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Getting Started



1.1 Introduction

Purpose

WaterSense,[®] a voluntary partnership program sponsored by the U.S. Environmental Protection Agency (EPA), seeks to protect the future of our nation's water supply. By transforming the market for water-efficient products, services, and practices, WaterSense is helping to address the increasing demand on the nation's water supplies and reduce the strain on municipal water infrastructure across the country. WaterSense labeled products are independently certified to use at least 20 percent less water and perform as well or better than standard models. In addition, WaterSense labeled new homes incorporate water-efficient products and designs, and WaterSense labeled certification programs focus on water-efficient practices by professionals.



WaterSense has developed *WaterSense at Work*, a compilation of water-efficiency best management practices, to help commercial and institutional facility owners and managers understand and better manage their water use. *WaterSense at Work* is designed to provide guidance to help establish an effective facility water management program and identify projects and practices that can reduce facility water use.

In today's economic and corporate environment, there is a strong business case to be made for undertaking activities to reduce water use, which in turn can reduce energy and other operating costs. By implementing

water-efficiency best management practices, commercial and institutional facility owners and managers can:

- **Achieve cost savings.** Improving water efficiency can lower variable costs associated with the operation and maintenance of equipment, as well as the energy embedded in the treatment, storage, heating, and movement of water throughout the facility. Organizations can often reduce associated costs of treatment chemicals, detergents, and other supplies when undertaking water-efficiency improvements. When considered together, the cost savings from water, wastewater, energy, and supply bills create a greater return on investment and a shorter payback period for an improvement project, while reducing a facility's impact on local water supplies.
- **Increase competitive advantage.** Demand for green buildings and sustainable products is increasing as consumers become more aware of the environmental impacts of water and energy use. By promoting tangible improvements in a facility's environmental performance, organizations can reinforce their image as a sustainable brand while reducing their environmental impact on the community.

1.1 Introduction

Practicing water efficiency not only enhances the public perception of the organization, but can also help differentiate the organization among its competitors.

- **Reduce risk.** Water-efficient facilities can be less vulnerable to fluctuations in water supply and pricing by reducing their dependence on limited local water resources. This not only reduces risk, but also the burden on associated water and wastewater utility infrastructure, ensuring a more sustainable future water supply for the community.
- **Demonstrate leadership.** Water-efficient organizations can clearly demonstrate their commitment to the community and environmental leadership. By implementing projects that result in real water savings, an organization can share both quantitative and qualitative results. Water efficiency also contributes to meeting corporate sustainability goals and demonstrates an organization's contribution to reducing demand on natural resources.
- **Access opportunities in the green building marketplace.** The principles of water efficiency are becoming ingrained in the commercial real estate market as an integral part of green building and sustainable event planning. Implementing specific measures that make a facility more water- and energy-efficient helps an organization earn recognition from local green building programs, EPA and the U.S. Energy Department's (DOE's) ENERGY STAR,[®] or the U.S. Green Building Council's LEED[®] rating system. At the same time, many national, state, and local organizations have instituted environmental requirements for both their own facilities and those where meetings and conferences are held. Hotels, restaurants, and other facilities can strengthen their ability to compete in this growing market niche by undertaking specific water- and energy-efficiency measures.

Reducing facility water use not only makes sense at the facility level, but it also helps communities to delay costly infrastructure upgrades, while preserving our limited water supplies for future generations. *WaterSense at Work* is designed to help facility owners and managers do their part to reduce water demand and achieve organizational goals in the process.

Water Use in the Commercial and Institutional Sector

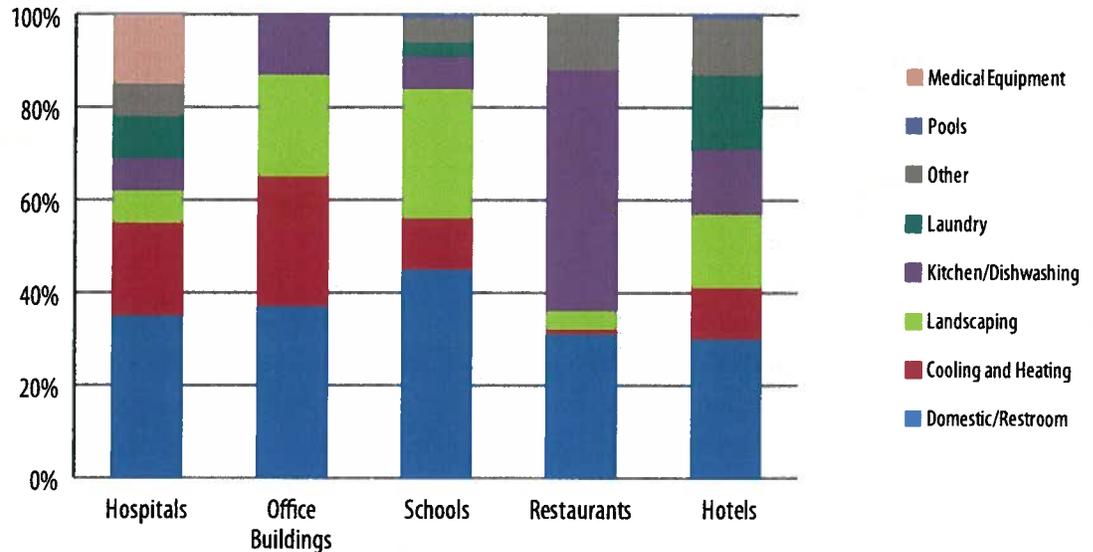
The commercial and institutional sector is the second largest consumer of publicly supplied water in the United States, accounting for 17 percent of the withdrawals from public water supplies.¹ This sector includes a variety of facility types, such as hotels, restaurants, office buildings, schools, hospitals, laboratories, and government and military institutions. Each facility type has different water use patterns depending upon its function and use. Figure 1-1 shows how water is used in several types of commercial and institutional facilities.²

¹ Estimated from analyzing data in: Solley, Wayne B., et al. 1998. *Estimated Use of Water in the United States in 1995*. U.S. Geological Survey Circular 1200. water.usgs.gov/watuse/pdf1995/html/.

² Created from analyzing data in: Schultz Communications. July 1999. *A Water Conservation Guide for Commercial, Institutional and Industrial Water Users*. Prepared for the New Mexico Office of the State Engineer. www.ose.state.nm.us/wucp_ici.html; Dziegielewski, Benedykt, et al. American Water Works Association (AWWA) and AWWA Research Foundation. 2000. *Commercial and Institutional End Uses of Water*; East Bay Municipal Utility District. 2008. *WaterSmart Guidebook: A Water-Use Efficiency Plan Review Guide for New Businesses*. www.ebmud.com/for-customers/conservation-rebates-and-services/commercial/watersmart-guidebook; AWWA. *Helping Businesses Manage Water Use—A Guide for Water Utilities*.

