

# Water Management Plan

Revision 2

United States Environmental  
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Region 3 & Office of Pesticide Programs  
Environmental Science Center  
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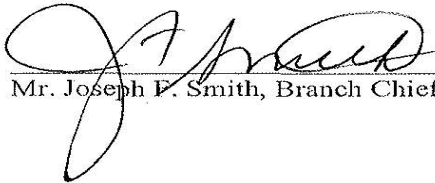
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
REGION 3 & OFFICE OF PESTICIDE PROGRAMS  
ENVIRONMENTAL SCIENCE CENTER  
FORT MEADE, MARYLAND

WATER MANAGEMENT PLAN, REVISION 2

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8/8/14  
Date

  
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9-9-14  
Date

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## **1.0 IDENTIFIED WATER CONSERVATION OPPORTUNITIES**

A water use and conservation assessment was conducted at the U.S. Environmental Protection Agency's (EPA's) Environmental Science Center (ESC) at the U.S. Army's Fort George G. Meade in Maryland. The assessment occurred in April 2014. Under this Water Management Plan, ESC will consider implementing the potential water conservation and management opportunities identified during the water assessment, which are summarized in Table 1.

The rest of this Water Management Plan describes ESC's water reduction goals, water use trends, end uses of water, completed water efficiency projects, and drought management plans.

## **2.0 BACKGROUND AND PURPOSE**

In 2007, Executive Order (EO) 13423, *Strengthening Federal Environmental, Energy, and Transportation Management*, called for federal agencies to reduce water use intensity by 2 percent per year between fiscal year (FY) 2007 and FY 2015 for a total reduction of 16 percent, compared to a FY 2007 baseline. This goal was revised and extended by EO 13514, *Federal Leadership in Environmental, Energy, and Economic Performance*. EO 13514 calls for reducing potable water use intensity by 2 percent annually through FY 2020, relative to the FY 2007 baseline, for a 26 percent total reduction. Water use intensity is measured in gallons per gross square feet (gsf).

The implementation instructions for water efficiency and management provisions of EO 13514 direct that agencies replacing fixtures or other water-using products should purchase Federal Energy Management Program-designated or WaterSense<sup>®</sup> labeled products.

In addition to the potable water use reduction requirements, EO 13514 requires agencies to reduce industrial, landscaping, and agricultural (ILA) water use by 2 percent annually or 20 percent by the end of FY 2020, relative to an FY 2010 baseline (including non-potable sources). The EO also directs agencies to identify, promote, and implement water reuse strategies that reduce potable water use.

The Energy Independence and Security Act of 2007 directs agencies to complete comprehensive energy and water evaluations of 25 percent of covered facilities (i.e., those accounting for 75 percent of total energy use) each year; implement cost-effective measures identified through life cycle analyses; and measure and verify water savings.

In summary, existing EOs and federal law require substantial reductions in all forms of water use, as well as ongoing, regular assessments of facility water use to identify and implement saving opportunities.

This Water Management Plan has been developed to document and promote the efficient use of water at ESC, so that the facility can contribute to meeting these Agency-wide objectives.

**Table 1. Potential Water Conservation Opportunities, ESC**

<b>Suggested Priority</b>	<b>Project Description</b>	<b>Project Cost</b>	<b>Potential Water Savings (gallons)</b>	<b>Potential Energy Savings (MMBtus)</b>	<b>Potential Utility Cost Savings</b>	<b>Potential Payback (years)</b>
1	Fix the control module on the steam sterilizer in Room B206 so that it only applies tempering water when condensate is flowing to drain.	\$0	262,000	N/A	\$4,300	Immediate
2	Adjust the thermostatic water valve on the steam condensate flash tank tempering so that the condensate temperature is closer to 140°F (COMPLETED)	\$0	42,000	N/A	\$680	Immediate
3	Conduct maintenance on the boiler blowdown tempering water valve to eliminate continuous flow.	\$0	35,000	N/A	\$560	Immediate
4	Evaluate reverse osmosis (RO) system use and reduce its operating schedule to minimize the amount of RO permeate water being sent to drain. Savings estimate based on reducing operation from 10 to 5 hours per day.	\$0	24,000	N/A	\$380	Immediate
5	Ensure leak in water softener system is eliminated during planned FY 2014 system rebuild.	\$0	14,000	N/A	\$230	Immediate
6	Install 0.5 gallon per flush (gpf) urinal diaphragm inserts to replace existing 1.0 gpf inserts. Implement a pilot project in one restroom first to ensure adequate urinal performance and user satisfaction.	\$400	25,000	N/A	\$410	1.0
7	Replace existing showerheads flowing at 2.5 gallons per minute (gpm) with WaterSense labeled models flowing at 1.75 gpm or less.	\$360	5,000	3	\$110	3.3

