{2013}) \times (1 + i)^{-2} \\ & + (M_{2016} \times C_{2013}) \times (1 + i)^{-3} \\ & + (M_{2017} \times C_{2013}) \times (1 + i)^{-4} \end{aligned}$$

Where: P_{2004} = Total present worth cost of program in 20013 dollars

M_{2004} = Number of measures (or rebates issued) in 2013
C_{2004} = Cost per rebate in 2013
i = Interest rate

5.6.2 Calculating the Total Water Savings

To determine total water savings over twenty years, it is assumed that the cumulative number of rebates issued in the final year of the 5-year program duration would continue to save water on an annual basis for an additional 30 years. However, the water savings are calculated by this BMP over a 30-year horizon; therefore, the savings in the fifth year are multiplied by 25 years. The water saved over a 30-year period is calculated as follows.

$$S_{20\text{-yr}} = [S_{2013} + S_{2014} + S_{2015} + S_{2016} + (S_{2017} \times 25 \text{ years})] \times 365$$

Where: $S_{20\text{-yr}}$ = Total 30-year water savings in million gallons (MG)
S_{2013} = Water savings in 2013 in million gallons per day (MGD)

5.6.3 Calculating the Cost Effectiveness

Program cost effectiveness is defined as the cost per 1,000 gallons of water saved for implementing a BMP. It is calculated as follows.

$$C/E = (P_{2013} \div S_{30\text{-yr}}) \times 1{,}000$$

Where: C/E = Program cost effectiveness in dollars per 1,000 gallons
P_{2013} = Total present worth cost of program in 2013 dollars
$S_{30\text{-yr}}$ = Total 30-year water savings in MG

5.7 Program Implementation Options

Utilities should network with other utilities that have implemented similar programs to gain insight on program costs, savings and possible complications. As discussed in section 5.5, rebate processing could be done by the utility (internally) or be outsourced. Another option is to use or recommend water-based performance contractors. Performance contracting is an innovative financing technique that uses cost savings from reduced utility (water and sewer) consumption to repay the cost of installing water conservation measures. Normally offered by water service companies (WASCOs), this technique allows for the development of a water-savings program without significant up-front capital expenses on the part of the user. Instead, the cost of water-efficiency improvements are borne by either the WASCO or a third party lender who recoups cost and shares water savings profits with the user.

Utilities should consider the option of providing rebates of higher value for HE urinals compared to ULF urinals. The higher rebate value would be incentive for a facility to install a HEU model instead of a ULF model. The increased savings that HE urinals provide could justify the increased cost of the rebate. It is recommended in the implementation of future urinal rebate programs that the number of HEU, ULF and non-ULF urinals per account be recorded at the time of urinal rebate inspection.

5.8 Evaluation of Customer Satisfaction and Program Effectiveness

Approximately one year after a rebate is processed, the utility should follow-up with the participating customer or customer group. The objective of the customer-satisfaction evaluation is to gauge the participant's satisfaction with the program. This could be accomplished by use of a questionnaire sent as a post card. Survey questions could include the customer's satisfaction with the new urinal(s), satisfaction with utility personnel and/or utility-appointed contractors who processed the rebate and the customer's perceived change in their water bill. The questionnaire could also include information about new or ongoing programs and relevant maintenance tips.

In addition to gauging the participating customer's satisfaction with the program, an evaluation of the actual cost-effectiveness of the program should be conducted. Water savings attributed to rebates can be estimated from pre- and post-rebate water use as indicated on the participant's water bill.

Chapter 6 Industrial, Commercial and Institutional Water-Use Evaluations/Implementation

Definition: Programming providing water-use evaluations to industrial, commercial and institutional (ICI) water users.

Categories: None.

Applicable sector: Non-residential.

Location of Use: Indoor water use only (includes cooling/does not include landscape irrigation).

SWFWMD Consolidated WUP Conditions: 5B(9) and 5B(11).

BMP Life: 20 years.

Implementation Background: This BMP describes how to select ICI customers for evaluations, provides a discussion of the typical water uses encountered during an evaluation, and includes guidelines on preparing the evaluation report and conducting follow-up assessments. Since the ICI sector is extremely broad, all types of ICI facilities are not discussed herein, but benchmarks for several types of facilities are provided where literature was available. This BMP does not include specific guidelines for providing financial incentives to facilities to help pay for the recommended modifications. However, providing financial incentives may increase the likelihood that the recommendations listed in the evaluation report are implemented.

ICI conservation programs are becoming more popular locally and nationally. "According to the 1999 AWWA Water:\Stats® Financial and Revenue Survey, which compares data from utilities across North America, the [ICI] sector consumed 20% of the water that the 570 responding water utilities provided but comprised only 8% of the customer base" (DeNileon, 2003). Therefore, focusing on the ICI sector can result in a more cost-effective monetary conservation program expenditure.

The California Urban Water Conservation Council (CUWCC) defined a list of BMPs in the CUWCC's Memorandum of Understanding (MOU) that targeted both residential and ICI sectors. An economic analysis was performed for the quantifiable BMPs in approximately 20 urban water utilities. Results determined that the benefit/cost ratio (evaluated at $500/ac-ft of water) of water-use evaluations was 2.47 for the ICI sector compared to the ratios of 1.10 for the single-family sector and 0.20 for the multi-family sector (Selsky, 2002). These results exemplify ICI-sector water conservation benefits and are indicative of cost-effective program implementation.

In addition to implementing an ICI water-use evaluation program, classifying non-residential customers by their Standard Industrial Classification (SIC) or North American Industry Classification System (NAICS) codes would assist in identifying the potential water savings for facilities based on billing data and benchmark values (presented in Table 6-1 through Table 6-2).