1.1 Introduction

Figure 1-1. End Uses of Water in Various Types of Commercial and Institutional Facilities



While the equipment and processes vary widely, there are opportunities in all commercial and institutional buildings to achieve significant water savings indoors and outdoors by making improvements in several operational areas.

Using *WaterSense at Work*

Any facility manager, owner, or employee involved in facility resource conservation can use *WaterSense at Work* to help:

- Assess facility water use.
- Establish a water management plan.
- Effectively communicate and achieve water management goals.
- Reduce water loss from leaks.
- Generate ideas for increasing the efficiency of water-using fixtures, equipment, systems, and processes.
- Identify opportunities for reusing onsite alternative water to replace potable water use.

WaterSense at Work provides water-efficiency best management practices that are relevant to multiple commercial and institutional sectors. Depending upon the type of water-using equipment or systems installed, these best management practices can be used as a whole or in part to guide facility water management planning and to facilitate water use reductions. Table 1-1 provides a quick overview of what can be found in *WaterSense at Work*.

1.1 Introduction

Facility owners and managers interested in better managing and reducing facility water use should review Sections 1 and 2. These sections provide overarching best management practices applicable to all facility types and outline actions that can be taken to ensure the success of any water management plan or water use reduction strategy. Sections 3 through 8 address opportunities associated with specific equipment and systems used at commercial and institutional facilities. Appendix A presents case studies that illustrate how specific facilities have successfully implemented one or more of the best management practices described in *WaterSense at Work*. Appendix B provides sample worksheets to facilitate water management planning.

Table 1-1. Quick Guide to *WaterSense at Work*

Section	Best Management Practices Covered
1. Getting Started	<ul style="list-style-type: none"> • Water Management Planning
2. Water Use Monitoring and Education	<ul style="list-style-type: none"> • Metering and Submetering • Leak Detection and Repair • User Education and Facility Outreach • Codes, Standards, and Voluntary Programs for Water Efficiency
3. Sanitary Fixtures and Equipment	<ul style="list-style-type: none"> • Toilets • Urinals • Faucets • Showerheads • Laundry Equipment
4. Commercial Kitchen Equipment	<ul style="list-style-type: none"> • Commercial Ice Machines • Combination Ovens • Steam Cookers • Steam Kettles • Wok Stoves • Dipper Wells • Pre-Rinse Spray Valves • Food Disposals • Commercial Dishwashers • Wash-Down Sprayers
5. Outdoor Water Use	<ul style="list-style-type: none"> • Landscaping • Irrigation • Commercial Pool and Spa Equipment • Vehicle Washing
6. Mechanical Systems	<ul style="list-style-type: none"> • Single-Pass Cooling • Cooling Towers • Chilled Water Systems • Boiler and Steam Systems

(continued)

1.1 Introduction

Table 1-1. Quick Guide to *WaterSense at Work* (cont.)

Section	Best Management Practices Covered
7. Laboratory and Medical Equipment	<ul style="list-style-type: none"> • Water Purification • Vacuum Pumps • Steam Sterilizers • Glassware Washers • Fume Hood Filtration and Wash-Down Systems • Vivarium Washing and Watering Systems • Photographic and X-Ray Equipment
8. Onsite Alternative Water Sources	<ul style="list-style-type: none"> • Onsite Alternative Water Sources
9. Resources	<ul style="list-style-type: none"> • Compilation of Water-Efficiency Resources
Appendix A: Case Studies Demonstrating Best Management Practices in Action	<ul style="list-style-type: none"> • Federal Agency Implements Comprehensive Water Management Strategy • Hotel Installs Water-Efficient Sanitary Fixtures • Restaurants Install Water-Efficient Commercial Kitchen Equipment • Office Complex Reduces Outdoor Water Use • Laboratory Eliminates Single-Pass Cooling • Hospital Installs Water-Efficient Laboratory and Medical Equipment • University Makes the Most of Onsite Alternative Water Sources
Appendix B: Sample Worksheets for Water Management Planning	<ul style="list-style-type: none"> • Building Water Survey Worksheet • List of Water Meters Worksheet • Water Consumption History Worksheet • Existing Plumbing Equipment Worksheet • Water Use Inventory Worksheet

1.2 Water Management Planning

Overview

Water management planning serves as the foundation for any successful water reduction effort. It is the first step a commercial or institutional facility owner or manager should take to achieve and sustain long-term water savings. Water management planning generally addresses water use reductions in four areas:³

- Reducing water losses (e.g., leaks).
- Increasing the water efficiency of fixtures, equipment, systems, and processes.
- Educating employees and occupants about water efficiency to encourage water-saving behaviors.
- Reusing onsite alternative water that would otherwise be discarded or discharged to the sewer (e.g., reusing treated gray water or rainwater to water landscape areas).



Effective water management planning is easily coupled with energy and waste management. Water management follows the same framework used in the U.S. Environmental Protection Agency (EPA) and the U.S. Energy Department's (DOE's) ENERGY STAR® Guidelines for Energy Management,⁴ and consists of these seven basic steps:

- Step 1. Making a commitment
- Step 2. Assessing facility water use
- Step 3. Setting and communicating goals
- Step 4. Creating an action plan
- Step 5. Implementing the action plan
- Step 6. Evaluating progress
- Step 7. Recognizing achievement

Step 1. Making a Commitment

The relative success of any water management program hinges on the organization's long-term commitment to use water more efficiently. Commitment should come from all levels within an organization to ensure that appropriate water management goals are established and that continuous improvements are made. A champion is necessary to provide guidance, maintain momentum, and infuse energy into project implementation. A champion often advocates for the improvements and celebrates successes to support additional water-saving projects in the future.

³ Arizona Municipal Water Users Association (AMWUA) Regional Water Conservation Committee and Black and Veatch. August 2008. *Facility Manager's Guide to Water Management Version 2.7*. Page 2. www.amwua.org/business.html.

⁴ U.S. Environmental Protection Agency (EPA) and U.S. Energy Department's (DOE's) ENERGY STAR. Guidelines for Energy Management Overview. www.energystar.gov/index.cfm?c=guidelines.guidelines_index.

1.2 Water Management Planning

When an organization chooses to make a commitment to water efficiency, it should consider the following:

- Form a dedicated water management team of staff and other professionals, including a team leader (i.e., champion) that is responsible for overseeing and implementing the water management program. Team members should include people from all parts of the organization, including someone familiar with regulatory compliance and a facility or building manager with knowledge of the building's infrastructure and major mechanical systems.
- Develop a water management policy that provides the structure for establishing and achieving water management goals.
- Incorporate water efficiency into long-term facility operation objectives and allocate the resources necessary to achieve goals.
- Integrate water management planning and goal tracking into company performance and sustainability reporting to elevate the importance of water efficiency and maintain accountability.
- Consider incorporating water-efficiency policies and goals into the facility's environmental management system (EMS),⁵ if one has been developed, and track progress on the goals through the EMS process.