### **3.0 FACILITY INFORMATION**

ESC occupies a 162,799 gross-square-foot building situated on approximately 24 acres at the U.S. Army's Fort George G. Meade. The facility is EPA-owned and -operated under a 25-year land use agreement granted by the Army that began in 1996. EPA has the option to renew the land use agreement for an additional 25 years once it expires. The building, which was dedicated and occupied in 1999, includes 75 laboratories with 94 fumehoods and 12 biological safety cabinets.

ESC is occupied by approximately 135 employees. The laboratory operates on a flex time schedule and is typically occupied Monday through Friday between the hours of 6 a.m. and 6:30 p.m.

#### **4.0 WATER MANAGEMENT GOALS**

ESC achieves its resource conservation goals by implementing the ESC Environmental Management System (EMS) program. A new, multi-site EMS is in the process of being developed for ESC and other Region 3 facilities. The multi-site EMS is expected to be completed in June 2014, at which point ESC will adopt the new EMS. Consistent with the EMS and EPA policy, ESC's water management goals include:

- Reduce facility potable water use by the amount established by EPA's Sustainable Facilities Practices Branch (SFPB) (i.e., meet the ConservW target set annually by SFPB).
- Reduce potable water intensity by 26 percent by FY 2020, based on a FY 2007 baseline.

#### **5.0 WATER USE INFORMATION**

ESC uses potable water primarily for cooling tower make-up, research, building humidification, steam sterilizer tempering, restroom use, and steam boiler needs. Discussed further in Section 5.3, ESC's potable water use has decreased since the FY 2007 baseline year because ESC implemented suggested water-saving projects from previous Water Management Plans. The following sections provide additional details on ESC's water uses.

##### **5.1 Water Supply**

ESC's potable water and sewer service is provided by the U.S. Army's Fort George G. Meade. ESC does not use any source of non-potable water.

##### **5.2 Meters and Submeters**

Incoming potable water supply is metered. Flow totalizing meters are also installed on many of the major subsystem flows. Meters and submeters include:

- Potable water supply meter to laboratory
- Cooling tower potable make-up water submeter
- Boiler potable feed water submeter
- RO reject water to boiler make-up submeter
- Recovered air handler condensate to cooling tower make-up submeter