Resources: The following is a list of resources utilities can refer to when performing an ICI water-use evaluation. Data includes efficient water-use rates for various types of equipment, operation and maintenance requirements, and how to retrofit and replace water-using equipment.

Name of Resource	Location of Resource
SWFWMD Links to other Conservation Sites	http://www.swfwmd.state.fl.us/conservation/
Tampa Bay Water	http://www.tampabaywater.org/water-conservation-and-efficiency/Conservation.aspx
Commercial and Institutional End Uses of Water	AWWA Research Foundation, 2000
Federal Energy Management Program (FEMP)	http://www1.eere.energy.gov/femp/
Florida Water Conservation Initiative	Florida Department of Environmental Protection, April 2002
ENERGY STAR	http://www.energystar.gov/
ICI Water Audit Handbook	Tampa Bay Water, October 2001
California Urban Water Conservation Council (CUWCC)	http://www.cuwcc.org/
City of Austin Water Conservation	http://www.austintexas.gov/environment/water-conservation
American Water Works Association WaterWiser	http://www.awwa.org/resources-tools/water-knowledge/water-conservation.aspx

6.1 Number of Applicable Accounts

The number of applicable accounts is the total number of non-residential accounts minus the number of non-residential accounts that previously received an evaluation. However, there is a notable caveat when using the term “account” in the ICI sector. In some cases a large facility can have several accounts.

6.2 Interactions

There are no interactions with this BMP and other BMPs that would affect the number of applicable accounts. However, there may be *conceptual* interactions between this BMP and the irrigation evaluation BMP. It may be standard practice in an ICI program to include a water-efficient irrigation evaluation for facilities with irrigated landscape. The water savings identified by the irrigation evaluation can be included with the ICI savings in the evaluation report that is provided to the facility. However, since the ICI BMP and the Irrigation BMP are different BMPs, the costs and savings should be kept separate from one another. The ICI evaluation is for indoor and cooling uses only; therefore, the costs and potential savings attributed to the irrigation evaluation should be reported by the utility under the Irrigation BMP and not the ICI BMP. Conversely, if a utility intends on including a rebate applicable to indoor uses, for example an ultra low-flow (ULF) toilet and/or ULF/waterless urinal rebate, the costs and savings for the rebate are to be included in the ICI Evaluation BMP and are not duplicated in the ULF Toilet Rebate and/or Urinal Rebate BMPs.

6.3 Water Savings Rates

Water savings vary greatly between facilities and are expressed as potential savings based on benchmark data for various types of facilities. The benchmarks in Table 6-1 through Table 6-6 represent efficient water use. A rough estimate of potential savings can be determined by comparing a subject facility's current water use to the benchmark for a facility of its type. For example, if a restaurant uses 20% more water than the restaurant benchmark, the potential savings for the subject restaurant is estimated to be 20% of its current water use. These benchmarks are presented as guidelines only, as non-residential water use is highly variable. Only a detailed evaluation of the subject facility will allow a reasonable estimate of water-savings potential. This comparison to the benchmarks is a screening tool to help select ICI customers for detailed evaluations.

Table 6-1. Efficient Water-Use Benchmarks for Restaurants

Restaurants		
AWWA[1]	**FEMP**[2]	
130-331 gal/yr per sf of building area	Conventional	8-10 gal/customer per day
6-9 gal/meal served		
20-31 gal/seat per day	Short-order	3-8 gal/customer per day
86-122 gal/employee per day		

[1] *From (Dziegielewski, 2000).*
[2] *From (http://www.eere.energy.gov/femp/).*

Table 6-2. Efficient Water-Use Benchmarks for Hotels, Motels and other Lodging Facilities

Hotels/Motels/Other Lodging		
AWWA[1]	**FEMP[2]**	
Total water use = inside use + irrigation	Hotel	40-60 gal/guest per day + 8-13 gal/employee per day
	Motel without Kitchen	25-40 gal/guest per day
	Motel with Kitchen	25-60 gal/guest per day
60-115 gal/occupied room per yr for inside use	Lodging house or tourist home	30-50 gal/guest per day
16-50 inches per year for irrigation	Boarding house	25-50 gal/person per day
39-54 Kgal/yr per occupied room for total use	Apartment, resort	50-70 gal/ day per person

[1]*From (Dziegielewski, 2000).*
[2]*From (http://www.eere.energy.gov/femp/).*

Table 6-3. Efficient Water-Use Benchmarks for Office Buildings

Office Buildings	
AWWA[1]	**FEMP[2]**
Total water use = inside use + cooling + irrigation	8-20 gal/employee per day
9-15 gal/yr per sf of building area for inside use	
9-16 gal/employee per day for inside use	
8.5-22 gal/yr per sf of building area for cooling	
26-50 inches/yr for irrigation	
26-35 gal/yr per sf of building area for total use	

[1]*From (Dziegielewski, 2000).*
[2]*From (http://www.eere.energy.gov/femp/).*

Table 6-4. Efficient Water-Use Benchmarks for Schools

Schools		
AWWA[1]	**FEMP[2]**	
Total water use = inside use + cooling + irrigation	Day School with cafeteria, gym and showers	15-30 gal/student per school day
8-16 gal/yr per sf of building area for inside use	Day School with cafeteria only	10-20 gal/student per school day
3-15 gal/student per school day for inside use	Day School without cafeteria and gym	5-15 gal/student per school day
8-20 gal/yr per sf of building area for cooling		
22-50 inches/yr for irrigation	Boarding school	50-100 gal/student per school day

[1]From (Dziegielewski, 2000).
[2] From (http://www.eere.energy.gov/femp/).