Step 2. Assessing Facility Water Use

Understanding how water is used within a facility is critical for the water management planning process. A water assessment provides a comprehensive account of all known water uses at the facility. It allows the water management team to establish a baseline from which progress and program success can be measured. It also enables the water management team to set achievable goals and identify and prioritize specific projects based on the relative savings opportunities and project cost-effectiveness. Assessing facility water use incorporates the following steps:

- Gathering readily available information
- Establishing a water use baseline
- Inventorying major water-using fixtures, equipment, systems, and processes
- Creating a facility water balance

Gathering Readily Available Information

The first steps in conducting an in-depth water assessment include: collecting any readily available information that can provide a basic understanding of building operational characteristics and general water use patterns; determining major uses of water within the facility; and estimating the costs of water use and sewer discharges. This information can be used to facilitate a more detailed investigation of facility water use and return on investment for any water-efficiency related projects.

⁵ EPA. Environmental Management Systems (EMS). www.epa.gov/EMS/.

1.2 Water Management Planning

Developing an Understanding of Building Operational Characteristics

To better understand a facility's water use patterns, consider the following:

- Survey operations and maintenance personnel to determine typical facility operating conditions (e.g., hours of operation, number of employees and visitors) and building characteristics (e.g., size, number of floors). Document this information using a tool such as the Building Water Survey Worksheet provided in Appendix B.
- Determine how many days the facility is operating per year and when fluctuations in water use may be expected. Facilities such as schools use less water during months when school is not in session; office buildings use less water on the weekends; and hospitals operating 24 hours per day, 365 days per year see no daily or monthly variation.

Defining How Water Is Used at the Facility

Once the water management team has a clear understanding of the facility's operational attributes and typical water use patterns, the next step is to determine specifically how water is used and currently tracked at the facility by doing the following:

- Identify all sources of water use at the facility. This can include: municipally supplied potable water, municipally supplied reclaimed water, wells or other freshwater sources, and onsite alternative water. For purposes of establishing a baseline, water sources can be more broadly grouped as potable, non-potable, onsite alternative, or purchased reclaimed water.
- Identify and record basic information for all metered sources of water, including billing account numbers and meter numbers, size/type, and location. Also note whether meters are dedicated to specific end uses (e.g., irrigation, indoor water use). Document this information using a form such as the List of Water Meters Worksheet provided in Appendix B. In addition, consider

Water Sources

Water sources can be defined as follows, based on the definitions developed by an interagency group working to implement requirements associated with a federal executive order on sustainability:⁶

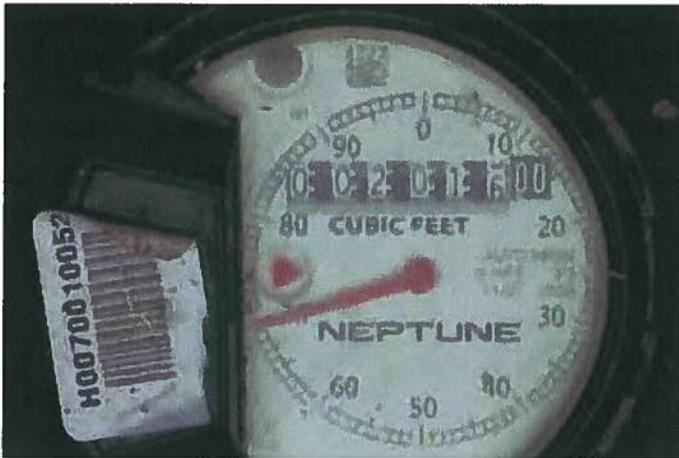
- **Potable water:** Water that is of sufficient quality for human consumption and that is obtained from public water systems or from natural freshwater sources, such as lakes, streams, and aquifers that are classified, permitted, and approved for human consumption.
- **Non-potable water:** Water that is obtained from natural freshwater sources that is not of sufficient quality for human consumption and has not been properly treated, permitted, or approved for human consumption.
- **Onsite alternative water:** Water that is not obtained from a surface water source, groundwater source, nor purchased reclaimed water from a third party. It can include rainwater or stormwater harvested on site, sump pump water harvesting, gray water, air-cooling condensate, reject water from water purification systems, water reclaimed on site, or water derived from other water reuse strategies.
- **Purchased reclaimed water:** Wastewater treatment plant effluent purchased from a third party that has been diverted for beneficial uses, such as irrigation, that substitute the use of an existing freshwater source.

⁶ DOE, Energy Efficiency & Renewable Energy (EERE), Federal Energy Management Program (FEMP). Federal Water Efficiency Requirements. www1.eere.energy.gov/femp/program/waterefficiency_requirements.html#eo13514.

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documenting and tracking water use information for each meter using ENERGY STAR's Portfolio Manager.⁷

- Identify sources of unmetered water use.
- Work with operation and maintenance personnel to identify all submetered fixtures, equipment, systems, and processes. If available, obtain copies of internal log books or electronic records of submetered water use.