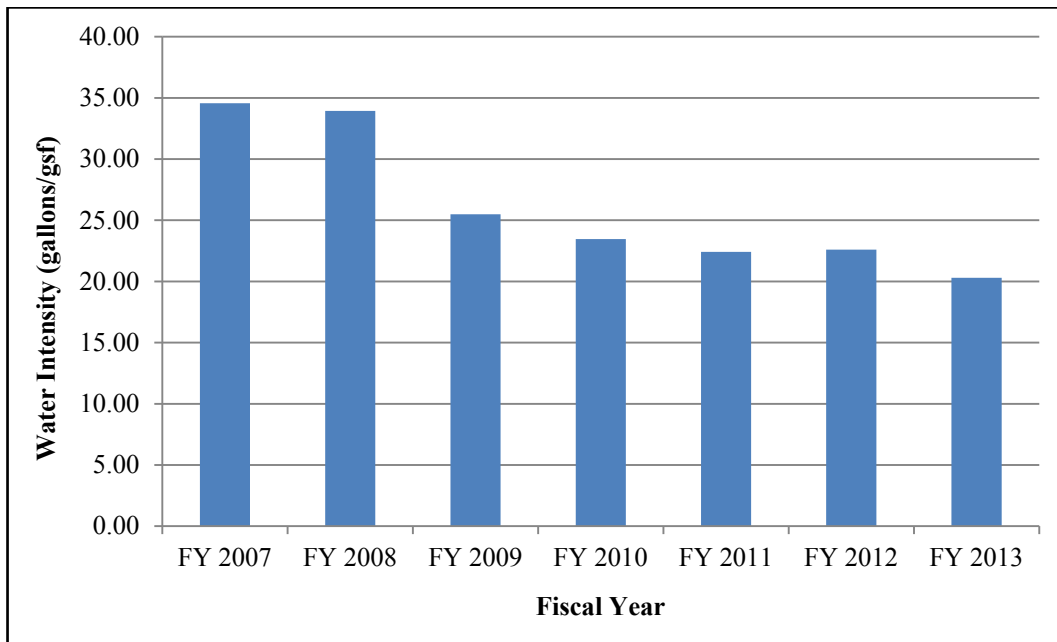
Facilities management staff record readings from each of these meters weekly and report values to the Facilities Manager. Water use trends are monitored on an ongoing basis, and unexpected changes in water use are investigated and resolved.

### 5.3 Historical Water Use

In response to EO 13423, ESC set a FY 2007 potable water use intensity baseline of 34.57 gallons per gsf. In FY 2013, water use intensity had decreased to 20.29 gallons per gsf—a 41.3 percent reduction compared to the FY 2007 baseline. Figure 1 illustrates ESC’s potable water use intensity from FY 2007 to FY 2013.

ESC completed several water efficiency projects to contribute to its significant water use reduction since FY 2007. These projects are described in Table 2.

**Figure 1. Annual Potable Water Use Intensity, ESC, FY 2007–FY 2013**



**Table 2. Completed Water Efficiency Projects Since FY 2008, ESC**

Project	Implementation Cost	Estimated Annual Water Savings (gallons)	Completion Year	Additional Notes
Steam condensate recovery	\$500	600,000	FY 2010	ESC completed a project to redirect clean steam condensate back to its boiler system in FY 2010. It is estimated that approximately 85 percent of steam condensate is recovered in the boiler system.
Air handler condensate recovery	\$6,000	180,000	FY 2009	ESC’s air handler condensate recovery system was installed in FY 2009. In FY 2013, the system provided 178,129 gallons of make-up water to the cooling tower system.

**Table 2. Completed Water Efficiency Projects Since FY 2008, ESC**

<b>Project</b>	<b>Implementation Cost</b>	<b>Estimated Annual Water Savings (gallons)</b>	<b>Completion Year</b>	<b>Additional Notes</b>
Steam sterilizers	\$3,000	240,000	FY 2009	As of FY 2009, all steam sterilizers have been retrofitted with water conservation kits to only apply tempering water to the steam trap when necessary.
RO reject recovery	Unknown	80,000	FY 2008	ESC began capturing RO reject water prior to drain and routing it to the steam boiler system as make-up water. In FY 2013, 80,510 gallons of RO reject water was collected and used to offset the need for potable boiler feed water.
Faucet aerators	Unknown	47,000	FY 2008	As of FY 2008, all faucets at ESC have been fitted with 0.5 gpm faucet aerators.
Toilets	Unknown	30,000	FY 2008	As of FY 2008, all toilets at ESC have been replaced with dual-flush models with an effective flush volume of 1.28 gpf.

**5.4 End Uses of Water**

Table 3 and Figure 2 describe the end uses of water at ESC.

Figure 3 provides a graph of ESC’s quarterly potable water use in FY 2013, which illustrates ESC’s seasonal water use pattern that can be attributed to high cooling tower make-up water use in the summer months.

ESC’s end uses of water are described in more detail in this section. Potential projects discussed in this section are summarized in Table 1.