Table 6-5. Efficient Water-Use Benchmarks for Supermarkets

Supermarkets
AWWA[1]
Total water use = inside use + cooling + irrigation
52-64 gal/yr per sf of building area for inside use
0.02-0.03 gal/sf of building area per number of daily transactions
30-50 inches/yr for irrigation
57-80 gal/yr per sf of building area for total use
3 gal/ day per number of transactions for total use

[1]From (Dziegielewski, 2000).
[2] From (http://www.eere.energy.gov/femp/).

Table 6-6. Efficient Water-Use Benchmarks for Other ICI Facilities

ICI Other	
FEMP[1]	
Airport	4-5 gal/day per passenger
Boarding house	25-50 gal/day per person
Laundry (self- service)	400- 650 gal/day per machine
Public lavatory	3-6 gal/day per user
Bowling alley	150- 250 gal/day per alley
Shopping Center	1-3 gal/day per parking space
	8-13 gal/day per employee
Camp: pioneer type	15-30 gal/day per person
Camp: with toilet and bath	35-50 gal/day per person
Camp: day, with meals	10-20 gal/day per person
Camp: day, without meals	8-18 gal/day per person
Campground	20-40 gal/day per person
Country club	80-125 gal/day per member
	10-15 gal/day per employee
Fairground	1-2 gal/day per visitor
Picnic park with flush toilets	5-10 gal/day per visitor
Swimming pool and beach	5-15 gal/day per customer
	8-15 gal/day per employee
Visitor center	4-8 gal/day per visitor
Assembly hall	2-4 gal/day per seat
Hospital medical	80-150 gal/day per bed
	5-15 gal/day per employee
Prison	80-150 gal/day per inmate
	5-15 gal/day per employee
Rest home	5-120 gal/day per resident
	5-15 gal/day per employee

[1]*From (http://www.eere.energy.gov/femp/).*

6.4 Public Awareness and Education

Facility staff should receive background and instruction on how to operate water-conserving equipment and how to conserve water in their daily tasks. This could include verbal and/or written instruction and should be tailored to the language needs of the staff. For example, hotel laundry personnel may be Spanish-literate rather than English-literate.

Recognition programs can provide facilities implementing recommended changes positive public opinion. The facilities may be recognized through media or by providing a poster or plaque to be displayed in a high-visibility area. A poster may include pre- and post-program water use. Such recognition would serve as education to other facilities and could be the impetus for increased program participation.

6.5 Program Costs

There are two types of program costs: (1) internal costs and (2) outsourced costs. Internal costs include the cost of the utility's staff time and materials needed for program implementation. Outsourced costs would be the cost of a contractor or consultant. Program costs include labor, materials, public awareness/education, and rebates or other financial incentives if offered in conjunction with the evaluation. If the utility chooses to outsource some of the program tasks, the relative costs associated with the outsourced tasks would be handled accordingly. If outsourcing is applied, the utility will typically also incur some internal costs to cover administrative time for meeting with the consultant/contractor and reviewing program implementation.

6.6 Program Cost Effectiveness

Program cost effectiveness is the total present worth of the cost of the program divided by the volume of water saved. Calculations for costs and savings and for cost effectiveness are provided below.

6.6.1 Calculating the Present Worth of Program Costs

The present worth of the total program cost is calculated by summing all costs associated with the number of evaluations conducted during the proposed 5-year program duration. The interest rate used for the present worth analysis is 7%. The present worth costs for a program beginning in year 2013 is calculated as follows.

$$
\begin{aligned}
P_{2004} = {} & (M_{2013} \times C_{2013}) \\
& + (M_{2014} \times C_{2013}) \times (1 + i)^{-1} \\
& + (M_{2015} \times C_{2013}) \times (1 + i)^{-2} \\
& + (M_{2016} \times C_{2013}) \times (1 + i)^{-3} \\
& + (M_{2017} \times C_{2013}) \times (1 + i)^{-4}
\end{aligned}
$$

Where: P_{2004} = Total present worth cost of program in 2013 dollars
M_{2004} = Number of measures (or evaluations) in 2013
C_{2004} = Cost per evaluation in 2013
i = Interest rate

6.6.2 Calculating the Total Water Savings

To determine total water savings over twenty years, it is assumed that the cumulative number of evaluations conducted in the final year of the 5-year program duration would continue to save water on an annual basis for an additional 20 years. However, the water savings are calculated by this BMP over a 20-year horizon; therefore, the savings in the fifth year are multiplied by 16 years. The water saved over a 20-year period is calculated as follows.

$$S_{20\text{-yr}} = [S_{2013} + S_{2014} + S_{2015} + S_{2016} + (S_{2017} \times 16 \text{ years})] \times 365$$

Where: $S_{20\text{-yr}}$ = Total 20-year water savings in million gallons (MG)
S_{2004} = Water savings in 2013 in million gallons per day (MGD)

6.6.3 Calculating Cost Effectiveness

Program cost effectiveness is defined as the cost per 1,000 gallons of water saved for implementing a BMP. It is calculated as follows.

$$C/E = (P_{2013} \div S_{20\text{-yr}}) \times 1{,}000$$

Where: C/E = Program cost effectiveness in dollars per 1,000 gallons
P_{2004} = Total present worth cost of program in 2013 dollars
$S_{20\text{-yr}}$ = Total 20-year water savings in MG

6.7 Program Implementation Options

Utilities should network with other utilities that have implemented similar programs to receive insight on program costs, savings and possible complications. As discussed in section 6.5, evaluations could be conducted by the utility (internally) or they could be outsourced. Another option is to use or recommend water-based performance contractors. Performance contracting is an innovative financing technique that uses cost savings from reduced utility (water and sewer) consumption to repay the cost of installing water conservation measures. Normally offered by water service companies (WASCOs), this technique allows for the development of a water-savings program without significant up-front capital expenses on the part of the user. Instead, the cost of water-efficiency improvements are borne by either the WASCO or a third party lender who recoups cost and shares water savings profits with the user.