Water meter

Gathering and Reviewing Water Bills to Understand Use and Cost

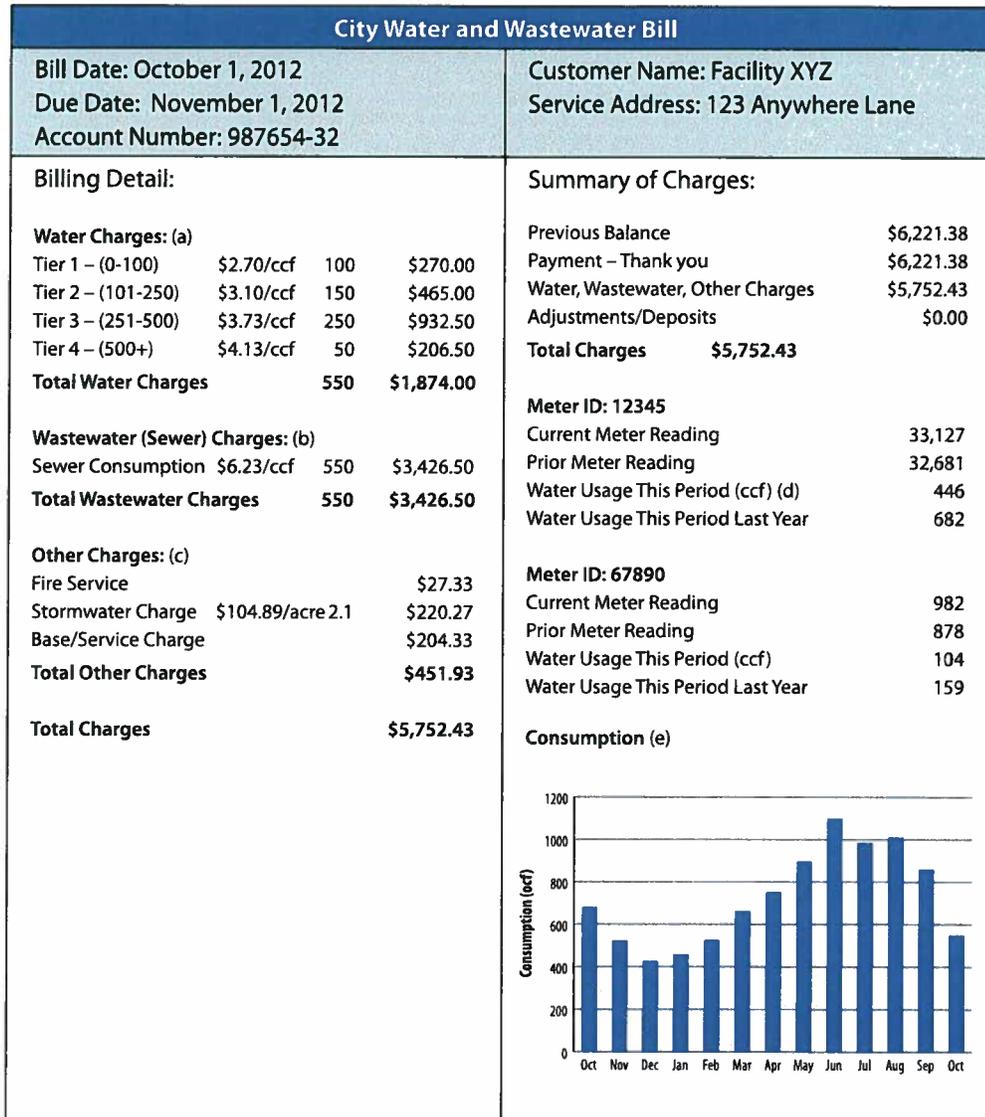
Collecting at least two years of water and sewer use data for the most recent timeframe possible for each identified source will help facility owners and managers better understand how much their facility's water use costs. These data can include records or logs from source water meters and/or utility water bills. If bills are delivered to and paid off site, be sure to receive copies for tracking and evaluating costs. In addition, consider the following:

- Water bills usually contain several separate charges, which vary by utility. Figure 1-2 provides an example bill with the charges specifically labeled. Water managers should contact the utility to clarify any questions before using the information to evaluate potential water use reductions and any associated cost savings. With this information, the water management team can prioritize water-saving project opportunities.
- In addition to gathering data for metered sources, gather information necessary to estimate annual water use for any unmetered sources of water, such as well water or other source water brought on site. For example, water use may be estimated based on source water pumping rates or the consumption of the end uses supplied by the source.

⁷ EPA and DOE's ENERGY STAR. Portfolio Manager Overview. www.energystar.gov/index.cfm?c=evaluate_performance.bus_portfoliomanager.

1.2 Water Management Planning

Figure 1-2. Example Information on a Water Bill



- Example shows an increasing block rate structure in which the utility charges a higher rate for increasing increments of water consumed. Some utilities charge a flat rate regardless of consumption volume, while other utilities charge a decreasing block rate structure. Water charges take into account total water consumption from all water meters.
- Charge is per amount of water discharged to sewer, which is often billed at a single rate, but could also have varying rates depending upon the quantity discharged. Oftentimes, this is based on the metered amount of water use (not a separate wastewater meter), which assumes that all water used was discharged to the sewer. In some cases, a facility can receive a sewer charge deduction for water uses that are known to not be sent to the sewer, such as cooling tower evaporation and irrigation water use. This deduction might appear on the bill.
- The utility could charge other fees, including fire service, stormwater, or other base or service charges. Stormwater fees can be based on the facility acreage. The base or service charge could depend upon the size of the water meter.
- Water usage is for the billing period for a specific water meter. In this example, water usage is reported in units of hundred cubic feet (ccf). Other common units include gallons and liters. Note: A ccf is equivalent to approximately 748 gallons.
- In some cases, the utility might provide historical water use information, which can help identify any large leaks or anomalies. It might also show seasonal trends in water use.

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Establishing a Water Use Baseline

Establishing a water use baseline provides a reference point from which progress can be measured toward achieving water management goals. It is also an important component of developing a facility water balance, as discussed below. To develop a water use baseline, consider the following:

- Using the water bills gathered from one or two years prior, document the facility's water use history using a form such as the Water Consumption History Worksheet provided in Appendix B. In addition, consider documenting and tracking water use history using ENERGY STAR's Portfolio Manager.⁸
- Calculate the facility's total annual water use for each metered and unmetered water source and total for all water sources combined. This total annual water figure will serve as the facility's water use baseline.
- If long-term historical water use data are available, look for any anomalies that might suggest that the established water use baseline is not representative of typical facility water use (e.g., a large leak or a system or process change that occurred and temporarily skewed water use). If an anomaly is present, either adjust the baseline as appropriate or identify a different year that can serve as the baseline.

Inventorying Major Water-Using Fixtures, Equipment, Systems, and Processes

Once the baseline is established, it is critical to understand how specific fixtures, equipment, systems, and processes contribute to the overall facility water use. This process can help the water management team establish a baseline for individual end uses of water and identify potential reduction opportunities. It can also facilitate the establishment of water management planning goals. Three important components of a water assessment include: reviewing existing data, touring the facility to inventory water-using equipment, and verifying water use when possible.

Reviewing Existing Data

As a first step in the inventory process, plot one or two years of water use data from bills, log books, or other available sources to identify seasonal trends or abnormalities. Note any peaks, particularly in the summer months, which can indicate how much additional water is used for building cooling and irrigation systems. Use this analysis to estimate cooling and irrigation water use, if those sources are not submetered.