**Table 3. Major Water Uses, ESC, FY 2013**

<b>Major Process</b>	<b>FY 2013 Annual Water Use (gallons)</b>	<b>Percent of Total Potable Water Use (%)</b>	<b>Estimated Utility Costs<sup>a</sup></b>	<b>Supporting Calculations and Source Documentation</b>
<b>Potable Water Use</b>				
Cooling tower make-up (potable water)	2,193,509	66.4	\$18,400	FY 2013 metered total.
Research water use (including RO permeate use) and building humidification	330,078	10.0	\$5,300	Calculated by difference from known total water use and all other calculated water uses.

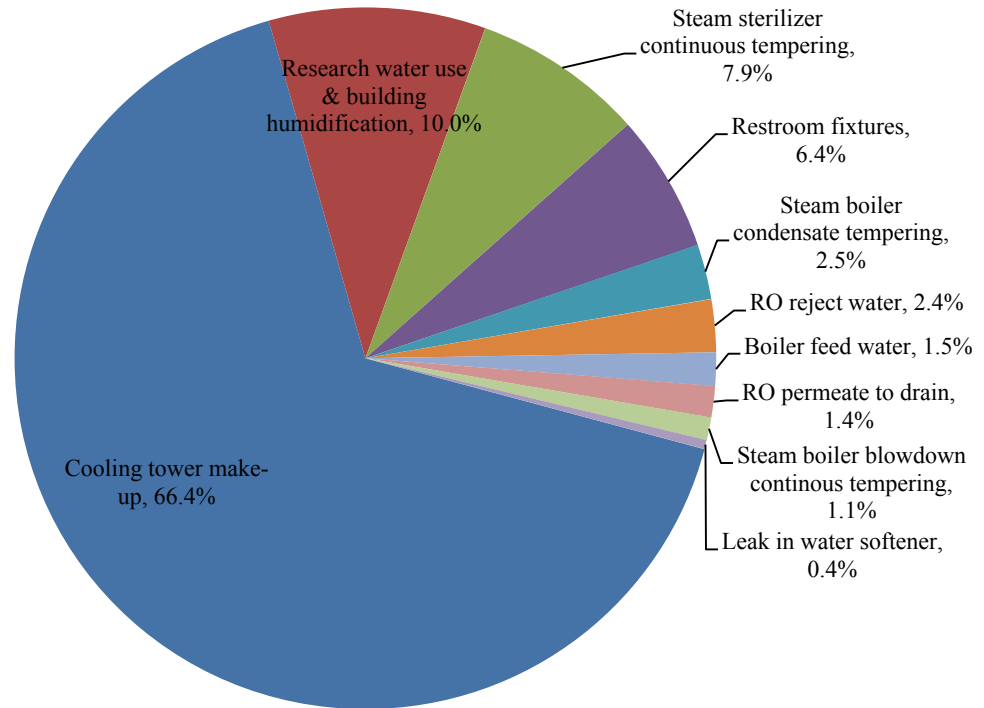


**Table 3. Major Water Uses, ESC, FY 2013**

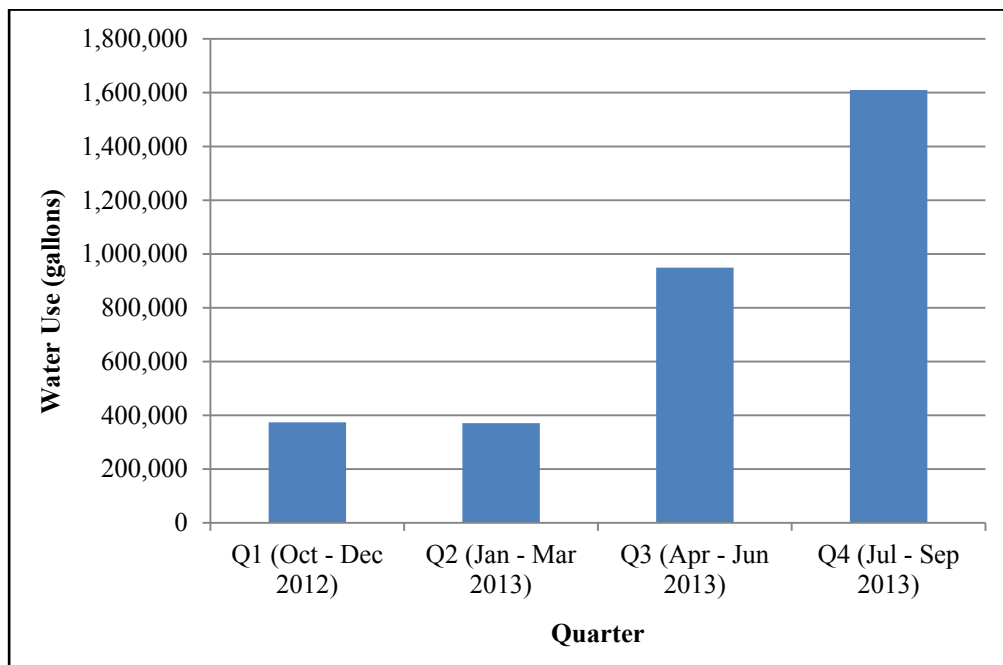
<b>Major Process</b>	<b>FY 2013 Annual Water Use (gallons)</b>	<b>Percent of Total Potable Water Use (%)</b>	<b>Estimated Utility Costs<sup>a</sup></b>	<b>Supporting Calculations and Source Documentation</b>
Steam sterilizer continuous tempering water	260,000	7.9	\$4,200	Based on assumed flow rate of 0.5 gpm of tempering water being applied to the steam sterilizer in Lab B206. Assumes the tempering water is applied 24 hours per day, 365 days per year.
Restroom fixtures	210,000	6.4	\$3,400	Engineering estimate based on fixtures installed, occupancy, and daily usage factors.
Steam boiler condensate tempering	83,300	2.5	\$1,400	Based on a measured tempering water flow rate of 600 milliliters (mL) per minute. Assumes tempering water is applied 24 hours per day, 365 days per year.
RO reject water (used for steam boiler make-up water)	80,510	2.4	\$1,300	FY 2013 metered total.
Steam boiler feed water (potable water)	50,503	1.5	\$800	FY 2013 metered total.
RO permeate to drain	47,500	1.4	\$800	Based on a measured flow rate of 1,200 mL per minute while RO system is operating. Assumes that the RO system is operating 10 hours per day, 250 days per year.