Regardless of who is tasked with the actual evaluation, there are five major components to an ICI Evaluation Program:

1. **Selecting Facilities to Receive an Evaluation.** The objective is to screen for facilities with the greatest potential for water savings, which are not necessarily the facilities with the highest water use. This component is detailed by steps in Section 6.7.1.

2. **Inviting Facilities to Participate in an Evaluation.** Facilities of interest are contacted to get an acceptance to receive the evaluation as discussed in Section 6.7.2.

3. **Conducting the On-site Evaluation.** Data is collected for the various water uses as described in Section 6.7.3.

4. **Preparing and Presenting the Evaluation Report.** Components of the report and guidance on presenting the report are provided in Section 6.7.4.

5. **Following-up.** Follow-up is needed to track the success of the program as discussed in Section 6.7.5.

6.7.1 Selecting Facilities to Receive an Evaluation

- **Step one-** Sort non-residential billing data by water use to identify the accounts using the most water.

- **Step two-** Refine the accounts by water use per measurement parameter(s) (i.e. gallons per employee per day and/or gallons per day per square foot of building area). The measurement parameter(s) will vary by facility and is based on benchmark data provided in Table 6-1 through Table 6-6.

- **Step three-** Compare the water-use rate to the benchmark value for the type of facility. The difference between the benchmark and the actual use is the potential savings for the facility.

- **Step four-** Re-order the list of the top water users by potential water savings in descending order. This list ranks the facilities to be selected for an evaluation.

EXAMPLE:

Step 1: A utility sorts its non-residential billing data from the users with the highest water use to the users with the lowest water use. Since a facility is likely to have several account numbers, it is important to order data according to facility name and sum the accounts, provided they are for the same location. A facility, such as a nursing-home corporation may have 15 accounts. Those accounts may be for three different campuses, or nursing homes. Each campus will need to be handled separately. The total water use for each campus is the summation of the water use on each of the accounts associated with that campus. It is important to note that the addresses for the accounts for a facility may differ but be located in close proximity to each other. The goal of this step is to have the total water use for each facility (possibly from several different accounts, summed for the same campus) ordered by descending water use.

Step 2: Now that the list of the highest water users has been created, a telephone survey is conducted to (1) determine if the party responsible for paying the water bill is also responsible for making plumbing changes and (2) obtain the appropriate measurement parameter(s).

Facilities that pay the water bill and are responsible for plumbing changes should be targeted because there is little incentive for a property owner to change water-using fixtures if he/she does not pay the water bill. Likewise, tenants are less likely to change or fix equipment or fixtures in a rental property.

After it has been determined that the facility owns the property on which it conducts business, the measurement parameters identified Tables 6-1 through 6-6 should be obtained. For a restaurant, the utility will need to ask the facility for the square footage of building area, number of meals served, seats per day, employees per day and/or customers per day. The restaurant may be able to easily provide the number of meals served. In this case the utility will use the water use from the billing data and the number of meals served to compute a water use rate in gallons per meals served per day (or per year or month, depending on the data received). This will be compared to the benchmark value. A utility should seek to obtain several measurement parameters so the rate can be computed by different parameters and then averaged.

During the phone survey other relevant questions may be asked. Such questions may include the use of cooling towers (or some other water-cooled equipment), and what is used for irrigation source water and approximate irrigated area. These are important questions because, for a school for example, the benchmarks are detailed by inside use, cooling and irrigation. However, the savings in irrigation will not be included in the savings reported by this BMP, as the savings need to be handled through the Water-Efficient Landscape and Irrigation BMP. Also during the phone survey, the total number of accounts should be confirmed with the facility, to insure that all accounts for the same campus are being considered in the overall water use for the facility. It may be prudent to also get a general response as to their interest in receiving a free water use evaluation and the likelihood of implementing modifications indicated in the evaluation report. However, the utility should relate to the customer that an ICI program is being *considered*, and that they *might* be selected to participate. This additional background work can help the utility to choose facilities based on potential water savings as well as potential interest.

Step 3: After water use rates have been calculated using the appropriate measurement parameter(s), the rates are compared to the benchmark values. The difference between the facility water-use rate and the benchmark value is the facility's potential water savings.

Step 4: The water user list is re-ordered by potential water savings in descending order. This will rank the facilities by potential water savings so that the facilities can be easily selected based on rank (and interest in implementing suggested changes, if that information is available).

6.7.2 Inviting Facilities to Participate in an Evaluation

After a list of facilities to target has been developed, the next step is to formally invite a select number of facilities to participate. The invitation process is just as important as the actual evaluation and the utility must be choosey as to whom to offer the evaluation to. Evaluations should be provided to participants that indicate some commitment to implement the recommendations. This will increase assurances that monetary and time expenditures are worthwhile. Optimizing the implementation of evaluation-recommended modifications can be accomplished by offering rebates and other financial incentives or by making lists available to performance contractors for their implementation.