Touring the Facility to Inventory Water-Using Equipment and Meter Locations

Touring the facility to identify and inventory all of the major water-using fixtures, equipment, systems, and processes is a key step in identifying how a facility can improve its water efficiency. During the tour, note any obvious areas for

⁸ *Ibid.*

1.2 Water Management Planning

improvement (e.g., leaking fixtures, single-pass cooling, outdated equipment). In addition, consider the following:

- Interview any personnel that manage water-using systems or equipment to understand how the systems and equipment are operated and maintained and to verify water use.
- Capture enough detailed information about all water-using fixtures, equipment, systems, and processes to determine how much water is consumed by each end use.
- Use survey forms or checklists, such as the Existing Plumbing Equipment and Water Use Inventory Worksheets, provided in Appendix B, to record fixture or equipment inventories, water use specifications (e.g., fixture flow rates), and water use patterns. This information can later be used to estimate water use.⁹ Be sure to record the hours of operation for each system or fixture to more accurately calculate water use over time.
- During the tour, pay particular attention to drain lines plumbed to floor drains in building mechanical and utility spaces. Trace these drain lines back to the originating equipment to make sure they are included in the inventory.
- Identify locations of all meters and submeters if the locations were not determined during the data-gathering phase. Read the meters and submeters, and check that the units and scale of the readings match water bills and internal log books.



Water assessor conducting a facility tour

Verifying Water Use When Possible

In some instances, it may be possible to measure or verify the water use from specific fixtures, equipment, systems, or processes. When verifying water use, consider the following:

- If discharge from water-using equipment or processes is evident during the tour, use a bucket to manually collect water use over a 15-, 30-, or 60-second time period. Measure the water use collected during that time period to determine flow rates.
- If possible, install temporary water meters or flow meters for larger water-using equipment or processes and briefly monitor water use. If the water use is fairly consistent throughout the day, water use could be measured for a period of a few minutes to estimate typical water use. If the water use fluctuates throughout the day, water use data should be collected over a 24-hour period to estimate an average water use. It is important to note the days of operation for each water use measured in order to estimate an annual water use.

⁹ AMWUA Regional Water Conservation Committee and Black and Veatch, *op. cit.*, Page 18.

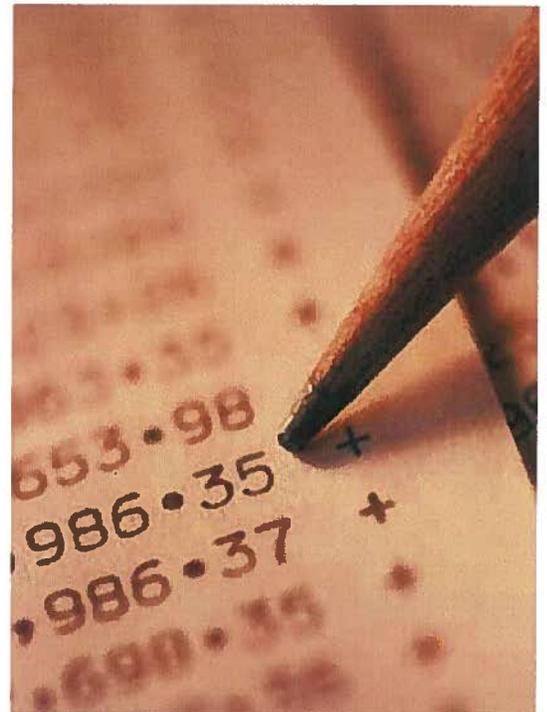
1.2 Water Management Planning

Consult the documents referenced in the Additional Resources section at the end of this section for more specific information about conducting a water assessment.

Creating a Facility Water Balance

The facility water balance is an accounting of all water uses at the facility. It indicates the relative contribution of specific end uses to the facility's overall water use (i.e., baseline) and is a powerful tool for identifying, evaluating, and prioritizing water-efficiency improvements. It also provides a mechanism to identify water that is unaccounted for, which might be attributed to leaks. See Tables 1-2 and 1-3 for an example of a laboratory facility water balance. It is important to develop a water balance for all types of source water that a facility might be using. The following steps will help with creating a water balance:

- Sum the measured or estimated water use from all of the individual end uses for each water source. The sum of all end uses should roughly equal the facility's total baseline water use.
- For metered or submetered fixtures, equipment, systems, and processes identified, calculate typical annual water use from meter readings, water bills, or internal log books.
- For unmetered fixtures, equipment, systems, and processes identified, estimate the annual water use from flow rate measurements collected during the facility tour (if available) or use equipment specifications and patterns of use. Consult the relevant best management practices within *WaterSense at Work* to help develop water use estimates for specific fixtures or equipment. Most of these sections provide equations to help calculate water use of existing equipment and potential retrofits or replacements.
- In some cases, the use of onsite alternative water sources (see *Section 8: Onsite Alternative Water Sources*) can offset the use of potable water. Track these sources separately in the facility water balance to fully account for all sources of supplied water.
- If more than 10 percent of water use cannot be accounted for in the water balance, there could be an unidentified source, a leak, or another issue warranting further investigation. Refer to *Section 2.3: Leak Detection and Repair* to help identify and fix leaks.



1.2 Water Management Planning

Table 1-2. Example Laboratory Facility Water Balance for Potable Water Source

Major Process	Annual Water Use (gallons)	Percent of Total	Basis of Estimate
Total Annual Potable Water Supplied	4,900,000	100	Monthly Water Bills
Use 1: Sanitary (e.g., toilets, urinals, showerheads, faucets)	550,000	11	Engineering estimate of 750,000 gallons per year, subtracting onsite rainwater supply of 200,000 gallons/year
Use 2: Water-Cooled Ice Machine in Commercial Kitchen	300,000	6	Engineering estimate using manufacturer product literature
Use 3: Pre-Rinse Spray Valve	50,000	1	Engineering estimate
Use 4: Steam Sterilizer (i.e., continuous discharge tempering water)	300,000	6	Instantaneous flow rate measurement
Use 5: Reverse Osmosis Supply	100,000	2	Metered
Use 6: Cooling Tower Make-Up Water	3,000,000	62	Metered
Use 7: Steam Boiler Make-Up Water	300,000	6	Metered
Sum of Accounted-for Potable Water Use	4,600,000	94	Summed from uses 1 through 7
Unaccounted-for Potable Water Use	300,000	6	Calculated by difference from total water use and accounted for water use (since this is less than 10 percent, the facility likely does not have a significant leak)

Table 1-3. Example Laboratory Facility Water Balance for Air Handler Condensate Supply

Major Process	Annual Water Use (gallons)	Percent of Total	Basis of Estimate
Total Annual Air Handler Condensate Supplied	500,000	100	Metered
Use 1: Cooling Tower Make-Up Water	500,000	100	Metered (separately from city-supplied make-up water)
Sum of Accounted-for Air Handler Condensate Water Use	500,000	100	Use 1
Unaccounted-for Air Handler Condensate Water Use	0	0	Calculated by difference from total water use and accounted for water use

1.2 Water Management Planning

Step 3. Setting and Communicating Goals

Once the water management team understands how the facility is currently using water, the next step in the water management planning process is to gather building owners, facility management staff, senior management, and any other key decision makers to develop a list of water management goals and policy initiatives. Employees from all different parts of the organization should be included in the goal-setting process to obtain a range of perspectives and promote a sense of ownership. The goals will drive the water management program and help fuel continuous improvement.