Steam boiler blowdown continuous tempering water	34,700	1.1	\$600	Based on a measured flow rate of 250 mL per minute. Assumes tempering flow occurs 24 hours per day, 365 days per year.
Leak in water softener serving steam boiler feed	13,900	0.4	\$200	Based on a measured flow rate of 100 mL per minute. Assumes the leak occurs 24 hours per day, 365 days per year.
<b>Total Potable Water Use</b>	<b>3,304,000</b>	<b>100</b>	<b>\$36,400</b>	FY 2013 metered total.
<b>Other Onsite Alternative Water Use</b>				
Cooling tower make-up (air handler condensate)	178,129	-	-	FY 2013 metered total.

<sup>a</sup> Utility cost savings are calculated using the most current water and sewer rates available. Beginning in 2008, the incremental water rate applicable to ESC is \$8.40 per 1,000 gallons. The incremental sewer rate applicable to ESC is \$9.76 per 1,000 gallons for 80 percent of the metered water use. A cooling tower evaporation credit is applied for water used at the cooling tower; therefore sewer charges do not apply for the cooling tower water use.

**Figure 2. Percentage of Potable Water End Uses, ESC, FY 2013**



**Figure 3. Quarterly Water Use, ESC, FY 2013**



## **Cooling Tower Make-Up**

The largest end use of water at ESC is the cooling tower system, which accounts for 66.4 percent of total potable water use annually. Condenser water is cooled in a three-cell cooling tower with 2,400 tons of total capacity. Cooling tower make-up water is metered, and water use trends are tracked weekly. Unusual trends are investigated and resolved. Cooling tower water use is subtracted from total water use when sewer fees are calculated.