6.7.3 Conducting the On-site Evaluation

Performing an evaluation consists of determining the water use amount from each water-use source at the facility. While some water uses, such as toilets and faucets, are common to all sites, special processes and equipment may also be encountered. Wherever possible, water use evaluation methodologies should be consistent from site to site, while the measurement or estimation of other water uses will vary between sites. The key to successfully evaluating sites is to implement consistent water use evaluation methodologies, but not at the expense of applying a more appropriate method of measurement when available.

A description of typical ICI water uses and associated water-conserving opportunities are provided in Section 6.7.3.1 through Section 6.7.3.12. There may be operation and maintenance, as well as retrofitting and replacement opportunities for each water use that may not be described in these sections. ICI evaluations are very site-specific; therefore, a complete guide of how to perform an evaluation is not provided in this BMP. Manufacturing facilities vary in water-use processes and are not covered by this BMP, but generally, process water should be recycled or reused wherever possible.

Landscape irrigation is not included in the water uses discussed herein. See the Landscape and Irrigation Evaluations/Rebates BMP for more information. The ICI water-use evaluation report should include the findings of the irrigation evaluation, if included in the evaluation. The utility should track potential savings attributed to irrigation separate from ICI savings, through use of the Landscape and Irrigation Evaluations/Rebates BMP, in their water conservation reporting.

6.7.3.1 Cooling

During the evaluation, all cooling equipment, from refrigeration/ice making to cooling towers, should be investigated. All single-pass cooling systems should be replaced by air-cooled systems and cooling tower water should be managed efficiently. Since cooling systems are common and typically attribute to a large portion of a facility's overall water use in Florida, they are discussed in detail.

Single Pass Cooling Systems

In single pass cooling systems, water is passed through the system one time and is then disposed to the sanitary sewer. A single pass cooling system uses 40 times more water than a cooling tower operated at five cycles of concentration (FEMP, BMP#7). The types of equipment that typically use single pass cooling are ice machines, x-ray equipment, ice cream and yogurt machines, walk-in coolers, vacuum pumps, air compressors, condensers, hydraulic equipment, degreasers, CAT scanners and some air conditioning equipment. For information regarding operation and maintenance options, and retrofitting and replacement options, as well as other references the utility should refer to www.eere.energy.gov/femp/techassist/BMP7.html. All single-pass cooling systems should be replaced by air-cooled systems and cooling tower water should be managed efficiently with at least six cycles of concentration.

Cooling Towers

Significant savings can frequently be realized in a facility's cooling tower operation. Altering the tower's operation must be well coordinated with the facility engineer and the chemical contractor. The chemical contractor is responsible for maintaining the tower by injecting chemicals in the tower stream and controlling bleed-off. The purpose of the chemicals is to keep the solids in the tower water in solution so that they do not deposit on the tower media. Bleed-off is controlled by a conductivity meter. When the meter reaches a certain value, water is discharged from the tower (called bleed-off or blow-down).

There are many factors influencing water loss in a cooling tower, but the introduction of clean water to the system is where most of consumption happens. Cycles of concentration (COC) defines the accumulation of dissolved minerals (e.g. chlorides, total dissolved solids (TDS) or calcium) as number of times the tower water is concentrated over that of the makeup water introduce into the system. All cooling towers in the region are assumed to operate at approximately 2.5 COC's at best. Industry water savings estimates reflect the difference in water use at 2.5 and 6.0 COC's to be 3.23 gallons/ton. Managing the towers to function on 6.0 COC's is the most efficient practice for water conservation.

Table 6-7 Water Use per Ton at Specified COC's

COC	Gallons/Ton	% Reduction in Water Use
1.5	5.40	
2.0	3.59	34%
2.5	3.15	na
3.0	2.70	25%
4.0	2.40	11%
5.0	2.26	6%

6.0	2.17	4%

As previously mentioned, all cooling towers currently in use are assumed to be operating at 2.5 COC's and therefore are considered eligible for efficiency improvements. The number of eligible cooling towers is assumed to increase at the same rate as nonresidential accounts, resulting in 801 rebate eligible cooling towers by 2035.After 210 rebates, 591 eligible cooling towers are assumed to remain in 2035.

Cost estimate is consistent with national estimates and considered conservative for Florida. Program costs are based on evaluation of national programs. With utility costs estimated at $1000 per intervention and a 10-year useful technology life, the average program costs is estimated at $0.07 per 1000 gallons of water saved making cooling towers a strong candidate for water conservation.

Table 6-1 Cooling Tower Rebate Estimated Savings Potential

Variable	Total GPD	Median GPY
Water Use @ 2.5 COC	10,386,840	4,449,743
Water Use @ 6.0 COC	7,152,752	3,063,214
Savings Potential	3,234,089	1,386,530

6.7.3.2 Heating

For steam heat, two components should be evaluated. It should be confirmed that boiler condensate water is recycled back into the boiler. Also, the method of blow-down should be investigated. Like cooling towers, solids are removed from boilers by bleed off. There are two methods or locations of bleed off. Some boilers use a bottom bleed. For this type of boiler, a valve is opened manually or via a timer once per day and remains open for less than one minute. Some boilers, however, use a top blow-down, which is continuous unless it is equipped with a solenoid valve activated by a conductivity meter. For boilers requiring a top blow-down, and not equipped with a conductivity meter, the facility should install one. If condensate water is not recycled back into the boiler, facilities may be in violation of local wastewater regulations relative to temperature limits. This could provide incentive to recycle the condensate. In some cases, additional water savings could be realized by recycling condensate because the facility adds cold water before discharging condensate to the sewer in order to adhere to sewer temperature limits.