Once water management goals and policies have been developed, they must be communicated to the entire organization with the support of senior management or the building owners. Top-level support gives legitimacy to the initiative and informs employees that water and energy reductions are a priority. A feedback mechanism should be created to encourage input, suggestions, and reporting of problems.

Examples of water management goals might include:

- Reduce water use by a certain percentage per year for a period of years for a total target percent reduction, based upon the facility's established water use baseline.
- Complete projects identified through the water management planning process within a set timeframe.
- Upgrade and focus on making whole areas water-efficient, such as mechanical systems, restrooms, or commercial kitchens.
- Establish a leak detection program to identify and correct any water use that is unaccounted for and could be attributed to leaks.
- Use onsite alternative water sources to replace a certain percentage of potable water use.
- Participate in a program to incentivize water use reductions (e.g., ENERGY STAR National Building Competition).¹⁰
- Obtain recognition for water reduction efforts from a federal, state, or local program (e.g., California Green Business Program, Wisconsin Green Tier Program, New Mexico Green Zia Leadership Program).^{11, 12, 13}
- Achieve facility-level certification, such as the U.S. Green Building Council's LEED® rating system or ENERGY STAR. State and local level certification programs can also provide benefits to commercial and institutional buildings. Sector-specific programs, such as the Michigan Green Lodging Program or the Green Restaurant Association program, are often tailored to promote significant reductions in environmental impacts.^{14, 15}

¹⁰ EPA and DOE's ENERGY STAR. The ENERGY STAR Challenge. www.energystar.gov/index.cfm?c=challenge.bus_challenge.

¹¹ California Green Business Program. www.greenbusinessca.org/.

¹² Wisconsin Green Tier Program. dnr.wi.gov/topic/greentier/.

¹³ New Mexico Green Zia Leadership Program. www.nmenv.state.nm.us/P2/GreenZia/index.html.

¹⁴ Green Lodging Michigan. www.michigan.gov/mdcd/0,1607,7-122-25676_25677_37026---,00.html.

¹⁵ Green Restaurant Association. www.dinegreen.com/.

1.2 Water Management Planning

When setting and communicating goals, consider the following:

- Ensure that goals are measurable and achievable. Remember that goals can always be strengthened if the organization achieves success sooner than initially anticipated.
- Establish realistic implementation timeframes and dates.
- Consider facility-specific conditions, such as long-term drought or water use restrictions, when establishing goals.
- Communicate goals to employees, building occupants, and other relevant stakeholders to gain support for future projects.
- Conduct a kickoff event to engage employees facility-wide.

Step 4. Creating an Action Plan

Using the water balance as a guide and considering any major areas for improvement noted during the water assessment, the water management team can create a detailed action plan. This includes solidifying water savings opportunities into specific projects or operation and maintenance changes and prioritizing that project list. The action plan should determine which projects and practices can be implemented at the facility to achieve established water management goals. Creating an action plan consists of the following steps:

- Identifying projects and calculating cost and potential savings
- Identifying financing sources
- Calculating simple payback
- Prioritizing projects
- Documenting project priorities in a detailed action plan

Identifying Projects and Calculating Cost and Potential Savings

To develop an initial list of potential projects, consider the following:

- Utilize information gathered during the water assessment to determine which operation and maintenance changes and retrofit and replacement projects might be viable at the facility. Consider the largest uses of water identified from the water assessment and included in the facility water balance. These might be areas to target for the most significant water savings.
- Review the checklist in Table 1-4 to help identify potential projects and practices for inclusion in the action plan. The checklist can be filled out after the water assessment to help the facility owner or manager determine where to focus his or her efforts.
- Consider the impact of codes and standards, which may mandate or incentivize the use of certain fixtures or equipment (see *Section 2.5: Codes, Standards, and Voluntary Programs for Water Efficiency*).

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Once all opportunities have been evaluated, develop a final list of potential projects to prioritize, and estimate individual project costs and potential savings as follows:

- For each identified project or practice, calculate the total water, energy, and cost savings from the water and energy use reductions. Remember to include savings from other associated materials and disposal costs. Consult the relevant best management practices in Sections 2 through 8 of *WaterSense at Work* for assistance with some of these calculations.
- South Florida Water Management District's *Water Efficiency Self-Assessment Guide for Commercial and Institutional Building Facility Managers* provides several equipment and process-specific water use and savings calculators, which can be useful for analyzing project-related water savings.^{16, 17}

Identifying Financing Sources

As a first step, determine if the project can be funded through the facility's operating expenses or capital funding mechanisms. The following financing sources and options can also be considered:

- For larger, more expensive pieces of equipment, consider leasing the equipment from a technology vendor. ENERGY STAR provides information on a variety of lease types for energy-using equipment, many of which might apply to water-using equipment, such as commercial laundry systems or water purification systems.¹⁸
- Look for rebates and incentive programs offered by the local water utility to assist commercial and institutional building owners in making water-efficiency upgrades. Energy utilities also have rebates and incentives available to support projects that provide associated energy savings (e.g., laundry replacements, pre-rinse spray valve replacements). Rebate and incentive programs include free product distribution, partial rebates on purchases of water- and energy-efficient products, financial incentives based on total gallons of water saved from implementing large-scale projects, and billing offsets based on submetered water use that can account for water that is not being sent to the sewer (e.g., metering cooling tower make-up water and blowdown water to account for evaporation).
- Consider private financing, which can be obtained through performance contracts managed by water management service companies and energy service companies (ESCOs). The service company develops, finances, and installs projects designed to improve efficiency and maintenance costs for facilities over a seven- to 10-year time period. Water management service companies and ESCOs generally act as project developers for a wide range of tasks and assume the technical and performance risk associated with the project. Water management service companies will develop and finance water-efficiency projects, and some ESCOs will also develop and fund stand-alone water-efficiency projects, although

¹⁶ South Florida Water Management District Water Supply Development Section. April 2012. *Water Efficiency Self-Assessment Guide for Commercial and Institutional Building Facility Managers*. www.sfwmd.gov/portal/page/portal/xweb%20-%20release%203%20water%20conservation/water%20conservation%20businesses#efficiency.

¹⁷ South Florida Water Management District. SFWMD Library & Multimedia. my.sfwmd.gov/portal/pls/portal/portal_apps.repository_lib_pkg.repository_browse?p_keywords=waterefficiency&p_thumbnails=no.