A cooling tower maintenance contractor conducts monthly cooling tower system quality and performance reviews. The contractor maintains a conductivity meter to automatically control cooling tower blowdown and provides chemical treatment to control scale and corrosion. Incoming make-up water provided by the U.S. Army's Fort George G. Meade has a conductivity of approximately 50 microSiemens per centimeter ( $\mu\text{S}/\text{cm}$ ). The conductivity meter is set to blowdown when the water in the tower reaches approximately 800  $\mu\text{S}/\text{cm}$ . Therefore, ESC's cooling tower achieves between 13 and 16 cycles of concentration. It is recommended to achieve at least six cycles of concentration in a cooling tower to ensure optimum water efficiency. ESC's towers are maximizing water efficiency by achieving more than twice as many cycles.

In summer months, ESC collects condensate from air handling units and uses it as cooling tower make-up water. The collected condensate is metered and readings are recorded weekly. In FY 2013, 178,129 gallons of condensate were collected and used in the cooling tower as make-up water, offsetting the total potable water use required by approximately 8 percent.

## **Research Water and Building Humidification**

Deionized (DI) water is generated for laboratory use through a multi-step process consisting of multimedia filtration, water softening, carbon adsorption, and RO. Treated water from the RO unit is used as feed water to the DI water recirculating loop. The DI water is circulated through an ion exchange bed, ultraviolet disinfection unit, and ultra filtration unit. The rejected water from the RO unit is routed to a condensate collector and is ultimately reused as steam boiler make-up water, where it offsets some boiler feed water demand. The RO system is run on a daily basis for 10 hours per day. Production regularly exceeds demand. The RO unit is operated in recycle mode, but some permeate is discharged to drain to prevent heat from building up in the system, since the membranes can be damaged if the temperature exceeds 100°F. To reduce the amount of permeate being sent to the drain, ESC could consider reducing the operation of the RO system from 10 hours per day to 5 hours per day.

Laboratory humidity is controlled in the winter months through direct injection of steam. The clean steam generator has capacity of 9,735 pounds per hour at 100 pounds per square inch (psi).

Water is also used as necessary in individual laboratories for bench-scale experimentation and glassware preparation.

## Steam Sterilizers

ESC is equipped with eight steam sterilizers, listed in Table 4. All eight steam sterilizers have integral control of tempering water or have had a retrofit kit installed to eliminate the tempering water flow except for times when condensate is being discharged above 140°F.

During the April 2014 water assessment, the Steris/Amsco 3031-S steam sterilizer in Room B206 had tempering water being continuously applied at an estimated rate of approximately 0.5 gallons per minute (gpm) while the sterilizer was not under heated condition. While it had a retrofit kit installed to control tempering water flow, the retrofit kit appeared not to be functioning correctly. ESC should service the retrofit kit to ensure it is only applying tempering water when needed.

**Table 4. ESC Steam Sterilizers**

<b>Room</b>	<b>Model</b>	<b>Continuous Tempering Water Flow?</b>
B202	Steris SG-120	No – Only when needed
B204	Steris/Amsco 3031-S	No – Only when needed
B206	Steris/Amsco 3031-S	Yes – 0.5 gpm
B207	Steris SG-116/Amsco Century	No – Only when needed
D122	Tuttnauer	No – Only when needed
H104	Steris Amsco Lab 250	No – Only when needed
H104	Steris SG-120/Amsco Century	No – Only when needed
H104	Steris SG-120/Amsco Century	No – Only when needed

## Restroom Fixtures

All toilets at ESC have been retrofit with dual-flush handles, allowing users to select a full flush of 1.6 gallons per flush (gpf) for solid waste or 1.1 gpf for liquid waste. Urinals are compliant with the 1992 Energy Policy Act (EPAct) water efficiency requirements (1.0 gpf).

High-efficiency faucets with a maximum flow rate of 0.5 gpm are used throughout the facility. The 0.5 gpm flow rate is lower than the EPAct requirement for faucets and is compliant with the American Society of Mechanical Engineers/Canadian Standards Association (ASME/CSA) standard for lavatory faucets in public use. This flow rate is sufficient for hand washing and is considered a best practice for lavatory sinks in public settings.