6.7.3.3 Fire Pump and Hydrant Testing

Frequency of fire pump and private fire hydrant testing, and the length of time the valve is left open during the test, should be evaluated. According to National Fire Protection Association (NFPA) Codes, the flow condition of a fire pump and a private fire hydrant should be tested annually. Once data is collected, the pump or hydrant is turned off. This typically takes about one to ten minutes. Although NFPA Codes require annual testing, local codes or insurance requirements may specify a more frequent testing schedule. However, some fire protection equipment testing contractors test pumps and/or hydrants for flow more often than is required. Customers should be encouraged to ensure that fire protection contractors are not testing more frequently than what is necessary. Also, customers should oversee pump and/or hydrant tests to insure timely readings are taken to minimize pump/hydrant run times.

If pump and/or private hydrant testing exceeds required frequency, significant water loss will be incurred. Fire pumps are rated from 500 to 3,000 gpm, resulting in a loss of 5,000 to 30,000 gallons of potable water for a ten-minute test. Private fire hydrants are typically rated at 1,175 gpm, resulting in an 11,750-gallon loss for a ten-minute flow test.

6.7.3.4 Laundry

Commercial laundry systems typically have a chemical optimization program with automated chemical feed. Similar to cooling towers, ozone technology can provide significant water savings. For laundries, however, savings are more attributed to energy as most systems save approximately 80% of the energy required to wash and dry laundry. The energy savings are accrued from low use of hot water (typically only the pre-rinse cycle uses hot water) and allows the laundry to release more water in the spin cycle than does a chemical program not using ozone. Water savings are typically quoted to be 25%. Ozone systems work with existing chemical optimization programs and due to lowered water use, typically there are chemical savings. An ozone contractor can typically provide quotes that include water and energy savings. Recommendations may also include fixing leaking solenoid valves, sub-metering the laundry facility if it is part of a larger operation, or installing smaller, more efficient clothes washers if the current ones are oversized for the operation.

Measurement of water use in a laundry facility should be done by either sub-metering the entire facility or by installing temporary meters on the hot and cold taps that feed the washing machines. Data should be collected over a minimum of one week.

High efficiency clothes washers in the commercial setting are another way to provide water savings. The water usage of a commercial clothes washer is based on the washers' water factor. The lower the water factor, the more efficient the washer.

6.7.3.5 Food Thawing

Food service facilities commonly thaw food with running water. The Federal Food and Drug Administration and local health rules typically specify that food is to be thawed either in a cooler or by running cold water over the food. Therefore, when facilities do not allow ample time for food thawing in coolers, food is thawed by running water. Recommendations are to encourage the facility to anticipate thawing time in a cooler.

6.7.3.6 Dishwashers

The efficiency of commercial dishwashers can be improved upon by retrofitting the dishwasher with an automatic shut-off device and by recycling the final rinse water.

Water use reduction can be achieved by converting older inefficient machines to an Energy Star product which typically uses 40% less water than a standard dishwasher. The dishwasher is to meet the facilities requirements of use. Among the possibilities are under counter, door, conveyor and flight. These are in order of smallest to biggest to suit specific facility needs.

Costs vary substantially depending on the type and desired options. Given incentives ranging from $250 to $1000, the average cost of these programs ranges from $0.21/gal for a $250 conveyor incentive to $12.28/gal for a $1000 under-counter incentive

6.7.3.7 Faucets

Recommendations for faucets typically include fixing all leaking faucets and installing 0.5-gallon per minute (gpm) aerators on all hand sinks. For kitchen faucets, it is generally recommended to install 2.0-gpm aerators as these faucets are typically used for filling sinks and a 0.5-gpm aerator would be too flow-restrictive.

6.7.3.8 Showers

It is typically recommended to install showerheads rated at 1.5 gpm.

6.7.3.9 Toilets

For each facility evaluated, the number of ULF toilets and high-consumption toilets should be recorded. For conventional models, the consumption per flush is between three to seven gallons per flush (gpf) depending on the age of the facility. All conventional toilets should be replaced with HET toilets that provide 1.28 gpf.

6.7.3.10 Urinals

For each facility evaluated, the number of conventional urinals and ULF urinals should be recorded. The facility manager should be questioned regarding ratings of any replacement valves, which are typically 3-gpf. Option recommended for urinals; replace all non-ULF urinals with High Efficient urinals.

6.7.3.11 Pre-rinse Spray Nozzles

A pre-rinse spray nozzle is a hand-held nozzle that is used to clean food from dishes, utensils, and pots and pans in the food service industry. Conventional spray nozzles use approximately three gallons per minute (gpm) and are responsible of up to 50% of the total dishwashing water use. A California water and energy conservation pilot program that replaced older pre-rinse spray nozzles with new 1.6-gpm nozzles reported a savings of 100 to 300 gpd per spray nozzle installed (Koeller and Dickinson, 2003). The new spray nozzles have a “knife-like” spray pattern compared to the shower-like spray pattern of conventional nozzles. This design is less subject to the effects of mineral buildup and allows for more efficient removal of food products. Studies have shown that operators are able to reduce the time required to pr-rinse or clean dishes as a result of installing the new valve. For more information visit http://www.CUWCC.com.

6.7.3.12 Water Softening Equipment

Water softeners are often regenerated based on a timer rather than on an as-needed basis. Water savings can typically be realized if the softening equipment regeneration is controlled by effluent hardness or by a flow volume control that is based on the hardness of the incoming water.