¹⁸ EPA and DOE's ENERGY STAR. 2007. *ENERGY STAR Building Upgrade Manual*. Chapter 4: Financing. www.energystar.gov/index.cfm?c=business.bus_upgrade_manual.

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it is more common for ESCOs to bundle energy- and water-efficiency upgrades. The utility cost savings from the projects pay for the projects themselves, and any additional cost savings on top of the capital cost are shared between the service company and the facility.^{19,20}

- Look for state-specific financing programs. Many states have made water-efficiency projects eligible for Property Assessed Clean Energy (PACE) financing programs that are carried out by local governments.²¹

Calculating Simple Payback

Simple payback, based on the project cost and anticipated annual water savings, can be an effective metric for prioritizing potential projects and practices for inclusion in the facility-specific action plan. In some cases, retrofitting or replacing equipment can also save energy, further reducing the simple payback period and increasing project cost-effectiveness. To calculate the simple payback for a specific project or practice, gather the following information and use Equation 1-1:

- Determine the total project cost that will come from the facility's operating budget. If an alternative source of funding is available, such as a rebate to offset money spent from the facility's budget, subtract it from the total project cost, as it will make the project more cost-effective. The project cost should be the total that will come directly from the facility's budget only.
- Estimate the water savings from the project, as calculated using equations in Sections 2 through 8 of *WaterSense at Work*.
- Identify the cost of water and wastewater. In some cases, the water utility deducts sewer charges for water that is not discharged to the sanitary sewer (e.g., water evaporated from the cooling tower or water applied to the landscape). In these cases, only consider the water cost when calculating simple payback of the project.

Equation 1-1. Simple Payback (years)

$$= \text{Project Cost} \div (\text{Water Savings} \times \text{Cost of Water and Wastewater})$$

Where:

- Project Cost (dollars)
- Water Savings (gallons per year)
- Cost of Water and Wastewater (dollars per gallon)

If the project has an associated energy impact, determine the energy source (e.g., gas or electricity) and utility cost. Calculate the energy impact and consider including it in the simple payback calculation.

¹⁹ *Ibid.* Page 6.

²⁰ National Association of Energy Service Companies. Resources—What is an ESCO? www.naesco.org/resources/esco.htm.

²¹ Database of State Incentives for Renewables & Efficiency. PACE Financing. dsireusa.org/solar/solarpolicyguide/?id=26.

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Table 1-4. Action Plan Water Use Reduction Opportunity Checklist

Water Use Reduction Opportunity/Project	Reference Section	Already Implemented	Evaluate/ Consider	Not Applicable
		✓	✓	✓
Water Use Monitoring and Education				
Read water meters and record monthly water use.	2.2			
Install submeters on any major water-using equipment, systems, or processes.	2.2			
Implement a leak detection and repair program.	2.3			
Educate facility staff, building occupants, employees, and visitors on water management program goals and initiatives.	2.4			
Review, understand, and utilize information in codes, standards, and voluntary programs for water efficiency.	2.5			
Sanitary Fixtures and Equipment				
Replace old tank-type toilets with WaterSense labeled models.	3.2			
Replace old flushometer-valve toilets flushing greater than 1.6 gallons per flush (gpf) with high-efficiency models, and install retrofit dual-flush conversion devices on 1.6 gpf flushometer valve toilets.	3.2			
Replace old flushing urinals with WaterSense labeled models.	3.3			
Replace lavatory faucets or faucet aerators (for private use) with WaterSense labeled models and install 0.5 gallons per minute (gpm) faucets or aerators in public-use settings.	3.4			
Replace old showerheads with WaterSense labeled models.	3.5			
Wash only full loads of laundry.	3.6			
Replace old single-load clothes washers with ENERGY STAR qualified models or consider the water factor when purchasing larger or more industrial-sized laundry machines.	3.6			
Commercial Kitchen Equipment				
Replace old ice machines with ENERGY STAR qualified models.	4.2			
Replace old steam cookers with ENERGY STAR qualified models.	4.4			
Load steam cookers, steam kettles, and combination ovens to capacity.	4.3, 4.4, 4.5			
Switch to connectionless combination ovens, steam cookers, and steam kettles.	4.3, 4.4, 4.5			
Replace old water-cooled wok stoves with a waterless model.	4.6			
Install in-line flow restrictor to reduce dipper well flow rate to 0.3 gpm.	4.7			

(continued)

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Table 1-4. Action Plan Water Use Reduction Opportunity Checklist (cont.)

Water Use Reduction Opportunity/Project	Reference Section	Already Implemented	Evaluate/ Consider	Not Applicable
		✓	✓	✓
Commercial Kitchen Equipment (cont.)				
Replace existing pre-rinse spray valves with models that use 1.3 gpm or less.	4.8			
Hand scrape food from dishes or install food strainers and compost food waste.	4.9			
Load dishwashers to capacity.	4.10			
Replace old dishwashers with ENERGY STAR qualified models.	4.10			
Use a broom or mop instead of a water broom or high-pressure hose to clean floors.	4.11			
Outdoor Water Use				
Plant native or drought-tolerant species.	5.2			
Use mulch around trees and plant beds.	5.2			
Install WaterSense labeled weather-based irrigation controllers or consider irrigation controllers with rain or soil moisture sensors.	5.3			
Use drip irrigation to water plant beds.	5.3			
Ensure irrigation schedule is appropriate for climate, soil conditions, plant materials, grading, and season.	5.3			
Have an irrigation professional certified by a WaterSense labeled program conduct an irrigation audit.	5.3			
Check the position and location of spray heads to ensure that they are working properly and water is not being directed onto non-landscaped areas, such as sidewalks.	5.3			
Use pool covers to control evaporation loss.	5.4			
Maintain proper pool chemistry to limit pool cleaning and drainage events.	5.4			
Use friction washing in vehicle washes and consider installing a water reclamation and reuse system.	5.5			
Mechanical Systems				
Eliminate single-pass cooling.	6.2			
Professionally monitor cooling tower and boiler chemistry and maximize cycles of concentration.	6.2, 6.5			
Install cooling tower meters and control systems to control chemical feed and blowdown based on conductivity.	6.3			

(continued)

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Table 1-4. Action Plan Water Use Reduction Opportunity Checklist (cont.)