Four of ESC's 12 showerheads flow at 2.0 gpm, while the remaining eight showerheads flow at 2.5 gpm. All showerhead flow rates fall at or below the EPAct requirement of 2.5 gpm. System pressure is maintained between 20 to 80 psi.

Table 5 provides an inventory of restroom fixtures.

**Table 5. Restroom Fixtures Inventory, ESC**

<b>Fixture Type</b>	<b>Flow Rate</b>	<b>Total Number</b>
Toilets	Dual flush: 1.6/1.1 gpf	42
Urinals	1.0 gpf	10
Lavatory faucets	0.5 gpm	32
Showerheads	2.5 gpm	8
	2.0 gpm	4

To reduce restroom water use, ESC could consider replacing urinal diaphragm inserts with inserts rated at 0.5 gpf. ESC should first conduct a pilot project in one restroom to verify that performance and user satisfaction are maintained under the lower flush volume. If the pilot project is successful, ESC could replace diaphragm inserts in all of its urinal fixtures.

To further reduce restroom water use, ESC should also consider replacing its existing showerheads with WaterSense labeled models that flow at 1.75 gpm or less.

### **Steam Boilers**

ESC is equipped with two 375 horsepower and one 350 horsepower steam boilers. The boilers primarily use natural gas as fuel; however, they can utilize fuel oil when natural gas is curtailed or doing so is more economical. The boiler water system is monitored and maintained under a service contract to prevent system corrosion and optimize condensate reuse. Boiler water quality parameters such as conductivity, alkalinity, sulfite concentration, and phosphate concentration are monitored and controlled through periodic testing and chemical treatment provided by the service contractor. Boiler feed water is softened, metered, and checked for hardness and conductivity. Approximately 85 percent of steam condensate is captured and returned to the boiler system as make-up water.

The water softener system that feeds the boilers will be rehabilitated and upgraded in FY 2014. The filters, filter media, and other components will be replaced to improve the operations of the system. During the April 2014 water assessment, a small leak from the water softener system was identified, flowing at approximately 0.03 gpm. This will leak will be addressed during the system rehabilitation.

Reject water from the RO system is collected and routed to a steam condensate collector that provides make-up water to the boiler. In FY 2013, 80,510 gallons of RO reject water was collected and used to offset the need for additional boiler feed water.

Tempering water is applied to a flash tank on the steam condensate return system. During the April 2014 water assessment, tempering water was being applied at approximately 0.15 gpm. After tempering, the temperature of the water being released to the drain was approximately 90°F, well below the 140°F limit allowed by plumbing code. The thermostatic water valve that controls the tempering water flow was adjusted to allow the water temperature to rise to approximately 125°F, reducing the amount of tempering water needed by about half. The

thermostatic water valve and thermometer should be routinely monitored to ensure that excess tempering water is not applied.

Also during the assessment, tempering water was flowing continuously to the boiler blowdown flash tank at 0.07 gpm even when no blowdown was being discharged. Maintenance should be performed on the cutoff valve to make sure the valve seats completely.

## **6.0 DROUGHT CONTINGENCY PLAN**

ESC will follow the water use recommendations and requirements of the Maryland Department of the Environment, which coordinates drought response within the State of Maryland. General information on drought conditions and information on associated water use restrictions are posted at the Maryland drought information web page:  
[www.mde.state.md.us/programs/Water/DroughtInformation/Pages/Water/Drought/index.aspx](http://www.mde.state.md.us/programs/Water/DroughtInformation/Pages/Water/Drought/index.aspx).

As matter of general operating practice, ESC already follows most of the water conservation approaches that could be required under drought conditions. Water is not used for irrigation, decorative fountains, maintenance of paved surfaces, or washing of mobile equipment.

In the event that voluntary or mandatory water use reductions are instituted by the Maryland Department of the Environment, ESC will form a task force of facilities management staff to identify and implement modifications to facility operations to achieve additional specified reductions in water use.