6.7.3.13 Waterless Wok

Conventional wok's use water for cooling and cleaning. A waterless wok has three key features to help conserve water: A spout to automatically shut off when not in use, air gaps to release heat to prevent the stove from overheating instead of water to cool the cook top, and a timer tap to control the amount and length of time water will flow to the reservoir. In addition to conserving significant amounts of water (Conventional wok using approximately 1,453 gal/day vs Waterless wok using approximately 132 gal/day equaling a savings of approximately 1,321 gal/day), waterless woks present operating cost savings, less maintenance, improved reliability, longer equipment life, reduced load on sewage treatment plants, and reduced demands on water supply. The cost of a waterless wok is approximately the same as a conventional water cooled wok.

6.7.3.14 Connectionless Steamer

A connectionless steamer uses a water reservoir in the bottom of the cooking compartment instead of a boiler and is heated by electric or gas. The water that condenses on the food product and inside the cooking compartment is recycled to the reservoir instead of into a drain. A conventional boiler steamer is connected to a water supply where the water is heated in a boiler, the pumped to the cooking compartment. The condensed steam is drained and cooled by another stream of cold water. There is approximately a 393 gallon/day of water saving when a connectionless steamer is used instead of a boiler-based steamer. In addition to saving water, there is also a cost savings. An average retail price for a boiler based steamer is $10,000 where as the average retail cost of a connectionless steamer is around $8,000 presenting an on average savings of $2000.

6.7.3.15 Commercial Ice Machines

An air-cooled ice machine presents a 145 gal/100lbs of ice savings when switching from a water-cooled machine. Air-cooled ice machines use about 13% of the total amount of potable water per 100 pounds of ice that water-cooled ice machines use. The cost of the air-cooled ice machine is relatively close to the water-cooled ice machine depending on the amount and type of ice wanted.

6.7.4 Preparing and Presenting the Evaluation Report

An evaluation report should be prepared and presented to the facility, in person, if possible. The evaluation report should include a discussion of all water-using equipment/fixtures and practices within the subject facility, along with efficiency recommendations. Estimated current water-use rates and potential savings per water use type should be provided in tabular format. Using the current rate structure of the utility, water savings should also be represented in annual savings. If a tiered rate structure is in place and the facility is often charged at higher rates due to consumption, the customer should be made aware they would be saving money on the higher rate(s) followed by the lower rate.

The report will also include a simple payback analysis based on recommendations. Payback is calculated by dividing the cost of implementation by the potential annual savings in dollars per year. The cost of implementation is typically provided by working with local contractors and vendors. In cases where the facility uses a specific contractor for irrigation or plumbing, request that contractor supply a cost estimate to perform the recommended scope of work. The annual savings is based on the billing rate that the customer pays for water (and sewer, when sewer consumption is based on water consumption). Payback is calculated as follows:

Payback in years = Cost of implementation ÷ Annual savings

After the evaluation has been completed, the report should be presented, in person, to the facility manager and business manager, who might not have been involved at all until this point. Savings and payback analysis should be stressed in the report and in personal meetings. Also, the level of interest in implementing the recommendations can be re-evaluated. Business manager presence at meetings is important to enhance the likelihood that changes will occur based on the payback analysis.

If program funding allows and the customer is willing to make changes, the utility may offer to sub meter a particular process or building (for example a laundry facility) before and after changes are implemented. This data will help validate measurements or estimations made during the evaluation and would document the actual cost-effectiveness of the BMP.

6.7.5 Follow-up

Approximately three to six months after the report has been delivered, there should be a follow-up meeting with the customer to find out if recommendations were implemented. If recommendations have been implemented, water use should be evaluated to determine if projected savings were achieved.

6.8 Evaluation of Customer Satisfaction and Program Effectiveness

Approximately one year after an evaluation has been conducted, the utility should follow-up with the participating customer or customer group once again. The objective of the customer-satisfaction evaluation is to determine the implementation rate of recommended modifications and to gauge the participant's satisfaction with the program. This could be accomplished by use of a questionnaire sent as a post card. Survey questions could include the extent to which modifications were implemented (possibly modifications that were not implemented before the previous follow-up meeting, have been made at the one-year mark), the customer's satisfaction with new equipment and/or processes, satisfaction with utility personnel and/or utility-appointed contractors who performed the evaluation and the customer's perceived change in their water bill. The questionnaire could also include information about new or ongoing programs and relevant maintenance tips.

In addition to gauging the participating customer's satisfaction with the program, an evaluation of the actual cost-effectiveness of the program should be conducted. Water savings attributed to evaluations can be estimated from pre- and post-evaluation water use as indicated on the participant's water bill.

Chapter 7 BMP Template

Definition: This BMP template is to provide a program of choice for the member government when the member government wants to develop a BMP that has not previously been defined. This template can also be used to develop a BMP that combines two or more previously defined BMPs.

Categories: To be defined.

Applicable sectors: Single-family residential, multi-family residential and/or non-residential.

Location of Use: Indoor and/or Outdoor water use.

SWFWMD Consolidated WUP Conditions: To be defined.

BMP Life: 20 years.

Implementation Background: The objective of this BMP is to allow flexibility for a member government to create its own BMP or to combine two or more BMPs.

7.1 Number of Applicable Accounts

The number of applicable accounts in any sector is the total number of accounts in that sector minus the accounts that would not qualify for the BMP and minus the number of accounts that previously received the benefit of the BMP (for example an evaluation or rebate).

7.2 Interactions

The BMP should be designed such that there are no interactions between the subject BMP and other BMPs that would affect the number of applicable accounts.