Water Use Reduction Opportunity/Project	Reference Section	Already Implemented	Evaluate/ Consider	Not Applicable
		✓	✓	✓
Mechanical Systems (cont.)				
Inspect chillers and air handler coils regularly and remove dirt and scale buildup.	6.4			
Regularly check and maintain boilers, steam lines, and steam traps.	6.5			
Laboratory and Medical Equipment				
Use water purification only when necessary.	7.2			
Turn off pumps when not in use.	7.3			
Install thermostatically actuated valves to control the flow of cooling water for steam sterilizer condensate discharge.	7.4			
Replace old steam sterilizers and vacuum pumps with newer models that do not use single-pass cooling or condensate discharge tempering water.	7.3, 7.4			
Replace old fume hoods with a filtration system that does not require water (e.g., activated carbon).	7.6			
Inspect and repair worn cage-and-rack washer valves and rinse nozzles.	7.7			
Run glassware and cage-and-rack washers only when full.	7.5, 7.7			
Consider converting from traditional film to digital X-ray equipment.	7.8			
Onsite Alternative Water Use				
Consider using onsite alternative water for irrigation, cooling tower make-up, toilet and urinal flushing, fume hood scrubbers, and other uses not requiring potable water.	8.0			

Prioritizing Projects

All projects and practices selected should be considered in the context of achieving established water management goals, as well as overall cost-effectiveness. Once water-saving opportunities have been identified, they should be prioritized using criteria, such as urgency, cost-effectiveness, amount of potential water savings, visibility, and environmental impact. The water management team should address the simplest and most urgent tasks first, as follows:

- Fix any equipment that is malfunctioning or leaking to target the most urgent issues first.
- Start with simple projects and practices, particularly for new water management programs. This will help create initial positive results and gain acceptance of program goals and initiatives.

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- Note where simply changing the operations and maintenance for equipment or systems will result in savings. These changes are often are low- to no-cost options that can be more cost-effective than retrofits or replacements.

Remaining projects should be prioritized based on facility goals. Depending on what the facility values most, projects can be prioritized in a variety of ways, including:

- Shortest to longest simple payback period.
- Highest to lowest potential of water savings.
- Most visibility to least visibility (e.g., implementing a landscaping project before increasing cooling tower cycles of concentration).
- Greatest to least environmental impact (e.g., implementing projects with the greatest associated energy savings before those with only water savings).

Documenting Project Priorities in a Detailed Action Plan

Documenting in order of priority the identified water-saving opportunities and specific projects or operation and maintenance changes is an effective way to help ensure that projects are implemented and water management goals are reached. Remember that projects can be re-prioritized as they are completed or based on changing goals.

The water management team should also consider developing an emergency contingency plan, which can be a stand-alone document or incorporated into the facility-specific action plan. The emergency contingency plan can help the team further prioritize actions and identify ways to prepare for and respond to significant drought or other water restrictions. When developing an emergency contingency plan, consider the following tips:

- Describe how the facility will meet minimum water needs in an emergency or minimum water use requirements in a drought or water shortage. This may require determining the highest-priority water use needs at the facility and planning for how those needs will continue to be met in an emergency.
- Work with the local water utility and other regional and state associations to ensure that plans are compliant with all requirements and that water use will be reduced regionally as needed.
- Refer to the emergency water supply planning guide for water outages for hospitals and health care facilities developed by the Centers for Disease Control and Prevention and the American Water Works Association for examples of issues to consider when developing a facility-specific plan.²²



²² Centers for Disease Control and Prevention and American Water Works Association. 2012. *Emergency Water Supply Planning Guide for Hospitals and Health Care Facilities*. Atlanta: U.S. Department of Health and Human Services. www.cdc.gov/healthywater/emergency/drinking_water_advisory/index.html#planningguide.

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Step 5. Implementing the Action Plan

The water management team should develop a targeted implementation strategy for the action plan, which can significantly increase project success and help achieve water management goals. This might include gathering support for specific projects and practices. To maximize the opportunities for success, consider the following:

- Ensure that the necessary resources (i.e., time, money, personnel) are available to complete projects and practices included in the action plan.
- Complete identified projects and practices in order of priority.
- Promote key components of the action plan to employees and other relevant stakeholders to gain support for specific projects.
- Create incentives to encourage staff or those responsible for specific projects and practices to take action and do their part to help achieve water management goals.
- Be creative and consider other resources that may be available to assist in implementation, such as other employees, utility and government programs, interns, or engineering students.
- In the event of a drought or other water emergency, implement measures as specified in the emergency contingency plan.

Step 6. Evaluating Progress

The water management team should periodically conduct a formal review of water use data and action plan implementation in the context of achieving the established water management goals. This review allows the organization to evaluate progress, set new goals, and continually improve. The water management team can also use the review to demonstrate and promote the success of the water management program, which can provide long-term support for the program and future projects and initiatives. Evaluations can include the following:

- Review water bills and meter and submeter readings to verify that the expected water savings are achieved. Ensuring that expected savings are seen is referred to as measurement and verification, and it is an important exercise to ensure that projects are operating as expected. DOE's FEMP has issued guidance on how to conduct measurement and verification for water projects.²³
- Review the action plan, at least on an annual basis, and revise water management goals as they are achieved.
- Use ENERGY STAR's Portfolio Manager²⁴ to track progress and compare water use over time. The Portfolio Manager tool is an effective way to keep track of water use data and note water reduction successes.

²³ DOE, EERE, FEMP. April 2008. *M&V Guidelines: Measurement and Verification for Federal Energy Projects, Version 3.0*, Section 11.6. mnv.lbl.gov/keyMnVDocs/femp.

²⁴ EPA and DOE's ENERGY STAR, Portfolio Manager Overview, *op. cit.*

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- Conduct a detailed reassessment of the facility approximately every four years to develop an updated water balance and identify new water management goals and savings opportunities.

Step 7. Recognizing Achievements

To gain and sustain support for a facility's water management program, the water management team can consider providing recognition for water management activities and achievements. This includes recognizing the contributions of those who have helped achieve the water management goals, as well as promoting the success of the program internally and to external stakeholders. Following are a few ways to recognize water management efforts:

- Establish an internal recognition program to award personnel or teams that provided significant contributions toward achieving the water management goals. This might include an award for the generation of the best water-efficiency ideas or the achievement of the greatest water use reductions (if measurable on an individual basis).
- Respond to employee and staff suggestions and reports of issues to encourage all parts of the organization to participate in the efforts.
- Explore opportunities for external recognition, such as competing in ENERGY STAR's annual National Building Competition,²⁵ which recognizes top water savers.
- Report progress publicly to interested stakeholders to gain support for initiatives and recognition for water-efficiency achievements.
- Report progress to facility staff and building occupants by using a newsletter or other outreach means as discussed in *Section 2.4: User Education and Facility Outreach*.

Water Management Planning Case Study

To learn how EPA's comprehensive water management strategy resulted in an 18.7 percent reduction in water use across 29 of its laboratories in just three short years, read the case study in Appendix A.



²⁵ EPA and DOE's ENERGY STAR. National Building Competition. www.energystar.gov/index.cfm?fuseaction=buildingcontest.index.

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Additional Resources

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