7.3 Water Savings Rates

The water savings rates are typically applied as savings per account for the single-family residential and non-residential sectors and as savings per account or per unit for the multi-family residential sector. Water savings rates should be supported by existing data; therefore, a thorough literature review of similar programs should be conducted. Water savings rates may be the same or may differ between sectors and categories. Typically, for any BMP, single-family savings rates are consistent from account to account compared to the multifamily and non-residential sectors where variability is much higher.

7.4 Public Awareness and Education

In order for a water conservation program to be successful, the qualifying candidates must be made aware of the program's existence. This could be accomplished by informing them through the use of post cards, water-bill inserts, radio public service announcements, a television or bill-board advertising campaign, or by posting notices in home improvement and plumbing retail stores or on a utility's website.

The program may also include public education by identifying the benefits of saving water in the advertising campaign. Non-residential facilities may be recognized through media or by providing a poster or plaque to be displayed in a high-visibility area. A poster may include pre- and post-program water use. Such recognition would serve as education to others and could be the impetus for increased program participation.

7.5 Program Costs

There are two types of program costs: (1) internal costs and (2) outsourced costs. Internal costs include the cost of the utility's staff time and materials needed for program implementation. Outsourced costs would be the cost of a contractor or consultant. Program costs include labor, materials, public awareness/education and the cost of the rebates (if applicable). If the utility chooses to outsource some of the program tasks, the relative costs associated with the outsourced tasks would be handled accordingly. If outsourcing is applied, the utility will typically also incur some internal costs to cover administrative time for meeting with the consultant/contractor and reviewing program implementation. The member government should do a literature review of similar programs to determine the likely cost of the program. The cost is typically reported as cost per account for the single family and non-residential sectors and as cost per account or per unit for the multi-family sector.

7.6 Program Cost Effectiveness

The cost effectiveness of the program is the total present worth of the cost of the program divided by the volume of water saved. Calculations for costs and savings and for cost effectiveness are provided below.

7.6.1 Calculating the Present Worth of Program Costs

The present worth of the total program cost is calculated by summing all costs associated with the number of measures implemented during the proposed 5-year program duration. The interest rate used for the present worth analysis is 7%. The present worth cost for a program beginning in year 2013 is calculated as follows.

$$
\begin{aligned}
P_{2004} = \; & (M_{2013} \times C_{2013}) \\
& + (M_{2014} \times C_{2013}) \times (1 + i)^{-1} \\
& + (M_{2015} \times C_{2013}) \times (1 + i)^{-2} \\
& + (M_{2016} \times C_{2013}) \times (1 + i)^{-3} \\
& + (M_{2017} \times C_{2013}) \times (1 + i)^{-4}
\end{aligned}
$$

Where: P_{2004} = Total present worth cost of program in 2013 dollars
M_{2004} = Number of measures in 2013
C_{2004} = Cost per measure in 2013
i = Interest rate

7.6.2 Calculating the Total Water Savings

To determine total water savings over twenty years, it is assumed that the cumulative number of measures implemented in the final year of the 5-year program duration would continue to save water on an annual basis for an additional 20 years. However, the water savings are calculated by this BMP over a 20-year horizon; therefore, the savings in the fifth year are multiplied by 16 years. The water saved over a 20-year period is calculated as follows.

$$S_{20\text{-yr}} = [S_{2013} + S_{2014} + S_{2015} + S_{2016} + (S_{2017} \times 16 \text{ years})] \times 365$$

Where: $S_{20\text{-yr}}$ = Total 20-year water savings in million gallons (MG)
S_{2004} = Water savings in 2013 in million gallons per day (MGD)

7.6.3 Calculating the Cost Effectiveness

Program cost effectiveness is defined as the cost per 1,000 gallons of water saved for implementing a BMP. It is calculated as follows.

$$C/E = (P_{2013} \div S_{20\text{-yr}}) \times 1{,}000$$

Where: C/E = Program cost effectiveness in dollars per 1,000 gallons
P_{2004} = Total present worth cost of program in 2013 dollars
$S_{20\text{-yr}}$ = Total 20-year water savings in MG

7.7 Program Implementation Options

Utilities should network with other utilities that have implemented similar programs to gain insight on program costs, savings and possible complications. As discussed in Section 7.5, portions of the program could be done by the utility (internally) or be outsourced. For the non-residential sector, another option may be to use or recommend a water-based performance contractor (depending on the nature of the BMP). Performance contracting is an innovative financing technique that uses cost savings from reduced utility (water and sewer) consumption to repay the cost of installing water conservation measures. Normally offered by water service companies (WASCOs), this technique allows for the development of a water-savings program without significant up-front capital expenses on the part of the user. Instead, the cost of water-efficiency improvements are borne by either the WASCO or a third party lender who recoups cost and shares water savings profits with the user.

7.8 Evaluation of Customer Satisfaction and Program Effectiveness

Approximately one year after a customer has participated in a program, the utility should follow-up with the customer or customer group. The objective of the customer-satisfaction evaluation is to determine the implementation rate of recommended modifications (where applicable) and to gauge the participant's satisfaction with the program. This could be accomplished by use of a questionnaire sent as a post card. Survey questions could include the extent to which modifications were implemented, the customer's satisfaction with new equipment, satisfaction with utility personnel and/or utility-appointed contractors who performed an evaluation and/or processed a rebate and the customer's perceived change in their water bill. The questionnaire could also include information about new or ongoing programs and relevant maintenance tips.

In addition to gauging the participating customer's satisfaction with the program, an evaluation of the actual cost-effectiveness of the program should be conducted. Water savings can be estimated from pre- and post-program water use as indicated on the participant's water bill.